Rupture of the urinary bladder : based on the records of more than 300 cases of the affection / by Walter Rivington.

RUPTURE OF THE URINARY BLADDER.

BASED ON THE RECORDS OF MORE THAN 300 CASES OF THE AFFECTION.

BY

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TO THE

HUNTERIAN SOCIETY

THIS WORK IS DEDICATED

BY THEIR

President.

PREFACE.

This work embodies the papers on "Rupture of the Urinary Bladder," which I read before the Hunterian Society, and contributed in the first instance to the *Lancet*, and afterwards in a more extended form to the *Medical Press and Circular*, in 1882 and 1883. Many additional cases have been introduced, and a careful revision undertaken. Originally I intended to publish in an appendix the particulars of all the fatal cases in full, but I have been obliged to content myself with an abbreviated list and summary, for which, however, I believe that full compensation has been made by the incorporation of the most important features of the cases, as illustrations of the statements, in the text. The cases to which I have not been able or had time to refer are distinguished in the lists by the insertion in brackets of the name of the writer on whose authority they are given; as, for instance, M. Houel, Dr. Stephen Smith, and Dr. Max Bartels. I need scarcely say that it is much more satisfactory to see and quote the original reports of cases, as old errors are liable to be perpetuated, and new errors to be engendered by quoting at second-hand.

To the text as originally written and published, I have added an appendix containing the lists of fatal cases which have come under my notice, as well as some notes dealing with special classes of cases of rupture of the bladder, as for instance, from hypertrophy of the prostate, labour, stricture, retroversion of the gravid uterus, extra-uterine fœtation, and rupture in the female sex. In compiling one or two of these notes I have been indebted to my friend and colleague, Mr. Waren Tay, for helping me to decipher the pages of German authors, Drs. Krukenberg, Groedel, Litzmann, and Max Bartels.

All the cases which I have collected since this work has been in the printer's hands I have placed in a separate note in the appendix. Some of these cases are very instructive, and I have therefore felt bound to insert them in full, with such comments as they seemed to require. It has not been possible in all places to alter the text so as to make the statistics or illustrations from cases include the cases in this last note. The reader can readily supply this unavoidable omission.

Some confusion has arisen from the ambiguous use of the word

"fundus" in descriptions of the site of the rent in the bladder. Properly applied the term denotes the base of the bladder, but it is frequently employed to denote the summit of the bladder, probably in accordance with the application of the word to describe the rounded upper end of the uterus. It is generally obvious from the context which part is denoted, but not always so, and as it has occasioned mistakes, it would be as well if authors would either give up the use of the term altogether as descriptive of the superior part of the bladder, or prefix the adjective "upper" or "superior."

Although I have treated the affection which is the subject of this publication at considerable length, I do not pretend to have exhausted it, or to have collected all recorded cases. I merely offer a contribution towards the elucidation of the subject, recommending those who may be interested in it to refer for themselves to the authors of important cases and monographs, and form their own opinion upon the points at issue. With regard to the reported cases of recovery after rupture of the bladder into the peritoneal cavity, I cannot expect to convince every one—and least of all the surgeons who treated the cases—that the cases were not intra-peritoneal ruptures. Those who believe that urine is not so repugnant to the peritoneum as I think it is will not hesitate to admit the genuineness of some or all of the reported recoveries, and will be sanguine that success will not be denied to the surgeon in the future, whether he adopts an expectant or an active method of treatment. They will rather agree with Mr. Holmes, who thus expresses himself in the new edition of his text-book on surgery. "Now that we no longer regard rupture of the bladder as a necessarily fatal accident, even when the rupture involves the peritoneal cavity, I have no doubt that the accident will be treated with occasional success by any of these methods" (p. 224). I wish I could think so. My feelings and wishes favour this issue, but my judgment opposes it. The only way in which sound conclusions can be reached is by subjecting all reported recoveries to a thorough and critical examination. This I have endeavoured to accomplish, feeling persuaded that in free criticism and discussion we obtain the best guarantee for the fulfilment of the prediction, *Magna est veritas et prævalebit.*

22, Finsbury Square,
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RUPTURE OF THE URINARY BLADDER.

PART I.

CASES, GENERAL CONSIDERATIONS, AND CAUSES.

Rupture of the urinary bladder is an affection which is seen infrequently by practitioners. Cases entering the hospitals are but sparsely sprinkled through the pages of journals, hospital reports, and transactions of societies. Nevertheless it is an injury of sufficient interest and importance to deserve very careful study. It is a condition very liable to be overlooked by the practitioner, or mistaken for peritonitis or for some other lesion, and it may give rise to medico-legal inquiry. Its extreme fatality renders it imperative upon us both to recognize it as early as possible and to apply promptly any means which may seem to hold out a reasonable prospect of relief. It has fallen to my lot to meet with four fatal cases of ruptured bladder, each case being of a different kind. After the occurrence of my first case, in 1871, I collected the particulars of about 100 published cases, made some experiments on the cadaver, and acquainted myself with the opinions of authors for the purpose of writing a monograph on the injury. The undertaking was not then completed, mainly, I think, because I was hoping to acquire an enlarged experience, including the application of operative measures, and it is now resumed because the interest of surgeons in the subject has revived in recent years, owing to the publication of several cases treated, some successfully and others unsuccessfully, by abdominal or perineal incisions, and because I am particularly anxious to examine critically the cases which have been adduced as instances of recovery after rupture of the urinary bladder into the peritoneal cavity. Several authors have treated the subject of rupture of the bladder in a masterly manner, but three authors may be especially mentioned, whose monographs have constituted the leading authorities on the subject. I refer to Dr. Harrison, of Dublin;[1] M. Houel, of Paris;[2] and Dr. Stephen Smith, of New York.[3] But for the collection of cases by M. Houel and Dr. Stephen Smith I should scarcely have been able to find as readily so large a

[1] "Dublin Journal of Medical Science," 1836.

[2] "Des Plaies et des Ruptures de la Vessie. Thèse de Concours pour l'Aggrégation en Chirurgie." Par M. le Docteur Ch. Houel. Paris, 1857.

[3] "A Contribution to the Statistics of Rupture of the Urinary Bladder," with a Table of Seventy-eight Cases. By Stephen Smith, M.D., Assist. Surgeon

number, or to deal with the affection with equal breadth of view. Valuable papers or remarks, which I have consulted with advantage, have been contributed by Cusack,[4] Stokes,[5] Ellis,[6] Blundell,[7] Syme,[8] Willett,[9] M'Dougal,[1] Erskine Mason,[2] Heath,[3] Morris,[4] Rynd,[5] Solly,[6] Le Gros Clark,[7] Prescott Hewett, and others, including the authors of standard surgical treatises—Birkett,[8] Bryant, Holmes, Gross, Henry Thompson, Coulson, Reginald Harrison,[9] and Lane. In 1878 Dr. Max Bartels [1] published an elaborate paper on Wounds and Ruptures of the Bladder, in which he collated 169 cases; and, according to the writer of an excellent article in the *Lancet*, on the Causes of Rupture of the Bladder, "his paper is the best source of information as regards the statistics of the lesion."[2] In 1881 Dr. E. Vincent published a treatise on penetrating intraperitoneal wounds of the bladder with the special object of advocating their treatment by laparotomy and cystoraphy.[3] The best method of handling the subject will be to relate at the outset the particulars of the four cases to which I have alluded, and then to make remarks founded on the whole series of collected cases. My first case was seen in consultation with Mr. Chambers, of Hackney. Its history was as follows :—

Case 1.—On Wednesday, Oct. 25, 1871, Fredk. C——, aged forty-nine, was returning from a party, when he tripped and fell down flat on the pavement in the prone position, his nose and stomach coming violently in contact with the ground. He was taken home and put to bed; and some hours later was seen by Mr. Chambers. He was then suffering great pain, chiefly at the lower part of the abdomen. Mr. Chambers introduced a catheter, and drew off a large quantity of blood. The patient was not in a state of collapse. When seen on the following morning, he was still complaining of pain, referred chiefly to the region of the umbilicus. There was tenderness on

to Bellevue Hospital, New York. "New York Journal of Medicine," 1851, p. 336 *et seq.*

4 "Dublin Hospital Reports," vol. ii.

5 "British Medical Journal," March 23rd, 1872.

6 *Lancet*, Sept. 26th, 1833.

7 "Observations on some of the more important Diseases of Women."

8 "Pathology and Practice of Surgery," p. 336.

9 "St. Bartholomew's Hospital Reports," 1876.

1 "Edinburgh Medical Journal," Jan., 1877.

2 "New York Medical Journal," 1872.

3 "Medico-Chirurgical Transactions," 1879, vol. lxii. p. 335.

4 "Medical Times and Gazette," Nov., 1879; and *Lancet*, July 7th, 1883.

5 "Pathological and Practical Observations on Strictures."

6 "Surgical Experiences."

7 "Lectures on Surgical Diagnosis."

8 "System of Surgery," vol. ii. p. 716.

9 "Lectures on the Surgical Disorders of the Urinary Organs."

1 "Langenbeck's Archiv für Klin. Chirurg." Band xxii. The sub-editor of the *Lancet* courteously supplied me with the reference. I find that about six of the cases in the list are duplicates.

2 The *Lancet*, Nov. 12th, 1881.

3 "Plaies pénétrantes intrapéritonéales de la Vessie." Par le Dr. E. Vincent. Paris, 1881. I am indebted to Mr. Christopher Heath for bringing this essay under my notice and sending it to me.

pressure over the abdomen between the umbilicus and pubes, over each iliac fossa, and over the course of the ureters. There was no marked dulness on percussion. No urine had been passed, and the bowels had not acted. The patient did not complain of any continuous desire to micturate, but whenever the desire was felt he experienced pain in the body of the penis. The testicles were retracted. When the finger was introduced into the rectum, and pressure was made on the base of the bladder, much tenderness was apparent. Increased pain followed the passage of the catheter, and the instrument could not be made to rotate, nor could it be depressed between the patient's thighs; but subsequently, on varying its position, it seemed to slip in further than usual. Only a small quantity of urine mixed with blood was withdrawn through the instrument. These were the main local symptoms when I saw the patient with Mr. Chambers on the Thursday evening, and we were both of opinion that they indicated injury to the bladder. There was one additional symptom present, however, which rendered it uncertain whether a rupture of the bladder was the only injury from which the patient was suffering. This was the occurrence of vomiting. As the case progressed the vomiting became more urgent, and nothing would relieve it. The obstinacy of this symptom, which is passed over lightly in works on surgery in connexion with ruptured bladder, but emphasized as a symptom of rupture of the intestine, led me to suspect some injury to the bowel as well as to the bladder; but in this I was mistaken. On the following day I found the patient decidedly worse, and we informed his friends that he was in great danger, and would probably succumb in forty-eight hours. From this time, I understand (for I did not again see the patient alive), the symptoms increased in severity, the vomiting and pain being most urgent and distressing. The pain came on in violent paroxysms, extending over the whole abdomen. Cold sweats followed, and death took place about three p.m. on Sunday, October 29th. Fortunately we were able to inspect the abdomen. On opening the abdomen there was some, but by no means marked, evidence of peritonitis. The recto-vesical pouch was filled with a blood-stained fluid. The bladder was firmly contracted, and lay at the bottom of the pelvis. A rent, which in a bladder half filled would be about two inches in length, was seen at the upper and posterior aspect. The edges of the rent were sloughy. There can be no doubt, I think, that the bladder was quite full at the time of the accident. The patient had been drinking freely. He was of a very stout build, with a prominent abdomen. He simply fell flat on his face (his nose was bruised), and the bladder gave way at a point exactly opposite the surface on which the force of the concussion was received. He lived four days after the accident. The treatment consisted mainly in the administration of opium and morphia, and the regular introduction of the catheter.

A year afterwards I met with my second case.

Case 2.—Charles R——, nineteen years of age, was admitted into the London Hospital on the evening of October 28th, 1872.

He had been drinking, and was riding in a cart. His foot slipped and he fell forwards, one of the cart-wheels passing over his pelvis. On admission he appeared to be drunk, and could not give any coherent account of himself; but he complained of severe pain across his loins. The perineum was ecchymosed. The testicles were drawn up to the external rings, could be felt lying just over the pubic rami, and were very tender. On pressing the pelvic bones together, he complained of pain in the sacral region. He had not passed water since the accident, which had happened three hours before his admission. He could move his legs, but experienced great pain whenever he did so. At eleven p.m. five ounces of urine highly coloured with blood were drawn off with the catheter. Some clots were found blocking up the eyes of the instrument. The patient had slept a little during the night and said he felt tolerably easy. He attempted, but unsuccessfully, to pass a motion, only a little blood coming away. The temperature was 99·2°; the pulse 120. In the afternoon, during my visit to the hospital, I examined him and diagnosed a rupture of the bladder on the following grounds:—The patient had been drinking, his bladder was full, and he had evidently sustained a severe contusion in the hypogastric region. He had not passed any urine, and only a small quantity mixed with blood and clots had been drawn off with the catheter. He had constant desire, but inability, to pass water. His comparative freedom from pain was attributable to his not having recovered from his condition of alcoholic narcotism. In addition, the catheter passed easily, but could not be depressed, and it was deflected as it passed towards the left side. The patient complained of great pain whenever catheterism was attempted, and on examination per rectum tenderness in the site of the bladder was elicited. The soft parts over the symphysis were much swollen and ecchymosed and abnormally tender, the ecchymosis and tenderness reaching backwards through the whole perineum. The testicles were greatly retracted. I suspected some injury to the pelvis (the retraction of the testicles was really produced by a separation of the innominate bones at the symphysis), but I could not say positively what the injury was, for the extreme sensitiveness of the soft parts, combined with the swelling, rendered it impracticable to make a thorough exploration. I was also uncertain as to the exact site of the rupture of the bladder, the arrest of the catheter tending to negative its position on the posterior wall. Under these circumstances I did not pursue any heroic treatment, content to order narcotics and regular catheterism. On the 30th sixteen ounces of smoky urine were drawn off with the catheter. The patient had slept a little during the night. He had not taken food, and could not keep down even fluids. He was sick early in the day, bringing up a pint of dark-green fluid, very acid in its reaction. He had not passed any water, nor had his bowels been opened. The temperature was 104°; the pulse was still 120. He continued in great pain on and off during the day and following night. On the 31st the pain and sickness continued.

Ten ounces of urine were drawn off, and the patient himself passed about six ounces. During the night he passed a fluid motion without blood in it. The following day he was decidedly better. He was neither so thirsty nor so sick, and he passed a little clear urine. His abdomen, however, was tense and tender, and he was still restless, sometimes raising himself and kneeling upon the bed. A faint hope of recovery began to dawn. The following day, however, sickness recurred, and he was in all respects worse. No water could be drawn off, but he passed a few ounces by himself, and possibly more with a fluid motion, which the nurse reported. On the sixth day he died. At the post-mortem I found very intense peritonitis, especially in the pelvis. The whole of the pelvic peritoneum was coated with a layer of lymph, and the sigmoid flexure was adherent to the posterior surface of the bladder. On removing the bowel I did not see any aperture in the bladder, for its lips were glued together by lymph, and it was undergoing repair. The bladder was not completely contracted; it was much inflamed throughout. There was a considerable quantity of flaky, turbid urinous fluid in the pelvis. The rent in the bladder was at the upper and posterior part, and was vertical in direction. The pubic bones were widely separated at the symphysis; the separation probably having been much increased during the removal of the body to the mortuary.

The third case, though nominally under me, was treated by my colleague Mr. Reeves, and I will refer to it briefly.

Case 3.—Joseph C ——, twenty-four, a Hebrew, had been drinking, and had not passed water for hours. He was sitting on a parapet, and fell a distance of 12 ft. into an area. The accident happened at three a.m. on a Thursday, at the end of July, 1874. The patient was brought to the hospital, and the house-surgeon drew off with the catheter about eight ounces of fluid, half blood and half urine. Night and morning six or eight ounces of sanguineous fluid were drawn off. I had given up the charge of my wards to Mr. Reeves, for the purpose of taking my annual holiday; but before leaving town I had occasion to go down to the hospital, and on entering the ward my attention was attracted to the subject of the injury. I found him suffering from pain in the hypogastrium, and from inability, with continuous desire, to micturate. These symptoms, with the history of the case, and the additional facts that the catheter passed easily, but could not be depressed or rotated until it was manipulated with the finger in the rectum, through which the prostate and the catheter beyond it could be detected, left no doubt in my own mind concerning the nature of the case. The less severity of the abdominal symptoms, and a suspicious swelling of the scrotum, with fulness in the right inguinal region and upper part of the right thigh, pointed strongly to effusion of urine into the pelvic fascia through a rent in the bladder, where it was uncovered by peritoneum. As my colleague was expected to visit the cases in an hour or two, I contented myself with explaining my views to the house-surgeon for

communication to my colleague, and with recommending incisions into the scrotum, in the first instance, and, if urine should issue, into the thigh. My diagnosis was confirmed when the patient died, as nearly as might be four days after the injury. The conjoined rami of the pubes and ischium were found to be fractured, and a hole was discovered on the right side at the antero-lateral aspect of the neck of the bladder.

Case 4.—This is a case of peculiar interest, and stands almost alone amongst reported instances of ruptured bladder. The viscus was either empty or nearly empty, the rupture being neither complicated with nor caused by a fracture of the pelvis. The history is as follows:—

W. S——, aged thirty-three, was admitted into the London Hospital on November 21st, 1875. A light cart had passed over his abdomen. After the accident he could not walk. He had incontinence of urine, and passed blood with it. On admission he was not in a state of collapse. Neither increased mobility nor crepitus could be detected on examining the pelvis. Bloody urine dribbled away. A large catheter was passed and drew off more, the urine being expelled with some force. Blood in considerable quantity was uniformly mixed with the urine. No pain attended either the act of micturition or the passage of the catheter. The pulse was fairly strong, and the temperature 100·4°.

This was the history given to me when I saw the case on the following day, and I at once inquired into the condition of the bladder at the time of the accident, and elicited the important fact that the patient had passed his usual quantity of urine a few minutes before the accident occurred, so that, if this was a reliable statement, the bladder had been empty at the time. The patient had vomited, but only once on the preceding evening, at eight p.m. He had taken and retained some beef-tea and milk. He complained of pain across the lower part of the abdomen below the umbilicus, and there was tenderness when pressure was made with the finger on the prostate and base of the bladder; there was also tenderness on pressure in the posterior portion of the left lumbar and in the right iliac regions. The patient was not troubled with any constant desire to micturate. Was the bladder ruptured? My house-surgeon, Mr. Boase, had arrived at the conclusion that it was, and expressed his opinion to me to that effect. But then came the inquiry, If the bladder was ruptured, on which I could not myself pronounce at once an absolute opinion on account of its apparently empty condition at the time of the accident, and the unusual symptom of incontinence of urine, &c., what was the position of the rupture? Evidently, as I observed, not through the peritoneum in the usual position at the upper and back part of the bladder. The empty state of the bladder, the quantity of urine passed since the accident, and the symptoms as a whole negatived that. If ruptured at all, the rent, I said, must be near the neck, in such a position that the urine could gravitate into the urethra. In the absence of any appearance of extravasation of urine, it

seemed advisable to wait a few hours until there was some more decided indication for interference, watching the patient carefully in the meantime. The exact mechanism of the possible lesion was not clear to me, but no doubt existed in my mind that, if the bladder had been torn, the injury must have been accompanied with great laceration and bruising of the pelvic fasciæ, &c., and considerable extravasation of blood, constituting of themselves grave conditions likely to prove fatal.

On the following day I found that the quantity of water which had been drawn off was only six ounces, and that there was an extending blush on the lower part of the abdomen, uniform on both sides. Feeling now convinced that there was a laceration at the neck of the bladder, through which effused urine had been able to return into the viscus, I was about to undertake an exploratory operation above the pubes; but on examining the patient I found that he was sinking fast. His pulse was extremely feeble, his face yellow and sunken, his voice low and extremities cold. It was therefore useless to interfere, for he might have died during the operation. He lived but a few hours longer. At the post-mortem examination it was found that the peritoneum had been dragged back from its attachment to the anterior abdominal wall, and had probably carried the bladder with it, causing the laceration just above the prostate gland. Blood and urine were extravasated freely.

Each of the four instances which I have related may be regarded as representative of a distinct group of cases of ruptured bladder. The first case belongs to the group of simple or uncomplicated ruptures into the peritoneal cavity; the second to the group of intra-peritoneal ruptures, complicated with dislocation or fracture of the pelvis; the third and fourth to the division of extra-peritoneal ruptures; the third belonging to the group of ruptures associated with, and often caused by, fracture of the pelvic bones; and the fourth to the group which is free from complications of the kind. Adding these four cases, and one recently under Mr. Hutchinson at the London Hospital, to my list, I obtain a total grouped as follows:—

1. Simple fatal intra-peritoneal ruptures . .	152
2. Complicated fatal intra-peritoneal ruptures .	30
3. Fatal extra-peritoneal ruptures, simple and complicated	90
4. Reported cases of recovery, genuine or otherwise	40
5. Fatal ruptures of uncertain position . . .	10
Total	322

Besides these, cases of intra-uterine rupture in the fœtus have been recorded.

In a few cases there was more than one rent in the bladder, and where an intra- and an extra-peritoneal rent were combined I have reckoned the case as belonging to the intra-peritoneal group. In some cases the rent was sub-peritoneal, and in a few the peritoneum gave way subsequently to the primary lesion. Undoubtedly, of

the four groups into which the cases of ruptured bladder naturally fall, the first, or that comprising the uncomplicated intra-peritoneal ruptures, possesses the greatest interest for the surgeon. The treatment of extra-peritoneal rupture resolves itself, perhaps, in the main, into the treatment of extravasation of urine; and when the grave lesion of a ruptured bladder is complicated with dislocation or fracture, or rupture of some other viscus, the complication is apt to betoken an amount of violence and injury almost necessarily fatal. It is chiefly, though not by any means exclusively, in the uncomplicated cases that the surgeon may entertain a hope that his measures may be attended with success, and more peculiar interest is attached to the intra-peritoneal ruptures from the fact that the best method of treatment has still to be determined. For these reasons I purpose to devote especial attention to the intra-peritoneal ruptures, premising some remarks which will apply to all the varieties.

1. Of fatal intra-peritoneal ruptures it will be seen that I have found 182 instances, and of fatal extra-peritoneal ruptures only 90. Whether the intra-peritoneal is really the more common form, or whether the cases have only been more frequently reported, is more than I can say. Certainly the simple intra-peritoneal rupture is far more frequent than the simple extra-peritoneal, the extra-peritoneal being more often associated with fracture of the pelvic bones, and capable under these circumstances of being produced when the bladder is not distended. About one-half of the ninety extra-peritoneal ruptures were complicated with fracture or displacement, and in a few there was some other complication. It is remarkable, however, that out of a series of ten cases occurring at St. George's Hospital, and brought by Mr. (now Sir) Prescott Hewett before the Pathological Society, six should have been extra-peritoneal, complicated with fracture or displacement of the pelvic bones; two simple extra-peritoneal; and two only intra-peritoneal, one of these being associated with extensive fracture. This would seem to point to the conclusion that the extra-peritoneal rupture is more common than would appear from the total number of published instances, but that it is so frequently the result or the accompaniment of other grave mischief of a hopeless nature that surgeons deem it useless and uninstructive to report the cases which occur in their practice.

2. Of 288 cases, 240 were males and 48 females. The large proportion of males to females is in accordance with the differences of habit and occupation in the two sexes. The female is less frequently exposed to the accidents which beset the male; less frequently the victim to the pothouse orgies and brawls so prolific of danger to men. Not satisfied with this obvious explanation, Dr. Harrison attributed the immunity of the female to the greater size of the female pelvis, the cavity of which is not so extensively occupied by the bladder when full of urine. According to him the bladder does not incline so much backwards, but inclines forwards, and enlarges transversely. The uterus and its folds break the shock of

violence and prevent direct concussion against the sacral promontory. The idea that concussion against the sacral promontory is a potent factor in determining rupture of the bladder is not tenable, as I shall have occasion to show, whilst Dr. Stephen Smith has pointed out that when Dr. Harrison wrote no case of rupture of the bladder in the female from external violence had occurred to him. Several instances have since been placed on record, some by Dublin surgeons. It is a popular anatomical notion that the bladder is more capacious in the female than in the male, but according to a statement in Quain, made on the authority of Henle and Luschka, the female bladder is decidedly smaller than the male, but of a different shape, being wider transversely but shorter from apex to base. If, then, the popular anatomy be wrong, the popular physiology of the female bladder, that it can hold more water and retain it longer than the male bladder, must also be wrong. M. Houel, for whose authority great respect must be entertained, affirms that the female micturates less frequently than the male.

3. A comparison of the ages of the fatal cases shows that rupture of the bladder occurs most frequently in the prime of life, in persons between twenty and forty years of age. Of 159 fatal cases, whose ages are given in my notes, five were under ten years of age, fourteen between ten and twenty, thirty-six between twenty and thirty, fifty-two between thirty and forty, twenty-nine between forty and fifty, twelve between fifty and sixty, seven between sixty and seventy, and four between seventy and eighty. A good many more are simply described as adult males. All the patients above seventy were males; in all these the bladder was ruptured into the peritoneal cavity, and the cause of the rupture was retention from obstruction in the urethra, either stricture or enlargement of the prostate. The cases of rupture affecting the fœtus in utero and recently collected cases are not included in the above comparison.

4. With regard to the period of survival after the injury, it may be broadly stated that a patient with an extra-peritoneal rupture has a much better chance of recovery, and, other things being equal, is likely to live longer than a patient with an intra-peritoneal rupture. Thus, out of eighty-five fatal simple intra-peritoneal ruptures, eight died within twenty-four hours, fifteen within two days, fifteen within three days, sixteen within four days, ten within five days, four within six days, five within seven days, five within eight days, one within nine days, whilst one lived twelve days (Anton Graw), one more than twelve days (Montagu), one fourteen days (Von Roonhuysen), two about fifteen days (Ellis and *Gazette des Hôpitaux*), and one sixteen clear days (Crossley). Out of twenty-two fatal intra-peritoneal ruptures, complicated with dislocation or fracture of pelvis, &c., six died within twenty-four hours, six within forty-eight hours, three within three days, three within four days, one within six days (Rivington), two within seven days (Fano and A. Wernher), whilst one, a man of twenty-four, survived sixteen days in spite of having fallen from a window, and having sustained at the same time a fracture of the calcaneum

and pubes (De Brantes). John Stone's case is omitted. On the other hand, of 67 fatal extra-peritoneal ruptures seven died within twenty-four hours, six within forty-eight hours, ten within three days, eight within four days, four within five days, five within six days, two within seven days, three within eight days, one within nine days, three within ten days, three within twelve days, four within and one after fourteen days, three within eighteen days; whilst one survived three weeks (Hoffmeister), two twenty-three days (Prescott Hewett and Hutchinson), one twenty-five days (Clark), one five weeks (Bennett), one forty-two days (Peaslee), and one forty-four days (Gouley). It is noticeable that four of the longest surviving cases were complicated with fracture. The comparison between the fatal intra- and extra-peritoneal cases may be put briefly thus:—Out of 107 intra-peritoneal cases twenty-five lived over five days, seven over ten days, and none over sixteen days. Out of 51 extra-peritoneal cases, twenty-four lived over five days, fifteen over ten days, eight over sixteen days, five over three weeks, one five, and two six weeks. The accompaniments of fracture and dislocation of the pelvis cannot be said of themselves to exercise much influence on the length of the survival.

5. The causes of rupture of the urinary bladder may be divided into predisposing conditions and determining causes. The main predisposing condition of rupture of the bladder is distension of the organ with urine. For an uncomplicated intra-peritoneal rupture to occur I believe that it is almost essential that the bladder should be full. It may not be necessary for it to be completely distended, but it must have risen well above the pubes, so as to present a sufficient surface, and a sufficient resistance to blows and pressure. M. Houel remarks that "all surgeons agree in saying that there is no rupture possible without repletion, except in utter smashes and perforation by fragments of bone." This statement must be modified in view of the fourth case which I have related, and in which an extra-peritoneal rupture of the bladder, immediately above the prostate gland, had been caused by the undistended viscus being dragged backwards with the peritoneum when a cart-wheel passed over the patient's abdomen. Parallel, if not identical, conditions will be found in the records of one or two of the extra-peritoneal ruptures in my collection. Take, for example, the case of a man, forty-six years of age, under the care of Mr. Hawkins,[4] at St. George's Hospital. He had been kicked in the belly by a horse five hours before admission, and lived fifty-eight hours. At the post-mortem examination the peritoneum was found stripped off the anterior wall of the abdomen as high as the umbilicus, and there was a laceration an inch long in the fore-part of the bladder just below the reflexion of peritoneum. As the patient only lived two or three days the detachment of peritoneum must have been chiefly the direct effect of the injury and not of urinary extravasation. Again, in another case also brought forward by Sir Prescott Hewett, and under the care of Mr. Tatum, a similar con-

[4] "Transactions of Pathological Society," vol. ii.

dition was found. The patient was a man of fifty, who had been injured two days before admission by a man jumping on his abdomen. He lived twenty-three days, and at the post-mortem the peritoneum was found stripped off each iliac fossa, and parts in the neighbourhood of the bladder and walls of the abdomen, as high as the umbilicus. There was a rupture in the fore-part of the bladder an inch long and half an inch deep. In the same category may be placed a case of M. Nivet's, adduced in Houel. A female, sixteen years of age, was pressed between a wall and a carriage. She lived forty-four hours, and a rupture of the bladder was found at the point of junction of the neck and the body. There were multiple fractures of the pelvis. In the absence of any note as to the state of the bladder in these cases at the time the injuries were received it is not possible to speak confidently; but in all, the injuries were of a nature likely to act upon the bladder in a manner similar to the injury in my own case, whether the viscus happened to be nearly empty or partially occupied by urine.

On looking over the records of the simple intra-peritoneal ruptures, I find distinct evidence of the bladder being full in 55 out of 110 cases, in others the patient is described as drunk, whilst in the remainder nothing is said about the condition either of the patient or the bladder. In two the statements of the patients might lead to the inference that the bladder contained very little urine at the time of the rupture. Thus Mr. Cusack's second patient, who fell twenty feet from the battlement of a bridge into a garden, said, in reply to questions, that he had evacuated his water a short time before the accident; and Mr. Heath's second patient, on whom he performed abdominal section, and who had received a severe blow from the elbow of one of his companions, with whom he had been "larking about," was quite sure that he passed water freely half an hour before the accident. If we are to place implicit reliance on these statements, in neither could the bladder have contained sufficient urine to accord with what is generally regarded as a necessary condition for an intra-peritoneal rupture. Mr. Heath's patient had drunk two pints of beer, whether after or before he made water is not stated. If he drank his two pints of beer after he made water and within an hour or an hour and a half of the accident, the bladder would be sufficiently distended, and, therefore, it is probable that his estimate of the lapse of time is not to be absolutely relied on. This seems to be the best way out of the difficulty in both cases; for it is impossible to understand the mode of production of the ruptures unless the bladders had risen well above the pubes. Moreover, it is clear from the cause of the injury—a blow from an elbow—and from the history of Mr. Heath's case prior to his admission to the hospital, that the bladder was full at the time of the accident. The doctor who attended him sent the following account:—"Patient is suffering from hæmaturia and retention of urine. A No. 6 catheter has been passed at intervals, but only a few ounces of bloody urine have been drawn off, the bladder remaining dis-

tended." Clearly the collection of fluid in the peritoneal cavity was so considerable as to be mistaken for a distended bladder. This has happened in other cases which will be quoted at a later stage. Among the complicated intra-peritoneal ruptures, A. Wernher's patient is stated to have passed his water half an hour before the accident. The complication was a fracture of the horizontal ramus of the pubes on the left side. Cusack's and Wernher's cases do not weigh strongly against the mass of evidence on the other side; and I think it may be laid down that, with the exception of cases in which the bladder is wounded by broken pelvic bones or dragged away from its attachment, distension is a necessary antecedent to rupture. M. Houel, and the writer of the article in the *Lancet* already referred to, place alcohol among the predisposing causes. "Alcohol," says the latter, "has a double influence in predisposing to this injury; for it causes an increased and rapid secretion of urine and quick distension of the bladder, and it also deadens the sensitiveness of its mucous membrane, and the call to micturate is so feeble that it is disregarded by the drunkard and the distension allowed to increase." Certainly it is a sad fact that rupture, and particularly intra-peritoneal rupture, of the bladder is one of the penalties of drink. In 41 out of 107 cases of simple intra-peritoneal rupture, it is distinctly specified or implied that the patients had been drinking alcoholic liquors freely, or were actually drunk, at the time of the accident. It did not escape M. Houel's observation that the lesion appeared to be much more common in England than in France or Germany. A second predisposing condition is the existence of some obstacle to the passage of urine from the bladder, such as stricture and hypertrophy of the prostate gland. A third condition, well described by M. Houel, and especially applicable to the small group of so-called spontaneous ruptures, is the presence of pouches of the mucous membrane passing out through intervals between the muscular fibres. Distension of the bladder destroys the elasticity of the muscular fibres and occasions their separation. This separation is not found equally over the organ, but is most considerable behind towards the bas fond at the level of the insertion of the ureters and at the summit of the bladder. The supplementary pouches were studied by M. Cruveilhier, who called them tunicated or tunicary herniæ. When large the pouches have been taken for multiple bladders.

In the female during labour the bladder is apt to become distended owing to the mechanical obstruction occasioned by the pressure of the head or some other prominent part of the child. Retroversion of the gravid uterus produces a similar effect.

In considering the determining causes of rupture I think it as well to adopt M. Houel's division of ruptures of the bladder into idiopathic and traumatic. Of 283 fatal cases in the collection, 224 were traumatic and 59 idiopathic. In the traumatic cases the determining cause was some kind of injury to the lower part of the abdomen. The category comprises kicks from man and beast; blows in fighting or wrestling, or accidentally received, as for

instance, from a watchman's pole; a violent blow on the back from a piece of timber or an engine; man, husband, or antagonist falling, or jumping, or kneeling, or treading forcibly on the sufferer; horses falling on their riders; various bodies, such as iron railings, carriages, stones, or rocks, or earth, or trees falling on the abdomen; the wheels of vehicles passing over the abdomen; falls during wrestling, falls from heights or the windows of houses, falls from hammocks, falls or impact against some projecting body, as a post, the edge of a tub, the corner of a bench, or the footboard of a bed; and squeezes, as between two railway cars, or a carriage and the wall. In two cases occurring, one to Spence and the other to Fergusson, the patients fell backwards and struck the backs of their heads, indicating the probability of the injuries being the result of the strain of the abdominal muscles against the distended bladder. In one case, taken by Houel from the *Gazette des Hôpitaux*, the subject of the lesion fell from a height on to the soles of the feet, and probably, but by no means certainly, the concussion alone sufficed to cause the rupture.

Among the idiopathic cases I include all in which no external violence was applied to the abdomen, and the group comprises cases in which the bladder appears to have ruptured from muscular action, combined with over-distention, or from simple over-distention due to various causes—e. g. stricture, enlargement of the prostate, hysteria, retroversion of the gravid uterus, labour, and alcoholism; rupture in the fœtus, rupture during disease, as fever, or erysipelas following previous ulceration or softening.

The fifty-nine fatal idiopathic cases may be classified thus:—Forty-six intra-peritoneal, eleven extra-peritoneal, two uncertain; eleven cases due to stricture, six intra-peritoneal, five extra-peritoneal; seven to labour, six intra-peritoneal, one partial; two to muscular action, intra-peritoneal; nine from retroversion of the gravid uterus, intra-peritoneal; eight due to hypertrophy of the prostate, seven intra-peritoneal, one doubtful; ten due to retention of some other kind, four intra-peritoneal, three extra-peritoneal, three doubtful; seven due to ulceration, three intra-peritoneal, three extra-peritoneal, one doubtful; two from extra-uterine fœtation, intra-peritoneal; and three of doubtful character, two intra-peritoneal in insane patients and one extra-peritoneal. Very likely the three last cases (those of Deguise, Dr. W. R. Williams, and Dr. G. C. Walker) were of traumatic origin.

It seems to me sufficiently proved that the action of the muscles of the anterior abdominal wall, strongly contracting on an over-distended bladder, weakened, it may be, by separation of the muscular fibres, can produce rupture of the organ. Two cases of intra-peritoneal rupture from this cause in adult males, who were engaged in lifting heavy weights, have been recently recorded by M. Assmuth.[5] The same cause may operate in the female during labour, when the bladder is between two forces, the abdominal muscles and

[5] "Petersburger Medic. Wochenschrift," No. 22. See the article in the *Lancet* already quoted.

some part of the child's body in its descent, or a misplaced uterus, and in the male suffering from stricture, or from an hypertrophied prostate gland. Dr. Gouley has related the case of a man sixty years of age, who was suffering from retention from stricture. The bladder was distended up to the umbilicus; neither catheter nor filiform bougie could be passed. The patient was placed under ether, and during its administration the tumour disappeared, owing to the restlessness of the patient. Death occurred four hours afterwards. Five pints of bloody urine were found in the peritoneal cavity, and there was a laceration at the posterior aspect of the upper fundus half an inch in length, and involving all the coats. The membranous urethra was torn, probably from an injury to the perineum. In some cases of stricture, straining at stool produced rupture into the peritoneal cavity. Dr. Arthur Garry, of Dublin, related the case of Benjamin Morgan, aged thirty-two, of small stature and stout build, who had an attack of gonorrhœa, which was followed by penile stricture, lasting five years. He was not an habitual tippler, but he suffered from occasional stoppage of his water, leading to distension and hypertrophy. One evening he went to stool, and, without previous pain, felt something suddenly jump in his belly. From that time he was unable to pass water; his belly swelled, and he was sick. He lived about thirty-six hours. The post-mortem revealed a hole at the back of the bladder, with three flaps, the wall of the bladder around the hole being thin, as if from overstretching. There was no mark of ulceration. In a case, recorded by Stoll, an adult male suffering from retention through urethal obstruction was straining at stool, when he felt something burst in the abdomen. He died on the second day, and a rupture was found in the posterior part of the superior fundus. Straining to pass water was, no doubt, the immediate cause of some of the other recorded cases of rupture succeeding retention from stricture. As a general rule, in cases of stricture of the membranous or penile portion of the urethra, unrelieved retention and straining lead to ulceration or rupture of the dilated urethra behind the stricture, and to extravasation of urine. Rupture of the bladder itself is exceptional. When the bladder gives way, the rupture may either be intra-peritoneal, as in the two cases just related, or extra-peritoneal. Mr. Reginald Harrison has recorded a remarkable case of intra-peritoneal rupture an inch and a half in length on the posterior surface of the bladder, apparently due to retention from spasmodic stricture and straining efforts at micturition. In size, direction, and position, the rent resembled that usually found in traumatic ruptures. The patient denied receiving any injury, but if, as was believed, he had been drinking before sending for the doctor, he may have injured himself without recollecting it. The urethra was nowhere narrowed. In a case given by Sir Everard Home, the rupture was situated on the anterior aspect of the superior fundus, and did not involve the peritoneum at the seat of rupture. The urine, however, being admitted into the areolar tissue, travelled up to the umbilicus, where it ruptured the peritoneum and entered the

abdomen. The opening in the mucous membrane was the size of a goose quill, whilst that in the muscular tissue was an inch in diameter. In a second case related by the same author, in which rupture followed retention from stricture, the bladder gave way on the left side, midway between the fundus and the prostate gland. The urine was admitted into the cellular tissue of the pelvis, forming a tumour underneath the peritoneal covering of the bladder. In the course of a few days the peritoneum gave way, an orifice in the peritoneum an inch in length being found at the post-mortem examination. The rent in the bladder was situated anteriorly in two other cases. One of these is given by Dr. Gouley. A man, thirty-six years of age, the subject of stricture, was straining to pass water when he felt something give way within him. Extravasation of urine resulted, abscesses formed, and the case lasted for forty-four days. At the post-mortem a rupture was found in the anterior wall about the middle of the vertical diameter. The opening in the mucous coat was rounded and large enough to admit the index finger; the muscular and fibrous coats showed a vertical laceration an inch in length. Mr. Henry Arnott has related a case of rupture from retention due to tight bridle stricture of the membranous portion of the urethra. Catheterism had failed. A rent, an inch long, was found in the upper and anterior part of the viscus. The serous coat was not torn. Again, in a case recorded by Johnstone of rupture from retention in a man of twenty-eight, a circular hole, an inch and a half in extent, with smooth edges, was found in the left side of the bladder. In Mr. Hutchinson's case also the rent was behind the prostate. Two cases of rupture of the bladder into the rectum, due to retention from stricture, have been placed on record. As both were followed by recovery I shall have occasion to refer to them again; but I may state here that in one the opening into the rectum was secondary from sloughing, and in the other the rupture was, in all probability, not a rupture of the bladder into the rectum, but of the membranous urethra into the rectum.

It has always been a moot point whether the healthy bladder ever ruptures from over-distension alone. Houel asks, Can a spontaneous rupture occur from repletion in a normal bladder?—and answers easily, No. "Without previous alteration or violence the bladder cannot rupture spontaneously. When a patient presents himself at the hospital suffering from complete retention of urine, if there is no previous alteration of the bladder the surgeon need not fear to see it burst from the simple fact of over-distension. Dupuytren says, 'The bladder can rupture spontaneously when there is an invincible obstacle to the passage of urine,' but gives no fact." In Houel's opinion, for spontaneous rupture of the bladder to occur there must have been tunicary herniæ, and thinning of the coats or inflammatory softening, or gangrenous inflammation; and he adduces the statement of Cruveilhier,[6] "I do not know any positive example of rupture of the bladder from

[6] "Traité d'Anatomie Path. Gén.," t. i. p. 118.

the single fact of over-distension." The late Mr. Hancock laid it down that, in cases of retention of urine, the surgeon need not fear rupture of the bladder for forty-eight hours at least after the commencement of the attack; but I do not know on what evidence the statement was made.

Sir B. Brodie makes the following observations:[7]—"The time during which a retention of urine may continue before a rupture of the urethra or bladder takes place is much longer than you would expect. Such a catastrophe as that which I have endeavoured to describe rarely occurs before the third or fourth day. It may indeed occur sooner, but often the period is even later than this. The retention may continue for a week with occasional intermissions, during which small quantities of urine are discharged, then it may become complete, and, the urethra giving way, the urine may be extravasted. The secretion of urine may be more or less abundant; the bladder may be more or less capable of dilatation, and the period of the extravasation taking place must vary accordingly."

Among the ruptures due to the formation of tunicary herniæ, Houel places rupture of the bladder in the fœtus, examples of which have been recorded by Wilkinson King, Cock, Robert Lee, and Malgaigne. Mr. King's case,[8] which is often quoted, was a fœtus of four months with imperforate urethra. The bladder was hypertrophied. Near the summit of the organ on the posterior aspect was a perforation leading into the peritoneal cavity; around the orifice the vesical tissues were thinned. In like manner Houel excludes from the category of spontaneous ruptures the cases of hypertrophy of the prostate gland. In my first list I find six cases of rupture ascribed to the obstruction occasioned by hypertrophy of the prostate. These are the cases of MM. Sasie, Mercier, Tanchou, Liston, Howship, and Field. Five were examples of rupture into the cavity of the peritoneum. In M. Sasie's case there was a narrow rupture on the posterior aspect of the bladder. In M. Mercier's, the rupture was posteriorly and to the left, and there existed several diverticula. In M. Tanchou's, the rupture was situated near the base on the left side, and was three or four lines in diameter. The symptoms preceding these ruptures are not given by Houel in detail, and the description of the rents themselves in Mercier's and Tanchou's cases is not so clear as could be wished. In Liston's case the mucous membrane of the bladder was sacculated, the muscular fibres fasciculated, and the serous coat was bulged out into a pouch. The urine escaped posteriorly by a small hole in a round sloughy patch of the size of a shilling. The patient, seventy years of age, had been admitted into the hospital for a wound of the throat, inflicted because he had not passed water for three days. He had had stricture for several years, but never before a complete stoppage. In Howship's case a small hole was found on the peritoneal surface of the bladder, and several

7 "Lectures on the Diseases of the Urinary Organs," Fourth Edit. pp. 14, 15.
8 "Guy's Hospital Reports," 1837.

small ulcers were observed in the mucous membrane. At the perforated spot the ulceration appeared to have reached the peritoneal surface. The patient was a gentleman, fifty years of age, afflicted with enlarged prostate, and resulting atony of the bladder, which had to be emptied regularly with the catheter. Whilst lying one day in bed, to which he was confined, he felt considerable pain and uneasiness coming on at the lower part of the abdomen, soon increasing in severity, and at last becoming intolerable. He died in thirty-six hours. In Field's case the opening into the peritoneal cavity was near the middle of the superior fundus, and admitted a sound. The edges of the opening were smooth and rounded, as if a portion had become sacculated and given way, the peritoneum rupturing subsequently. The muscular coat was hypertrophied and fasciculated. The patient, seventy-two years of age, had had enlarged prostate for several years, and when seen by Mr. Field was suffering from retention, the bladder being distended, and the urine dribbling away. He was relieved with the catheter, and subsequently secured Mr. Field's instrument and used it himself. One day, however, he was unable to pass it, and obstinately refused to allow Mr. Field to do so. The result was that the bladder gave way, and that he died on the tenth day from the first attack of retention. The sequence of events, then, in this class of ruptures, is hypertrophy of the prostate, chronic obstruction to the flow of urine, straining, hypertrophy of the muscular fibres of the bladder, and formation of tunicary herniæ, thinning of the pouches, attack of retention, rupture of a diverticulum, with or without previous ulceration or sloughing. (See Note A, p. 106, Note C, p. 108, and Note G, p. 122.)

M. Houel says that spontaneous ruptures of the bladder are always sub-peritoneal, and consequently it is into the cellular tissue of the pelvis that the urinary effusion occurs. This dictum is scarcely borne out even by the seven cases adduced in his paper, for so far as I can ascertain the peritoneum was implicated in six. The discrepancy is to be explained by the supposition that M. Houel meant to imply that spontaneous ruptures are primarily sub-peritoneal, the peritoneum giving way only when it happens to be in contact with and connected with a diverticulum, or as the result of subsequent ulceration or gangrene. The further experience of idiopathic ruptures obtained since M. Houel wrote does not warrant any rigid statement. Rupture from over-distension may be either intra-peritoneal or extra-peritoneal, according to the condition of the individual bladder.[9]

Nor can we place among ruptures from simple over-distension the cases of rupture of the bladder in the female occasioned by labour. In these cases the bladder becomes distended, and inquiry into its

[9] In his work on the "Diseases of the Urinary Organs," Professor Gross, referring to the seven cases adduced by Houel, observes, "Of seven spontaneous ruptures, on the other hand, the posterior wall was involved in five, and the bas fond in two, and it is noteworthy *that the peritoneum remained intact in all*" (p. 318). For the determination of this matter I must refer the reader to the cases themselves. (See Appendix, p. 92, and Note A, p 106.)

state is overlooked by the medical or other attendant. Labour commences and proceeds, and the bladder is placed between two opposing forces, the violent contractions of the abdominal muscles, and the descending head or shoulders of the child, combined, possibly, with the forceps of the practitioner. The neglected bladder gives way either posteriorly into the peritoneal cavity, or, as in Wilkinson's case of recovery, into the vagina which had been the seat of extraction with forceps. The rupture may occur either during the continuance of the labour, as in Ramsbotham's cases, or after its conclusion, as in Bedingfield's and Hey's cases. In the second case given by Ramsbotham there was a hole on the posterior face of the bladder sufficiently large to admit the finger freely, and the aperture corresponded with a fleshy tubercle larger than a hen's egg on the fore and upper part of the uterus.

Exclusion from the category of ruptures from simple over-distension must also be the fate of cases of rupture occurring during the progress of certain diseases, such as fever, erysipelas, and, possibly, syphilis. Here the efficient cause is either softening of the coats of the bladder or the occurrence of ulceration. An example of rupture during erysipelas is given by Lloyd. A female, forty years of age, was admitted into the hospital for erysipelas of the head and face. The erysipelas was declining when, on the sixth day after admission, she was suddenly seized with acute pain in the abdomen, followed by collapse. She died in twenty minutes after the accession of the attack. At the post-mortem there was a pint of urinous fluid in the cavity of the abdomen. There was general peritonitis with lymph on the posterior surface of the uterus and peritoneum. The posterior part of the bladder was perforated with an ulcerated aperture, elongated, and with ragged edges. There were no other marks of disease in the vesical coats. An example of perforating ulcer of the bladder has been recorded by Mr. Bartleet, the actual perforation occurring whilst the patient was stooping to lift a bar of iron.

Besides Blundell's case, about the precise nature of which I am uncertain, I may refer to a case of rupture of the bladder in the pregnant female, due to the distension caused by retroversion of the gravid uterus, reported by Lynn. The patient was a female, forty years of age, the mother of four children, and over three months pregnant. She became the subject of a prolapse which was reduced, but soon afterwards experienced a retroversion of the gravid uterus whilst she was gleaning wheat. Retention of urine and distension of the bladder resulted, and continued for seven days; then she felt something burst within her, with relief to her previous symptoms. She miscarried, and died early the next morning. Unavailing efforts had been made to reduce the retroversion, and puncture of the bladder above the pubes had been proposed, but the patient determined rather to submit to her fate. At the post-mortem nine or ten pints of urine were found in the abdomen, and the bladder, empty and flaccid, was ruptured near the fundus, enough to admit the end of the finger. The tissues for about the breadth of a

shilling round the aperture were in a gangrenous state. In this case the retained urine produced probably a twofold effect, stretching and weakening the coats of the bladder, and perhaps setting up gangrenous inflammation at the site of the rupture. It is possible that the mucous coat gave way first, and that the peritoneal coat withstood the pressure until after the urine had caused gangrene or a sloughy condition of the edges of the opening. The action of the abdominal muscles may have accelerated the ruptures but the main feature after all is over-distension operating over a short period of time; in this respect differing from the cases of chronic obstruction in the urethra from stricture or enlarged prostate which has been seen to produce tunicary herniæ of the bladder, and thus to lay the foundation for rupture when complete retention supervenes. "The subject of rupture of the bladder from retroversion of the gravid uterus has been treated recently by Dr. Krukenburg, who has collected ten cases and added one observed by himself. Dr. Krukenburg considers rupture of the bladder and gangrene of the vesical wall to be identical in their pathology. In some cases the gangrenous inflammation of the coats of the bladder may cause the peritoneal surface to become adherent to the neighbouring parts, and the gangrenous portion may be cast off entire or broken up. If no adhesion has occurred, and the bladder is subject to distension, its wall will give way at the weakened spot, or the separation of the slough may lead to perforation even without overfilling of the bladder. The conclusions at which Dr. Krukenburg has arrived are these: 1. When the catheter has been employed and the uterus replaced before the sixth day, exfoliation of a portion of the vesical wall has not been observed. 2. If regular catheterism is begun before the tenth day, rupture of the bladder need not be feared; but when retention of urine persists longer than this, either gangrene or rupture of the bladder may supervene, rupture being the more frequent. 3. Rupture of the bladder may also take place suddenly from great distension of the bladder, or from efforts even most carefully made to replace the uterus. 4. If gangrenous portions of the vesical wall are cast off, it should be an indication to abstain from attempts to replace the uterus (lest rupture of the bladder should take place), and to treat the case by induction of abortion."[1]

A very instructive case of rupture of the bladder occurring suddenly a month after confinement has been reported by Mr. Rawson. A woman, thirty-five years of age, had been confined with a live child, by a midwife, a month previously, and had had apparently a favourable labour. She attended to her usual work after the first week, and never complained of pain in the hypogastric region or inability to empty her bladder. She was taken suddenly ill, whilst eating boiled milk, with great faintness, sickness, pain in the stomach, and burning sensation in the mouth and throat. She had

[1] The particulars concerning Dr. Krukenburg's paper, which is published in the "Archiv für Gynakologie," are taken from an annotation in the "Medical Times and Gazette" for July 8th, 1882. For this reference I am indebted to Dr. Herman. (See Appendix, Note D, p. 108.)

constant pain, retching and vomiting of a dark-coloured fluid, intense thirst, occasional purging, swollen lips, cold extremities, imperceptible pulse; and she died in convulsions thirty-six hours after the commencement of the attack. She did not pass any water during her illness. At the post-mortem a small ulcerated aperture was found at the summit of the bladder, perforating the coats at the point of attachment of the superior ligament. The mucous membrane round the aperture was dark and highly injected, and purulent matter adhered round the edges of the ulcer. About two pints of fluid were contained in the peritoneal cavity, but there was no appearance of inflammation. Mr. Rawson accounts for the absence of peritonitis by stating that the patient had never recovered from her first state of collapse. The case is the more interesting because a report gained ground that the woman had been poisoned. An inquest was held, and the post-mortem was made by coroner's warrant. In this case it is most probable that there had been previous distension of the bladder, setting up ulceration at the apex. The mucous membrane of the bladder presented generally an inflammatory appearance.

Dr. Fix has recorded a case of retention in a female twenty years of age, leading to rupture of the bladder. At the post-mortem ten or twelve pounds of urine were found in the abdomen, and the rupture was "nearly throughout the whole extent of the organ," the tissues being much thinned. Dr. J. B. Wilmot has related a very interesting case. A highly nervous and hysterical girl of nineteen was admitted into the Tunbridge Wells Infirmary, after a fortnight's illness under medical care. Her catamenia were passing. She complained of inability to pass her urine, and asked to have it drawn off on the second day after admission, but the house-surgeon declined to interfere unless the retention lasted longer. She had passed some water, and under purgatives a considerable quantity came away with her motions. Pain, thirst, sleeplessness, and incoherence in her talk, the symptoms present on admission, continued. On the fifth and sixth days she passed urine freely, as well as during the succeeding night. On the seventh day there was no water, but no distress. Dr. Wilmot was quite free from anxiety about her. Only fourteen hours had passed since she made water, and she had partaken freely of her dinner. An hour later she gave a most piercing shriek, saying she felt a sudden pain in the left pubic region as if a needle had run into her. She became tranquil, but half an hour later was seized with a sudden most acute pain in the epigastric region, and this too subsided. She expired suddenly not long afterwards. At the post-mortem a highly red vascular patch, more than an inch in diameter, was found on the posterior surface of the bladder, and in its centre an opening one-third of an inch long by a quarter of an inch wide, through which the urine had escaped. There was no ulceration, but the bladder had not fully contracted, and was so thin and pulpy as to tear here.

This case seems to be as pure a case of rupture from over-distension as is likely to be met with. Over-anxiety not to

humour an hysterical girl led, it would seem, to a distended bladder being overlooked, and the distension continued long enough to thin and weaken the vesical tunics, in spite of occasional, but probably only partial, relief to the organ by the overflow of urine.

Another case of rupture which was accounted for by over-distension, the effect of profound alcoholism, has been recorded by Dr. McEwen. A lad of nineteen, addicted to drinking to excess, was taken up in an insensible state and put to bed in a lodging-house. He continued comatose, and no attention was paid to his bladder. On the third day he was drowsy and stupid, drank water, but took no food. On the fourth day he seemed very uneasy, rolled about in his bed, would not answer questions, was pained internally, and lay with his limbs flexed on the abdomen. He was removed to the hospital, and died shortly after admission. The bladder was found contracted and deep in the pelvis, which contained a quantity of straw-coloured fluid. At the junction of the upper and middle thirds posteriorly a little to the left of the middle line there was an aperture through the peritoneal and other layers, sufficiently large to admit the tip of the little finger. There were no indications of disease, no gangrene, no ulceration, no stricture, no obstruction or false passage in the urethra. Dr. McEwen thinks that the bladder ruptured after the patient's admission to the lodging-house, because there were no signs of peritonitis after three days. The reason is not at all conclusive, and the possibility of a previous injury, as indicated by a slight bruise in the epigastric region, diminishes the scientific value of the case. At the same time the nature of the hole in the bladder associates the case rather with the idiopathic than with the traumatic ruptures. For further exemplification of the effects of over-distension, reference may be made to Mr. Reginald Harrison's case of intra-peritoneal rupture, quoted on a previous page, and to a case under Dr. G. C. Walker, which was seen by Mr. Harrison in consultation. Here the rupture was on the anterior aspect. There was nothing but over-distension to account for the rupture, but Mr. Harrison has informed me that he thinks some injury must have been the cause of the rent. Extravasation of blood was very free. Mr. Brown's case, which will be given among the recoveries, appears to have resulted from simple over-distension. In the Museum of the Royal College of Surgeons of England there is a preparation (No. 1967) of the bladder of a woman which burst into the peritoneal cavity in consequence of neglected retention of urine. In the idiopathic cases the aperture is small, often circular, or triquetrous, but in the traumatic cases it is generally a rent from an inch to two or more inches long. This corresponds with the results of experiments on the dead body. M. Houel conducted four experiments with Charrière's force-pump. When the pressure marked on a manometer equalled one atmosphere, the mucous coat appeared to give way, followed by a separation of the muscular fibres. The seat of the rupture was

uncertain. In one experiment made by myself with hydrostatic pressure, I found that the mucous membrane yielded in the first place to the left of the apex, admitting the fluid beneath the serous coat, which subsequently gave way when the pressure was continued. The aperture was small. Mr. Henry Arnott's case of rupture following stricture appears to me to bear considerable resemblance to the experimental effects of over-distension of the bladder. On the other hand, in two experiments, which I made on distended bladders by the administration of a forcible blow with the fist on the anterior aspect of the abdominal wall, in the hypogastric region, the bladder gave way posteriorly, the rent running through all the coats in a more or less vertical direction. In a third experiment with the bladder of a lad of seventeen fully exposed and containing between two and three pints of water, after several ineffectual blows with the fist and a block, a final blow with the fist caused a vertical rupture down the whole anterior face of the viscus, not involving the peritoneum. Now the posterior aspect of the bladder is the most common site, and the more or less vertical direction is the most common disposition of the simple intra-peritoneal rupture resulting from injuries. Thus, out of a hundred cases in which the position of the aperture is clearly noted, forty-four presented the rent on the posterior aspect of the bladder, twenty-two posteriorly and superiorly, twenty-two at the superior fundus, three superiorly and anteriorly, four on the anterior aspect of the superior fundus, four behind and below, and one at the side. Dr. Max Bartels' figures are:—In eighty-two of the intra-peritoneal cases the rupture was situated as follows: twenty-four at the fundus, fourteen in front near the fundus, thirty-nine posteriorly, and five at the side. Gross says, "Of seventy-eight cases, analyzed in 1851, by Dr. Stephen Smith, the posterior wall suffered in fifty, the anterior wall in nine, and the neck in six." In brief, the ordinary site of the intra-peritoneal rupture in the distended bladder is between the urachus and a point three or four inches below it. In 8 out of 110 cases the rent was transverse; one of these was a female. In about an equal number the rent is described as vertical and oblique. In many the direction of the rupture is not mentioned, but I think it may be fairly inferred that the rupture was vertical, or nearly so, in the great majority.

The question has been asked why the bladder ruptures so frequently on the posterior surface, and no satisfactory answer, so far as I know, has been elicited. Dr. Harrison ascribed the circumstance to pressure against the promontory of the sacrum, but, as Dr. Stephen Smith has remarked, the rent in the distended state of the bladder is usually well above the level of the promontory. Mr. Hilton, who had seen several cases, threw out the suggestion that the bladder was easily ruptured posteriorly because of the longitudinal fibres at the posterior aspect, a by no means satisfactory explanation. There appear to me to be two chief factors in the determination of the site of rupture of the distended bladder in any given case of injury. One factor is the situation of

the weakest part of the parietes of the organ, and the other the nature of the violence applied, acting in accordance with the physical principles of the resolution of forces. The extent to which the bladder is distended, and the presence of fæces in the rectum, may also have influence. Weakness of the bladder at any one spot, and the spot will vary in different bladders, comes into play, as has been seen, in cases of chronic obstruction to the outflow of the urine, leading to thinning of the coats and tunicary herniæ. But this factor scarcely operates to the full extent where the violence is applied suddenly and extremely to a healthy bladder, and we must look to the site and mode of application of the force. The force is applied usually to the anterior aspect of the hypogastrium. When the bladder is distended its lower half occupies and pretty accurately fits into the cavity of the pelvis, being well supported on all sides by the walls of the pelvis. The upper half is situated above the brim of the pelvis. The anterior surface, to which the force is applied, is supported by the pressure of the abdominal muscles; the posterior, superior, and lateral aspects are in contact with the intestines, and are less protected than any other parts. It is on the posterior surface that the stress of the violence applied anteriorly falls, being conveyed through the fluid contents of the bladder. If a fair, straightforward, equable blow is administered in the middle line to the hypogastrium over a distended bladder, or uniform force be conveyed through the sudden contraction of the abdominal muscles, the rupture may be expected to be a vertical rent on the posterior surface, as I found it to be in two of the experiments which I made on the dead body. In M. Assmuth's two cases of rupture from lifting heavy weights, in Fergusson's and Spence's cases of falls on the back of the head, in my own case of the stout patient who fell flat on to his abdomen, in Mr. Poland's case of a stout man who fell on his abdomen on a heap of stones, in Platerus's case of an adult male who fell upon the ground and struck his abdomen, and in sundry other cases of blows or kicks, the rent was on the posterior aspect, and, where noted, was vertical. If the force be less regular, as for example in running against the corner of a table or bench, or falling on the edge of a tub, or if a wheel pass over the abdomen, the rent may be at the opposite side of the bladder, or oblique, or even transverse, or, in some cases, be situated anteriorly. One case of transverse rupture into the peritoneal cavity was caused by a horse falling on his rider after conviviality,[2] and another by a kick in the hypogastrium.[3] Dr. S. G. Wilmot has recorded the case of a railway porter, thirty years of age, in whom a large transverse rent into the peritoneal cavity was caused during a fall on the back. He was walking with his hands in his coat-pockets when his foot slipped. He made a violent effort to save himself from falling, but in doing so the other foot slipped, and he was thrown on his back with great violence to the ground. The direction of the rent was fairly attributed to the in-

[2] "Medical Times and Gazette," Feb. 20th, 1869. Mr. Wathen's case.

[3] Dr. Harrison, *op. cit.*

fluence of the promontory of the sacrum, and was held to corroborate Dr. Harrison's theory. A fourth instance, recorded by Professor R. W. Smith,[4] was in a female who fell across the edge of a tub, and doubtless the transverse edge of the fundus of the uterus, *vis à-vis* with the edge of the tub, may have exercised some influence. In like manner a transverse rent on the anterior wall was produced in the case of a woman of intemperate habits, under Mr. M. Collis, through falling across a footboard.

Several cases have been related in which the violence was applied to the back. In a case under Mr. Hawkins, a piece of timber fell on the patient's back. The stress of the violence expended itself anteriorly, and the bladder was found ruptured in front, just below the reflexion of the peritoneum. In a second, or Watson's case, the patient was caught in a steam-engine, and received a severe blow on the back, causing injury to the pelvic bones and articulations. A transverse rupture admitting three fingers was produced at the fundus. This case appears to me to illustrate the principle that when the fluid in the bladder is forced, as it were, towards the apex, as, for example, by the pressure of a large surface or by concussion (?), the rupture will be found at the superior aspect. This was the situation in several cases of horses and antagonists falling on the abdomen, and in the case of a man who fell from a height on to the soles of his feet. When the violence, instead of at once rupturing the bladder through the medium of the fluid, presses it forcibly backwards, a rent will be found anteriorly just above the prostate gland. On an empty bladder the pressure may act through the peritoneum, urachus, obliterated hypogastric arteries, and pelvic fascia. Very likely strong traction on the bladder from above in this manner tears through the attachment of the anterior true ligaments to the viscus, and thus determines rupture just above the gland. Instances of rupture in this situation have been adduced.

These cases and remarks will suffice to illustrate the views here put forward for the first time—views which, *mutatis mutandis*, receive some corroboration from the effects witnessed in injuries to the head. The force of a blow on the head extends itself on the brain, not merely at the seat of injury, but at a point directly opposite. In a fall on the occiput the anterior lobes of the brain will be found bruised as well as the posterior. The brain seems to be driven forward against the frontal bone. A blow administered to a distended bladder in front drives the fluid forcibly against the posterior wall, which is burst open by the expanding force. The aperture thus produced is not a clean-cut wound like one made with a sharp knife, but it is generally an irregular jagged rent with contused edges. Blood is often poured out freely, and submucous extravasation may be found, either confined to the neighbourhood of the rent or spread over a wider area. A considerable amount of blood has been found in a few cases in the abdominal cavity.

[4] *Lancet*, 1844, vol. i. p. 102. Compare also Wiesbach's case, No. 106, in Max Bartels' paper.

In the case related by Bonetus there was a large quantity of fluid blood, due, it was thought, to rupture of vessels belonging to the urinary organs, but not unlikely to the paracentesis. When Mr. Heath operated, he was surprised at the amount of clots which had to be taken out of the peritoneal cavity; and at the post-mortem in Dr. Dewar's case, three pounds of clotted blood were removed. In one of the cases reported by Mr. B. Cooper, three or four pints of nearly pure uncoagulated blood were found effused into the cavity of the peritoneum.

In some cases the rent has been described as of a valvular character, the edges sloping from within outwards, or separated by a protrusion, or pad, of the mucous coat. In others one coat may be found to have been torn to a greater extent than the others — the mucous than the peritoneal, or the peritoneal than the mucous. The peritoneum may be stripped up around the opening, and even hang loosely over it. This disposition, however, is rare. It may be indicative of secondary rupture of the peritoneum. After rupture the bladder usually contracts, and is incapable of holding more than a few ounces of urine. The records of post-mortems on the intra-peritoneal cases prove the frequency with which the bladder is found contracted. Thus, out of 106 cases, in seventy-two no note has been made of the condition of the bladder; but of the remaining thirty-four, in twenty-seven the bladder is described as contracted, in two as empty, in one as collapsed, in one as not fully contracted, in one as contracted to one-third its natural size (whatever that may mean), in one as not much contracted, and one as much enlarged. In some the contraction was very considerable, being described as "very much contracted and entirely empty" (Cusack), "firmly contracted," "bladder a small hard, scarcely elastic mass like a schirrus uterus, and capable of holding four or five ounces" (Garry), "greatly contracted and thickened" (Dewar), "quite empty and contracted into a firm ball" (Ellis), and "completely shrivelled up around the entrance of the urethra" (Dobell). In all these the rent was intra-peritoneal. On the other hand, in a remarkable case of extra-peritoneal rupture following stricture, related by Sir Everard Home, the bladder contained at the post-mortem a pint of urine, and a quart had been removed by puncture per rectum during life.

PART II.

SYMPTOMS AND DIAGNOSIS.

(A) *Symptoms.*

The primary symptoms of rupture of the urinary bladder will be more or less marked, according to the condition of the patient at the time of the occurrence. If the sufferer, as is too frequently the case, happens to be intoxicated, he may be unconscious of anything amiss. He may be found lying insensible on the highway, or be picked up in the street as simply inebriate, and be carried to a police-station or to the hospital, or walk into an adjoining room and go to bed, or stagger to his home, and only become alive the next morning, or after the lapse of several hours, to the fact that he has sustained a grave injury. If the accident occurs to a sober individual, or to one who is only convivial, or slightly tipsy, there will be at the moment of rupture intense pain at the umbilicus or in the hypogastrium, and perhaps sickness, faintness, or complete syncope, and a feeling of something having given way within the abdomen. To quote a few instances, more especially in illustration of the last symptom, in addition to those reported by Scott, Lynn, Garry, Wilmot, Howship, and Lloyd adduced in the previous part of this paper. A stout young man of seventeen, who, fortunately, came under Mr. Syme's care, and happily recovered, experienced immediately an intense pain, with a feeling as if the bowels had protruded. His brother remarked that his clothes were distended over his belly. In Sir Prescott Hewett's collection, a woman thrown down by her husband in a scuffle, and knelt upon with great force, was immediately sensible of having sustained a severe internal injury. A woman in labour, whose case is given by Dr. John Ramsbotham, and already referred to, had a sudden pain on the right side of the navel, and a feeling of something giving way. Mr. Collis's patient, a woman, twenty-six years of age, of intemperate habits, retired to rest without emptying her bladder and got up for the purpose. Being unsuccessful, she endeavoured to get into bed again, but fell across the footboard. She felt something give way inside her, fainted, and was lifted into bed. Mr. Cusack's first patient, M. G——, aged twenty-six, a servant, who had drunk largely of whisky punch before going to the theatre, feeling a desire to void urine, attempted to leave the gallery of

the theatre, and, while doing so, fell and struck his hypogastric region against the edge of one of the benches. He felt as if his heart had burst. His second patient, E. S——, an ostler, aged thirty, who fell a height of twenty feet from the battlement of a bridge into a garden, experienced a peculiar feeling about the præcordia, as in the preceding case. Mr. Gamack's patient, an adult male of twenty-one, in good health, caught under a falling bank of earth, felt something give way in the belly. Mr. Willett's patient, a man forty-eight years of age, called up in the morning to fight another man, and in too great a hurry to give his adversary satisfaction to stay and empty his bladder, which he knew was full, felt, at the moment when he received the fatal kick, that something had given way in his abdomen. Reference to the cases in which the bladder has given way from over-distension, and which I have already quoted, will show that a similar sensation was experienced. Mr. Garry's patient felt something "suddenly jump in his belly," and Sir E. Home's patient, after an urgent desire to make water, felt a rush from the upper part and a severe pain in the region of the bladder, the desire ceasing at once.

In the majority of cases of intra-peritoneal rupture the power of locomotion is either abolished or very greatly impaired. Mr. Cusack's first patient was incapable of raising himself up, or of standing without support, and was compelled to incline his body forward. Montagu's patient stood for a few moments and then fainted. Mr. Willett's patient was seized with acute pain, was helped up, and taken into the house. McGuinness, a patient under Mr. Hamilton, of Dublin, was engaged in a fight after a brawl in a public-house; his antagonist fell on him. He got up, complained of great pain, and was carried home. Mr. Wathen's patient, a surgeon, thirty-one years of age—whose horse had fallen on him after conviviality—helped to undress himself and stood up leaning a little forward. A woman of twenty-eight, intoxicated, whose case is reported by Mr. Stokes, was unable to rise after her fall, and was carried upstairs. The following morning, when admitted into Richmond Hospital, she was barely able to walk.

Even if the sufferer be able to walk, he will, in all probability, do so slowly, painfully, in a stooping position, or with the assistance of others. Thus, Wm. Sykes, thirty-one years of age, whose case is reported by Mr. Hiley, received several kicks on the abdomen in a drunken brawl in an ale-house. He was sobered by the accident, and walked home a quarter of a mile in great agony with cries and groans, and he was compelled to walk in a stooping position. J. L. Baker, twenty-nine years of age, under Mr. Bower, fell in a scuffle, and his abdomen came in violent contact with the corner of a table. He was placed on a form, complained bitterly of pain in the abdomen, but, supported by two men, walked home, where he passed a restless night. A few have been able to walk a short distance after the injury, or on the following day. Mr. Poland's patient, John P——, aged thirty-five, stout and well-built, had been drinking, and betook himself to jumping over a stile; he succeeded

in doing so, but came violently on a heap of stones on the other side of the stile, striking his abdomen as he fell. Though suffering much, and bleeding from the wound caused by the injury, he managed to walk some thirty yards to a surgeon who tried to catheterize, but failed. The man passed a little drop of blood instead of urine that night. After thirty-six hours had elapsed he was brought to Guy's Hospital. Mr. Stapleton's patient, Charles Scarlet, twenty-two, labourer, drunk, fell from a ladder, a distance of twelve feet. He was taken to Jervis Street Hospital, Dublin, in a cab, but sent home. The following morning he walked from his lodgings in Britain Street to the hospital. Dr. McDougall states that a man came to his hospital thirty-six hours after a severe fall, walked into the out-patient room, and from thence to his bed, making all the while little complaint of pain. He died five days afterwards, and his bladder was found to be extensively ruptured, but whether through the peritoneum or not is not mentioned. Anton Graw's patient, a man of thirty-seven, thrown to the ground in a fight, and injured by some one falling on his belly, experienced intense pain. The following day he could merely reel without help and drag himself slowly along.

In five cases the power of locomotion seems to have been retained to a more remarkable degree. In his standard work on medical jurisprudence Dr. Alfred Taylor adduces, *but only on the verbal authority of a pupil*, the case of a gentleman who had been compelled to retain his urine, and had his bladder distended. He descended a staircase, fell and struck the lower part of his abdomen against a stair. The sense of fulness of his bladder ceased and he walked to a friend's house to dinner. He recounted the accident to a surgeon present, and the latter at once suspected that the bladder was ruptured. The patient died in twenty-four hours. Stephen W——, a bricklayer, aged thirty-six, after drinking with his friends at a public-house, was knocked down, while intoxicated, and run over by a cab. He was taken to the house of a surgeon in Lambeth, who dressed a slight wound in his head. After this he walked home to Pimlico, a distance of nearly two miles. Mr. Hird, who reports the case, saw him at eleven o'clock the same evening, about three hours after the accident. He found him in bed, but unable to give any account of his sensations at the time of the accident, as he had drunk to excess.

Dr. Harrison gives an extraordinary case. A man of thirty-five, intoxicated, was fighting; he was thrown down, and his antagonist fell across the lower part of his belly. He felt excessive pain in the hypogastrum. Sick and weak he rallied and walked home alone; tried to urinate, but could not. He passed a restless night, but had some sleep. He made ineffectual efforts to urinate, took some breakfast, and walked three miles to a surgeon. The catheter was introduced, and drew off six ounces of urine. He walked home again and passed two ounces of urine. On the third day he rose and began his usual labour. At noon he felt so sick that he drank some whisky and walked again to town, three miles, for

medical relief On the fourth day he still kept about and passed urine at frequent intervals, but the symptoms increased in severity. He got worse, and gradually sank eight days after the injury. The result of the post-mortem examination is noteworthy. There was an oblique fissure in the bladder an inch and a half in length, and the cavity of the pelvis was separated from that of the abdomen by agglutination of the lower intestines with the bladder. A quart of colourless urine containing shreds of lymph was found in the pelvis.

In Dr. Gillespie's case,[1] which is worthy of careful study, remarkable powers of locomotion were shown. M. M——, aged thirty-one, a tailor, was drinking in a tavern on November 29th, 1858, and had some altercation with another man. A wrestling match ensued, which ended in M. M——, being thrown, his adversary falling on the top of him. He left the tavern, and shortly afterwards fell backwards upon his nates down a flight of steps. He was very drunk, but complained of severe pain in the lower part of the belly. He was assisted by the police to the station, where he passed the night, and in the morning he walked fully half a mile to his lodgings. He was suffering much from pain in the abdomen, and was unable to pass any urine. Medical assistance was obtained in the afternoon, and urine to the extent of six or eight ounces, untinged with blood, was drawn off. During this day and the next he was confined to the house with the pain increasing in intensity, and without any further introduction of the catheter. The first night at his lodgings he was in and out of bed, and walking up and down the room, complaining of desire but inability to micturate. On December 2nd, at eight a.m., he walked up to the infirmary, and complained of retention of urine. A catheter was passed, and between five and six pints of clear normal urine were evacuated. He expressed relief and left the hospital. About two hours afterwards he returned complaining of general malaise, his countenance indicating much suffering, and his pulse rapid and thready. He was accordingly admitted as a patient. His skin was moist and cold; there was general uneasiness over the abdomen, most localized at the epigastrium; the pulse was 120, small and thready; the tongue coated at the centre with a dry red margin. In the afternoon the catheter drew off twenty ounces of high-coloured but not bloody urine. Vomiting was almost incessant throughout the day. There was little variation in the symptoms on the two following days; the vomiting, uneasiness, depression, and inability to void urine continuing, and the catheter drawing off urine almost normal in quantity and quality. On December 6th the vomiting had been much relieved by the application of a large mustard blister, but the patient had been excessively restless and slightly delirious, and there were anxiety of countenance and cold perspirations all over the body. On December 7th the patient, in a semi-

[1] "Edinburgh Medical Journal," 1859, p. 811 *et seq.*; see also p. 844 for discussion at Edinburgh Medico-Chirurgical Society.

delirious state, got up and dressed himself and signified his intention of returning home, and was with difficulty persuaded to return to bed. Before doing so he passed urine voluntarily to the extent of eight ounces. Extreme prostration speedily followed, and he died at half-past eight on the morning of December 8th. At the post-mortem the great omentum and visceral layer of the peritoneum presented numerous patches of scarlet vascularity; serous exudation was found in the pelvis, with some flakes of lymph. There was no gluing together of the intestinal coils. The bladder was contracted, being a little larger than a hen's egg. There was a vertical rent on the posterior surface an inch in length, proceeding downwards from the urachus. The opening was almost closed in consequence of a protrusion of the mucous and muscular coats. The edges of the wound in the peritoneum were thickened and infiltrated; those of the substance of the bladder presented a decidedly granulating appearance. There was a moderate submucous infiltration of blood.

Another remarkable case is recorded by Mr. Crossley.[2] A. O——, twenty-four years of age, received during a fight a blow in the hypogastric region from his antagonist's knee. He experienced a sensation of something having given way, followed by severe pain. These symptoms passing off, he walked two miles to his home, which he reached without difficulty. He tried to pass water, but failed. He sent for his medical attendant, Mr. Robinson, who introduced a full-sized gum-elastic catheter, and drew off twenty ounces of bloody urine. This was repeated twice daily up to the day of his admission to the Leicester Infirmary, November 20th, 1871. The patient walked without assistance from the infirmary door to his bed. His countenance was rather anxious; his pulse 80; his skin cold. There was a sensation of weight in the hypogastric region, but no tenderness on pressure. On percussion the area of dulness over the abdomen was increased, and there was a distinct sense of fluctuation on palpation. A silver catheter was immediately introduced, the abdominal dulness and fluctuation entirely disappearing. A gum-elastic catheter was passed night and morning. He went on well till the evening of December 1st, when, without premonitory symptoms, he was attacked with convulsions, rapidly followed by coma. Every effort was made to rouse him. A catheter was immediately introduced, and about twenty ounces of urine were drawn off, consciousness returning in about an hour. On the following day he was again attacked in a similar way, and on December 3rd he was seized with a more violent form of convulsions, and sank in three hours into a comatose state, which ended in death. An oblique laceration two inches in length was found on the posterior surface of the bladder.

A question arises in regard to the powers of locomotion exhibited in these cases, whether the bladder was ruptured through all the coats at the time of the injury, or whether a partial rupture became

[2] "Medical Times and Gazette," 1872.

complete some hours or days afterwards. Dr. Andrew Dewar, of Dumfermline, has narrated a case in which it is probable that the bladder received some damage during a scuffle, and gave way the next day, at the time of a fall, and, probably, in consequence of it. William Niblo, twenty-seven, received some blows in a drunken brawl. He assisted in unloading a vessel for an hour without complaining of any injury. He staggered home at midnight, and went to bed. He rose in the morning, twice drank spirits, and was seen wandering about in a state of apparent intoxication. About midday he fell on smooth ground, and could not get up without assistance. He was carried home and put to bed, and never rose again. Dr. Dewar thinks that the bladder was not ruptured in the scuffle, but when the patient fell; and in this view I entirely concur. The occasional occurrence of ruptures involving only the mucous and muscular coats is shown by the appearances in Gruber's case.[3] In addition to a complete intra-peritoneal rupture an inch and a half long, there was a second tear lower down, involving only the mucous and muscular tissues. Another explanation has been offered to account for Dr. Harrison's case. At the post-mortem the recto-vesical *cul-de-sac* was seen to be shut off from the general cavity of the peritoneum by adhesions between the lower intestines and the bladder, and contained a quart of colourless urine. It has been conjectured that the retention of the urine in the *cul-de-sac* would not be attended with the same immediate disturbance to the system as its diffusion through the general peritoneal cavity. This explanation, though possible, does not appear to me to be so probable as the occurrence at first of a partial rupture, afterwards becoming complete. Dr. Max Bartels alludes to the latter method of explanation, and appears to lean towards it. In Dr. Harrison's and Dr. Gillespie's cases I believe that the peritoneum did not give way for two or three days after the injuries, and that in Mr. Crossley's case the interval was much longer.

As soon as the shock, pain, and peculiar feelings occasioned by a ruptured bladder have subsided, the subject of the injury, who had previously felt an urgent call to void urine, and may have been on his way to satisfy the call, experiences, perhaps, a temporary feeling of relief. Very soon, however, he begins to be tormented with a strong and frequent desire to make water. On attempting to do so, nothing comes away; but straining may cause a few drops of blood or bloody urine to issue from the urethra. Accompanying this distressing condition, pain will be felt in the hypogastric region, or there may be constant acute pain at the umbilicus, at the upper part of the thigh or all over the body, the pain being intolerable in the erect position. Pallor and anxiety or a pinched aspect of countenance, restlessness, thirst, difficulty in movement, nausea and vomiting, depression, and quick, feeble, and irregular pulse will be the evidences of grave constitutional disturbance. In this condi-

[3] Quoted in Dr. Thorp's paper, "Dublin Quarterly Journal," vol. xlvi. p. 313. (See Appendix, Note G, p. 138, and Case XXXIX. p. 137.)

tion the patient is seen by his medical attendant, who introduces a catheter, and draws off blood, or a variable quantity of blood and urine combined, or fails to remove anything at all. The desire to micturate may not be relieved by the catheter. If the patient is not the subject of stricture, or of fracture or displacement of the pelvic bones interfering with the urethra, the catheter will pass readily enough into the empty and more or less contracted or collapsed bladder. Separation of the innominate bones at the symphysis may cause a deflection of the catheter to one or the other side. Having entered the bladder, the point of the catheter may impinge against a sound part of the viscus, and then it will be found difficult to rotate the instrument, and to depress it between the patient's thighs, but, if the rent be on the posterior wall, on withdrawing the catheter a little and altering its direction, it may suddenly slip through the rent into the peritoneal cavity, become freely movable, and withdraw, probably, a large quantity of fluid in place of the small quantity of blood, or the few ounces of blood and urine previously removed. Gross says that the point of the catheter, after entering the peritoneal cavity, may be made to move about in different directions, and even be felt by the finger across the walls of the abdomen. When the rent in the bladder is large, the end of the catheter will most likely at once pass through it, entering the urethra up to the hilt, and drawing off a large quantity of bloody urine, mixed, perhaps, with serous fluid from the peritoneum. Mr. Poland's case is instructive on this point. Two days after the accident, five ounces of bloody urine were drawn off by Mr. Poland, but six hours later Mr. Durham removed with the catheter, three quarts of bloody urine, and evidently from the abdominal cavity. So, also, in Mr. Cusack's first case. The catheter, when introduced on the second day, drew no water, but, on altering its direction with the finger in the rectum, three pints issued. In Fergusson's case, a very small quantity of bloody urine was drawn off, but shortly afterwards about 102 ounces. In one of Dupuytren's cases the catheter removed turbid urine, but when directed to the anterior superior portion, it entered to an indefinite extent, and more urine was evacuated. The amount of blood mixed with the urine is also variable. Occasionally pure blood passes, or blood-clot speedily blocks up the eyes of the catheter. Rarely the urine, though scanty, is clear. The quantity of blood in the urine diminishes steadily, and the urine will become clear by the second or third day, or, at most, be of a dull brownish-red colour, or have the appearance of coffee-grounds The quantity of urine drawn on occasions subsequent to the first introduction will vary, according to the frequency of catheterizing and the position of the extremity of the instrument. A catheter confined to the cavity of a ruptured bladder may not remove any urine at all, but if it removes any, it will not remove more than a few ounces—rarely, I think, more than four or six at the most; but whenever it traverses the rent, half a pint to thirty ounces, and even more, fluid may be expected to issue. The character of the stream

issuing from the catheter is important. As the contraction of the muscular coats of the bladder no longer assists the flow, and as the abdominal muscles will probably be exerted only for the purposes of respiration, the urine will either well out gradually, and run down by the side of the catheter, come out almost *guttatim*, or pass from the instrument in an intermittent stream during the periods either of inspiration or of expiration. It may be necessary for the medical attendant to compress the abdomen before he obtains any urine, but compression does not always assist the flow. As a general rule, the patient from the first is unable to pass water, and may continue to display this inability to the end. In not a few cases water has been passed voluntarily by the patient, either at the outset, or at some period during the progress of the case. Mr. Hiley's patient passed water several times in a stream at five a.m. on the third day, and at ten a.m. made water, which ran down to his knees. This was accompanied by an evident improvement in the patient's condition. The pain abated, pressure on the abdomen could be borne, and he could turn over in bed without pain; vomiting ceased, his spirits revived, and a little later he voided three ounces of urine. The next day he relapsed, and speedily sank. One of Mr. Ellis's patients passed a little water on the second and third days. Mr. Hey's patient, a female, discharged two or three ounces of urine on the second day, and passed urine in drops on the third days. One of Dr. Ramsbotham's patients passed a small quantity of urine on the second day. Dr. Lente's patient, a lad of eighteen, is said to have discharged urine two feet from the meatus on the second day. Mr. Drake's patient passed water on the third day, and Mr. Bower's patient passed one and a half ounces of water voluntarily on the second day. On the first day Mr. Wathen's patient got on a night chair and passed one ounce of bloody urine, and on the ninth day while at stool he passed some ounces in a regular stream. In Mr. Le Gros Clark's case on the sixth day, and in my second case on the third and fourth days, the patient rallied and passed water freely himself. In Mr. Hird's case two or three tablespoonfuls of urine dribbled away on the evening of the accident. In Surgeon-Major Hamilton's case of transverse intra-peritoneal rent at the anterior and upper part of the bladder, the patient suffered from incontinence of urine during some hours on the first day, and passed water twice naturally on the fifth day. Dr. Fix's patient, a female, passed urine often in small quantities. All the foregoing were intra-peritoneal ruptures. A few of the patients with extra-peritoneal ruptures passed some blood when trying to make water; one passed a spoonful of urine, another half a pint on the second day; a female passed a small quantity mixed with blood, whilst half a pint dribbled away, and in the course of her illness she voluntarily passed urine more than once; another patient is said to have made water on the second day with tolerable freedom. In my fourth case, where the rupture was situated just above the prostate, there was at first incontinence of urine, and in

a recent case of idiopathic rupture behind the prostate, brought before the Hunterian Society by Mr. Tay, urine seems to have dribbled rather freely from the urethra. In Dr. Kneeland's case, the patient, on the third day, passed water standing with his feet on the floor, his hips resting against the edge of the bed, his body leaning forward, and his hands pressed on the abdomen. Drawing in a full breath and bearing down forcibly urine started in a full stream. When he expired the stream would stop, and on making a full inspiration would again start in a full stream. He complained of it hurting him over the bowels and being very hard work.

The second case of rupture of the bladder consequent on stricture of the urethra, reported by Sir E. Home, presents some remarkable features. The patient was an officer in the navy, about forty years of age, who had been troubled with stricture in the urethra for ten or twelve years, and had been treated with caustic. No bougie could be passed, and strangury followed each application of the caustic. On the subsidence of the last attack of strangury, he made small quantities of water with great difficulty, but none passed from eleven o'clock one night till the following morning, when Sir E. Home was called. A catgut bougie was passed, and was grasped by the stricture. At one the next morning the patient had a feeling of something giving way internally, and on examination it was found that the bladder must have burst, and emptied itself of its contents, since it was not to be felt in the rectum by the finger. There was great pain on the left side, shooting down to the testicles and up to the loins. Occasionally he was in agony. He took fifty drops of laudanum every four hours. The pulse was 130. On the second day there were constant vomiting and purging, and all the water came away on cloths from the penis. Fluctuation was apparent on pressure on the left side. He continued to take his opium, but it seldom remained on his stomach. On the third day the patient passed a good deal of urine on cloths. On the fourth he was delirious, and broke out of the house in a frenzy, wounded a woman in the street, and called the watch, believing himself hurt by every one who came near. In six hours he became more calm and manageable, but he experienced an internal feeling of distress connected with the bladder, and crumpled himself up in different ways, in hopes of removing it, and in these attitudes got more water to pass, and voided the contents of the bowels, which had been before relieved by a clyster; the urine came away in a small stream, and more than half a pint was saved. On the fifth day he became less irritable, apparently because he passed his urine more freely and in greater quantity at a time. In the course of the day a pint and a half was saved in a urinal; and his pulse became fuller and less frequent. In the evening the bladder was much distended, and it was proposed to puncture it per anum. At seven a.m. on the following, or the sixth, day the surgeon punctured the bladder, and drew off a quart of urine. After this, the patient became composed and tranquil, and his bowels were relieved freely. At

four p.m. he was attacked with bilious vomiting, and displayed great restlessness and anxiety. The sense of dying was strongly expressed on his countenance; his pulse was weak, frequent, and intermitting; and at two a.m. on the following morning he died, in extreme agony from feelings which he could not describe. On opening the body, about a pint of urine was found in the abdominal cavity. On looking at the peritoneal surface of the bladder, there was a tumour on the left side, under it, and an orifice through the peritoneum, opening into the abdomen, an inch long. The tumour was nearly the size of the clenched fist, and lay between the groin and the fundus of the bladder, which contained a pint of water. On the left side, midway between the fundus and the prostate, there was a rent two inches long, leading into the tumour above mentioned, which, when opened into, contained urine and coagulable lymph. Sir E. Home observes, "From these appearances, it is reasonable to believe that the urine did not at first escape beyond the cellular membrane, bringing on the nervous affection and irritation upon the external surface of the peritoneum; afterwards the urine escaped into the tumour, the peritoneum gave way, and the urine got into the belly; but when inflammation took place the urine was wholly confined to the bladder, so as to admit of a quart being drawn by the operation."

The primary symptoms which have been enumerated, pain in the abdomen, a feeling of something having given way within that cavity, difficulty in standing and walking, a certain amount of shock or depression, temporary relief to the desire to make water followed by a more urgent desire but inability to do so, and the results of catheterism in bringing away blood or bloody urine, or nothing whatever, are common both to the intra- and extra-peritoneal ruptures. Here, however, the two classes of cases diverge from each other. In the intra-peritoneal ruptures the symptoms are decidedly more severe. The shock at first is greater, and the symptoms of peritonitis, as a rule, set in within a few hours and increase in severity. A surgeon called to a case of the kind, having noted the history, will at once proceed to an examination of the patient's abdomen. Only in a severe injury, or one occasioned by great force and accompanied by other lesions, is he likely to observe any external mark of violence. "No sign of external injury" is a frequent note. But he will find most probably that the abdomen is swollen or prominent in front, yielding perhaps the sense of fluctuation, tender on the slightest pressure, and tympanitic; but in the hypogastric region for a variable distance, and sometimes extending toward one or both of the iliac fossæ, the percussion note is likely to be dull, more especially in the erect position. There may even be a more or less defined and fluctuating swelling resembling the bladder between the umbilicus and the pubes, due, I believe, to the circumstance that the urine is temporarily confined by the disposition of the coils of intestine. A tumour of this kind was noticed in the case under Mr. Spence, who brings forward several arguments to show that the tumour

was really formed by the bladder itself, distended with urine which had been confined accidentally within the organ owing to the peculiar character of the rent, and to temporary adhesion or occlusion of its edges. That the urine was really outside the bladder is proved, I think, by the details of other cases in which a swelling of the kind has been noticed. In Dr. Ramsbotham's second case of rupture in a woman in labour, it is stated that no vesical tumour was perceptible, but an irregularity was observed on the uterine tumour like a bent knee or elbow. In Mr. Partridge's case, which was complicated with stricture, there was a tumour in the region of the bladder, and, under chloroform, twelve ounces of urine were drawn off. Mr. Partridge was sent for on the second day after the admission of the patient because the house-surgeon could not pass the catheter. He cut into the bladder and found it empty, and observed that the catheter had evidently been passed through the rent. In a female under Mr. Stokes there was a large circumscribed tumour, very much resembling the gravid uterus, and very dull on percussion, filling the hypogastrium, and extending upwards to within an inch of the umbilicus. The woman had not passed water since the receipt of the accident ; yet, when the catheter was introduced, it drew off only one ounce of urine, slightly tinged with blood, which trickled slowly through the catheter. The tumour increased in size, and was larger the next day, but on the third day it is noted that the tumour was larger, but no longer circumscribed, showing that the urine was gradually becoming diffused.

In the case under Mr. Heath, who made a very careful examination of the abdomen, the following particulars were observed :— "The abdomen is prominent in front ; no bulging in the flanks ; it is firm and tense to the feel, and very painful on the slightest pressure, notably over the hypogastrium. There is dulness above the pubes to a point midway between the pubes and umbilicus. The left flank is dull on percussion ; the right resonant. There is no bruising of the back, but there is tenderness in the left lumbar region." The dulness was evidently the result of the effused urine, for directly an incision was made through the anterior abdominal wall, a gush of urine followed. In one case (Wathen) it was found that dulness, which had been perceptible in the right flank, had been due to the presence of omentum in mass. Examination per rectum will elicit tenderness and pain, and in some cases the finger may be able to detect a collection of fluid in the recto-vesical *cul-de-sac*. I could not feel this in either of my own cases, and Mr. Spence, whose attention was particularly directed to this point, found, at the post-mortem, that a little turbid urinous fluid, and *some folds of small intestine* occupied the inferior *cul-de-sac* of the peritoneum, but no fluctuation or distension could be detected, on examination with the finger, in the rectum.

In Mr. Hird's case the collection was readily demonstrated. The abdomen of the patient was distended, but did not evince the circumscribed form observable in cases of distended bladder from

retention. A full-sized catheter was introduced, and withdrew two or three tablespoonfuls of water only. The bladder was contracted, and greatly opposed the moving of the catheter On examination *per rectum*, Mr. Hird could distinctly feel a swelling between the bladder and intestine, yielding to pressure, and returning to its original size.

In a typical case of intra-peritoneal rupture the patient will exhibit all the symptoms of peritonitis, in addition to those proper to the lesion itself. He will lie in bed, with his knees drawn up, or be propped up with pillows, to relax the abdominal muscles. He will have a pinched, anxious, haggard, and even ghastly expression of countenance, look pale and anæmic, and be tormented with a frequent or constant desire to pass water, leading him to make many ineffectual efforts to empty his bladder. He will suffer from thirst, and sooner or later be troubled with vomiting, bringing up a greenish yellow fluid, and even the water which he had drunk copiously to quench his thirst. Vomiting is sometimes present at the outset, sometimes sets in on the second day, or appears towards the termination of the case. Usually it increases in urgency, from its appearance till death ensues. With vomiting, hiccough is frequently associated. The pulse will be small, feeble, irregular, and rapid, ranging between 90 and 130 degrees. The temperature will probably be a little over the normal. The respirations will be hurried, accompanied, perhaps, by dyspnœa, or a feeling of oppression at the chest. The abdomen will be tense, tender, tympanitic above, dull, and possibly fluctuating below. Occasionally the agony will be extreme, the slightest touch may cause cries of pain. The tongue will be furred and dry, and the bowels confined. Occasionally there may be rolling of the intestines and distressing tenesmus. Purgative medicines will probably produce fœtid stools, and enemata may give exit to flatus, occasioning relief to the feeling of distension of the belly. Unless stupefied with alcohol, the patient may be expected to pass the first night after the injury in much torture, vainly endeavouring to obtain rest and sleep. Throughout the illness there will be marked restlessness and insomnia. As the case proceeds, the symptoms become aggravated, the swelling and tension of the abdomen increase; clammy sweats appear on the skin; the hiccough and vomiting become more urgent and distressing; the pain is intolerable; the countenance sunken and ghastly; the voice low and feeble; and the patient may sink into a state of collapse, or into a typhoid condition, attended with delirium and coma. In one of Mr. Cusack's cases, on the sixth day there were frequent involuntary seminal emissions. Not infrequently, after a few days, especially about the fifth or sixth, if the patient survive so long, there are marked signs of amendment. Nature has commenced the repair of the rent in the bladder, and the edges of the rent have become agglutinated, or blocked by the sigmoid flexure, or a coil of small intestine. The patient passes water voluntarily, takes food without rejecting it, sits up in bed, is free from pain and comparatively

cheerful. An error in diet, or a purgative acting on the bowel, or the course of the disease itself, dispels the deceitful improvement; the former symptoms recur, and the patient may expire on the very day which follows the signs of hopefulness and recovery. In one or two cases, stercoraceous vomiting has occurred; and in a case at St. Bartholomew's Hospital, a coil of intestine entered the rent in the bladder, and gave rise to symptoms of intestinal obstruction which masked the symptoms of rupture of the bladder.

In the extra-peritoneal ruptures the symptoms of peritonitis will not be present unless the peritoneum has been injured by the violence which occasioned the rupture of the bladder, or becomes involved secondarily, either by contact with urine effused under it, or in the course of the diffuse inflammation and sloughing of the sub-peritoneal connective tissue and fasciæ consequent upon extravasation of urine. The general symptoms, therefore, will be more subdued, but sooner or later there will be marked depression and evidence of septicæmia. Chills, shivering, or actual rigors, clammy sweats, pale, earthy countenance, accelerated and feeble pulse, variable temperature, nausea and occasional vomiting, coldness of extremities, and muttering delirium will supervene, and the patient will succumb in a state of extreme prostration. In regard to the local symptoms, a less amount of urine may be expected to follow the introduction of the catheter than in the intra-peritoneal ruptures, as the point of the catheter will not readily enter the rent in the bladder. Nevertheless, manipulation with the finger in the rectum may occasionally succeed in causing the end of the catheter to pass through the rent into a pouch outside the bladder containing urine, extravasated blood, and the products of inflammation. Thus in Mr. Walford's case, the rent in the bladder was situated outside the right vesicula seminalis leading into a cavity containing a quart of urine and blood clot. During life a large catheter, introduced into the bladder, drew off urine and blood. With a little manipulation, the point of the catheter could be passed through the rent in the viscus. The situation of the collection will vary according to the position of the opening in the bladder. When the rent is in front, the urine either forms a circumscribed collection outside and anteriorly to the bladder, occasioning marked dulness on percussion, or it becomes widely diffused, mounting up towards the umbilicus between the peritoneum and the abdominal muscles, or passing into the iliac fossæ, or through the obturator foramina and the inguinal and femoral canals into the scrotum and thigh. When the opening is behind the prostate the fluid will ascend into one or other of the iliac fossæ. Wherever extravasation occurs, it sets up inflammation of the connective tissue and fasciæ, followed in due time by suppuration and sloughing. Occasionally the urine is collected in a kind of sacculus, the walls of which are composed of connective tissue matted by lymph, simulating the appearance of a lining membrane to the adventitious cavity.

(B) *Diagnosis.*

A thorough acquaintance with the symptoms resulting from a ruptured bladder, and with the distinctive features of the intra-peritoneal and the extra-peritoneal rupture, ought to lead the surgeon to form a correct diagnosis in a typical case. But the frequency with which the practitioner encounters difficulty and doubt, overlooks the lesion, or mistakes for it a contusion of the bladder, or some other abdominal injury, proves that the diagnosis is not the easy matter depicted in some of the standard treatises on surgery. The diagnosis will be especially obscure if the surgeon cannot obtain a satisfactory history of the patient before coming under his care, and in cases in which the symptoms are masked or slight, and in which possibly the patient has passed urine voluntarily, or in which it flows from the urethra. The surgeon needs to be constantly on the alert, and to have his mind directed to the possibility of rupture, not only where there has been an abdominal injury, but in cases of retention from stricture, or from hypertrophy of the prostate gland, or from any other cause, and where the patient comes under his care stupefied with alcohol. In extra-peritoneal ruptures doubt will soon be removed by the occurrence of extravasation of urine; but in the intra-peritoneal ruptures I believe that the best local test is the possibility of passing the point of a long catheter through the rent into the peritoneal cavity, allowing free movement, and drawing off a large quantity of fluid. When contrasted with a prior limitation of rotation and of depression, and the removal of blood or a very small quantity of bloody urine after the instrument has undoubtedly passed the prostate gland, the sudden slipping of the catheter up to the hilt in the urethra, with the effects stated, is extremely significant. Mr. Heath injected warm water through the catheter, and the stream was distinctly felt by the patient in the groins and abdomen. This means of diagnosis might be used where the surgeon could not make a diagnosis without it, but it tends to diffuse the urine already present in the peritoneal cavity, and it is probable that the warm water itself may exercise an injurious influence upon the peritoneum. On the other hand, if the bladder is sound, injection of fluid ought to furnish decisive evidence by causing the formation of a circumscribed tumour, which disappears on catheterism, with recovery of the fluid. It is scarcely possible to determine which is the more important mistake—to overlook a rupture of the bladder, and therefore fail to apply surgical measures promptly, or to mistake some other lesion for the injury, and subject the patient to an unnecessary and dangerous interference. There is another great disadvantage in mistaking some other form of abdominal injury for a ruptured bladder, or an extra-peritoneal or sub-peritoneal for an intra-peritoneal rent. The case is published with a flourish, and the treatment pursued is quoted as well worthy of adoption, thus leading surgeons to apply to other cases means either prejudicial or inadequate. In recent years there has been a serious increase in the number of reported cases of recovery after

an alleged rupture of the urinary bladder. Several are said to have been ruptures into the peritoneal cavity, and it would be quite impossible to decide from them what is the correct treatment of an intra-peritoneal rupture, inasmuch as expectancy and operative measures have been alike successful. As it is extremely important to arrive at a right conclusion in this matter, it will be useful to weigh critically the claims of the cases of asserted recovery; but before doing so a few general observations are necessary.

1. In the first place, before accepting any case as a case of recovery after simple uncomplicated rupture of the bladder into the peritoneal cavity, it is desirable to have clear evidence that the bladder was full at the time of the accident. A distended bladder can scarcely escape from a severe blow or contusion of the abdomen; but a bladder empty, or nearly so, and under the protection of the pelvic bones, may elude the greatest violence. A bladder containing some ounces of urine is more likely to be contused than ruptured by violence, as the coats of the organ are not upon the stretch, and the bladder is not in a fixed position.

2. Secondly, it must be borne in mind that the bladder may have been contused or dragged backwards; that blood may appear in the urine for some days after the injury; that the patient may be unable to micturate, though experiencing a strong desire to do so; and that there may be some difficulty in the passage of the catheter. A case of this kind I have had under my care at the London Hospital. After a severe contusion of the abdomen there were many of the signs of rupture of the bladder—blood drawn off with the catheter; bloody urine for several days; tenderness and swelling of the abdomen; and some of the symptoms of peritonitis. A very severe case occurred to Mr. Le Gros Clark. The patient was a man over whom an omnibus-wheel had passed. "The abdomen was severely contused, and he was in a state of collapse. Bloody urine was drawn off. On the following day he had severe pain in the belly and back. Fresh blood was mingled with the urine, and there was a noticeable variation in the temperature of the stream. Constant sickness was present. On the third day urine flowed through the catheter slowly, but free from blood, and was not accelerated by pressure on the abdomen. On the fifth day there was constant abdominal pain; pressure excited vomiting; and the abdomen was distended. He was delirious at night. On the seventh day it was evident that the distension was partly due to effusion; he said his belly felt like a furnace. During the succeeding week the symptoms somewhat abated; the urine was abundant and clear. On the twentieth day the fluctuation in the distended abdomen was more distinct, and he suffered from frequent sharp pain; the urine was albuminous; the tension of the abdomen diminishing. On the thirty-first day there was a sensation communicated to the hand as of some solid body in the lower part of the abdomen gliding away under pressure; the tenderness had ceased. In six weeks he was well." With commendable hesitation Mr. Le Gros Clark observes:—"The nature of the lesion is

conjectural, but for some days the symptoms were such as to induce me to suspect injury to the bladder, and the nature of the accident rendered it not improbable that such was the fact. Indeed, the favourable issue of the case alone points to an opposite conclusion. But is that conclusion of necessity justified by the result? I do not feel sure that it is." That the bladder was contused is very probable, unless the blood came from the kidney. The latter organ may have been bruised, for the wheel took a direction from the right groin upwards and outwards. That the bladder was completely ruptured I think is disproved by the absence of any evidence in the record of the case that the organ contained any considerable quantity of urine at the time of the accident, and absence of the typical primary symptoms, notably, of the distressing desire and inability to micturate, and of the peculiar results obtainable by manipulation after the passage of the catheter. Moreover, the quantity of urine passed does not appear to have been at any time defective. A more complete record of the case would have been desirable, but Mr. Le Gros Clark's philosophic caution is worthy of more general imitation.

3. In the third place, it may be affirmed that difficulty experienced in drawing off a patient's water, and the necessity for altering the direction of the catheter, or the position of the patient, &c., before succeeding, cannot be taken as conclusive evidence of a rupture of the bladder. It happens to every surgeon to meet with impediments to complete entrance into the bladder, and to removal of urine, other than enlargement of the prostate gland. A blocked catheter, hitching in a fold of mucous membrane of the bladder, and, I believe, against a swollen veru-montanum, perhaps the entrance of the point into the sinus pocularis, a false passage—displacement of the bladder or effusion of blood, may all come into play.

4. Fourthly, it must be recollected that after a severe abdominal injury there may be temporary suppression of urine or a considerable diminution in the amount excreted by the kidneys. In his article on rupture of the bladder in the "System of Surgery," Mr. Birkett remarks, "The surgeon should remember that the secretion of urine would be lessened and the quantity becomes very small indeed, as generally occurs in collapse and peritonitis." Dr. Roberts also remarks, "Suppression is a common attendant on the shock and collapse following serious internal injuries such as rupture of the bowels or of the liver, spleen, or uterus." The sympathy between the kidneys and the rest of the urinary apparatus is too well known to surgeons to require illustration.

5. Fifthly, in judging of the amount of urine contained in the bladder in any particular case, ordinary physiological principles must be applied. When no fluid has been drunk and the cutaneous functions are active, hours may elapse without urine being secreted in any noticeable quantity. On the other hand when large quantities of fluid are taken in a short space of time, the flow may be very rapid. Dr. Roberts says, "There is very great irregularity in the flow of urine from hour to hour, as the conditions of its separation vary. After prolonged fasting the urine may sink to

two and a half drachms per hour; during sleep likewise the urine flows slowly—at the rate of about half an ounce per hour; but after meals it rises to two or three ounces, and after drinking abundantly on an empty stomach I have seen twenty-six and a half ounces secreted in an hour; so that the stream of urine may run eighty-five times stronger at one time than another."[4] Very precise statements are necessary to establish the genuineness of cases brought forward as instances of recovery after rupture of the urinary bladder into the peritoneal cavity. The amount of urine necessary to bring the bladder out of the pelvis cannot be stated absolutely, for it will vary according to the age, sex, and condition of the patient. My observations on this point have not been many, but I should estimate the average quantity necessary to bring the upper surface of the bladder on a level with the brim of the pelvis at about a pint. In a lad of seventeen with fæces in the rectum, the bladder required fifteen ounces to make it rise to this level. With a pint in the bladder the organ projected about an inch above the brim, and with two pints it reached to a point midway between the umbilicus and pubes, and some very hard blows were administered to it without causing rupture. In a female seventy years of age, a pint was quite insufficient to elevate the bladder above the pubes, and in both instances the bladder was freely moveable and more or less flaccid, giving me the impression that violence applied over the hypogastrium, whilst the bladder remained in that condition, would be more likely to contuse than rupture the viscus.

6. Sixthly, there is, as it seems to me, an erroneous opinion prevalent that the peritoneum often tolerates the presence of pent-up urine. At the discussion on Mr. Heath's case at the Medico-Chirurgical Society, my second case was mentioned as an illustration. As it happened, no case could more completely show the exact opposite of tolerance of the presence of urine by the peritoneum, both locally and constitutionally. With the exception of a brief interval of apparent improvement on the fourth day, the patient was in a most distressing condition throughout, with restlessness, wakefulness, vomiting, and pain. The peritonitis was intense, and lymph was found in abundance coating the intestine and bladder.

The idea of tolerance seems to have originated partly from the fact that post-mortem examinations of cases of ruptured bladder sometimes detect very slight, if any, traces of peritonitis, and partly from cases which appear to indicate the ability of the peritoneum to absorb urine effused into its cavity. The basis will not support the superstructure. For, if the history and progress of the cases in which pathological peritonitis was absent be examined, all the symptoms of intense irritation and inflammation of the peritoneum will be found, and the issue was death. The presence or absence of lymph as evidence of inflammation and irritation, or the contrary, is little to the purpose. Purulent col-

[4] "On Urinary and Renal Diseases," p. 19.

lections, or serous exudation, may take the place of lymph. In Mr. Spence's case, on opening the abdomen, the large intestine was found contracted, the small intestines were rather more congested than naturally, but the peritoneum presented the usual smooth, glistening appearance. There was no marked vascularity, either of the parietal or visceral peritoneum; its surfaces seemed more bedewed with serous secretion than usual, although this did not amount to serous effusion. There were no adhesions, and only a very few minute flakes of lymph towards the epigastric region. In many cases abundance of lymph is effused, gluing together the coils of intestine, and on removing any fluid that may have gravitated into the pelvic cavity the peritoneum lining it and covering the rectum and bladder will sometimes be found coated with lymph. The edges of the rent in the bladder have been found adherent to the rectum in one or two cases, and in others to small intestine, omentum, or the sigmoid flexure. In one of Dupuytren's cases there were adhesions between the bladder and the abdominal wall, whilst the bladder and adjacent viscera were all agglutinated, forming an organized pouch which circumscribed the urine and prevented further effusion. Out of thirty intra-peritoneal ruptures, Dr. Stephen Smith notes that marks of inflammation were found in twenty-seven, and were absent in three. Out of sixty cases in my list in which the post-mortem appearances are given clearly, the marks of peritonitis were strongly developed in thirty-nine, slight in twelve, and absent in nine. Of the nine cases, one was an insane patient, four died early—that is, within two or three days—one died in four and a half days, another in five, one on the seventh day, and the other on the eighth day. Some allowance must certainly be made for errors in observation, for in one of the cases in which it is stated that there were no signs of peritonitis a patch of lymph was seen over the bladder. Again, in the discussion at the Medico-Chirurgical Society of Edinburgh on Dr. Gillespie's case, one of the speakers described it as almost unique as regarded the absence of peritonitis; but if the account of the post-mortem examination be consulted, it will be seen that, though the coils of intestine were not glued together, there was plenty of turbid, flaky serum in the dependent portions of the peritoneal cavity, and there were numerous patches of bright vascularity on the visceral and omental layers of peritoneum. And here I may say, in passing, that I include under apparent errors in observation such statements as are made in the reports of two American cases concerning the *disappearance of the bladder*. In Dr. Kneeland's [5] case

[5] "New York Journal of Medicine," March, 1851. This case gave rise to an action against the man who had injured the patient, and some curious evidence was given. Medical witnesses for the defence averred that a man with a ruptured bladder could not make water, and that two quarts of urine could not have been obtained at a time unless the patient had been tapped. With more truth it was urged that probably the bladder had not been found at all, that the bladder collapsed after death would not have been noticed *unless it was looked for*, and that if gangrened it would have turned black, but would all remain *in situ*.

of extra-peritoneal rupture "no part of the bladder was found except the neck, to which adhered shreds of softened membrane in which a blood-vessel was observed, the ureters terminating in a pulpy mass in the pelvic cavity." Dr. Kneeland's patient died on the seventh day. Dr. Pendleton's[6] case is very extraordinary. A boy of seven, with his bladder distended, was trod upon, and was not considered injured till twenty-four hours afterwards. He died on the fourth day. Three gallons of fluid were found in the abdomen with pus in the pelvic cavity. There was *no appearance of the bladder*. Doubtless it was merely strongly contracted, lying concealed deep in the pelvis in front of the peritoneum; whilst in Dr. Kneeland's case, I imagine that the sloughy and infiltrated areolar tissue in the neighbourhood of the bladder was taken for the bladder itself, and that the so-called neck of the bladder was the actual bladder contracted. To support this view, I refer to a case of a man of thirty, who was under Mr. (now Sir) Spencer Wells.[7] He fell from a hammock, and died on the sixth day. At the post-mortem it was seen that the tissues beneath the superficial fascia of the abdomen were dark coloured and softened and gangrenous, exuding bloody serum with urinous odour. The cellular tissue round the bladder was in the same condition. The peritoneum was entire, but pushed upwards from the anterior surface of the rectum, and from the posterior and superior surfaces of the bladder, forming a large cavity with coagulated blood and urine, at the bottom of which cavity was the bladder, having a rent one and a half inches long in the anterior wall. The edges of the rent were red and hard.

The majority of the cases in which there was only slight peritonitis died within three days, but Mr. Spence's case did not terminate till the fifth day, and Mr. Ellis's lasted fifteen days. Mr. Spence, in commenting on this matter, observes: "When we recollect the amount of organic changes, such as extreme and general vascularity of the serous surface, the effusion of turbid serum and masses of lymph, and the matting together of the viscera, which usually follow the escape of even a small quantity of the contents of the intestines in cases of minute perforation, and where the fatal result generally occurs more rapidly, or in cases where a comparatively small quantity of urine is extravasated into the sub-peritoneal cellular tissue, it seems to me that the absence of such appearances in this and some other similar cases recorded, can only be accounted for on the supposition that the extremely destructive character of the extravasated urine in large quantity, and in immediate contact with the peritoneal surface, may so depress the vital powers as to prevent the formation of the ordinary inflammatory products; a condition, however, somewhat difficult to reconcile with the acute nature of the symptoms during life, and the period intervening between the receipt of the injury and its fatal termination."

[6] "Charleston Medical Journal," vol. iv., quoted by Stephen Smith.
[7] "London Medical Gazette," Aug., 1845.

Evidently the tolerance of urine by the peritoneum must be judged, not merely by the effusion of lymph, but by the local and general symptoms and by the issue of the case. If the intrusion of urine into the peritoneum produces intense pain, tenderness, and distension of the abdomen, and if these symptoms are accompanied by constant vomiting, restlessness, a sunken, anxious countenance, altered temperature, feeble pulse, hurried respiration, clammy sweats, and intense prostration terminating in death, I cannot understand why it should be affirmed that the peritoneum tolerates the presence of urine, because after death it is found to have retained its smooth, glistening aspect, and to be free from undue vascularity, adhesions, and lymph. That the peritoneum may absorb urine poured into its cavity I do not doubt, but careful examination of the post-mortem records, induces me to think that this absorption is usually slight. The absence of any considerable quantity of urine in some of the cases is explained by the withdrawal of the fluid by catheterism of the peritoneum through the rent in the bladder, in others by its diffusion through the peritoneal cavity so that its actual quantity was insufficiently estimated. Many cases show abundance of urine in the cavity for the length of survival. To quote only one instance out of many. In Mr. Ellis's second case, which terminated on the fifteenth day, two or three gallons of pale urinous fluid were found in the abdomen, allowing for the accumulation of a pint and a half a day in addition to the amount drawn off with the catheter.

But even if urine be absorbed by the peritoneum in large quantity, as conjectured by Solly, Le Gros Clark, Max Bartels, and others, I entertain very little doubt that such absorption must exercise a most depressing influence upon the system of the patient in whom the absorption occurs. This is not denied even by some of the advocates of tolerance. Thus, in his lectures "On the Surgical Disorders of the Urinary Organs" (p. 318), Mr. Reginald Harrison observes: "There is good reason for believing that the peritoneal cavity is more tolerant of the presence of healthy urine than at first we might be inclined to suppose. In fact, I would go further, and say that, in these cases the fatal peritonitis set up is not due so much to the entrance of healthy urine within the limits of an uninjured peritoneum, as to the decomposition of urine which follows its confinement by, or even contact with, tissues more or less disintegrated by violence. Menzel's experiments (*Wien Med. Wochenschrift*, Nos. 81—85, 1869), are confirmatory of this view, as they demonstrate that healthy urine does not in itself cause destruction, and that its effects on the tissues are innocuous, so long as an escape is provided for it." Mr. Harrison then adduces Mr. Crossley's case, already quoted, as one in which the patient was almost within the limits of recovery, and observes that the patient "was poisoned by his own urea before nature had time to provide some compensating action by which it could have been got rid of. Such instances seem to show that if no extensive damage is done to the structures of the abdomen, if

the urine that finds its way into the cavity of the peritoneum is not largely contaminated with blood, or other source of putrefaction; and if escape, as by catheterism, is provided for urine so effused, serious peritonitis is not necessarily provoked. In the majority of cases of intra-peritoneal rupture of the bladder one or other or all of these conditions are usually absent. The urine, under such circumstances, largely mixed with blood, decomposes and gives rise to that rapid and destructive inflammation which, in spite of all treatment, brings these cases to a fatal termination in the course of a few days." In short, the subject of an intra-peritoneal rupture of the urinary bladder is placed between two fires—either he falls a victim to an intense peritonitis, or he succumbs to urinary intoxication—and the idea of tolerance disappears, for however tolerant the peritoneum may occasionally appear, intolerance is plainly exhibited by the system of the patient. Nor is urine tolerated by the areolar tissue, be it the urine of the infant or the urine of the adult. Both alike when penned up in the meshes of the tissue will set up intense inflammation, suppuration, and sloughing, and I look with distrust upon statements which would involve any opposite conclusion. I must not, however, pass over an important and interesting observation made by the author just quoted, concerning the innocuous character of urine deficient in its organic solids. Mr. Harrison says: "As bearing upon what has been said about the decomposition of urea as a cause of alkaline urine, I may mention a case which I saw some little time ago which much interested me. It was one of stricture, with extravasation of urine into the scrotum, occurring in a person suffering from Bright's disease of the kidneys. Though the extravasation had come on suddenly, and had existed for twenty-four hours unrelieved, there were no signs of acute inflammatory action and commencing gangrene, such as are usually expected. However, the tension being considerable, I incised the parts involved in the extravasation. As the fluid escaped from the incisions, I noticed that it had not that strong ammoniacal odour which is so perceptible in such cases. Subsequently I treated the stricture, which was exceedingly tight, and for some time kept in abeyance the more threatening urinary symptoms. I was somewhat puzzled for an explanation, as I felt sure that the case was one of extravasation, and not of acute scrotal œdema. How was it, then, that extravasated urine failed to create gangrene? I collected some of the urine as it trickled through the wound, and compared it with some subsequently drawn off by the catheter. I found them identical, and in both there was almost a complete absence of urea. This, then, to my mind, solved the mystery, and explained that as there was no urea to decompose, there was no source for the production of the ammonia by which the destruction of tissues in connexion with extravasated normal urine is effected. By the absence of urea the urine was rendered chemically harmless to the tissues with which it came in contact." (*Op. cit.*, p. 51.)

PART III.

REPORTED CASES OF RECOVERY.

THE reported cases of recovery, after rupture of the urinary bladder, with which I am acquainted, are thirty-eight in number, and may be arranged as follows :—

1. *Partial or sub-peritoneal ruptures;* one case, under Mr. Keal.
2. *Extra-peritoneal ruptures.*
   (a) *Ruptures into the vagina;* four cases, under Wilkinson, Earle,[1] a friend of Dr. Blundell's,[2] and Fritsch, respectively.
   (b) *Ruptures into the rectum;* two cases, under Ward and Call, respectively.
   (c) *Perforations by splinters of bone;* four cases, under Eve, Astier, Townsend, and Thompson, respectively.
   (d) *Ruptures into the perivesical connective tissue;* eighteen cases, under Syme, Porter, Walker, Padley, Rose, Max Bartels, Berner, Jeanmaire, Williams, Brown, Durham, Sacerdoti, Denonvilliers, Bell (two cases), Tomkins, Paget, and Morris. In connexion with these cases I shall relate a case of uncertain origin which came under my own care at a late stage.
3. *Intra-peritoneal ruptures;* eight cases, reported respectively by Walter, Le Gros Clark, Thorp, Erskine Mason, McDougall (two cases), Morris, and Chaldecott.

A second case under Dr. Erskine Mason has been reported, but I have not seen the particulars and do not know whether it was intra-peritoneal or extra-peritoneal. (See Note G, p. 123.)

These groups will be taken seriatim.

Mr. Keal's[3] case was modestly reported as a "supposed rupture of the inner coats of the bladder without injury to the investing peritoneum." The patient was a man twenty-two years of age, suffering from stricture after gonorrhœa. He was knocked down one Saturday by a horse, which fell on the lower part of his abdomen. He felt pain soon afterwards in the pubic region, accompanied with a more frequent desire to pass his urine, which he accomplished with no more than the ordinary difficulty. In about eight hours after the injury the difficulty increased, and soon retention became complete. Up to that period there had been no discoloration of the urine. Retention continued till Monday

[1] *Lancet*, June 27th, 1829.
[2] Lectures, *Lancet*, Feb. 28th, 1829, p. 677.
[3] "London Medical Gazette," 1836.

evening, when he passed a moderate quantity, which relieved him from pain; and he slept from ten till two. On awaking he had much pain, with extreme desire to make water. His medical attendant was now, for the first time, sent for, and had to go home for a catheter. On his return, the patient said he had experienced a sudden "crack," with a sensation of cold pervading the pubic region, at the same time finding relief from distressing pains. Mr. Keal found the patient tolerably easy, with tenderness over the abdomen, and a sense of distension without any circumscribed tumour. Two quarts of bloody urine were drawn off with the catheter with much relief. The patient was submitted to copious bleeding from the arm, leeches to the pubic region, fomentations, saline aperients, calomel and antimony, opiates at bed-time, and catheterism, and made an early and complete recovery. No comment is needed, for the diagnosis may be admitted without inconvenience.

The examples of rupture into the vagina may be dismissed in a few words. In all, distended and neglected bladders were ruptured in consequence of the accession of labour and the use of instruments. The rents were in a most favourable situation, and in this class of cases there is nothing to militate against recovery. Doubtless examples of this class might be multiplied on extended inquiry. (See Appendix, Note B, p. 107, and Note G, pp. 134, 144, 145.)

It ought to be generally known that the occurrence of rupture of the bladder during labour may fix a charge of malpraxis against the medical attendant. Dr. Taylor observes that the medical attendant is expected to know the probability of such an accident occurring, and to guard against it, if necessary, by the frequent use of the catheter. in Reg. *v.* Balsoner (Liverpool Lent Assizes, 1838) a surgeon was tried on a charge of this kind.

We now come to the rectal cases.

Dr. Ward's[4] patient was a man of twenty-eight, who suffered from retention from stricture for four days at sea. He was suddenly seized with severe pain in the abdomen in the region of the bladder, followed by great prostration. Sloughs of cellular tissue separated from the rectum, so that the hand passed up to the sacrum, and urine came in a stream from the rectum. A catheter was retained in the bladder. The patient recovered. Presumably in this case ulceration occurred at some point behind the stricture of the urethra, and urine was admitted into the connective tissue between the rectum and the bladder, fortunately securing for itself a free opening into the rectum. Dr. J. T. Call's[5] case, reported recently in the *Lancet*, was briefly this: A chimney-sweep, between fifty and sixty, the subject of a "small stricture," was suffering from an attack of retention. Whilst the doctor was away, fetching a catheter, water came with a great

[4] "New York Lancet," vol. i., 1842.
[5] *Lancet*, Dec. 10th, 1881.

rush through the anus, according to the combined testimony of the patient and his wife. The patient was walking about the room at the time, stripped to his shirt. Dr. Call does not appear to have made a digital examination of the rectum to clear up the case, but assumes that the *bladder* ruptured into the rectum. Admitting the reliability of the patient's statement, I think that a far more probable explanation would be that the *membranous urethra* gave way into the rectum. Such communications are sometimes met with in cases of stricture, and I recently had a case where an aperture existed just within the external sphincter. In Dr. Call's case the opening closed with remarkable rapidity without further extravasation, and remained closed, notwithstanding the expulsive efforts made by the patient in a subsequent attack of retention. Mr. Coulson has related, on the authority of Dr. Peacock, a fatal case of traumatic rupture of the bladder, in which a communication was formed into the rectum. See case 70 of the extra-peritoneal series in the Appendix. Compare also Mr. Morris's case of recovery related below.

The cases of Eve, Astier, Townsend, and Thompson, which I find in Max Bartels' list, ought not to be included amongst ruptures of the urinary bladder. Splinters from fractures of the pelvis pierced the bladder; in one case a splinter came from the urethra; in the others the splinters became encrusted with phosphates, and were removed by lithotomy after the lapse of months or years. We now pass to the cases of rupture into the perivesical connective tissue.

Syme's case was as follows: The patient, as already stated, was a stout young gentleman of seventeen. He was endeavouring after dinner to leap a low paling, two feet high, when he fell, and struck the lower part of his belly with great force on the points of two upright spars of wood. Immediately he experienced an intense pain, with a feeling as if the bowels had protruded, and his brother remarked that his clothes were distended over his belly. He was able, with support, to walk a few steps to a carriage. He came under the care of Messrs. Joseph and Benjamin Bell. A catheter was introduced, and after drawing off four ounces of bloody urine, was allowed to remain in the bladder. When the patient was seen by Mr. Syme, a few hours later, there were great pain, distension of the bladder, and a sunken, anxious look. Twenty leeches and hot fomentations were applied. The catheter was taken out and an opiate prescribed. On the second day the abdominal pains and swelling were increased; there was dulness on percussion below the umbilicus, and more than ordinary resonance above it. The catheter was introduced, with the effect of withdrawing a few ounces of bloody urine. Leeches were again applied in the evening, and the opiate repeated. A restless night was passed, and on the third day there was some confusion of ideas, with considerable impatience for a change of posture. The abdominal swelling had increased, and there was some œdema of the posterior parts from the chest down to the thighs. The catheter twice drew off a quantity of bloody

urine. On the fifth day the patient was in much the same state, but the whole trunk was fearfully swollen, and the respiration was performed as if only a small portion of the lungs had room to act. Complete dulness and obscure fluctuation existed below the umbilicus. About a tumblerful of urine had been removed with the catheter. Mr. Syme now made an incision in the linea alba above the pubes, and cut through a thick mass of condensed tissue at this part, giving issue to a very large quantity of urine, which continued to flow after the operation. It was found necessary to enlarge the wound on the eighth day, when a cavity was discovered between the integuments and the muscles of the abdomen. Sloughs of cellular tissue separated. On the eighteenth day free counter openings were made in the flanks, and five days later a large slough of areolar tissue was drawn from the wound, and Mr. Syme detected with his finger a rent more than an inch long in the anterior part of the fundus, on the pubal side of the reflection of the peritoneum. A month after the accident the patient began to pass water by the urethra, and at the end of six weeks was perfectly well.

Porter's[6] patient was a boy of ten, crushed between a rolling cask and a cart. The pelvis was shattered, and the left femur broken just below the trochanter. The bladder was ruptured anteriorly. The patient suffered intense pain in the abdomen, which he would not allow to be touched, and he expressed a great desire to pass water, but could not void a drop. The catheter drew off a very small quantity of urine deeply tinged with blood; it was retained, and sometimes urine flowed through it. After the first twelve hours, the catheter always came out blackened with sulphuretted hydrogen, and this was considered by Mr. Porter to be a fatal symptom. At the end of forty-eight hours a small abscess pointed at the left side of the navel. An opening made into the abscess gave exit to an immense quantity of fœtid pus and urine. The aperture became fistulous, and discharged clear healthy urine for more than three months. The patient made a complete recovery.

Mr. Padley's[7] patient was syphilitic, and the subject of a tight stricture. The stream of water was small, and more effort than formerly was required to pass it. He had a perforating ulcer of the palate. Mr. Padley believes that an ulcer formed on the mucous membrane of the bladder perforated its wall, and admitted a little urine into the areolar tissue in front of the organ. The patient was attacked with rigors, pain, and pyrexia, followed by induration and extensive phlegmonous inflammation of the abdominal wall. Then came suppuration, sloughing of areolar tissue, and profuse discharge. A few days later there was a gush of urine from the wound above the pubes, ultimately leaving a sinus communicating with the bladder. At first, urine was freely discharged from the wound, but gradually diminished in quantity as

[6] "Rynd on Strictures," p. 48.

[7] *Lancet*, March 4th, 1882.

the opening contracted and the extensive chasms in the soft parts cicatrized. A small sinus was left. Mr. Padley's explanation of the case seems to be the correct one. The alternative explanation is that phlegmonous erysipelas or cellulitis was the primary condition, and that the opening into the bladder was secondary from sloughing. The objection to this view is that there was no apparent cause for the erysipelas or cellulitis in that situation.

I take the cases of Rose, Max Bartels, Berner, and Jeanmaire from Max Bartels' abstracts. Rose's patient was a man of twenty-five, struck in the left groin by a falling tree, and thrown to the ground. Blood came immediately from the urethra. Catheterism failed. At the end of forty-eight hours there was a spontaneous flow of bloody urine from the urethra lasting three weeks. At the end of two and a half months a fistulous opening formed at a spot corresponding to the junction of the left pubes and ischium. Here all the urine flowed away. For three-quarters of a year the patient was bedridden. At the end of fourteen months external urethrotomy was performed. Erysipelas supervened, and death ensued. At the autopsy a small round cavity was found between the bladder and the rectum in which the catheter lay. There was a united fracture of the descending ramus of the left os pubis, with displacement inwards. The abstract does not contain a description of the exact position or extent of the injury to the bladder.

Max Bartels' patient was a man, fifty years of age. His horse fell on him, causing a fracture of the os pubis. Great pain was felt in the right half of the pelvis, with tormenting pain and a feeling of numbness in the stomach, penis, and scrotum. There was great desire, but inability, to pass water. The catheter drew off much bloody urine, and a few drops of urine passed voluntarily. The catheter was used several times daily. At the end of thirty-six hours there was a rigor, and in ten days a swelling appeared above and on the inner side of the thigh. An incision gave exit to urine and decomposing fluid. At this spot a urinary fistula remained. At the end of three quarters of a year the patient went about on crutches; six months later he walked with a stick, and a cure resulted.

Berner's patient was a carter. A wheel passed over his belly. Extensive infiltration of urine resulted, with gangrene and sloughing of the soft parts. The patient was submitted to the *boutonnière* and ultimately recovered.

Jeanmaire's patient was a man fifty years of age, who was bruised by the falling of a brick arch. He felt something crack in his belly. An extensive tumour appeared in the right thigh. Ineffectual efforts to make water were always attended by pain in the tumour, which soon reached as far as the knee. The bladder *seemed* to be greatly distended. A catheter was retained, and drew off bloody urine. At the end of three days urine passed voluntarily, and after thirteen days incisions into the fluctuating tumour gave exit to a quantity of urinous fluid mixed with blood and pus. All the urine now came from the wound; none from the catheter.

When the patient lay upon his left side the rent was placed higher than the point of the catheter, and, therefore, all the urine flowed through the instrument, showing that the rent was on the right side of the bladder, beneath the peritoneum. The patient suffered from an attack of rheumatism in all his joints.

Dr. Walker's[8] patient was a temperate man, twenty-three years of age, caught between an engine and a car. His bladder is said to have been distended. He suffered from collapse, vomiting, and tenderness, and had neither desire nor power to micturate. A tumour appeared in the right iliac region, above Poupart's ligament, reaching nearly to the umbilicus. Fracture of the pelvic bones was detected. The catheter removed six ounces of bloody urine, *with relief, and with disappearance of the tumour*. A rupture of the anterior wall of the bladder was diagnosed, and lateral cystotomy was performed, with *subsidence of the tumour* and tenderness. Improvement and rapid convalescence followed, and in fifty-five days the patient resumed his occupation.

It is obvious that if the patient's bladder was full at the time of the accident, it could scarcely escape rupture during so severe a crush, and satisfactory evidence on this point would suffice to establish the correctness of the diagnosis formed by Dr. Walker. Not having seen the original report, I cannot estimate the value of the evidence afforded, and there are several points of interest omitted in the brief second-hand accounts to which I have alone had access. Under these circumstances, I reserve a final judgment. As the case stands, however, I do not comprehend the immunity from the inflammation and suppuration which might have been expected from extravasation of urine through a rent in the anterior wall of the bladder; nor do I see how lateral cystotomy would at once be followed by the outflow of urine already extravasated in front of the bladder, and into the iliac fossa. If the bladder held only a small quantity of urine at the time of the accident, the case would stand thus: Crush between two railway cars; the bladder containing only an ounce or two of urine; fracture of the pelvis; six ounces of urine drawn off with the catheter with relief and subsidence of swelling; subsequent retention; distended bladder and effusion of blood mistaken for extravasated urine; lateral cystotomy; emptying of bladder with relief; repair of fracture; recovery. Admission of the case into the list of real recoveries without the most critical examination would be injurious on account of the influence that it would exercise on the selection of a method of treatment in other cases. A strong argument in favour of the tumour having been really caused by the bladder itself, most probably with extravasated blood in front of it and in the iliac fossa, is derived from the disappearance of the tumour on the removal with the catheter of only six ounces of bloody urine.

[8] "Med. Com. of Massachusetts Med. Soc." Art. iv., case 6, vol. viii., 1845. Quoted in Erskine Mason's paper. The original was not accessible.

Mr. John Brown, of Burnley, has communicated to me the particulars of a case of an extra-peritoneal rupture, which came under his care a few months ago. The case was an example of the idiopathic variety, and seems to have resulted simply from over-distension of the bladder, occurring without any obvious cause. Not only was there an absence of any history of injury, but the patient was free from stricture, and had not suffered from gonorrhœa. The patient, a lad of eighteen, came from Colne on February 23rd, 1882, and saw Mr Brown's partner, Dr. Henry Briggs. He complained of wetting his bed at night. Dr. Briggs found his bladder distended after he had made water, and drew off about a pint of urine; he gave him a soft india-rubber catheter, which passed readily, and told him to use it night and morning. On March 3rd the patient returned, greatly pleased, to tell Dr. Briggs that he had not wetted the bed once since he saw him. On March 13th the lad noticed on drawing off his water at night that about a tablespoonful of white matter came. Next day he had considerable pain in the hypogastric region, and passed water frequently. The pain became very severe, and lasted for about a fortnight. Hot fomentations to the lower part of the belly gave him some ease. On the 29th, Dr. Briggs found some swelling of the abdomen, above the pubes, on the outside of the right rectus muscle, and made out fluctuation and dulness. On the 31st, the swelling was more central, and the fluctuation more distinct. The temperature was high, and the pulse 150. Mr. Brown made an incision in the middle line below the umbilicus through the skin and subcutaneous tissue, not reaching the linea alba. A considerable quantity of fluid, which proved to be urine, was evacuated. The fluctuation disappeared, and the symptoms improved. On April 5th the opening was unclosed and urine was oozing out abundantly, saturating the towels applied. The oozing ceased for some little time after the patient made water. An india-rubber catheter was passed and retained continuously. The patient made a good recovery. In this case, probably, frequent over-distension of the bladder led to the formation of a tunicary hernia near the urachus, followed by ulceration of the mucous membrane and effusion of urine between the peritoneum and the abdominal muscles. After mounting upwards to the umbilicus, the urine found a passage by which it came forward into the subcutaneous fascia. Another explanation is the prior formation of an abscess communicating with the bladder; but the fact of extravasation of urine is opposed to this view, for, if a circumscribed abscess opened a communication with the bladder, the urine would be prevented from becoming diffused by the wall of the abscess cavity.

The case under Dr. A. V. Williams [9] was one of spontaneous rup-

[9] Dr. A. V. Williams reported the case in the "New York Medical Times," for January, 1855. The abstract in the text is taken, however, from a paper on "Rupture of the Bladder from Stricture," by Dr. J. W. S. Gouley, Surgeon to the Bellevue Hospital, in the "New York Medical Record," 1872, p. 457. In the abstract no mention is made of the discovery of the aperture in the

ture caused by stricture, and strikingly exemplifies the advantage of early surgical interference. Wm. M——, thirty-two, of spare habit, but of great endurance, had for several years laboured under stricture of the urethra, with frequent desire to urinate from irritability of the bladder. He stated that on several occasions he had been unable to pass any water for several hours. On the 9th June, 1854, Dr. Williams was called to see him, and learned that the patient had not passed water for two days; that on the morning of the 9th, when making a violent effort to relieve his bladder, he "felt a snap," as if something had given way in his belly, from which time he had no desire to urinate, but was troubled with very great pain over the belly. The doctor tried to pass a catheter, but failed. Rupture of the bladder was diagnosed.

Dr. Willard Parker was summoned in consultation, and it was agreed to make an incision above the pubes, to cut into the bladder and pass a catheter, if possible from within outward through the penis, and re-establish a passage in that way. It was decided not to cut through the perineum, as the extravasation was above the pelvic fascia. The urine flowed out abundantly from the wound; there was but little hæmorrhage. The bladder was deep, and firmly contracted behind the pubes, and so altered in appearance that it could not be recognized as that organ. The doctor pushed up the peritoneum with one finger, and with a bistoury punctured the bladder, which Dr. Parker had drawn up with a hook. On dilating this opening with the finger, the internal surface was found corrugated and thickened. The urethro-vesical orifice could not be felt, so that the original design of forcing a passage from within outwards could not be carried out. Whilst the finger was retained in the bladder Dr. Parker passed a grooved sound into the urethra, down to the strictured part, and forced it onward until the point was felt by the finger through the thickened coats of the bladder. A cut was then made through the bladder upon the end of the sound with a probe-pointed bistoury passed along the finger. The lips of the wound made in the abdomen were brought together by a single suture, a catheter introduced through the false passage made into the bladder, an anodyne given, and the patient sent to bed. Urine flowed freely through the wound and through the catheter. With the exception of some local peritonitis, which was readily controlled, the case progressed to a favourable termination without any serious complications. On the twenty-seventh day the wound had entirely closed, and the urine was passed through the urethra in a fuller stream than had been done for years.

The case under Mr. Durham has not been published in full.

For the other cases, see Appendix, Note G.

Mr. Morris published in the *Lancet* for July 14th, 1883, the following case of recovery after rupture of the urinary bladder:—

H. F. G——, a boy aged eight, on Friday, September 8th, at one p.m., fell from a tree ten feet high, striking his left side against

bladder from which the urine had escaped into the perivesical connective tissue.

a branch, and then falling upon his abdomen against a stump on the ground. This occurred in the Crystal Palace grounds, where he had been playing with his sisters and brothers. No urine had been passed for four and a half hours, i.e. from breakfast till the time of the accident. Immediately after the fall he became sick and faint, and was driven home in a collapsed state in a recumbent posture. Dr. Montagu Sturges found that he was still collapsed, with a fluttering pulse, and that he had vomited several times. Between eight and nine o'clock in the evening, on attempting to micturate he passed half a tea-spoonful of blood with much pain, and then the flow stopped. Between nine and ten o'clock in the evening he micturated voluntarily, and within the space of an hour he voided nearly half a pint of a very high-coloured mixture of blood and urine. He had frequent desire to micturate, and during the night the pain in the abdomen was relieved by doing so. He passed a sleepless and very restless night, being in continual pain. He took a little ice and milk. The next day (9th) the abdomen was distended, very tender, and in constant pain, and a bruise was seen to the right of the umbilicus, one inch above the level of the right twelfth rib. Vomiting continued all day, and he passed urine loaded with blood at frequent intervals. On the 10th he was very restless, with frequent desire to micturate, and the pain in the abdomen was only relieved by his being allowed to do so. He looked ashen and cadaverous; his extremities were cold, and his urine was still loaded with blood. The urine continued bloody till the evening of the following day, when it became clear for the first time. Peritonitis was noted on the 11th. Blood reappeared in the urine three days later, and continued so more or less for about a week. On the night of the 15th he slept well, and the urine accumulated in the bladder to the amount of nearly a pint, which he voided in the morning, and which smelt very badly. On the 17th a No. 5 elastic catheter was passed and retained in the bladder to prevent the accumulation of urine. When the patient strained urine passed by the side of as well as through the catheter. On the 21st the patient had rigors, felt feverish, was very pale and vomited several times. Pulse 144, temperature 104°. Examined by the finger in the rectum there was no fulness, tenderness, nor heat detected. On the 22nd, when seen by Mr. Morris, the patient was lying in bed, with knees drawn up and on his back, and he complained of pain in the abdomen, which was tense and somewhat distended. His face was pale, pinched, and anxious, his pulse was 120, and the temperature 101·2°. He was very restless, and he had rigors in the morning. The urine was quite clear. On examination per rectum Mr. Morris thought he detected an unnatural fulness high up in the pelvis on the right side. Patient was made to pass water every two hours, to take as little fluid as possible, and to be kept slightly under the influence of opium. Poultices were applied to the abdomen. He continued in much the same condition till the 8th of October, when something broke internally in the evening, and he passed a horribly offensive

motion, quite unlike a child's motion, but more like liquid putty. The child remarked, "It came away all cold;" he was much easier afterwards. On the 13th he passed a very copious and offensive motion, very slimy like thick butter, and the abdomen, which had been noted as distended and dull on the left side, was now resonant there and not tender. From this time he made slow but steady progress to recovery.

In commenting on the case Mr. Morris remarks: "No one who will read the notes carefully can, I think, doubt that the bladder in this case was ruptured, though opinions may differ as to the exact situation of the rent. Some may incline to think the extravasation was beneath the peritoneum; others may lean to the view that it was into the cavity of the peritoneum, and that the pus passed per rectum came from a pouch behind the bladder, shut off from the rest of the serous cavity by inflammatory adhesions." Very conspicuous is the subtle dialectical skill with which Mr. Morris abstains from expressing his own opinion as to the nature of the rent, and throws the burden upon the reader to choose between the sub-peritoneal, the extra-peritoneal, and the intra-peritoneal form of rupture of the bladder; but it involves the inconvenience of suggesting conclusions which are open to grave objection. Having carefully read the notes, I doubt not that a rent in the bladder of some kind existed, but on the face of the evidence, I can see no ground for stepping beyond the limits of a primary sub-peritoneal rent. It is clear that at the time of the accident there was a moderate quantity of urine in the bladder, but there is nothing to show that it exceeded half a pint, and that any was extravasated at the time of the accident, or in other words, that the amount of urine in the bladder when the lad fell on the stump of a tree was not passed the same evening and night by the voluntary efforts of the patient. In reporting the case, would it not have been far more satisfactory if the amount of fluid which the patient took at breakfast-time had been stated? A couple of large breakfast-cups of coffee may be taken at half-past eight, and the amount of urine voided at one p.m., when active exercise has been undertaken, need not exceed ten or twelve ounces, as I have ascertained from observations upon myself. Dr. Roberts, taking the average of a large number of observations, gives barely seven ounces of urine as the quantity secreted between eight a.m. (breakfast-time) and two p.m. dinner-time). A boy running about and climbing trees on the 8th of September, would probably bring his skin freely into action, and the urinary secretion would be proportionately diminished. The reality of a tear of the mucous membrane at least is indicated by the fact that allowing the urine to accumulate in the viscus on the eighth day had the effect of reproducing hæmaturia. A violent contusion of the abdomen, and a sub-peritoneal rent in the bladder, sufficiently account for the symptoms; and such an injury might be followed by a sub-peritoneal abscess opening into the rectum, even without the admission of urine into the areolar tissue. The very fact of this abscess tends to negative the intra-peritoneal rent, for where among the fatal intra-peri-

toneal cases will be found one in which there was a large collection of putty-like pus in the rectovesical *cul-de-sac*, or one forming an opening into the rectum? The extreme limit of rupture to which, for my own part, I am prepared to accede, as justified by the evidence, would be a small extra-peritoneal opening into the pelvic fascia behind and to the left side of the bladder, formed either primarily or secondarily; and, unless the amount of urine in the bladder at the time of the accident can be shown to have been much in excess of half a pint, a secondary admission seems far more probable than a primary. No kind of assistance is derived from the results of local examination, for there is no account of any at the time, and even a catheter was not passed for many days after the commencement of the case!

The history of the case which came under my own observation, though defective in regard to the mode of causation of the communication with the bladder, is as follows:—

Rebecca G——, twenty-three, was admitted into the London Hospital on April 6th, 1874, for supposed hip disease. Eighteen months before admission she had fallen down whilst pregnant, and three weeks afterwards she was confined, and gave birth to a dead fœtus, seven and a half months old. Parturition was favourable, but she was ill directly afterwards, and suffered from a constant pain in her side, which continued for nine months. Suddenly the pain removed to the groin, and immediately afterwards the right thigh swelled, and an abscess pointed and broke about two inches below Poupart's ligament on the inner side. Three other abscesses in the same region broke in like manner, and left discharging sinuses. Prior to her admission under my care she had been under various medical practitioners, including Dr. Head, Dr. Palfrey, Mr. Sequeira, Mr. Swyer, and Mr. Richards, and she had been an inmate of the London, Tottenham, and King's College Hospitals. When she came under me there was a profuse discharge from four open sinuses at the upper part of the right thigh, which was drawn up towards the abdomen, and could not be extended. A week afterwards I placed her under the influence of an anæsthetic, straightened the leg, and explored the sinuses, laying one of them open and inserting drainage tubes in others. I could not detect any diseased bone or hip-joint disease. The leg was put up on a MacIntyre's splint, and a 6 lb. weight was applied. The patient progressed slowly, and on the 8th of June further incisions were made. On the 16th July a new light was thrown upon the case, as urine was discovered by Mr. Needham, the dresser, issuing from the wound on the inner side of the thigh during distension of the bladder. The patient was averse to submitting to any special treatment for the prevention of the outflow of urine through the sinuses. When she left the hospital she came under the care of Dr. Godfrey and Dr. Todd, and was seen once by Mr. Hilton, who wished to have a catheter retained in the bladder, but this the patient could not bear. After the lapse of some months the communication with the bladder closed spontaneously, the sinuses healed, and the patient gradually regained power over the right leg. She has since

borne several children, and at the present time is in perfect health. It is useless to speculate upon the manner in which the aperture in the wall of the bladder was formed, for there is not enough evidence to show whether it was a primary or secondary affection. If primary, the escape of urine through it into the areolar tissue was the cause of the formation of the abscesses; if secondary, there must have been pelvic cellulitis or parametritis leading to the formation of an abscess, which established an opening into the bladder. Before the abscesses broke externally pus had been observed to pass from the bladder, but this occurrence is compatible with either view.

We now reach the reported cases of recovery after intra-peritoneal rupture of the bladder. Abstracts of six of the eight cases referred to will be found in Max Bartels' list—viz., those reported by Walter, Erskine Mason, Thorp, McDougall (two), and Chaldecott—and only one is admitted by that laborious and careful author as a genuine case of recovery after intra-peritoneal rupture. He disposes of four – viz., the cases of Thorp, Erskine Mason, and McDougall—by regarding them either as errors of observation or as cases of sub-peritoneal or extra-peritoneal rupture mistaken for intra-peritoneal. Chaldecott's case is not commented on by name.

I will take Dr. Walter's[1] case first. A man, twenty-six years of age, in good health, received a blow upon the lower part of the belly. He almost fainted, and complained of violent pain in the region of the bladder. Some hours later the belly had swelled, and became very tender, especially just above the pubes. The pulse was small and frequent, the skin cold, respiration hurried, and urination almost impossible. There were nausea and vomiting. The catheter withdrew a very little bloody urine without relief. Three grains of opium were given at once, and one grain every hour afterwards. The catheter was retained in the bladder. Ice was given in fragments for the patient to suck. No relief being thus produced it was decided to open the belly. Ten hours after the accident chloroform was given. An incision was made in the linea alba, commencing one inch below the umbilicus and terminating one inch above the pubes. The intestines were found distended with gas, and the vessels beginning to be injected. A sponge introduced mopped out nearly a pint of urine and extravasated blood. A rent was observed in the fundus of the bladder two inches long. As soon as the urine was evacuated the bladder was left to itself, and the abdominal wound was closed with pins retained by silver threads, care being taken not to involve the peritoneum. A flannel bandage was placed round the belly. On waking from chloroform the patient felt much relieved. The vomiting ceased. One grain of opium was ordered to be taken every hour, and the general treatment was the same as before. The night passed well, and the next day there was neither pain nor desire to micturate. There was no tympanitis. A little iced water was allowed. The

[1] "Ranking's Abstract," 1862, vol. ii., and "Philadelphia Medical and Surgical Reporter." I could only refer to "Ranking's Abstract." See Stein's paper.

catheter gave exit to urine unmixed with blood. On the third day the quantity of opium was reduced. At the end of the first week the wound had united. During the third week the catheter was only used every four hours. That the foregoing is a genuine case of recovery can scarcely be questioned, unless it is possible for an observer to mistake serous fluid and blood for urine and blood, and by an optical illusion to fancy that he sees a rent where none exists. It would, however, have been as well if a catheter had been passed into the bladder and through the rent after the abdomen was opened, so as to complete the demonstration and leave no room for scepticism. Mr. Heath adopted this plan.

Of the seven other cases of reported recovery after a presumed intra-peritoneal rupture, Mr. Le Gros Clark's case is the only one which is not absolutely claimed by the author as a genuine instance of this happy termination. That case, as I have endeavoured to show, lacks the proof of the very essential primary condition for an intra-peritoneal rupture—distension of the bladder—and a careful examination of five of the others displays this deficiency in a greater or less degree. It is of little consequence, perhaps, which of these cases we investigate first, but I will take Dr. Henley Thorp's[2] case, because it has been elevated into a fictitious importance by the *imprimatur* of one of the leading surgeons of the day, Mr. Christopher Heath, and because Mr. Heath founds upon it a general recommendation for the treatment of cases yet to come. Dr. Thorp's preamble appears particularly inopportune, for, after regretting that "any want of precision or completeness in the details" of Mr. Chaldecott's case "should lead to doubts as to its real nature," and suggesting that Mr. Chaldecott was not "aware that the bladder is liable to give way in any other position than posteriorly," he makes this courageous assertion: "The following case, however, which has recently occurred in my practice, was seen by two other surgeons, and, watched throughout with great interest and anxiety, *places the question beyond dispute.*" The revenge of time reversed the respective positions of Mr. Chaldecott's and Dr. Thorp's cases, for in Mr. Birkett's excellent article I find that he admits Mr. Chaldecott's as one of the three cases of recovery out of the fifty to which he refers, the symptoms being "those of extravasation of urine into the peritoneum," whilst, after stating in a foot-note that "possibly Dr. Thorp's case should be added to those of recovery," he adduces in the text the following cogent reasons against its pretensions:—"It is to be much regretted that only the local symptoms of the injury are fully detailed. We vainly search in the account of the first two days after the injury for those constitutional symptoms, which are so constantly present after the occurrence. This omission is most unfortunate after the introductory observations which precede the recital of the case." The history is as follows:—

A farmer, thirty years of age, intoxicated, was thrown from his

[2] "Dublin Quarterly Journal," vol. xvi. p. 306.

horse. No account could be obtained from him as to the state of his bladder at the time of the accident, or as to any injury to the hypogastric region. He was found lying on the roadside, and when consciousness returned he experienced a severe pain at the bottom of his belly, attended with an urgent desire to pass water without the power of emptying his bladder. On visiting the patient four hours later, Dr. Thorp found him in a sitting posture, with his body bent forwards. He complained of an oppressive burning pain in the hypogastric region; there was pressing inclination, without the capacity, to micturate; the abdominal muscles, more especially the recti, were rigid and tense, and any attempt to stand upright produced a great increase of suffering. He had neither vomiting nor rigor, nor did the surface of the belly present any contusion or other mark of injury. "A full-sized gum-elastic catheter entered the bladder without difficulty. At first no fluid escaped, but upon pushing the instrument onwards, and at the same time turning it a little upon its axis, about a table-spoonful of bloody urine flowed out. No further quantity coming away, I withdrew the catheter a short distance, twisted it round in another direction, and again passed it backwards, when an additional ounce of a reddish fluid welled over without force or jet. By changing the position of the patient from side to side, turning him over upon his knees, and subtituting a silver for the gum-elastic instrument, I at length succeeded in obtaining nearly half a pint of urine mixed with blood. The patient expressed himself as much relieved. He was placed in a half-sitting posture, some laudanum administered, and a gum-elastic catheter was left in his bladder, a few drops of clear urine distilling over." Even before he had introduced the catheter, Dr. Thorp had jumped to the conclusion that there was a rupture of the bladder into the peritoneal cavity! "The diagnosis of the accident," he writes, "was *exceedingly simple*. The position of the patient in the sitting posture, with the body bent forward, the spastic rigidity of the abdominal muscles, and the urgent but unavailing efforts to pass water, *enabled me to predicate the mischief before I introduced the catheter*. Then the empty state of the organ, and the mode the bloody urine overflowed the instrument without impetus, in small quantities at a time, irregularly and interruptedly, uninfluenced by pressure above the pubes, but clearly affected by pushing the instrument backwards, changing its direction, turning it on its axis, &c., and also the postural expedients described, *placed the nature of the case beyond the possibility of doubt*. However, it is not every case of ruptured bladder that presents features so palpable and undisguised." Let it be remembered that this passage was written in the absence of any kind of evidence of a full bladder and direct injury to the hypogastric region, in the absence of symptoms of shock, and without accurate local examination of the abdomen or rectum. Anxiety of countenance, restlessness, constitutional depression, nausea and vomiting, distension of the abdomen and fluctuation, found in the less "palpable and disguised" cases, were conspicuous by their

absence. A mere contusion, with loss of power over the bladder, and a laceration of the mucous membrane, or some other cause of obstruction, such as a false passage near the orifice of the bladder, would account for the symptoms. There is, however, a sequel which is particularly instructive. Dr. Thorp left his patient for a few hours. The patient did not sleep, and suffered from pain in the belly. The distressing desire to urinate passed off, drops of clear urine escaping at intervals from the catheter. Dr. Thorp returned provided with a half-pint elastic bottle and a stopcock. He withdrew the gum-elastic catheter and introduced a silver instrument into the bladder. "The organ felt contracted, and did not easily admit of the complete introduction of the instrument; nor could the latter be depressed, pushed onwards, or moved about with the same ease as previously. Furthermore, the manipulation caused much pain, and accordingly the gum-elastic catheter, now mounted upon a strong stilet shaped like a sound, was again passed into the bladder. Its movements likewise were at first restricted and painful, until, after cautiously probing and turning its point, it entered nearly its full length, when a different feeling of resistance was communicated, and it could be moved about with *somewhat greater freedom.* The stilet being withdrawn, a *tablespoonful* of reddish urine flowed away." Clearly, then, the catheter had not passed into the peritoneal cavity through a rent in the bladder. The limitation of movement and the small quantity of urine show that it was in a nearly empty bladder. "The stopcock of the elastic bag was next adjusted to the catheter, and tepid water to the amount of three bagfuls injected through the instrument. Each portion when introduced was retained for a couple of minutes, and then allowed to return through the catheter, so that not more than eight ounces were injected at a time *into the abdominal cavity.* At first the water returned was of a reddish tinge, but the last half-pint was clear and bloodless. Each bagful regurgitated in a slow and interrupted manner, and pressure had no influence in accelerating or otherwise altering the mode of its discharge. During these proceedings, which occupied about twenty minutes, the patient was caused frequently to change his position, so as to mix the injected fluid as much as possible with *whatever urine remained in the peritoneal sac.*"

This account yields strong proof—to my mind, at any rate—that there was no rupture of the bladder at all. Eight ounces of fluid were injected each time, and each time eight ounces returned, showing that they entered and passed from a circumscribed cavity—viz., from the unruptured but incapacitated bladder, and not, as asserted, from the peritoneal cavity. If the tepid fluid had really passed into the peritoneal cavity the patient would have experienced during the injection some unwonted sensation, as in Mr. Heath's own case, and exactly the same quantity of fluid would not have been recovered. Moreover, if the catheter had entered the peritoneal cavity, a far larger quantity of urine should have been withdrawn. Yet the total amount of reddish urine evacuated

by the catheter in its various excursions did not exceed twelve ounces, a decisive proof of the want of distension of the bladder at the time of the accident. No wonder that Dr. Max Bartels[3] declines to regard the case as an intra-peritoneal rupture. He suggests that there may have been an extra-peritoneal rent, and that the urine was collected in a pouch of perivesical areolar tissue, into which the point of the catheter passed on manipulation; but if my criticism holds good, this explanation is superfluous. I now come to the cases related by Dr. McDougall.[4] The first case was under the care of Dr. Thom, of Brampton, and was seen also by Mr. Page, of Carlisle.

R. B——, a farmer, had been drinking freely at market. He passed his water at 2.30 p.m. He left for home in a heavily-loaded cart at three p.m., but stopped for a little while at a public-house on the way. In passing through a gateway he was thrown out of the cart, and the wheel passed over his belly. He lay for about an hour. He was then found and carried home at eight p.m. When he was seen by Mr. Thom, two hours later, the symptoms were—great pain in the belly, great desire and inability to micturate. There was a bruise extending from the left crista ilii across the pubes; a deep abrasion on the dorsum of the penis; and a fracture of the ilium, not extending into the true pelvis. A gum-elastic catheter drew off, with pressure over the bladder, six ounces of urine deeply-coloured with blood. The catheter did not move freely in the bladder, and it required constant pressure to get the urine away. The pulse was 88 and weak; the face flushed; but the countenance did not express much anxiety. Being very drunk, he threw himself about the bed in the most violent way. Beyond a rapid pulse, and respiration, and tender, distended, and tympanitic abdomen, there were no symptoms of ruptured bladder on the following day. Mr. Page himself remarked that "he seemed to bear the injury remarkably well, there being no marked evidence of abdominal shock." Opium, rest, and the retention of an elastic catheter comprised the treatment. On the third day he was better; on the fourth much improved, the abdomen being less swollen, and some dulness which had been noticed for two inches above the pubes had all but disappeared. The urine flowed freely through the catheter, but became purulent and ammoniacal. Directly the catheter was removed the patient made water freely and well, and the pus disappeared. A rapid recovery took place. The diagnosis of ruptured bladder was made on the following grounds:—1. The patient's bladder was probably much distended at the time of the accident, as he had been drinking freely, and had made no water for some hours. 2. The wheel of the cart had passed over the region of the bladder with sufficient force to fracture the ilium. 3. Only six ounces of urine came by the catheter

[3] Dr. Max Bartels' view is supported by Dr. E. Vincent in his valuable monograph, "Plaies pénétrantes intraperitonéales de la Vessie." Paris, 1881.

[4] "Edinburgh Medical Journal," January, 1877.

when it was first used, and only flowed when pressure was made above the pubes. Lastly, there were signs of severe peritonitis. The impartial critic would at once concede that if the wheel of a heavily-laden cart had passed over the hypogastric region when the bladder was distended, the organ would certainly have been ruptured. But was the bladder distended, or did it contain more than a few ounces of urine, or sufficient urine to make it rise well above the pubes? My reply would be decidedly in the negative. Not alone the absence of the severer symptoms of ruptured bladder, not alone the rapid recovery under the simplest treatment, compel me to this conclusion. Confirmation is obtainable from the history itself. The patient had been drinking heavily at market. His distended bladder urged him to the urinal at 2.30 p.m. From 2.30 p.m. to three p.m. he was probably not drinking, but superintending the harnessing of his horse and the preparation of his cart. At three p.m. he departs, but stops, perhaps for a glass, at a public-house. Very shortly after he is thrown out of his cart whilst passing through a gateway, and lies for a considerable time—it may have been two or three hours—before he was picked up. Not improbably the wheel of the cart pressed the bladder backwards, causing extravasation of blood and bruising of the tissues, including the peritoneum and the bladder itself. From the history more than six ounces of urine could not certainly be expected. For the rest, the lack of demonstration of a rupture by manipulation with the catheter, the absence of the severer symptoms of rupture into the peritoneal cavity, the violent jactitation of the patient, the failure of the countenance to express much anxiety, his bearing the injury remarkably well and without marked evidence of abdominal shock, and his very rapid recovery, convince me that the case was one of contusion and not of rupture. In the absence of proof of distention of the bladder at the time of the accident, there is no need to invoke the aid of so fatal a lesion as intra-peritoneal rupture of the bladder to account for the temporary incapacity of the organ, and a moderate attack of traumatic peritonitis.

Exactly the same defect helps to vitiate Dr. McDougall's second case. J. B——, a temperate waggon driver, aged twenty-three, was knocked down by one of his horses and run over. One wheel ran over the lower part of his abdomen, the other over his right arm, causing a comminuted fracture of the humerus. "He was taken to a bone-setter, who reduced and treated the fracture, then placed in a cart, and driven a somewhat long distance to his home. Just before reaching it, and after an interval of fully three hours from the receipt of his accident, he was seized with pain in the belly. With this came urgent and intense desire to make water, but all attempts to do so failed. Many miles removed from medical assistance, and feeling sick and weary, he retired to rest, and strangely enough he slept fairly well during the night. With morning, however, came an aggravation of all his symptoms, and he sought the advice of Dr. Robertson, of Penrith. He, learning from him the total inability to pass urine, used a catheter, but only

succeeded in removing four ounces. This was quite twenty hours after the last time he made water, and what he withdrew was deeply tinged with blood. The serious nature of the case was but too apparent, and he recommended his admission to the infirmary. Bland entered the ward while I was making the morning visit, and so freely and apparently easily did he walk that I never suspected that his condition was so serious. What of his history I have now told he then related, and he was immediately sent to bed." In this preamble it will be noted that there is a striking absence of all the primary conditions but one which are associated with a rupture of the bladder into the peritoneal cavity. There had been a severe contusion in the hypogastric region, but nothing whatever is said concerning the state of the bladder. Although sober, the man did not experience, as he should have done, a feeling of something having given way within the abdomen, nor was there any pain for three hours after the injury. There was no shock or collapse, no inability to walk or stand upright, and the man passed a fairly good night, apparently free from severe pain and restlessness. The next day he walked with freedom and ease, and exhibited littte indication of so grave a lesion. The symptoms which pointed in the direction of injury to the bladder were the inability of the patient to micturate, and the removal of only four ounces of bloody urine after the lapse of twenty hours. The further points which, combined with the history, left little doubt in Dr. McDougall's mind that the bladder had been ruptured, were these: "The patient had a pinched, anxious expression of countenance, and marked nervous twitching of the muscles of the face. Examination of the abdomen showed percussion dulness absolute in the right iliac region, the hypogastric region, part of the umbilical region, and in a less marked degree in the left iliac region. The lightest touch gave pain; pressure he could not bear. A full-sized catheter with a short curve was carefully introduced, and about one ounce of bloody urine withdrawn." Here again the main prop to the diagnosis is the removal of only one ounce of bloody urine. Demonstration of the rupture succeeds. "That the matter might be rendered if possible more certain, the patient was put under chloroform, and passing my left hand into the rectum well beyond the prostate, with a short-beaked catheter in the bladder, the empty and contracted condition of the viscus was readily demonstrated. In order to remove the urine effused into the peritoneal cavity, a No. 2 aspirator needle was introduced in the centre line an inch above the pubes. Bloody urine escaped slowly through it, and when nearly five ounces had been withdrawn, the instrument, partly due to the consistence of the fluid, partly to some fault in the suction apparatus, struck work. A few hours later the largest-sized trocar of the aspirator was introduced obliquely downwards and backwards close above the pubes; the aspirator fixed and twenty-ounces of fluid" (urine?) "were withdrawn. As it flowed the man expressed relief, and ere the operation was finished, his pulse, which had previously been

depressed and irregular, became sharper and more steady. All abdominal dulness had now disappeared, and the acute tenderness was even less." Prior to the tapping, the patient showed "very evident signs of abdominal inflammation" and some "symptoms suspiciously indicative of uræmia." Vomiting, which had occurred for the first time shortly after the first use of the aspirator, had rendered the pain more severe and the vital depression greater. A catheter was retained, and the urine, still containing much blood, passed freely from it, except on the evening of the second day, when Mr. Spence, the house-surgeon, "fearing that the urine was again finding its way into the peritoneum, used the aspirator, and withdrew several ounces of sanguineous fluid. The removal of this, which examination proved to be largely sero-purulent, was followed by benefit, for in a short time the urine again passed guttatim by the catheter." The main constitutional symptoms were jaundice and delirium, the jaundice appearing on the third day, and the delirium on the fourth. The abdomen was tympanitic. At the end of the seventh day the patient passed nearly a pint of clear urine during an effort of defæcation. The case lasted altogether for a month, a fluctuating temperature, nocturnal delirium, a tympanitic condition of the abdomen, perceptible dulness on percussion, in the hypogastric region, and diarrhœa being the main symptoms recorded.

In this case all the abdominal symptoms, with the exception of the vesical, are readily accounted for by the injury sustained from the passage of a cart-wheel over the belly; and the diagnosis of rupture of the bladder into the peritoneal cavity rests upon the presumed fulness of the bladder at the time of the accident, the inability to micturate, the presence of blood in the urine, the small amount of urine drawn off with the catheter, and upon the results of manual examination and the use of the aspirator. Are these circumstances conclusive? I think not by any means. In the original account not a word was said about the state of the bladder at the time of the accident. This is the play of *Hamlet*, with the character of "Hamlet" omitted. Dr. McDougall has since added,[5] that the patient had not micturated for some hours before the receipt of the injury. Even this statement is quite inconclusive. As the patient was a temperate waggoner, it is clear that he had not been imbibing alcoholic liquors; and if he had been drinking at all, Dr. McDougall would not have omitted so essential a fact. The secretion of urine is regulated by the quantity of fluids taken, the amount of pulmonary and cutaneous exhalation, and the condition of the organs and tissues of the body. Hence it is impossible to dogmatize in regard to any particular case; but surely it is in accordance with experience that when no

[5] Three months after the abstract of my critique on his cases appeared in the *Lancet*, Dr. McDougall replied in an article printed in the issue for Feb. 17th, 1883. My answer appeared on March 17th, 1883, and as I have not seen any rejoinder, I have incorporated in the text what I then urged against the genuineness of an intra-peritoneal rent in the cases reported by Dr. McDougall.

fluids have been imbibed during some hours of exertion on a summer's day the secretion of urine may be very small. The probability of the case, therefore, is that the bladder contained but very little urine, and this empty state of the bladder concurs with the absence of the usual primary symptoms—viz. a sensation of something having given way, pain, faintness, depression, shock or collapse, inability to walk or stand upright, insomnia and restlessness at night—in proving that the bladder was not at once ruptured into the peritoneal cavity. Prior to local examination, the facts sustaining the diagnosis were desire with inability to micturate, and the removal of only four ounces of urine, deeply tinged with blood, after the lapse of twenty hours—symptoms equally explicable on the ground of severe contusion. Dr. McDougall, however, claims to have established the diagnosis of intra-peritoneal rupture by local examination and manipulation. This part of the case is naturally the most delicate and difficult for the mere critic to handle and to explain, and I must be content with adducing the considerations which have led me to the conclusion that an intra-peritoneal rent in the bladder was not proven. A short-beaked catheter was introduced, and about an ounce of bloody urine was withdrawn. There was no demonstration of a rent by passing the catheter through it into the peritoneal cavity and drawing off a large quantity of urine. Dr McDougall tells us that thereupon he introduced his left hand into the rectum, well beyond the prostate, with the short-beaked catheter in the bladder, and readily demonstrated its contracted and empty condition. This description must be taken with more than a grain of salt, for in his comments in the *Edinburgh Medical Journal*, Dr. McDougall said, "Even with great part of my hand in the rectum, it was with difficulty that I could reach the upper border of the viscus, and I certainly quite failed to detect such evident fluctuation as would have warranted the plunging in of a trocar." This is a very dubious account; the limits of the bladder may or may not have been reached; there may or may not have been fluid there somewhere, and as we know the liability to errors in observation, especially in manual or semi-manual examination per rectum,[6] I feel justified in inferring that the information obtained was not absolutely trustworthy. After the examination about five ounces of bloody urine were removed with the aspirator; but it was not until some hours later, and without fresh local examination, that "twenty-one ounces of fluid" (urine?) were removed with the largest-sized trocar of the aspirator passed downwards and backwards above the pubes. The long interval had left time for the collection of urine in the bladder, if it was not present there before. The chief feature in the case puzzling to my mind is

[6] Mr. Walsham says, that with the whole hand in the rectum "the bladder is easily recognized when moderately distended as a soft semi-fluctuating tumour behind the prostate: when empty it cannot be distinguished from the intestines which then descend between the rectum and the pubes."—Holden's "Landmarks," p. 70.

the removal of five or six ounces of bloody fluid with the aspirator after the catheter had failed to abstract more than an ounce; but even this is not an insuperable difficulty, as there may have been some unusual condition resulting from the contusion, which interfered with the full entrance of the short-beaked catheter into the bladder, such as a laceration of mucous membrane, or the pressure of blood and serous fluid extravasated into the pelvic fascia. To sum up: an intra-peritoneal rupture is excluded by the empty state of the bladder at the time of the accident, by the absence of the usual primary symptoms in a sober patient, the lack of demonstration with the catheter, the density of the fluid withdrawn by the aspirator, and the recovery after aspiration. The improbability that several improbabilities, absence of symptoms, and departures from the usual course of events would be exemplified in a single case is so great as almost to amount to a certainty that an intra-peritoneal rupture did not exist. Hence the choice is narrowed to removal of fluid by aspiration from a bladder into which the short-beaked catheter through impediment of some kind had not fairly entered, or from a more or less circumscribed cavity behind the pubes containing urine and sero-purulent effusion, the result of an extra-peritoneal rent. Dr. Max Bartels carefully excludes the case from the category of intra-peritoneal ruptures, but seems willing to admit that it may have been an extra-peritoneal rupture, a view adopted also by Dr. Vincent. If so the urine must have been collected in the connective tissue in front of the bladder; and it must be concluded that the aspirator sufficed to remove it all and to prevent the inflammation, suppuration, and sloughing which ordinarily supervene when urine is effused. The objections to this view seem to me much stronger than any that can be advanced against the supposition of some impediment to the full passage of the catheter, and the entrance of an aspirator, pushed deeply downwards and backwards above the pubes, into a viscus containing urine and pressed backwards by extravasation of blood in front of it. An unusual condition of this kind would account for an error in observation and an unavoidable failure in the manipulation of an accomplished and a skilful surgeon.

Dr. Erskine Mason's[7] case was this: M. B——, twenty-six, fell downstairs on December 25th, 1871, and sustained some bruises about the face, arms, and legs. What part of the body he struck in his fall he was unable to state. The next day (December 26th) he was admitted into Roosvelt Hospital. He had urgent desire but inability to pass water. A No. 10 catheter, passed easily, drew off a few drops of urine streaked with blood. He complained of pains about the hips, and some tenderness over the hypogastrium. On December 27th the catheter was again passed, and four ounces of urine, "with some blood," drawn off. Tenderness over the abdomen seemed to be increasing. In the afternoon an injection of ol. ric. ℥j. caused no movement of the bowels. About

[7] "New York Medical Journal," 1872.

four o'clock he walked to the water-closet, and voided a small quantity of urine. The expression of his countenance was anxious and very pale; his tongue was very much furred; he was very thirsty; his pulse was only 68 small, and his temperature was $98\frac{3}{5}$. A catheter was introduced, and clear urine was drawn off. The finger in the rectum could not detect any injury to the urethra, but felt *doubtfully* a swelling posterior to and a little to the left of the prostate. The patient complained of great pain in the lumbar region. Dr. Mason could not decide whether the kidneys were injured or the bladder ruptured. Early on December 28th the patient was restless and thirsty, with pulse at 112, and temperature 102 degrees. A small quantity of bloody urine was drawn off. The abdomen was hard and extremely painful. At half-past six a.m. and nine a.m. a little bloody urine was drawn, but some difficulty was experienced in passing the catheter. At ten a.m., when seen by Dr. Mason, the patient was lying in bed with his knees drawn up, with great tympanitis, hiccough and vomiting, excessive tenderness over the whole abdomen, small wiry pulse of 120, coated tongue, great restlessness, and cool extremities. The diagnosis now formed was rupture of the bladder and general peritonitis. Lateral lithotomy was performed. Digital examination of the rectum detected posteriorly to the prostate a decided tumour yielding a sense of fluctuation. There was no laceration of the urethra or neck of the bladder around the prostate; no thickening or induration of the tissues anterior to the neck of the bladder. A large-sized staff was passed into the bladder with the greatest facility, and the bladder was laid open. *Bloody urine escaped in quantity.* Passing his finger into the bladder so as to enlarge the opening, Dr. Mason felt confident that he detected a rent in the posterior wall of the viscus, but he did not examine this opening thoroughly, as he feared he might do injury if he pursued his investigations farther in that direction. Two facts were observed—one that the interior of the bladder was sensibly cooler than the surface; the other the disappearance of the tumour felt through the rectum. The diagnosis now made was that the rupture had taken place through the posterior wall of the bladder, that the rent had extended through the peritoneal covering, and that the urine had extravasated into the pelvic cavity, but rested chiefly in the posterior *cul-de-sac*. Owing to venous hæmorrhage the wound was tamponed with lint for two days. On the second day it was noted, "A brown discoloration is now observed over the inguinal hypogastric and perineal regions and down the thighs." On the third day the parts presented a hard and indurated feeling, and the patient was bathed in profuse perspiration, having a urinous odour. On the fourth day the discoloration was fading, and there was considerable perspiration of the same strong urinous odour. The patient made a complete recovery, and was discharged cured on the thirty-seventh day after the operation.

Dr. Mason's diagnosis of intra-peritoneal rupture of the bladder has been challenged by Mr. Willett on the following grounds:—

1. The absence of any evidence of direct injury to the supra-pubic region, and of distension of the viscus at the time of the injury. 2. The fact that the symptoms did not warrant a diagnosis for seventy hours when peritonitis supervened, whereas blood and urine effused into the peritoneal cavity would have excited that action at a much earlier period. 3. If Dr. Mason had felt quite sure that bloody urine had collected in the peritoneal cavity, he would not have been so fearful of exploring the rent he thought he detected in the bladder, but would have deemed it essential to make certain that he had established a vent for the effusion. 4. The improbability that in an intra-peritoneal rupture urine would find its way only into the pelvic *cul-de-sac*, and not invade the general cavity of the peritoneum. Mr. Willett adds: "That a laceration occurred immediately posterior to the prostate is, I think, almost certain, as also that when the effused urine encroached upon the peritoneum, local peritonitis was excited. Equally I regard it as quite clear that the patient owed his life to Dr. Mason's decisive operation, and the timely performance of it." With Mr. Willett's opinion that Dr. Mason's case was not one of rupture of the bladder into the peritoneal cavity I entirely concur; but, curiously enough, Mr. Willett does not see that the absence of evidence of a distended bladder, and of direct injury to the hypogastric region, as well as the other details, militates equally against a simple extra-peritoneal rupture immediately behind the prostate. A *simple traumatic* rupture in this situation is a form of lesion almost, if not quite, unparalleled and inexplicable, as occurring from a fall downstairs to an almost empty bladder. Moreover, if urine had issued from a rent in this situation, in seventy hours it would either have become widely diffused, or confined in an adventitious cyst behind the prostate. In the one case lateral cystotomy would have effected little, and in the other, unless extended deeply through the prostate and into the cyst, would have left the collection of urine untouched. Fortunately, the records of the case render it as clear as noonday that neither the one nor the other condition existed. Digital examination had established the fact that no urine was effused between the rectum and prostate, or anteriorly to the latter organ, and that the fluctuating tumour was well behind the gland. The lateral cystotomy was performed *secundum artem*. The incision in the prostate was limited, and the finger was used to dilate the aperture, and yet the moment the knife had entered the bladder, with the apex of the prostate only notched, and even before the passage of the finger, bloody urine escaped in quantity, and the tumour disappeared. No demonstration could more convincingly have proved that the fluctuating tumour felt with the finger was part of the bladder itself. To the small quantity of urine drawn off by the house-surgeon, and subsequently by Dr. Mason, very little importance can be attached, for difficulty was experienced by the house-surgeon in passing the catheter, and the possibilities of false passages are infinite. As for the brown discoloration, on which Mr. Willett lays some stress, it is significant of bruising of subcu-

taneous tissues and blood extravasation, and the urinous odour, commonly noticeable after a lateral cystotomy, has a pervading influence readily transferable to the skin in the mind of the observer. Thus, by the process of exclusion supported by the clinical record of the case we may conclude that, if Dr. Mason felt a laceration on the posterior wall of the bladder, it was confined to the mucous, submucous, and muscular strata. A rent of this kind might readily be followed by peritoneal irritation through the close proximity of the urine to the vesical surface of the peritoneum, and Dr. Mason exercised a wise discretion when he left it unexplored.

The case under Mr. Morris[8] presents the following history:—On June 4th, 1879, W. H——, thirty-nine, an upholsterer, was drinking at a public-house, when a difference arose between him and another man which they thought they ought to settle by wrestling. He was thrown with much force, and forcibly knelt upon by his opponent with both knees applied to the lower part of the abdomen. He lost consciousness for a time, and on coming to, walked home—a mile, taking over an hour to do the distance. He stated that before the encounter he had not passed water for an hour or two, and that he was drinking up to the moment of wrestling. When he reached home he tried several times to pass water, but could not. Within an hour or two of getting into bed he voided a small quantity of blood. He continued his efforts, and passed small quantities of urine less and less charged with blood till it became nearly natural. Altogether, in thirty-six hours he estimated the amount of blood and urine voided together at not more than three-quarters of a pint. At first he experienced pain at the lower part of the stomach; but this, without altogether leaving the lower regions, gradually got higher and higher up his stomach. He vomited frequently a quantity of greenish fluid. On admission to the hospital his face looked pale, sunken, and anxious; his chin was covered with a cold perspiration; his abdomen was tympanitic, distended, and extremely tender, the slightest pressure causing him to wince and cry out. Nothing abnormal was discovered *per anum*. He had micturated voluntarily with great pain and difficulty. A No. 7 silver catheter was easily introduced, and between three and four ounces of clear normal urine were withdrawn, and by pressure a few blood-clots were expelled. *The point of the catheter was moved about to detect a rent, and none was found.* The patient was frequently vomiting a bright green bilious fluid. An elastic catheter with india-rubber tubing was fixed in the bladder. Plenty of urine was daily drawn off, at first clear, but afterwards becoming cloudy and purulent. On the twelfth day after the accident the catheter was removed; the patient passed water voluntarily, and from this time made uninterrupted progress towards recovery. It must be added that thickening and hardness of the tissues in front of the bladder was observed some days after the patient's admission to the hospital. Mr. Morris regarded his case as a rupture of the

[8] "Medical Times and Gazette," November, 1879.

bladder anteriorly, partly intra-peritoneal and partly extra-peritoneal, or, to use his own words, "No doubt the wound was in the front wall of the bladder chiefly, though perhaps not entirely extra-peritoneal, and being high up in the organ comparatively little urine escaped through the rent, while the bladder preserved some of its power of retaining and expelling its contents." He was supported in his diagnosis by all the surgeons who saw the case. The grounds for the diagnosis were these :—The patient had been drinking, and his bladder was full or moderately distended. He was knelt upon with great force. There was collapse followed by great pain, and several fruitless efforts to micturate. Only three-quarters of a pint of urine and blood were discharged from the bladder in the first thirty-six hours after the injury. On the introduction of the catheter thickening in front of the bladder was detected, and afterwards there was discharge of pus with the urine, this pus being poured through the rent into the cavity of the bladder. With the greatest respect for the opinion of so distinguished a surgeon as Mr. Morris, I cannot see adequate justification for the diagnosis propounded. It entirely rests upon the supposition that the bladder was full at the time of the injury. That the man had been drinking is most true, but equally true it is that he *had passed water* "*an hour or two*" (a very loose estimate of time) *before the injury;* and in all probability he was merely sipping his liquor whilst engaged in the hot argument, not gulping down the large quantities of liquid necessary to ensure the required distension of his bladder in the time between urination and the conflict. Even the patient's own account is insufficient to render it clear that the bladder contained any considerable quantity of urine, and his statements are not precise enough to be accepted without qualification. Now read the case on the supposition that the bladder had not risen above the pubes. The violent kneading with the knees—which must have produced rupture of a full bladder—contused the tissues, fasciæ, partially occupied bladder, and peritoneum, fully accounting for the blood in the bladder, the thickening and hardening of the tissues anteriorly, and the peritonitis. The shock and depression, and the constant vomiting of greenish fluid diminished the amount of secretion of urine in the first thirty-six hours; and the mere rough estimate of the patient is not as valid as the reception of the urine into a graduated measuring-glass. It is not unlikely that the patient under-estimated in his alcoholic condition the quantity voided, and to that three-quarters of a pint must be added, the three and a half ounces of clear urine drawn by the catheter on admission, and perhaps that which he had passed when he "micturated voluntarily with great pain and difficulty." Under the circumstances nearly a pint of urine may be regarded as sufficient. Moreover the passage of three-quarters of a pint of urine or more within the first thirty-six hours by the voluntary efforts of the patient is an unusual circumstance; whilst he was under observation in the hospital the urine removed was abundant. Pus in the urine is sufficiently accounted for, as in Mr. Page's case, by the retention

of the catheter. As soon as the catheter was removed the urine cleared. If the foregoing explanation suffices, a complete rupture of the bladder, intra-peritoneal or extra-peritoneal, would be out of court; and the accuracy of touch which Mr. Morris displayed when he used the catheter to search for a rent and found it not, would be amply vindicated.[9]

Mr. Chaldecott's[1] celebrated case remains. Though last to be considered, in point of time it commenced the series of recoveries; and it has, I fear, been the cause of claims to recovery in other instances, owing to the support which it has lent to the opinion that the peritoneum is capable of tolerating and absorbing urine effused into its cavity. The case has been incompletely recorded, and runs as follows: At midnight on the 7th of April, 1846, J. Philps, fifty, wine-merchant, of Dorking, *healthy and temperate* (?), having passed two or three hours at a concert, hastily crossed the street to empty a full bladder, and, the night being dark, ran against a newly-erected post, with the top of which the lower part of his abdomen came into violent contact. He fell immediately, and afterwards with great difficulty reached his home—about a hundred yards distant. Half an hour afterwards he was seen by Mr. Chaldecott, who found him faint, suffering from severe pain in the abdomen, feeling the desire, but deprived of the power, to evacuate his urine. A catheter was introduced easily and completely into the bladder, and drew off neither urine nor blood. He was kept in bed, and had hot fomentations applied. Reaction set in, attended with an increase of pain. Twenty leeches were ordered and a gum catheter passed, but still there was no urine. The catheter was used every three or four hours, but up to two p.m. fruitlessly. Eighteen hours after the accident—i.e. at six p.m.—he was seen by Mr. Aston Key. The symptoms of peritonitis had then increased; the belly was painful, swollen, tender: the pulse rapid and feeble; the countenance anxious. Mr. Key introduced a catheter, and drew off one ounce of bloody urine. At ten p.m. "two scruples" (forty minims?) of liquor opii sedativus were administered, and produced in a few hours a comfortable sleep. Four hours after Mr. Key's visit four ounces of clear urine were obtained; and from this time—that is, *twenty-two hours after the accident*—the pain, swelling, and heat in the stomach and abdomen gradually declined, and the bladder was found to hold urine. The catheter continued to bring away clear urine. On the 10th the patient had a smart attack of gout—a disease to which he had never been subject. All went on well till the 13th (sixth day), when, from a strong desire to be independent of the catheter, he made straining efforts to pass his water; and scarcely had he passed a tablespoonful when he felt (to use his own expression) something

[9] A brief reference to Mr. Morris's case was contained in the abstract of my paper in the *Lancet* for Nov. 4th, 1882. To this criticism Mr. Morris replied in the *Lancet* for July 7th, 1883, virtually closing the intra-peritoneal rent. My answer appeared in the *Lancet* for July 28th, 1883.

[1] "Provincial Medical and Surgical Journal," 1846.

give way, and a burning pain all over his stomach and bowels, as if boiling water had been poured over them, and the same symptoms of faintness and distress occurred as when the accident first happened. Mr. Chaldecott saw him within a few minutes of the second attack, and withdrew a teaspoonful of urine with the catheter. The peritonitis became again acute, with the addition of excessive sickness. He was treated with fomentations, leeches, calomel, and a full opiate; and *after the lapse of four hours* the bladder was found to retain urine. He had another attack of gout, and the peritonitis gradually subsided; and he recovered completely. Mr. Chaldecott diagnosed a rupture of the bladder into the peritoneal cavity, and Mr. Aston Key concurred and gave an unfavourable prognosis. The urine, according to Mr. Chaldecott, was absorbed by the peritoneum, and this absorption was the cause of the attack of gout. The wound in the bladder was under repair when it was reopened by the straining to pass water, and all the symptoms recurred. The following letter, kindly addressed to me by Dr. Todd, of Bognor, helps to elucidate the case, and will be read with interest:—

"Bognor, 7th of November, 1882.

"Dear Sir,—I have been interested by your papers in the *Lancet* on 'Rupture of the Bladder,' more especially as I was acquainted with the patient of Mr. Chaldecott. He was under my care for the last fifteen years of his life; I have frequently questioned him about his accident. In the main he agreed with the report as it appeared in the *Lancet*, 1846, vol. ii. p. 375 (he always kept a copy by him, which he amused his friends with). He states that before leaving the concert-room he had an urgent desire to pass water, but could not at once get out. When he did so he ran towards the yard, striking himself against a post as described. He insisted that he then felt something give way, and then became faint, &c. He was careful to distinguish the first giving way from the second on the occasion of his attempting to relieve his bladder without the catheter. He said Mr. Key was quite convinced as to the nature of the injury, and 'told him he must settle his worldly affairs, as he feared he had but a short time to live.' His daughter tells me he never had the gout until after the accident. Since then he had seven attacks—chiefly in the feet. I *should hardly* call him a temperate man; he was the landlord of an hotel, and his daughter says he used to drink the best part of a bottle of port daily, and from hints he has dropped I should think very often a good deal more. He died in 1876, in his eightieth year, from hypertrophy of the heart, chronic Bright's disease, and uræmia. For many years he suffered from chronic bronchitis; most probably gouty. I have sent you these few particulars thinking they might interest you, but more especially to draw your attention to the first sense of giving way when the patient struck the post.

"I am, dear Sir,

"Yours faithfully,

"J. M. Todd, M.D."

In my reply to Dr. Todd I endeavoured to ascertain when Mr. Philp had last made water, and whether he had drunk anything between that time and the hour of his leaving the concert-room; and, further, the exact nature of the sensation experienced when he ran against the post. I also regretted that a post-mortem examination had not been performed and the bladder preserved, as the presence of a cicatrix would have been conclusive evidence of rupture. Dr. Todd could not give me any further particulars, and did not remember that his patient mentioned any burning or smarting sensation at the time of the accident. Mr. Philp said that on receiving the blow he immediately became sick and faint; he reached his house crawling on his hands and knees. It is certainly a serious omission in the record of the case that no evidence is adduced to prove the fulness of the bladder at the time of the accident beyond the fact that the patient went across the road to make water. It should have been stated when the patient last made water, and whether he had been drinking in the interval. To describe the bladder as *full* or *distended* on the mere impression of the patient is a *petitio principii*. The sensation experienced of something having given way—not mentioned in the original account—does not appear to have been of a very definite character, and is not conclusive. The absence of both blood and urine from the bladder in a traumatic case, notwithstanding frequent introductions of the catheter in the first fourteen hours, is unusual, and there was no confirmation of the rupture by local examination or manipulation with the catheter. Whether the catheter was freely movable, or incapable of being rotated or depressed, is not mentioned. Clearly Mr. Aston Key did not demonstrate the existence of a rent in the bladder, and was influenced by the impression that the bladder was distended at the time of the accident, not taking into account the possibility of suppression. That the peritoneum should be capable of absorbing so large a quantity of urine as the bladder would contain when full, that peritonitis should immediately set in, and then *begin to subside in twenty-two hours* after the accident on the administration of "two scruples" of liquor opii sedativus, is a hard saying, and, to my mind, almost incredible. Nevertheless, if the bladder was really full when the patient ran against the post, it could scarcely escape a rupture, and any other explanation of the absence of urine on catheterism, as enlargement of the third lobe of the prostate, or the existence of a supplementary bladder or diverticulum, seems inadequate and improbable for more reasons than one. On the supposition of a rupture the choice lies between the sub-peritoneal, the extra-peritoneal, and the intra-peritoneal varieties, and the objections to either of the two former kinds are, in my opinion, as strong as to the intra-peritoneal rupture. Absorption of urine from the cellular tissue is not more tenable than absorption from the peritoneal cavity. But are we forced to choose between conclusions alike contrary to all probability and experience? I do not think that we are. I do not dispute the good faith of the patient, that

he had a desire to make water, that he believed his bladder to be full, and told Mr. Chaldecott so. I do not accede to a suggestion made years ago by Dr. Eben Watson, that the urine escaped from the patient's urethra, without his knowledge, after the accident; but I cannot help strongly suspecting that the bladder was empty. Temporary suppression of urine—determined possibly by a chill at the concert—with irritable kidney from latent or incubating gout, would account for the phenomena. At all events, the view of suppression of urine advanced by Dr. Eben Watson,[2] although supported by arguments which Dr. Gillespie combatted with some success, has not, by any means, been disproved. It is a noteworthy circumstance that neither blood nor urine was found in the bladder —not even a streak of blood on the catheter—but the bladder was absolutely empty. Nothing came away for fourteen hours. After eighteen hours Mr. Aston Key drew off an ounce of bloody urine, and then four hours later, under the influence of warmth and two scruples of liq. opii. sedativus, a *refreshing* sleep is obtained; the attack begins to pass off, and clear urine is secreted. Two days afterwards the gout plainly shows itself. If suppression of urine holds good for the first attack, it equally holds good for the second, notwithstanding the subjective sensations of the patient. The term "peritonitis" must not be taken literally, but as representing the group of symptoms resulting from the incompetent kidneys and the effects of the accident. If, in spite of the considerations here adduced, the case should be quoted by surgical authorities as an instance of recovery after intra-peritoneal rupture of the bladder, there is still a suggestion to be made which would diminish the difficulty of accepting this conclusion, and that is, that the urea may have been almost completely absent, as in the case of Bright's disease which came under Mr. Reginald Harrison's care on account of extravasation of urine, the result of a co-existing stricture. This explanation is not so satisfactory to my mind as complete suppression, but it is more satisfactory than recovery after effusion of a large quantity of normal urine into the peritoneal cavity not removed by operation. The insuperable character of the obstacle to recovery presented by urine pent up in the peritoneal cavity to the surgical mind is strikingly exemplified by a remark of Mr. Reginald Harrison, who, whilst endeavouring to uphold the genuineness of Mr. Chaldecott's and Dr. Thorp's cases, unwittingly overthrows their claims. "In these cases," he says,[3] "there can be no doubt that large quantities of urine were drawn off from the peritoneal cavity which, if allowed to remain, it is reasonable to suppose would have induced fatal consequences." Now it so

[2] For Dr. Eben Watson's views see the "Edinburgh Monthly Journal" for October, 1848, and for 1849, p. 561; and for the controversy between him and Dr. Gillespie concerning Mr. Chaldecott's case, see the "Edinburgh Medical Journal" for March, 1859, p. 84, and the "Glasgow Medical Journal" for 1859.

[3] *Op. cit.*, p. 317.

happens that in Mr. Chaldecott's case scarcely anything was drawn off by the catheter, and the urine believed to have been poured into the peritoneal cavity is supposed to have been absorbed by the peritoneum, though not without resentment, and after two or three days incubation, to have taken the form of gout; whilst in Dr. Thorp's case a prolonged research in the peritoneal cavity only resulted in the meagre amount of less than twelve ounces of urine with a reddish tinge. In both cases the results of catheterism constitute a strong argument against the correctness of the diagnosis of intra-peritoneal rupture, and inasmuch as "it is reasonable to suppose" that a quantity of urine retained in the peritoneum "would have induced fatal consequences," and inasmuch as in both instances, if the cases were genuine ruptures, this retention certainly occurred, and the patients nevertheless recovered with remarkable rapidity, I must claim Mr. Harrison as unconsciously a strong supporter of my view that a rupture of the urinary bladder into the peritoneal cavity did not exist in either instance.

PART IV.

TREATMENT.

NOTWITHSTANDING the freedom with which I have criticized the records of the reported recoveries after intra-peritoneal rupture of the bladder, I would gladly see all objections to their genuineness satisfactorily overcome, and obtain an assurance that the lesion is not beyond the possibility of spontaneous recovery, or the simplest resources of our art. In reply it may, of course, be urged that the very fact of recovery would at once excite antagonism, and cause the case to be rejected, unless the rent had been demonstrated beyond dispute. I do not think that this would be so if the evidence of distension of the bladder, injury to the hypogastric region, and of the typical symptoms, was really clear and satisfactory. It is because, on comparison with the records of indubitable cases, the reported cases of recovery are found wanting in the most essential particulars, and admit of a more probable solution, that they have to be set aside in spite of a sincere desire to welcome success as a gain both to humanity and surgery. Even in respect to Dr. Walter's case, which I am anxious to admit as an indubitable instance of recovery, I am obliged to suspend my judgment until I have before me a full report of the primary history, and have some reasonable scruples dispelled. But in addition to the objections which can be urged against the genuineness of the recorded recoveries after intra-peritoneal rupture of the bladder, there is one circumstance which, until their genuineness is established, would justify us in setting the cases on one side in considering the question of treatment. That circumstance is the remarkable fact that if the genuineness of all the eight cases were to be admitted, the effect in regard to the selection of the best method of treatment would be thoroughly bewildering. The record would show four cases of recovery after the use of the catheter only; one case of recovery after "washing out the peritoneal cavity" by means of the catheter passed through the rent in the bladder; one case successfully treated with the aspirator; one case of recovery after lateral lithotomy; and one case of recovery after abdominal section, sponging the urine and blood from the peritoneal cavity, and leaving the rent to itself without retaining a catheter in the bladder. The inference would be drawn that one mode of treatment is as good as another, and this "lame and impotent conclusion" would sadly mar the prospect of attaining an effectual means of dealing with a most fatal lesion.

Turning, then, to the accounts of the cases which are beyond the reach of doubt, we may affirm that in neither form of rupture—the intra-peritoneal or the extra-peritoneal—can reliance be placed on

constitutional and general means of treatment. Leeches, venesection, fomentations, clysters, purgatives, sinapisms, salines, poultices, calomel, opium, morphia, &c., probably affect the ultimate issue as little as the fresh sheepskins applied to the abdomen of the patient whose case is reported by Bonetus, and the oxyrrhodinum with which the parts were subsequently smeared. Morphia and opium may be very efficacious in relieving suffering, but uncombined with surgical measures they have no power to do more than promote euthanasia. If any hope is to be entertained it dawns in the prompt application of efficient local treatment. The main indications are two—first, the removal, as speedily as possible, of the effused urine, and secondly, the prevention of the further escape of urine through the rent in the bladder into the connective tissue or the peritoneal cavity. For these purposes the means at the disposal of the surgeon are catheterism—intermittent or permanent; washing out the peritoneal cavity and retaining a catheter in the bladder; paracentesis abdominis, or simple incision to evacuate the urine; perineal sections—median or lateral—as for stone in the bladder; tapping the rectovesical *cul-de-sac;* and abdominal section, combined or not with sewing up the wound in the bladder, and the establishment of drainage. Let me briefly review the advantages and disadvantages of each.

1. By the use of the *catheter* only it is possible to draw off a considerable proportion of the urine effused into the peritoneal cavity, provided that the rent happens to be in the posterior wall of the bladder, but it will not remove all of it; and when the rent is in another part of the viscus it may fail to remove any, whether from the peritoneum or connective tissue. If passed only at frequent intervals it will not altogether prevent further extravasation, and is liable to disturb the process of repair. Retention of a catheter in the bladder is more efficacious in preventing effusion, but it is not thoroughly reliable, and the patient, finding it intolerable, may remove the instrument in the absence of the medical attendant. It is no wonder then, that, as catheterism alone does not fulfil the necessary indications, it should have been "weighed in the balances and found wanting." For retention in the bladder the india-rubber catheter will be the best and the most comfortable for the patient. Retention of a catheter in the manner practised by Morris may prove very valuable in preventing over-distension of the bladder when a rent is undergoing repair.

2. *Washing out the peritoneal cavity*—as in Thorp's case it was euphemistically termed—by means of a catheter fitted with an india-rubber bag and stopcock, has been strongly recommended by Mr. Heath on the basis of its supposed success in the hands of Dr. Thorp, and the failure of abdominal section in his own and Mr. Willett's cases. Mr. Heath says, "It seems to me to offer as good, if not better, chances of success than any other proceeding, and has the great advantage that it can be put in action promptly, which is, after all, the great point. In addition it introduces no new element of danger to the patient, nor any serious surgical proceeding

which may be distasteful to his friends." As this method has not been adopted in any other case but Dr. Thorp's, it would be premature to pronounce any positive opinion on its merits; but if the friends objected, or the patient objected, to an operation, it might be tried with such modifications as experience may suggest. I cannot say that I entertain any well-grounded hope that it will prove efficacious in removing the extravasated urine or neutralizing its evil effects, for it appears to me to be a fallacy to suppose that the complicated peritoneal cavity can be washed out, as a simple circumscribed cavity like the bladder can be washed out, through a catheter alone. For effectual washing out an opening should be established into the peritoneum above the pubes, whereby the danger of merely driving the urine further amongst the intestinal coils could be obviated. Certainly such a will-o'-the-wisp as Dr. Thorp's case should not lead the surgeon astray from the employment of more active measures when he is at liberty to act as his judgment directs. For washing out, a solution of thymol might perhaps be better than warm water.

3. *Tapping the rectovesical cul-de-sac* was suggested by Dr. Harrison as a means of treating intra-peritoneal ruptures, under the mistaken impression that the urine frequently collects and is confined in that pouch, and that a dependent opening into the rectum would efficiently drain the peritoneal cavity. In speaking of this measure Mr. Spence pertinently observed: "The state of parts in my own case showed me that the operation of puncturing the inferior *cul-de-sac* of the peritoneum to evacuate urine supposed to be lodged in the peritoneal cavity must always be uncertain, and often dangerous; whilst, as the fluid is diffused it would not be fully drawn off, and this can only be possible in those very rare cases where the urine has accumulated, and is limited by adhesions, a condition of the existence of which I am very sceptical."

4. *Paracentesis abdominis* has been performed twice in intra-peritoneal ruptures. In the case observed by Dr. Spon, and reported by Bonetus, "paracentesis was performed by the hand of a skilled operator four fingers' breadth from the umbilicus at the part which slopes towards the right side" (right iliac region). "Six ounces of fluid blood leapt from the wound. The patient was in nowise benefited by the operation." Mr. Cusack used a lancet and director in one of his cases. A considerable quantity of urine was evacuated both at the time and some hours after the incision. An ordinary trocar and cannula, or an aspirating needle and cannula, might be employed, care being taken not to wound intestine. Paracentesis has not been practised often enough to warrant a decisive judgment. Performed with a cutting instrument, it appears to be more efficient for the removal of effused urine than the catheter or tapping the peritoneal cavity through the rectum, and much safer than the latter operation. It might be practised for the confirmation of a doubtful diagnosis as a preliminary to abdominal section, or as a substitute for it, when a more effectual procedure was forbidden. In extra-peritoneal

ruptures incision through the anterior abdominal wall above the pubes is indicated when the rupture is in the anterior part of the bladder. In the case which occurred at St. George's Hospital, and survived for thirteen days, a vertical incision drew off a collection of urine from behind the symphysis pubis. In Allin's case [4] an incision two inches long in the linea alba, close above the symphysis, drew off three pints of urine. In Delagarde's case [5] an incision was made above the pubes, evacuating urine, and drainage tubes were passed into the pelvis. The bladder was kept empty by means of a flexible catheter. Sloughing occurred, and the obturator vein was implicated. Recurring venous hæmorrhage caused the loss of several pints of blood, and death occurred from exhaustion. Incisions must be made also wherever there appears to be a collection of urine. Dr. Maxwell Ross has reported an interesting case of extra-peritoneal rupture complicated with a very tight stricture of the urethra. On the patient's admission to the Edinburgh Infirmary, all attempts made to pass a catheter failed, and a fine hollow needle of a Dieulafoy's aspirator was introduced above the pubes, and withdrew twelve ounces of a bloody fluid with a urinous odour, along with numerous bubbles of gas: a similar result followed subsequent introductions of the aspirating needle. The exact source of the gas bubbles was not determined. Aspiration failed to save the patient. (See Note G, case XIV. p. 128.)

5. The operations of *median and lateral lithotomy*, or *cystotomy*, are of unequal value. The median operation consists merely of urethrotomy and dilatation of the prostatic urethra and orifice of the bladder, and as the sphincter soon regains its retentive power, can scarcely be effectual either for the removal of urine already in the peritoneal cavity, or for subsequent drainage. For exploration it would be simple, safe, and valuable; and in cases complicated by stricture, the best method of preliminary procedure. In the case of rupture following stricture, reported by Mr. Henry Arnott, Mr. Lawson tapped the bladder *per rectum*, and drew off five ounces of bloody urine. In the case at St. George's Hospital above referred to, perineal section was performed because the catheter could not be passed. In Clark's case the bladder was cut into through the perineum, evacuating a large amount of blood and urine, to the great relief of the patient. Although he had been caught between two heavy timbers, and had sustained multiple fractures of the rami of the pubes and ischium, as well as a rupture of the bladder, the patient survived twenty-five days. In Dr. Chamber's [6] case the urethra was ruptured as well as the bladder, which was torn in two places. Free incisions were made into the scrotum and perineum, and the urethra was laid open on a lithotomy staff. Urine and blood escaped, and a catheter was introduced through the wound. In Earle's case, which was complicated with separation of the pubic and sacro-iliac symphyses and rupture of the rectum, and in which

[4] See Max Bartels' paper, case 38.
[5] "St. Bartholomew's Hospital Reports," 1868, p. 117.
[6] "Medical Times and Gazette," 1853, vol. ii. p. 59.

the bladder was torn away from the prostate, perineal section was performed, and the finger introduced into the bladder. Death took place in forty hours. Perineal section was also performed in Mr. Quain's case, which was complicated with separation of the pubic and sacro-iliac symphyses and laceration of the membranous urethra and muscles of the thigh. Blood and urine were emitted. Mr. Reginald Harrison[7] made a median perineal incision with advantage in a fatal case of injury to the bladder and prostate. Urine had escaped through a laceration, passing through the base of the bladder. Dr. Erskine Mason refers to the case of a middle-aged man caught between a ferry-boat and bridge. In addition to a rupture of the bladder, the man sustained a fracture of the pubic bones, which projected through the anterior abdominal wall. The median operation was performed by Dr. Robert F. Weir, but the man died. Dr. Erskine Mason quotes the case in illustration of the disadvantage of the median operation, as the bladder soon regains the power of holding water. In lateral cystotomy, on the other hand, the knife would be able to cut freely into the prostate, and reach the neck of the bladder, which would be slow to regain its retentive power. This constitutes the great recommendation of the lateral operation, and no other measure appears to me to equal it for efficiency in this important direction. By itself it could scarcely have much effect in removing urine already effused into the pelvic cavity, and for this purpose some supplementary procedure would be necessary. It is also difficult to understand how the operation could be effectual for the removal of urine which had already escaped into the pelvic fascia through an extra-peritoneal rent; but probably it might answer the purpose for extra-peritoneal ruptures immediately behind the prostate, if the operator had the boldness to carry his incision through the gland and its capsule. In a case of intra-peritoneal rupture Mr. Partridge cut into the bladder and found it empty. Median urethrotomy has been recently supported by Dr. Stein and Mr. Henry Morris;[8] the lateral procedure has been strongly advocated by Dr. Stephen Smith and Dr. John A. Lidell[9] in America, and Mr. Bryant in England.

6. Abdominal section and sewing up the rent in the bladder were discussed by Benjamin Bell and warmly advocated by Dr. Blundell.[1] The latter proposed that cases of intra-peritoneal rupture of the bladder should be treated by opening the abdomen, washing out the peritoneal cavity with water at a temperature of 98° Fahrenheit, fishing up the bladder, putting a ligature round the aperture in its wall, and allowing one end of the ligature to hang out of the abdominal wound. To determine the value of his suggestion, he experimented on rabbits. Four ounces of urine were injected into the peritoneal cavity, and allowed to remain an hour.

[7] "Lectures on Urinary Diseases," p. 321.

[8] *Lancet*, July 7th, 1883.

[9] See Lidell on "Rupture of Abdominal Viscera," for some valuable practical remarks, "American Medical Journal," April, 1867, p. 358.

[1] *Op. cit.*, and Lectures in the *Lancet*, 1829.

The fluid was then withdrawn, and the cavity well washed out with tepid cistern water. Three out of four rabbits died with general peritonitis, and one lived. In another class of experiments he tied up the fundus of the bladder, afterwards cutting the fundus away. The ligatures came away in a few days, leaving the bladder closed. In 1857 Dr. Gross proposed abdominal section for the removal of the effused urine; and Mr. Cusack as well as Mr. Holmes has suggested opening the abdomen, removing the urine, and sewing up the rent in the bladder. Mr. Willett [2] and Mr. Heath [3] put this method in practice without saving the patients. Both cases are valuable and instructive in the highest degree. In Mr. Willett's case an incision, five or six inches in length, from the umbilicus to the pubes, was made in the mesial line through the parietes; and at once several ounces of dull brownish fluid, with strong urinous odour, escaped. The intestines greatly distended, bulged out of the wound, and were protected by warm flannels. About half a pint of urinous fluid was removed from the pelvis, but a small quantity seems to have eluded the operator in the upper part of the cavity. The intestines were carefully cleaned before they were replaced. The rent in the bladder, which was a straight tear above, but jagged and uneven below, was sewn up by means of eight interrupted sutures of fine Chinese silk, placed at intervals of rather less than half an inch. The sutures appeared to close the rent completely. A carbolized drainage tube was passed into the pelvis through the lower angle of the abdominal wound, and secured in that position. A Thompson's catheter was introduced and retained in the bladder. After the operation the patient remained free from pain and sickness till the following day, when both recurred. He died rather suddenly twenty-two hours after the operation. At the post-mortem examination Mr. Willett found that, notwithstanding the care he had exercised, the rent in the bladder had not completely closed; for between the two posterior stitches there was an orifice, through which water injected *per urethram* escaped very freely. Except at this spot the edges of the wound were adherent. Mr. Willett thinks that the patient's life was not prolonged, but shortened by the shock of the operation.

Mr. Heath's case was operated on at four p.m.—forty-two and a half hours after the accident. "An incision was made in the middle line just above the pubes for two inches, and the tissues were divided down to the peritoneum, which appeared blue; the recti muscles, which were firmly contracted, being held aside by retractors with difficulty. The peritoneum was then picked up, and a cut made into it, when a gush of fluid like that drawn off by the catheter came out. A large quantity of clots was then taken out from the peritoneal cavity. Mr. Heath having introduced his finger found a long rent in the posterior wall of the bladder, high up. *It was proved to be a rent in the bladder by passing a catheter through it from the urethra.* The rent was

2 "St. Bartholomew's Hospital Reports," 1876, p. 209.
3 "Med. Chi. Trans.," 1879, vol. lxii. p. 335.

then sewn up in the following way:—The first stitch was put in at the lower end of the opening by means of a needle set at right angles to the handle, and was then firmly tied; one end of the catgut being then used by an assistant to pull the bladder up out of the pelvis, Mr. Heath threaded the other end into an ordinary needle, and carefully sewed the opening up with a continuous suture, a great part of which is still visible in the preparation. The clots were removed as far as possible from the peritoneum, and the cavity sponged out after injection with warm water; and a long, large-sized drainage tube was inserted at the lower angle of the wound, which was brought together by deep and superficial sutures. The carbolic spray ceased working before the operation was completed. A catheter was passed into the bladder, to which was afterwards attached some india-rubber tubing leading into a vessel under the bed. Patient being put back to bed a hot poultice was applied to the abdomen, and opium was administered—gr. j., in pil. 4tis horis. At eleven p.m. patient expressed himself as much better. His anxious Hippocratic aspect had passed off; pulse had improved; no sickness; abdominal pain much less; distension relieved." He passed a quiet night, almost free from pain, and lay with his legs outstretched. The drainage tube was removed the day after the operation. The improvement in the patient's condition was maintained till the third day after the operation, when he complained of being blown up with wind. The following night he was very restless; constant vomiting set in, and he passed several motions in bed. He got rapidly worse, and died rather more than four days after the operation, and six days after the accident. At the post-mortem, the rectovesical pouch of peritoneum was found to contain about six ounces of clotted blood, black in colour, and moderately offensive in odour. The catgut suture had given way at the lower part of the rent in the bladder, which was gaping. The mucous membrane of the bladder was blood-stained.

Mr. Willett's patient would have had a far better chance of recovery if he had been operated on when first seen after admission into the hospital. Owing to a natural and laudable desire to be fully certain concerning the nature of the lesion, and to be morally supported by his colleagues in the application of an unusual procedure, Mr. Willett deemed it advisable to wait twenty-four hours. The operation then performed was, undoubtedly, a far more severe operation than Mr. Heath's; the incision being two or three times as long, and the intestines much exposed and handled. Moreover, the object of the operation was partly defeated by the small aperture left between the two lower stitches, much to Mr. Willett's annoyance and regret. To obviate this occurrence in any future case, Mr. Willett suggests distending the bladder after the insertion of the sutures and before closing the abdominal wound. A moderate injection of fluid would probably suffice for the purpose; a large quantity might put a dangerous strain on the stitches.

In Mr. Heath's case the operation was done at the earliest opportunity, but rather longer after the accident than in Mr. Willett's case; and its want of ultimate success may have been due partly to the unavoidable interval, partly to the presence of six ounces of decomposing clot left in the rectovesical pouch, and partly to the giving way of the catgut sutures. Most probably the suture gave way on the third day after the operation, when the patient's condition markedly deteriorated. But though the patient died, the advantage of abdominal section is strikingly demonstrated by the great relief afforded to the patient. My second patient, who was treated only by the intermittent use of the catheter and opium, lived six days; but how remarkable the contrast between his suffering, restless state, with the constant vomiting, and the condition of Mr. Heath's patient—almost free from pain, entirely free from sickness, passing quiet nights and days, and dozing with limbs outstretched. Surely this is a solid gain, and I am sorry that Mr. Heath, having all but attained the success which he deserved, instead of directing his attention entirely to the improvement of the method which he adopted with courage and sagacity, should, in a moment of discouragement, pin his faith to the airy fabric of washing out the peritoneum through the rent in the bladder, erected on the unstable foundation of Dr. Thorp's equivocal case. Abdominal section has not yet been fully and fairly tried. Twenty or thirty cases may be needed before the value of the method can be determined. Much will depend upon points of detail, the promptitude with which it is applied, the age and condition of the patient and severity of the injury, the more or less complete removal of urine and blood from the peritoneal cavity, the length of incision, the treatment of the wound in the bladder, washing out the peritoneum, and the establishment of drainage. It is necessary to insist on the earliest possible formation of a diagnosis and performance of the operation, and a thorough removal of urine and blood from the peritoneum. Very probably it would uniformly be found useless unless performed at an early stage.

Few will dispute the less severity of an incision two or three inches long, compared with one of twice the length. Experience alone can determine whether the wound in the bladder should be sewn up or not. If we could unreservedly trust to the genuineness of Dr. Walter's case, the rent might be left to take care of itself; and we might find some justification for this in the frequently jagged and contused edges of the aperture, which render primary union unlikely to occur. Before the edges have cleaned and adhered the stitches might cut their way out; whereas, if the rent were left alone, the bladder being kept empty, adhesion of the edges might soon occur, and intestine might become attached to the back of the bladder. If the rent is sewn up, carbolized silk would hold better and longer than catgut. Washing out the peritoneum with tepid water seems to be objectionable. A warm solution of thymol or sanitas would be less favourable to the

introduction of impurities and germs. Mr. Heath is convinced of the inutility and harmfulness of a drainage tube passed through the abdominal wound into the pelvis; but he seems to regret that he did not pass a tube through the rectovesical pouch of the peritoneum and the wall of the rectum, bringing it out at the anus. I feel very strongly that this would be a dangerous procedure, and that the risk of gas getting into the peritoneal cavity would far outweigh any advantages arising from the dependent opening. If another opening be needed, and I am inclined to think that it is, the most efficient means of securing free exit of urine and giving perfect rest to the bladder would be to combine lateral or median lithotomy or cystotomy with abdominal section, performing the abdominal section first with antiseptic precautions, and sewing up the rent in the bladder, and afterwards making the perineal opening. Doubtless, the combined procedure may appear severe; but an intra-peritoneal rent in the bladder is a desperate injury, requiring to be met, not by desperate, but by thoroughly effectual means of treatment, directed first to the removal of urine already effused, and secondly to the prevention of further escape.

Dr. Vincent, for whose monograph I am indebted to Mr. Heath, advocates cystoraphy by a combination of two kinds of suture, which may be termed the sero-muscular and the serous suture respectively. The sero-muscular suture consists in entering the needle a little way from the edge of the rent, carrying it down as far as the mucous coat, and then making the thread traverse the edges of the rent between the muscular and mucous tissues, and bringing it out at a corresponding point on the opposite side. The suture draws the edges of the rent together, and by avoiding penetration of the mucous coat, obviates all danger of the sutures finding their way into the bladder and becoming calculi. The serous suture is effected by entering the needle at some distance from the edge of the rent, carrying it under the peritoneum for about a quarter of an inch or more, then bringing it through the serous coat, drawing the thread across the rent, and repeating the process on the other side. When this suture is tied the peritoneal surfaces on either side of the wound are brought into contact, and, according to Dr. Vincent, rapidly unite. The serous and the sero-muscular sutures may be alternated with advantage. Dr. Vincent attributes the failure of abdominal section and cystoraphy in Mr. Willett's and Mr. Heath's cases to the length of time which elapsed before the operations, and to the ineffectual character of the sutures. In his experiments on dogs he found that the procedure was uniformly successful when practised within eight and half hours, but constantly failed through urinary intoxication when performed twenty-four or twenty-five hours after the bladder was wounded. He deprecates founding any canon for treatment upon Dr. Thorp's case.

Occasionally it happens that the practitioner, whilst convinced that a rupture of the bladder has taken place, is in doubt whether the rent is intra-peritoneal or extra-peritoneal. As it is of the

highest importance to act promptly, an exploratory incision should be made immediately above the pubes, and the bladder reached before the peritoneum is opened. If no evidence of an extra-peritoneal rent is forthcoming, the peritoneum can then be divided, and the posterior surface of the viscus exposed. By proceeding cautiously, the surgeon may avoid the possible error of laying open the peritoneum for an extra-peritoneal rupture. Abdominal section was performed by Mr. Lyell on a boy who was the subject of an extra-peritoneal rent caused by fracture of the pelvis. A small quantity of blood-stained fluid but no urine was found in the peritoneum.[4] Median urethrotomy is valuable for exploration. Perineal exploration of the bladder is also available.

As illustrating the advantage of early incision above the pubes in the extra-peritoneal rents, I would again call attention to the case of recovery reported by Dr. A. V. Williams in 1855. Probably a good many more recoveries after extra-peritoneal rupture would have been chronicled if surgeons had acted more boldly and promptly in these dangerous cases. In a valuable paper on rupture of the bladder following stricture of the urethra, already referred to,[5] Dr. Gouley has related a case which came under his care in the initial stage, and subsequently passed under the treatment of Dr. Stephen Smith. The patient was a man, aged thirty-six, who had suffered from dysury, and other symptoms of advancing stricture, for two years prior to admission to the hospital. Whilst straining to pass water he felt something give way within him, and experienced severe pain in the abdomen. On admission to the hospital the patient had not made water for forty-two hours. He lay in bed with his knees drawn up, and the abdomen was tense, tender, and tympanitic. A capillary whalebone bougie was passed, and over this a tunnelled catheter ; six ounces of clear urine being drawn off without yielding much relief. On the second day after admission there were redness and tenderness over the right iliac fossa, but no deep incision was made till the twenty-ninth day, when pus and urine were emitted from a cavity above the pubes. The patient survived till the forty-fourth day after the accident. At the autopsy a rupture of the anterior wall of the bladder was found about the middle of the vertical diameter, and a little to the right of the median line. The opening in the mucous coat was somewhat rounded, and large enough to admit the index finger. The muscular and fibrous coats showed a vertical laceration an inch in length. A cavity existed in front and around the bladder. Dr. Gouley himself, in his comments on the case, regrets that an exploratory incision was not made. He advocates treating these cases by cystotomy combined with a supra-pubic incision, remarking that the latter is necessary for the evacuation of urine already extravasated, and the former for the prevention of further

[4] *Lancet*, July 7th, 1883, Morris on "Rupture of the Bladder."

[5] "New York Medical Record," 1872, p. 457. Dr. Gouley refers to a prior paper by Dr. Cruse in the "Record" for August, 1871, p. 241 ; and to a paper by Dr. Willard Parker on "Cystitis and Rupture of the Bladder treated by Cystotomy."

escape of urine from the bladder. Another instance in which an exploratory incision would have been beneficial has recently occurred in the practice of Dr. Walker at the Bootle Hospital.[6] The case was seen in consultation with Mr. Reginald Harrison, who diagnosed a rupture of the bladder.

The patient was a fireman of a steamship, aged forty, who went to bed in his usual good health, and woke suddenly between one and two o'clock in the morning, wanting to pass urine, and complaining of intense pain all over "the privates." A medical man who was summoned passed a No. 8 gum-elastic catheter, and drew off blood in considerable quantity. Early in the morning the patient was admitted into the hospital. His abdomen was distended, dull on percussion, and very tender over the bladder. The perineum was ecchymosed. During the day he passed about thirty ounces of blood. After the diagnosis of rupture of the bladder had been made the treatment consisted in the retention of an india-rubber catheter and ablution of the bladder with weak carbolic lotion (1 in 100). An erythematous rash characteristic of extravasation began to appear over the right iliac region, extending halfway down the thigh. Vomiting set in, and great prostration, and the patient died on the fourth day after the rupture. There was a cavity about the size of an orange behind the symphysis pubis filled with blood-clots. A rupture was found two inches in length in the anterior wall, commencing an inch from the neck, and extending to two inches from the apex. The urethra was normal. There was nothing whatever to account for the rupture, the patient averring that he had always been a temperate man, free from venereal diseases, and had not sustained any injury prior to the rupture. Mr. Harrison thinks it probable that the rupture was really due to an injury which escaped notice. The character of the rent, the quantity of blood effused into the pelvic areolar tissue and in the rectus muscle, and the ecchymosis of the perineum, point to injury rather than to spontaneous rupture. A supra-pubic exploratory incision made immediately after diagnosis would have afforded the patient the best chance of recovery.

The treatment of rupture of the bladder in the female must be conducted on the same principles as in the male. Laparotomy is indicated as strongly as in the male for intra-peritoneal rents, and incision through the anterior vaginal wall into the bladder will naturally take the place of median or lateral cystotomy. In any doubtful case exploration of the viscus, either by dilating the urethra or by vaginal cystotomy, might be undertaken as a preliminary measure.

Looking to the extreme violence which often occasions rupture of the urinary bladder, to the injurious character of the fluid effused, to the variety of conditions and ages of the patients, to the frequent complications, to the doubts which often beset diagnosis, and to other obstacles to successful treatment, surgeons can scarcely expect to rescue many who become the subjects of this

[6] "British Medical Journal," Dec. 16th, 1882, p. 1207.

dangerous lesion. Fortunate as it is that the accident is rare, the very rarity militates against the recovery of patients, for the attainment of personal experience in diagnosis and treatment becomes impossible for the individual surgeon. The recorded experience of many observers, combined into one view, must remedy this defect; and it has been with the object of rendering that experience more easily accessible to those who may meet with cases of the kind, and are desirous of acquainting themselves with the practical details of previous observations, that I have treated the subject at length. Entertaining a doubt similar to that expressed by Mr. Willett in 1876, whether a single unequivocal recovery after an intra-peritoneal rupture has occurred, I do not in this age of antiseptics absolutely despair of a time arriving when it can no longer be said, with Gross, "All the mischief that can be done is done in the first instance by the escape of urine into the peritoneal cavity, from which it will be out of the power of the surgeon to remove it, or to prevent its pernicious effects;" or with Cusack, "In accidents of this nature the surgeon has generally to lament the imperfection of his art while he witnesses the progress of the unfortunate patient to the termination of his sufferings;" or with Syme, "If the rupture takes place above or within the reflection of the peritoneum, there cannot be the slightest chance of escape;" or with Sir Henry Thompson,[7] "In any case a recovery has never been known to happen, and can scarcely be regarded as possible."

It is not by standing still and relying upon old methods which have conspicuously failed that future success can be obtained. Neither can any advantage be expected by placing confidence in the methods of treatment, various as they have been, which have been adopted in equivocal cases published as instances of recovery after intra-peritoneal rupture of the bladder. Examined apart from the individual claims of the cases themselves to the acceptation of surgical authorities, the methods employed do not fulfil the two cardinal indications for successful treatment. The long list of fatal cases and sound surgical reasoning alike urge upon practitioners the advisability of giving a fair trial to means that appear likely to prove thoroughly efficient. Failures there will be, for failures are often the necessary preliminaries to success. The history of abdominal surgery illustrates this, and abundantly testifies that the best results are the reward of judicious boldness. It has been well said by Mr. Bryant that surgeons have been looking for a satisfactory means of dealing with intra-peritoneal rupture of the bladder. Unfortunately, this discovery has not yet been made; neither are surgeons in agreement with each other. Further experience alone can decide between the conflicting views; and surgery will achieve no unimportant triumph when occasional and indubitable recoveries are ensured by improved methods of treatment.

[7] "System of Surgery," vol. iii. p. 233, Third Edit., 1883.

APPENDIX.

LIST OF FATAL CASES OF RUPTURE OF THE URINARY BLADDER.

I.—SIMPLE INTRA-PERITONEAL RUPTURE.

[No., Author and Reference, Sex, Age, Cause, Time of Survival, Size and Position of Rent, &c.]

1 Th. Bonetus Sepulchretum, lib. iii. sect. 24, obs. 12; Observatio Excell. DD. Caroli Sponii, Regii Vice Decani Facultatis Medico Lugdunensis Gallorum; 4th Aug., 1648. Male, 30; fall; 42 hours; rent on rectal surface, size of large hen's egg; commencing peritonitis. (See pp. 78 and 79).

2 Cusack, "Dublin Hospital Reports," vol. ii. 1814. Male, 26; fall against edge of bench; 7 days, 13 hours; rent one inch, posteriorly and to right side; abundant lymph. (See pp. 26 and 79).

3 Cusack, "Dublin Hospital Reports," vol. ii. 1818. Male, 30; fall from height; died on eighth day; rent at upper and back part, more transverse; abundant lymph. (See pp. 11 and 27.)

4 Hiley, J. S., *Lancet*, 1842. Male, 31; kick; 3 days, 9 hours; rent one inch at superior and posterior part, valvular, i.e. edges sloped from within the bladder outwards; "no sign of peritonitis" (?). (See pp. 27 and 33.)

5 Garry, A., *Lancet*, Oct., 1828. Male, 32; stricture, retention, and straining at stool; 36 hours; hole with three flaps posteriorly, incipient peritonitis; three quarts of urine in abdomen; intestine tympanitic; incipient vascularity of peritoneum. (P. 14.)

6 Southey, Dr., *Lancet*, 1871, vol. i. p. 610. Female, 16; retroflexion of gravid uterus; retention; sudden collapse on the 17th day; sloughy hole in posterior wall of bladder. (See Note D, p. 109.)

7 Bedingfield, J., *Lancet*, 1836-37. July 4th, 1829. Female, 36; labour and retention; 4 days; fundus ruptured; slight peritonitis.

8 Ramsbotham, Dr. J., "Practical Observations in Midwifery," case 158, second edition, 1816. Female; labour and retention; sudden collapse; no details.

9 Ramsbotham, Dr. J., "Practical Observations in Midwifery," case 159. 1829. Female, 36; labour and retention; about 2 days; hole size of finger on uterine surface; peritonitis. (See p. 18.)

10 Blundell, Dr., *Lancet*, Jan 24th, 1829. Female; retroversion of uterus; rupture of posterior part.

11 Dewar, A., "Edinburgh Medical and Surgical Journal," 1829 Male, 27; fall; between 3 and 4 days; ruptured along superior and anterior surface for three and a half inches; peritoneum dirty red, nine or ten pounds of urine in cavity and three pounds of clotted blood. (See p. 31.)

12 Ellis, Andrew, *Lancet*, Sept. 26th, 1833. Male, 26; struck on belly by a watchman's pole; death on fifteenth day; rent

size of little finger on posterior and superior part; slight peritonitis; two or three gallons of urinous fluid in cavity.

13 Ellis, Andrew, *Lancet*, Sept. 26th, 1833. Male, 28; horse fell on him; death in about 60 hours; small aperture in superior fundus; peritoneum vascular.

14 Andrews, Dr. H. C., "British Medical Journal," Oct. 24th, 1868. Male; man fell on him; death on fourth day; vertical slit one and a quarter inches at upper and anterior part of fundus; peritonitis; large quantity of fluid mixed with pus and blood in peritoneal cavity.

15 Dobell, Dr. H., "British Medical Journal," Nov. 14th, 1869. Male; fall on arm of chair; four and a half days; rent two inches on anterior free portion of fundus; "no signs of peritonitis;" abdomen full of high-coloured, strong-smelling fluid.

16 Poland, *Lancet*, April 4th, 1863. Male, 35; fall on abdomen; 60 hours; rent three and a half to four inches long at upper and back part; peritoneum vascular and containing two quarts of bloody urine. (See pp. 23, 27, and 32.)

17 "St. Bartholomew's Hospital Reports," 1865, p. 61. Male, 45; knocked down and jumped upon; death on third day; rent in superior fundus; general peritonitis.

18 Jones, T. D., *Lancet*, Aug. 20th, 1870. Male, 55; horse fell on him; lived about 54 hours; rent behind size of five-shilling piece blocked by omentum and sigmoid flexure; lymph.

19 Le Gros Clark, "British Medical Journal," Oct. 9th, 1869, "Lectures on Surgical Diagnosis." Male; horse fell on him; 7 days; lacerated rent one inch long at the back of the bladder; recent adhesions; rent cemented to adjacent rectum.

20 Drake, referred to by Mr. Le Gros Clark. Male; thrown violently whilst wrestling; lived 5 days; "no signs of peritonitis" (?); patch of lymph over bladder; four pints of straw-coloured fluid in abdomen.

21 Stapleton, "Dublin Quarterly Journal," 1850. Male, 22; fall from ladder; between 5 and 6 days; rent obliquely transverse three-quarters of an inch in length, with jagged and vascular edges; peritonitis; lymph; large quantity of fluid in peritoneal cavity. (See p. 28.)

22 Hamilton, "Dublin Quarterly Journal," 1846. Male; antagonist fell on him; 2 days and 13 hours; large transverse rent in superior fundus; intestines glued to each other. (See p. 27.)

23 Solly, "Trans. Path. Soc.," vol. ii.; "Medical Times and Gazette," April 26th, 1850, and "Surgical Experiences." Male; blow on abdomen; death on first day; longitudinal rent posteriorly one and quarter inches in length; recent lymph.

24 Prescott Hewett, "Trans. Path. Soc.," vol. ii. Female; thrown down by husband and knelt upon with great force; died in 24 hours in excruciating agony; two lacerations, one into peritoneal cavity half-inch long, the other into cellular tissue two inches long; only a small quantity of fluid in peritoneal cavity.

25 Ward, Nathaniel, "Catalogue, London Hospital Museum." Male, 27; opponent fell on abdomen; 3 days, 18 hours; rupture of upper part of bladder about size to admit halfpenny; adhesive peritonitis.

26 Smith, R. W., *Lancet*, 1844, vol. i. p. 102. Female. 53; fall across a tub; death in 5 days; large transverse rent in posterior and upper part of bladder; peritonitis.

27 Spence, James, "Edinburgh Medical Journal," 1859. Male, 32; fell backwards on stairs, striking back of head; nearly 5 days; rent half-inch in length at posterior aspect of superior fundus; no peritonitis. (See pp. 35 and 43.)

28 Partridge, *Lancet* and "Medical Times," &c., 1855; Pathological Society, March 6th, 1855. Male, 36; retention, fall on to a table; about 4 days; small slit through all the coats to the right of the fundus. (See pp. 36 and 81.)

29 Fergusson, Sir Wm., "Medical Times and Gazette," Sept. 8th, 1866. Female, 35; blow on head and fall backwards; not quite 2 days; clean longitudinal rent of two inches at upper and back part; adhesions of viscera. (See pp. 23 and 32.)

30 Field, A. G., "Medical Times and Gazette," Dec. 13th, 1856. Male, 72; enlarged prostate and retention; smooth and rounded opening in middle of superior fundus; turbid brown fluid and flakes of fibrin in peritoneal cavity. (See p. 17.)

31 Wilmot, Dr. J. B., "Medical Times and Gazette," Nov. 4th, 1854. Female, 19; hysteria and retention; sudden death; small opening one-third inch in posterior wall of bladder. (P. 20.)

32 Hird, *Lancet*, Oct. 31st, 1846, Male, 36; run over; 3 days; oblique fissure one and a quarter inches long in posterior part; bladder, &c., covered with lymph. (See pp. 28, 33, and 36.)

33 Bower, *Lancet*, Dec. 12th, 1846. Male, 29; abdomen struck corner of table; died on seventh day; rent one and a half inches long at superior, posterior, and lateral aspect; "not the slightest trace of peritoneal inflammation." (See p. 27.)

34 Montagu, Charles, "Medical Communications," vol. ii. p. 284, 1788. Male, 28; fell against edge of hatchway; nearly 4 days; rupture in fundus admitting the whole hand; peritonitis; three pints of urine in abdomen. (See p. 27.)

35 Wathen, J. H., "Medical Times and Gazette," Feb. 20th, 1869. Male, 31; horse fell on him; more than 12 days; transverse rent two and half inches long below fundus posteriorly; numerous adhesions shutting off bladder and pelvic cavity.

36 Stokes, Wm., "British Medical Journal," March 23rd, 1872. Female, 28; fall down a flight of stairs; 6 days, 15 hours; triquetrous rupture in most anterior part of fundus; extensive adhesions and lymph. (See p. 27.)

37 "Gazette des Hôpitaux," 1846, p. 387 (Houel). Male, 24, fall from second floor upon the soles of the feet; 15 days; rupture for two centimetres on superior part of left side of fundus; an immense quantity of purulent extravasation.

38 Cloquet, M. J., "Archives Générales de Médecine," 1827, t. xiv. p. 453 (Houel). Male; blow with knee above the pubic region; death on ninth day; fissure in summit of bladder; peritonitis; peritoneum full of urine.

39 Hourman, "Clin. des Hôpitaux," 1827, t. i. p. 3 (Houel). Male, 40; blow on belly; 6 days; long rupture on posterior wall between summit and bas fond for twenty-seven millimetres.

40 Hawkins, *Lancet*, 1853, vol. i. p. 33 (Houel). Male, 55; thrown down on his right side; 3 days; rent for three centimetres on posterior aspect, peritoneum being more extensively torn than the other tunics.

41 Oldfield, *Lancet*, 1844, vol. i. p. 79. Male, 42; cart-wheel passed over abdomen; 53 hours; oblique rent one and a quarter inches long on posterior and superior part of bladder;

viscera agglutinated by recent lymph; three or four pints of uncoagulated blood in peritoneal cavity.

42 Scott, *Lancet*, 1844, vol. i. p. 387. Male (Creole), 27; fallen upon in a fight; 3 days, 17 hours; oblique rent four centimetres (one and a quarter inches) on upper and hinder part of bladder; peritoneum torn most; viscera agglutinated by recent lymph; three pints of bloody fluid in cavity of abdomen.

43 Sasie, "Soc. Anat.," 1832, t. vii. p. 38 (Houel). Male, 75; hypertrophy of prostate, retention; narrow rupture on posterior aspect; urine in peritoneal cavity. (See Note A.)

44 Mercier, "Soc. Anat.," 1835, t. x. p. 11 (Houel). Male; hypertrophy of bladder and prostate, rupture on posterior aspect and to left; several diverticula. (See Note A.)

45 Tanchou, "Arch. Gén. de Méd.," t. xxii. p. 260, prèm. serie (Houel). Male, 70; hypertrophy of prostate; rupture three or four lines in diameter near the base and on the left side. (See Note A.)

46 Deguise (communicated to Houel by M. Deguise). Male, 57; fall (?); double rupture on posterior face of the bladder, the one four centimetres, and the other two centimetres; very evident softening of edges of aperture; no enlargement of prostate or urethral obstruction; abundant effusion in the cavity of the peritoneum.

47 Rawson, T. E., *Lancet*, 1843-44, vol. i. p. 299. Female, 35; confinement a month previously; sudden attack; 36 hours; a small ulcerated opening at the summit, perforating the coats of the bladder at point of attachment of superior ligament; two pints of fluid in peritoneal cavity; mucous membrane dark, highly congested; opening round, purulent matter adhering about the edges. (See p. 19.)

48 Pierus, "Hist. Anat. Med.," par Lieu-taud, lib. i. sec. 12. art. 4. obs. 1279 (Dr. S. Smith). Male, 23; rupture of fundus admitting two fingers.

49 Platerus, see last author (Dr. S. Smith). Male adult; fall on hypogastrium; rupture on posterior surface.

50 Hey, "Med. Obs. and Inq.," vol. iv. p. 58. Female, 38; confined with bladder distended; death on eighth day; rupture at superior part admitting a finger; edges ragged and blackish; fourteen pints of urine in abdominal cavity; viscera not inflamed.

51 Lynn[1] "Med. Obs. and Inq.," vol. iv. p. 388. Female, 40; retroversion of gravid uterus; bladder burst after distension for seven days; death the next day; rupture at fundus sufficient to admit finger; edges gangrenous; nine or ten pints of urine in cavity. (See p. 18.)

52 Home, Sir E., "Practical Observations on Treatment of Strictures," vol. ii. p. 236, London, 1803. Male, 44; stricture

[1] Lynn's case was erroneously ascribed by Houel to Dr. W. Hunter, and in my article in the *Lancet*, June 24th, 1882, I quoted Lynn's case on the authority of Dr. Stephen Smith, and Hunter's on the authority of Houel. Subsequent reference to the "Medical Observations and Inquiries" showed that the two cases were one and the same. Dr. Hunter reports a fatal case of retroversion of the gravid uterus, accompanied by retention of urine. At the post-mortem the bladder was found amazingly distended with urine, and filling up almost the whole anterior regions of the abdomen, like the uterus in the last months of pregnancy.

and retention; 3 days; rupture anterior to fundus; aperture in mucous membrane the size of a goose-quill, and in muscular tunic one inch in diameter; the urine infiltrated areolar tissue as far as umbilicus, where it ruptured the peritoneum and entered the abdomen; intestines adherent; much lymph; large quantity of urine in abdomen. (See p. 14.)

53 Stoll, "London Medical Repository," vol. xvii. Adult male; stricture, retention, and straining at stool; death on second day; rupture through posterior part of superior fundus; severe peritonitis; large quantity of urine in peritoneal cavity. (See Note G, case p. 126.)

54 Ewbank, "Bell on Diseases of the Urethra," p. 404, 1822. Adult male; subject of stricture; coach-wheel ran over belly; died on fifth day; jagged sloughy aperture at superior and posterior part of upper fundus.

55 Bell, *op. cit.* Adult male; horse fell on him; same appearances as in previous case.

56 Mott, Dr. (Dr. S Smith). Male, 35; fell and struck abdomen; death on second day; rupture near fundus large enough to admit three fingers.

57 Fix, Dr., "Phil. Medical and Surgical Journal," vol. ix. (Dr. S. Smith). Female, 10; retention; rupture nearly throughout whole extent; tissues much thinned; peritonitis; ten or twelve pounds of fluid in abdomen. (See p. 20.)

58 Gamack, "Med. Chi. Rev.," vol. xiii. (Dr. S. Smith). Male, 21; caught under a falling bank of earth; death on fourth day; rupture at fundus and at neck close to prostate: peritonitis slight.

59 Bush, "West. Jour. Med. and Phys. Sci.," vol. iv. (Dr. S. Smith). Adult male; fell on bed-post; death on fourth day; rupture at fundus; peritonitis severe.

60 Boyer, "Malad. Chi.," t. ix. p. 61, 1831 (Dr. S. Smith). Adult male; kick on abdomen; death on fifth day; round hole with sphacelated edges in upper fundus; fifteen pints of yellow fluid, not urinous (?), in abdominal cavity.

61 Dupuytren, "Arch. Gén.," June, 1834 (Dr. S. Smith). Male, 30; kick on hypogastrium; death on seventh day; rent two inches on posterior wall; peritonitis; extensive adhesions limiting effusion.

62 Legall, "Annales d'Hygiéne et de Médecine," No. 29, Jan., 1836 (Dr. S. Smith). Male, 35, kick on lower part of belly; death on seventh day; vertical rupture two inches long posteriorly and superiorly; at lower part only, all tissues involved; visceral adhesions.

63 "London Medical Gazette," April 9th, 1836 (Dr. S. Smith). Adult male; kick on lower part of belly; death on fifth day; rupture at posterior and superior part; pelvis full of urine.

64 Lawrence, "London Medical Gazette," 1839, vol. xxiii. p. 663. Male, 35; carriage fell on him; death on fourth day; rupture on posterior aspect; universal peritonitis.

65 Harrison, "Dublin Quarterly Journal of Medical Science," vol. ix. 1836. Male, 35; antagonist fell on belly; lived eight days; oblique fissure one and a half inches in length posteriorly; abundant lymph; cavity of pelvis shut off. (See p. 28.)

66 Harrison, *op. cit.* Male, 27; kick on lower part of belly; death on third day; transverse rent posteriorly one and a half

inches in length, most extensive through peritoneum; lymph abundant.

67 Taylor, "Medical Jurisprudence," 6th edition, p. 348. Adult male; fall against a stair; lived 24 hours. (See p. 28.)

68 Syme, "Taylor's Medical Jurisprudence." Adult male; fell upon a door-step; died in 2 days; rupture to the extent of two or three inches.

69 Vreeland, "New York Medical Journal," N.S. vol. iv. Male, 40; window-sash fell on lower part of belly; death on second day; large laceration at superior part; fluid and pus in abdominal cavity.

70 Syme, "Edinburgh Medical and Surgical Journal," vol. ii., Oct. 1836; "Taylor's Medical Jurisprudence," p. 377 (Dr. S. Smith). Female, 26; fell on edge of tub; death on sixth day; small aperture in superior fundus; severe peritonitis.

71 South, "St. Thomas's Hospital Reports," vol. i., 1836 (Dr. S. Smith). Male, 35; fell on a bench; died in 36 hours; rupture into peritoneal cavity.

72 Pendleton, "Charleston Medical Journal," vol. v. (Dr. S. Smith). Boy, 7; trod upon; "no appearance of bladder" (!); three gallons of fluid in abdomen; pus in pelvic cavity. (See p. 44.)

73 Lloyd, "London Medical Gazette," 1833, p. 816. Female, 40; erysipelas; death in 20 minutes; posterior part of bladder perforated by an ulcerated aperture elongated with ragged edges; general peritonitis; pint of urine in abdomen. (P. 18.)

74 Howship, "Diseases of Urinary Organs," 1823, case 54, p. 309. Male, 50; enlarged prostate; retention; 36 hours; small hole and numerous ulcers on mucous membrane; pus and lymph.

75 Larrey, "Relation du Siége d'Anvers" (Houel). Soldier; contusion; sudden death.

76 Heath, "Medico-Chi. Trans.," 1879, vol. lxii. p. 335. Male, 47; blow in stomach and fall on back; 6 days; vertical rent at posterior aspect; peritonitis. (See pp. 11, 36, and 82.)

77 Rivington, 1871. Male, 49; fall on abdomen; 4 days; vertical rent on posterior surface; peritonitis very slight. (See p. 2.)

78 Crossley, "Medical Times and Gazette," 1872. Male, 24; blow on hypogastric region; 16 clear days; oblique laceration for two inches on posterior surface; no peritonitis; four pints of clear urine in cavity. (See p. 30.)

79 McEwen, *Lancet*, Sept. 27th, 1873, p. 448. Male, 19; death on fourth day; aperture admitted tip of little finger to left of middle line behind; no urethral obstruction; large quantity of straw-coloured fluid in cavity. (See p. 21.)

80 M. Assmuth, "Petersburger Medic. Wochenschrift," No. 22, quoted in *Lancet*, Nov. 12th, 1881. Male; lifting heavy weight; rent three centimetres at back of bladder.

81 M. Assmuth, "Petersburger Medic. Wochenschrift, No. 22, quoted in *Lancet*, Nov. 12th, 1881. Male, 40; lifting heavy weight, with bladder distended; rent three centimetres at back of bladder.

82 Morris, "Medical Times and Gazette," 1879. Male, 64; fall downstairs; death on third day; on right side posteriorly large opening size of hen's egg, covered by a loose flap of peritoneum; "not a trace of peritonitis;" two pints of brownish-yellow blood-stained urine in cavity.

83 Rynd, "Pathological and Practical Observations on Strictures," p. 44. Adult male; found drunk in street; 37 hours; ragged

rent one and a half inches on posterior surface; edges soft, dark coloured, and in a state of slough.

84 Willett, "St. Bartholomew's Hospital Reports," 1876. Male, 48; kick in hypogastrium; 2 days and 3 hours; rent three and a half inches on superior and posterior surfaces, oblique; peritonitis. (See pp. 27 and 82.)

85 Williams, Dr. W. R., *Lancet*, March 31st, 1877. Male, 30; insane; injury? about 3 days; a large round hole size of chestnut at most superior and anterior part; no lymph; pint and a half of clear fluid.

86 McDougall, "Edinburgh Medical Journal," Jan., 1877. Male; fall; 5 days; rupture extensive (not specified whether into peritoneal cavity or not). (See p. 28.)

87 Porter, Dr. Henry, "Association Medical Journal," 1855, p. 589. Male, 35; kick; about 4 days; large aperture on posterior and superior surface with ragged edges.

88 Wilmot, S. G., "Association Medical Journal," 1855, quoted from "Dublin Hospital Gazette," June 1st, 1855. Male, 30; slipped, tried to save himself, fell on his back violently; 80 hours; large transverse rent posteriorly on level with brim of pelvis; "rupture in fundus for two inches;" general peritonitis; bladder contracted. (See p. 23.)

89 Gouley, Dr. J. W. S., "New York Medical Record," 1872, p. 457. Male, 60; stricture; rupture of urethra from injury; rupture of bladder whilst struggling under etherization (?); about 4 hours (?); laceration for half-inch in upper fundus. (P. 14.)

90 Harrison, Reginald, "Lectures on Diseases of Urinary Organs," p. 39. Male, about 27; spasmodic obstruction, retention, rupture during straining; between 3 and 4 days; rent one inch, almost at superior fundus; peritonitis. (See p. 14.)

91 Percy (Max Bartels). Male; kick; 28 hours; rent behind and below, somewhat above the orifice of the ureters; pelvis filled with blood and urine.

92 Guersant and Denis (Max Bartels). Male, 36; blow and kick on belly; death in 7 hours; a vertical jagged rent two inches long.

93 Eccles (Max Bartels). Male; kick in the region of the lower belly; death in 5 days; intra-peritoneal rupture; cavity of the belly full of urine.

94 Benno Schmidt (Max Bartels). Male, 49; kick in the region of the lower belly; death in 4 days; vertical rent in the bladder behind; coils of intestine adherent.

95 Ingham (Max Bartels). Male, 24; some one sprang on belly after he was thrown down in sport; death in 48 hours; rent posteriorly; lymph on intestines; large quantity of bloody urinous fluid in pelvis.

96 Anton Graw (Max Bartels). Male, 37; some one fell on belly; death in 12 days; rent in the vertex thirty m.m. long; a great quantity of reddish fluid in pelvis mixed with pus; purulent peritonitis.

97 "Catalogue, St. Thomas's Hospital" (Max Bartels). Adult male; transverse rent, edges smooth.

98 "Catalogue, St. Thomas's Hospital" (Max Bartels). Adult male; fall; transverse rent two and a half inches long at fundus, more in front than behind.

99 Percy (Max Bartels). Male; fall; 24 hours; intra-peritoneal rupture near rectum; urine in cavity of pelvis (identical, probably, with case 91).

100 H. Von Roonhuysen (Max Bartels). Male; fall; death in 14 days; rent in fundus of bladder; urine and exudation in pelvis.

101 Schaarschmidt (Max Bartels). Male; ran a stake into region of belly; death in 3 days; urine in pelvis.

102 Grüber, Joseph. Male, 32; fall; 80 hours; rent one and a half inches long behind and on right of fundus. (See Note G, p. 138.)

103 Wiesbach (Max Bartels). Male, 24; fall; 8 days; horizontal rupture in the fundus.

104 Leigh (Max Bartels). Male, 37; run over; 5 days; behind and in the bottom two rents, one through all the strata.

105 Cooper, "Guy's Hospital Reports," vol. ii., 1844. Male, 42; run over; 2 days; great rent in the bladder behind; few signs of peritonitis; peritoneum contained a pint and a half of blood and fluid.

106 Williams, H. (Max Bartels). Male, 26; run over; 34 hours; rent one and a half inches above and behind.

107 Himly, John (Max Bartels). Male, 44; 24 hours; rent semi-lunar.

108 Stationsbuch Von Bethanien (Max Bartels). Male, 44; run over; rent one and a half inches long in front.

109 Gillespie, "Edinburgh Medical Journal," 1859, p. 811 *et seq.* Male, 31; fall; 9 days; vertical rent of one inch posteriorly, proceeding downwards from the urachus, almost closed in consequence of a protrusion of the mucous and muscular coats; peritoneum vascular, serous exudation, and lymph. (P. 29.)

110 Hamilton, J. B., "British Medical Journal," June 16th, 1883. Male; fall; 5 days and 4 hours; transverse rent one and three-quarters inches in length at the anterior and upper part; bladder found in pelvis contracted and size of hen's egg; about sixty ounces of dark urinous fluid in peritoneal cavity; no adhesive peritonitis.

111 Howship, "Practical Treatise," &c. MS. of Mr. Watson in Mr. Heaviside's Museum. Male, thrown down; knee on abdomen; rupture in forepart of bladder near fundus.

112 Howship, *op. cit.*, p. 255. Mr. Heaviside's case. Robust heavy man, intoxicated, thrown from horse on to a post, which struck lower part of abdomen; 72 hours; opening on posterior surface of bladder admitting finger; three pints of urine in peritoneum and several ounces of blood; peritonitis.

113 and 114. Mr. Coulson, "Diseases of the Bladder and Prostate Gland," p. 270, says, "I have known it to occur during a struggle between two powerful men after drinking; the one fell with his knee on the abdomen of the other, and laceration of the bladder, followed by fatal peritonitis, ensued. I have also known the bladder to be lacerated by a fall from the top of a coach. A gentleman was riding on the box of his carriage with his coachman when the vehicle was upset; the coachman fell on him, and the master's bladder was lacerated. The patient lived from the Sunday on which the accident had occurred until the following Wednesday.

115 and 116. Mr. Coulson, in the same work, p. 273, says, "M. Amusat met with a case in which the accident arose from enlargement of the prostate. It may even take place without the existence of a mechanical obstacle. Thus Hauff relates the case of a person who was seized at the dinner-table, after having drunk a quantity of wine, with violent pain in the

abdomen; the abdomen, however, was not tense, nor was there any tumefaction over the region of the bladder; a small quantity of urine only was discharged through the urethra. The patient died in four days with symptoms of violent peritonitis; the bladder was small, thickened and perforated; urine was effused into the cavity of the abdomen.[3]

117 Cooper, B., "Guy's Hospital Reports," 1844, vol. ii. Male, 42; run over; 53 hours; transverse rent in posterior wall; three or four pints of nearly pure uncoagulated blood found effused into the cavity of the peritoneum.

118 Home, Sir E., "Practical Observations on the Treatment of Strictures of the Urethra," 1821, vol. iii. p. 245. Male, 40; stricture; retention; death on seventh day; rent two inches long on left side, "midway between fundus and prostate," leading into a sub-peritoneal collection of urine. An orifice an inch long led through peritoneum into abdominal cavity. Commencing peritonitis. (See p. 34.)

119 Bartleet, Dr. T. H., *Lancet*, Feb. 5th, 1876; also "Archives Générales de Médécine," vi^e^. serie, t. 27, p. 625. Male, 53; stooping to lift a bar of iron; death on eighth day from commencement of illness; perforating ulcer of bladder on posterior surface an inch from apex, causing oval hole half an inch by three-eighths in diameter; adhesive peritonitis with abundant lymph. On the peritoneal surface the hole was cleanly cut; on the mucous surface it was funnel-shaped with smooth edges, and resembled a gastric ulcer. *See* Mr. Bartleet's observations on his case.

For some additional cases (120—153 inclusive) see Notes D, E, and G, pp. 109—146.

II.—INTRA-PERITONEAL RUPTURES, COMPLICATED WITH FRACTURE OF PELVIS OR DISLOCATION AT SYMPHYSES, AND OTHER INJURIES.

[No., Author and Reference, Sex, Age, Cause, Time of Survival, Complications, Site and Nature of Rupture, Peritonitis, &c.]

1 "London Medical and Physical Journal," Sept., 1828 (Dr. S. Smith) with Male, 35; horse fell on him; death on third day; symphysis pubis separated; transverse rupture in fundus for four inches; peritonitis.

2 Kirkbride, "American Journal of Medical Science," vol. xvi. Male, 50; fall under a car; 3 hours; rupture posteriorly; extensive injury to other parts.

3 Syme, "London and Edinburgh Monthly Journal of Medical Science," June, 1843. Male, 32; rock fell on him; 12 hours; separation of symphysis pubis.

4 Watson, "Monthly Journal Medical Science," Dec., 1848. Male, 27; caught in steam engine; died on second day; injury to pelvic bones and articulations; transverse rupture of fundus admitting three fingers. (See p. 24.)

5 Lente, "New York Journal of Medicine," N.S. vol. iv. p. 286, 1850. Male, 18; caught between rail cars; severe blow on

[3] Ciriale, "Traité Pratique," t. iii. p. 260.

back; lived 2 days; separation of symphysis pubis; rupture at fundus admitting the thumb; no sign of peritonitis.

6 Cooper, "Guy's Hospital Reports," vol. ii., 1844. Female, 38; run over by cart-wheel; 17 hours; fracture of pelvis and separation at symphysis; rupture above and in front.

7 Cooper, "Guy's Hospital Reports," vol. ii., 1844. Female, 9; run over; 2 days; fracture of pelvic bones, spleen ruptured; bladder torn in three places.

8 Partridge, "Transactions Pathological Society," 1853-54, vol. v. p. 194, 1854. Male, 16; horse fell on him; 83 hours; multiple fractures and separation of symphysis; small aperture quarter of an inch in upper and posterior part; lymph and adhesions.

9 Prescott Hewett, "Transactions Pathological Society," vol. ii. Case under Mr. Hawkins. Male, 35; lived 2 days; extensive fracture of pelvis; rent two inches long, one and a half in breadth; "no marks of peritonitis;" turbid fluid in *cul-de-sac*.

10 "London Hospital Museum Catalogue." Male; run over; lived 2 or 3 days; fracture of ramus of pubes; rupture at highest part admitting three fingers; no peritonitis.

11 Cloquet, "Journal Gén. de Méd. de Chir. et de Pharm. t. xxi. p. 401 (Houel). Male, 32; fall; lived 4 days; fractures of pelvis; rent at superior aspect admitting two fingers.

12 Fano, "Soc. Anat.," 1845, vol. xx. p. 113 (Houel). Male, 29; thrown down beneath a fall of earth; lived 7 days; multiple fractures; transverse rupture posteriorly ten to twelve centimetres long.

13 Rivington. Male, 19; cart-wheel passed over pelvis; lived 6 days; separation at symphysis; vertical rent posteriorly; severe peritonitis. (See p. 3.)

14 A. Wernher (Max Bartels). Male, 51; thrown down from a hay-loft; death in 7 days; horizontal ramus of left pubes fractured; rupture behind gaping; adhesive peritonitis.

15 De Brantes (Max Bartels). Male, 24; fall from a window to the basement; death in 16 days; rent two centimetres in left side above; comminuted fractures; fluid in pelvis.

16 John Adams (Max Bartels). Girl, 15; run over between the legs; death in 4 days; fracture of the right pubes and ilium; intra-peritoneal rupture at fundus.

17 E. Rose (Max Bartels). Male, 32; run over by a manure waggon; death in 48 hours; great open rent in the bladder above and behind.

18 Liman (Max Bartels). Boy, 12; run over by a manure waggon; death in half an hour; fractures of pelvic bones; rent in liver and rectum; rent in fundus one and a half inches long (? base).

19 Max Boehm (Max Bartels). Girl, 2½; fall from a manure waggon and run over; death in 2 or 3 hours; great intra-peritoneal rent in front in which a splinter had stuck.

20 A. Dutsch (Max Bartels). Male, 20; crushed between two engines; death in 48 hours; separation of symphysis; rupture through all strata.

21 Ollenroth (Max Bartels). Male; thrown down by a broken-down wall; death in 56 hours; separation of symphysis pubis; rent in front; urine in cavity of peritoneum.

22 Liman (Max Bartels). Male, 30; precipitated from a wall eight feet high; fractures of pelvis and base of skull; rent in the anatomical fundus of the bladder (? base).

23 "Catalogue of St. Thomas's Hospital," vol. viii. (ii.), p. 128. Vertical rent in the bladder three-quarters of an inch in front, intra-peritoneal with irregular edge; fracture of os pubis.

24 John Stone (Max Bartels). Male, 30; fall, fifteen feet; 32 days; fracture of pelvis and separation at the sacro-iliac synchondrosis; bladder adherent to belly-wall; three openings behind through which it communicated with the cavity of the abdomen. (Communication with peritoneum secondary?) Large retro-peritoneal abscess.

25 Larry (Max Bartels). Male; wounded by splinter of granite; death in a few hours; fracture of hip-bone, and contusion of all abdominal viscera; laceration of bladder; urine in peritoneal cavity.

Note.—The inconvenience attending the use of the word "fundus" is exemplified in this list. In cases 18 and 22 the application of the term is doubtful. Perhaps these cases ought to be in the extra-peritoneal series. (For Cases 26 to 30, see Note G, pp. 129, 131, 134, 138, and 143.)

III.—EXTRA-PERITONEAL RUPTURES, SIMPLE AND COMPLICATED.

[No., Author and Reference, Sex, Age, Cause, Time of Survival, Complication, Site and Nature of Rent, &c.]

1 Delagarde, "St. Bartholomew's Hospital Reports," 1868. Male, 28; thrown down in scuffle; venous hæmorrhage from left obturator vein; irregular rent of size of half-a-crown in anterior wall of contracted bladder; large sac for urine in front of bladder, and to each side. (See p. 80.)

2 Kneeland, "New York Journal of Medicine," March, 1851. Male, 29; blow from knee in scuffle; death on seventh day; intussusception of ileum and fæcal vomiting; "no part of bladder found except neck" (!). (See pp. 34 and 43.)

3 Dupuytren, "Bull. de Thérap," 1832, t. iii. p. 349 (Houel). Male, 30; kick; 17 days; two ruptures on anterior surface; bladder and intestines adherent; effusion of urine and pus in pelvis.

4 "St. Bartholomew's Hospital Museum Catalogue," series xxvii. spec. 21. Adult male; rupture of venacava inferior and ilium; rupture in a line from the prostate gland to the fundus.

5 Arnott, "Transactions Pathological Society," 1868, vol. xix., p. 265. Male, tight bridle stricture of membranous urethra; lived about 3 days; rent an inch long from before, backwards in upper and anterior part; serous coat untorn and lifted up; no peritonitis. (See pp. 15 and 80.)

6 Collis, M., "Dublin Quarterly Journal," vol. xlvii., 1869, Feb. and May. Female, 26; fell across footboard of bed; died on fourth day; transverse rent admitting point of three fingers, no communication with the peritoneum; local peritonitis; gangrenous cavity in areolar tissue. (See pp. 24 and 26.)

7 Symes, "Dublin Quarterly Journal," vol. xlii, Aug. and Nov., 1866. Male, 45; fell forty or fifty feet from roof of chapel; lived 12 days; separation of innominate bones at symphysis; two rents in front of bladder; sac containing blood and urine, fetid and in large quantity.

8 Prescott Hewett, "Pathological Society's Transactions," vol. ii. Case under Mr. Tatum. Male, 50; man jumped on his abdomen; lived 23 days; rent in front one inch long, leading into a sacculus lined with condensed tissue; peritoneum stripped off each iliac fossa. (See p. 11.)

9 Prescott Hewett, "Pathological Society's Transactions," vol. ii. Case under Mr. Cutler. Male, 12; iron rails fell on abdomen; 6 days; extensive fractures of pelvis; two ruptures at forepart of bladder large enough to admit a large bougie; margins sloughy; extravasation of urine.

10 Prescott Hewett, "Pathological Society's Transactions," vol. ii. Case under Mr. Hawkins. Male, 40; lived 22 hours; extensive injury to pelvis; laceration one inch long, half-inch wide, on left side leading into sub-peritoneal areolar tissue.

11 Prescott Hewett, "Pathological Society's Transactions," vol. ii. Case under Mr. Keate. Male, 38; 5 days; extensive fracture of pelvis; anterior two-thirds of neck of bladder completely separated from prostatic portion of urethra; general infiltration of urine.

12 Prescott Hewett, "Pathological Society's Transactions," vol. ii. Case under Mr. Keate. Male, 32; wheel of chaise passed over belly; death on fourth day; extensive laceration of symphysis pubis; rent on right side of bladder, size of quill, leading into a circumscribed cavity; infiltration of adjacent tissues.

13 Prescott Hewett, "Pathological Society's Transactions," vol. ii. Case under Mr. Hawkins. Male, 32; piece of timber fell on back; lived 4 days; extensive injury to pelvis and dislocation of hip; rent in forepart of bladder, size of little finger, large cavity with urine in front of bladder; peritoneum stripped up. (See p. 24.)

14 Prescott Hewett, "Pathological Society's Transactions," vol. ii. Case under Mr. Hawkins. Male, 46; kick by a horse on the belly; lived 58 hours; laceration an inch long in forepart of bladder, just below reflexion of peritoneum; peritoneum stripped off anterior wall of abdomen as high as umbilicus. (See p. 10.)

15 Prescott Hewett, "Pathological Society's Transactions," vol. ii. Case under Mr. Hawkins. Male, 34; fall from a height; a few hours; separation at pubic symphysis; rent on anterior wall.

16 Cameron, Dr. T., "Philosophical Transactions," No. 484, p. 612. Male, 64; injury while riding a restive horse; death on fifth day; separation at pubic symphysis; rent above neck in middle line half-inch long.

17 Terry, "Medical Times and Gazette," Nov. 30th, 1861. Male, 44; knocked down as he was driving a waggon (run over?); 4 days, 18 hours; rent in left side of base; extravasation and sloughing.

18 Thouvenet, "Soc. Anat.," 1849, t. xxiv. p. 29 (Houel). Male, 27; thrown flat on stomach by a fall of earth; 44

hours; injury to bones of pelvis; rent about three centimetres on anterior face of bladder; urinary infiltration.

19 Nivet, "Soc. Anat.," 1837, t. xii. p. 194 (Houel). Female, 16; pressed between a wall and a voiture; 12 days; rupture at the point of junction of neck and body; multiple fractures of pelvis; urinary infiltration into the true pelvis without laceration of the peritoneum. (See p. 11.)

20 Quentin de Cambrai, "Gaz. Hebd.," 1856, p. 89 (Houel). Male, 28; fell from a window on second floor; 14 days; rupture anteriorly near summit; below and to left of trigone a second aperture communicating with the areolar tissue of the pelvis.

21 Denonvilliers, "Gazette des Hôpitaux," 1843, p. 50 (Houel). Male; blows on belly; 4 days; rupture on anterior aspect of the bladder, to extent of a franc piece; pouch in subperitoneal tissue containing bloody urine.

22 Bergeron, "Soc. Anat.," t. xviii. p. 186 (Houel). Male, 36; fell from window on second floor; 14 days; rupture on anterior face one and a half centimetres in diameter, communicating with cavity in front, behind abdominal muscles, containing urine.

23 Steavenson, "Taylor's Medical Jurisprudence," sixth edition, p. 376. Adult male; kick in hypogastrium; rupture near neck half-inch in length; peritoneum not lacerated, but extensively injured.

24 Spencer Wells, "London Medical Gazette," vol. xxxvi., Aug., 1845. Male, 30; fall from a hammock upon a stool; death on sixth day; rent one and a half inches in anterior wall, edges red and hard; peritoneum pushed upwards from anterior surface of rectum and posterior surface of bladder, forming a large cavity, at bottom of which lay contracted bladder; intestines adherent by effused fibrin; cellular tissue round bladder gangrenous. (See p. 44.)

25 Spencer Wells, "London Medical Gazette," vol. xxxvi., Aug., 1845. Male, 24; fall from hammock across a chain cable; death on ninth day; perforation one inch in length anteriorly and on right side underneath reflexion of peritoneum; mucous membrane intensely inflamed; posterior inferior surface gangrenous; urinary infiltration; adhesions of intestines.

26 Cooper, B., "London Medical Gazette," Aug. 27th, 1845. Male, 35; blow on lower part of belly; death on fourth day; rent three-fourths of an inch on inferior and left surfaces; no peritonitis, but dark fluid, not urinous, in abdominal cavity.

27 Rivington, 1873. Male, 33; run over; death on third day; small rent anteriorly, just above prostate; peritoneum extensively stripped off walls of abdomen. (See p. 6.)

28 Rivington, 1874. Case treated by Mr. Reeves. Male, 24; fell into an area; death on fourth day; fracture of ramus of ischium and pubes; small opening on right side of neck. (See p. 5.)

29 Chambers, J. W., M.D., "Medical Times and Gazette," 1853, vol. ii. p. 59. Male; middle-aged man fell on him; between 3 and 4 days; bladder torn in two places at its upper and anterior part, each rent about the size of a shilling; rent in membranous urethra; extravasation of urine; peritonitis. (See p. 80.)

30 Clark, "Boston Medical and Surgical Journal," "Hamilton on Fractures," p. 336. Male, 29; caught between two heavy

timbers; 25 days; multiple fractures of right rami of pubes and ischium. (See p. 80.)

31 Paterson, "Association Journal," Jan. 28th,1853; Taylor's Medical Juris.," p. 375. Male; severe kick in lower part of abdomen in a struggle; death immediate; rent of two inches on left side of body; bladder, urethra, and brain hyperæmic; viscera healthy; heart sound, but distended with coagula; pelvic cellular tissue infiltrated with blood and an ounce of urine.

32 Johnstone, "Mem. of Medical Society of London," 1773, vol. iii. p. 543 (Dr. S. Smith). Male, 28; retention; circular hole an inch and a half in extent on left side of bladder, edges smooth without appearance of laceration; this opening led into a cavity in the pelvis containing urine.

33 Walford, *Lancet*, 18th March, 1882, p. 442. Male, 41; fall; 58 hours; rent on right side of bladder outside right vesicula seminalis; a quart of urine and blood-clot on the right side of the pelvic cavity. (See p. 38.)

34 Harrison, Dr., "Dublin Quarterly Journal," vol. xi., 1836. Female, 2½; cart-wheel passed over abdomen; 10 days; fractures of pelvis; vertical rent in anterior wall.

35 Peaselee, Dr. E. R., "American Journal of Medical Science," N.S. vol. xix. (Dr. S. Smith). Male, 30; caught between two cars; 42 days; fracture of pelvic bones; rent at neck; large abscess in both iliac regions.

36 Weir, Robt. F. (given in Dr. Erskine Mason's paper). Male, middle-aged; caught between ferry-boat and bridge; pelvic bones fractured and projected through anterior wall. (P. 81.)

37 Heath, Christopher, *Lancet*, May 12th, 1877. Male, 30; engine-bed weighing one ton fell on him; 26 hours; wound of aorta, separation of pubic and sacro-iliac symphyses; bladder quite detached from pubes; peritoneum over apex torn through; longitudinal rent in anterior wall behind upper part of symphysis large enough to admit little finger (rent, probably, communicated with peritoneum?).

38 Gunsburg (Max Bartels). Male, 45; beam struck lower part of belly; 60 hours; rupture near symphysis.

39 Demme (Max Bartels). Male, 27; struck by fir-tree; 6 days; fractures; slender splinters had pierced bladder.

40 Hutchinson (Mr. Tay at Hunterian Society). Male; stricture, retention; 17 days; rent behind prostate. (See pp. 34 and 146.)

41 Allin (Max Bartels). Male; blow in the region of the belly; death in 10 days; rent in bladder on left side between upper and middle third; peritoneum untorn, stripped off. (P. 80.)

42 Hoffmeister (Max Bartels). Male, 61; knocked down; 3 weeks; laceration anteriorly, communicating with an abscess cavity.

43 W. Blizard. Male, adult; fall from the top of a coach; rent one inch long in front, and a second smaller one below on the right side. (Hunterian Museum, 1966.)

44 Schoemaker, A. H. (Max Bartels). Male, 21; fall twenty-five feet on belly; 14 days; fractures and separation of symphysis; two rents, one anteriorly, the other above, exactly behind fracture.

45 Fleming, C. (Max Bartels). Male, 40; fall from a scaffold; 12 days; separation of symphysis and fracture of sacrum; a gaping rent anteriorly opening into a large cavity behind; abdominal muscles full of blood, urine, and decomposing fluid and gas; peritoneum stripped off.

46 Dickinson and Holmes (T. P. Pick). Male, 42; fall from a height of seven feet; 13 days; fracture of ilium; hole in bladder on anterior wall size of little finger. (See pp. 80 and 142.)

47 Earle, H. (Max Bartels). Male, 60—70; riding without saddle and violently thrown; 40 hours; separation of pubic and sacro-iliac symphyses; rectum torn; bladder torn away from prostate. (See p. 80.)

48 Graw, Anton (Max Bartels). Male, 52; fall from a carriage, the belly coming in contact with the edge of a stone gutter; 6 days; large defect in bladder, communicating with a great sub-peritoneal hole.

49 Liston, R. (Max Bartels). Male, 12; run over by a loaded waggon; 3 days; fracture of pubes and ischium; splinter had penetrated bladder half-inch above vesical orifice of urethra.

50 Fleming, C. (Max Bartels). Male, 7; run over by a waggon; death in 8 days; fracture of pubes and ischium; rent on the right side of bladder; second partial rent on left wall.

51 Williams, H. (Max Bartels), Female, 53; run over by a waggon; death in 48 hours; fractured pubes; rent in the bladder one and a half inches long through penetration of fractured pubes.

52 Lyon (Max Bartels). Male, 14; death in 5 days; os sacrum and pubes fractured; rent in bladder near neck, through which a splinter of the os pubis passed.

53 Warren, J. M. (Max Bartels). Male, 30; caught under falling earth; death in one hour; separation of pubic and sacro-iliac symphyses; rent in bladder behind pubic symphysis.

54 "Allg. Krankenhausen," Wien (Max Bartels). Female, 33, slipped into a canal ditch; death in 6 days; pubes and ischium much comminuted; almost perpendicular rent in the neck.

55 Gross, S., ii. p. 791 (Max Bartels). Young man; thrown down by earth; death after 2 weeks; ischium and pubes fractured; penis almost loosened from its connexion with the symphysis; perineum and scrotum and rectum entirely destroyed; infiltration of urine; peritonitis; gangrene.

56 Smith, R. W. (Max Bartels). Female, 60; run over; multiple fractures of pelvis; 14 days; rent in neck of bladder.

57 Watson (Max Bartels). Male, 33; run over; 8 days; rent two fingers' breadth on left side of neck of bladder, leading into an abscess between bladder and sacrum.

58 Quain, Lancet, 1865, ii. p. 348. Male, 44; run over; 3 days; fractures of pelvis and separation at symphysis; laceration of urethra; hole as large as a shilling on the right side; external urethrotomy.

59 Richerand and Cloquet (Max Bartels). Male; crushed between two waggons; death in one hour; fracture of os pubis and separation of symphysis; femoral vein wounded; bladder pierced by a splinter near neck.

60 South, A. (Max Bartels). Adult, death after 3 days; comminuted fracture of the pelvis; a fragment had pierced the bladder.

61 Fleming, C. (Max Bartels). Male, 60; thrown down from a wall; death in 24 hours; separation of symphysis and left sacro-iliac synchondrosis and fracture of os sacrum; rent in front, edges close; escape of gas-bubbles on pressure.

62 Andrews and Willett (Max Bartels). Female, 15; run over; 18 days; sub-peritoneal hole on left side of bladder, with which the rent in the bladder communicated.

63 Gouley, Dr., "New York Medical Record," 1872, p. 457. Male, 36; stricture; retention; 44 days; rupture in anterior wall about the middle of the vertical diameter, and a little to the right of the median line; opening in mucous coat, somewhat rounded, large enough to admit index finger; muscular and fibrous coats showed a vertical laceration an inch in length; large cavity in front and round bladder. (See p. 15.)

64 Walker, Dr. G. C., "British Medical Journal," Dec. 16th, 1882, p. 1207. Male, 40; retention without obvious cause (injury?); 3 days; rent anteriorly two inches in length, commencing an inch from neck, and extending to within two inches from the summit; cavity behind symphysis pubis; extravasation of blood in all the pelvic areolar tissue; blood-stained extravasation, outside peritoneum and in muscles of back. (P. 87.)

65 Morris, *Lancet*, July 7th, 1883. Male, 15; run over; lived 16 hours; extensive fractures of pelvis, both pubic rami being broken on right side; in the front wall of the bladder to the right of the median line and beneath the peritoneum was a rounded tear about the size of a shilling; abdominal section was performed by Mr. Lyell.

66 Harrison, Reginald, *op. cit.*, p. 321; fall of earth; fracture of right ilium; 7th day, extensive rent through prostate and base of bladder. (See p. 81.)

67 Howship, "Practical Treatise," Watson's MS. Male, adult; intoxicated; fall from a loft on to a beam, and then to the ground; fracture of os pubis on each side; large rounded splinter forced through forepart of bladder.

68 Trye, C. B. "Remarks on Morbid Retentions of Urine," Gloucester, 1774. Male, adult; wheel of loaded cart passed over abdomen; 2 days; ramus of os pubis fractured, and bladder lacerated; urine effused into cellular tissue of lower part of pelvis, scrotum, thighs, and buttocks. (*See* Note B.)

69 Trye, C. B., *op. cit.* Male, adult; body jammed between cart and bank of river; 3 days; ramus of os pubis fractured, and bladder lacerated; effusion of urine. (*See* Note B.)

70 Coulson on "Diseases of the Bladder," &c., p. 275; case related by Dr. Peacock. Male, 38; thrown out of gig; wheel passed over abdomen; death on seventeenth day; no fluid in peritoneal cavity; old adhesions of omentum and intestines to each other and to parietes of abdomen and pelvis; lacerated opening at posterior part of fundus of bladder, capable of admitting the passage of two fingers, and leading into a cavity situated posteriorly and inferiorly to it, and which was bounded by the adherent intestines above, by the sides of the pelvic cavity laterally, and by the rectum behind and below. The cavity contained fætid urine mixed with shreds of lymph and gangrenous cellular tissue. On the side where it was bounded by the rectum there was an ulcerated aperture, by which it had opened into the rectum. This aperture was nearly the size of half-a-crown, and was situated at about four inches from the verge of the anus. The coats of the bladder were much thickened, and its lining membrane was covered with tough mucus mixed with lymph. Mr. Coulson remarks, "The prolongation of life in this case was evidently due to the peculiar situation of the laceration of the bladder, in consequence of which the urine had escaped into the vesico-rectal cellular tissue. The extension of inflammation to the

peritoneum had also been prevented by the old adhesions between the omentum and intestines in the hypogastric region."

71 Ross, J. Maxwell, "Edinburgh Medical Journal," January, 1882, p. 534. Male, 62; stricture and retention, kick on lower part of abdomen; lived 2 days; rupture in front wall of bladder one and a half inches long, not involving peritoneum; lymph on coils of small intestine. (See p. 80.)

72 Liston, *Lancet*, July 24th, 1841. Male, 70; stricture and retention; between 4 and 5 days; bladder adherent to rectum, contracted, and containing about two ounces of urine and a small calculus. Internally on the posterior wall was a round sloughy patch of the size of a shilling, and in this there was a small aperture leading into the sub-peritoneal connective tissue. Here the peritoneum was bulged out into a pouch. The connective tissue of the pelvis and bladder was infiltrated with urine, and the peritoneum covering the anterior abdominal wall was dark, black, and almost gangrenous, as far as the umbilicus. The mucous membrane of the bladder was sacculated, and the muscular fibres fasciculated. There was a slight enlargement of the middle lobe of the prostate gland. At the seat of stricture there was a warty thickening of the mucous membrane an inch in length.

For additional cases (73—84) see Note G.

IV.—RUPTURES OF UNCERTAIN SEAT.

[No., Author and Reference, Sex, Age, Cause, Time of Survival, &c.]

1 Portsmouth case, about 1854; reference wanted. Female (girl); been drinking, bladder full, rolled off hammock on to floor; screamed a good deal; local peritonitis. Inquest.

2 Zittman (Max Bartels), 1696. Woman; kick in the region of the belly; rupture of the bladder and injury to the uterus.

3 Angerer, O. (Max Bartels). Male, 31; thrown down into a stone-pit; 24 hours; laceration of diaphragm; displacement of viscera; fracture of leg and pelvis; concussion of brain; laceration of bladder.

4 Rake (Max Bartels). Male; drunken brawl, could walk a mile an hour later; death; laceration of the bladder.

5 Gruber, Joseph. Tycho de Brähe, over distension. (See Note G, p. 138.)

6 Boehm (Max Bartels). Male, 49; fall; death in 4 days; rent three centimetres on left side at the base.

7 Liston; reference wanted. Case thus referred to by Mr. Gant, "Diseases of the Bladder," p. 92, 4th Edition.:—"This accident may happen from a fall in wrestling, the uppermost man coming down upon his antagonist; or from running against a post in the dark, an instance of which Liston relates. In that case, a large calculus, which nearly occupied the bladder, was shattered into fragments by the concussion."

Note A.—Rupture of the Bladder from Enlargement of the Prostate Gland.

Having referred to the works quoted by Houel as containing the reports of the cases of MM. Sasie, Mercier, and Tanchou, I add the following particulars to those given by Houel. (See pp. 16 and 92):—

M. Sasie's patient, a man seventy-five years of age, had been treated for retention of urine at the Hospice of St. Cloud. On admission to the Necker Hospital, thirty-six hours had elapsed since he had been sounded. The bladder was distended, and formed a tumour in the hypogastric region. There was increase of pain on pressure. The skin was bathed in sweat with a urinous odour, and there was great anxiety. Catheterism withdrew two litres of fetid purulent fluid. On the second day he was better from the treatment; on the third day better; on the fourth day worse, the fever returning. On the fifth day he died suddenly with abundant vomiting, after an embrace of his wife.

In addition to the narrow rupture on the posterior surface of the bladder, and the extravasation of twelve ounces of urine into the peritoneal cavity, much peritonitis was noted, and the transverse colon was adherent to the bladder. A second perforation was about to take place near the other, the mucous tunic being already converted into a pulpy eschar, and only the peritoneum opposing the effusion.

M. Mercier exhibited to the society a specimen of hypertrophy of the bladder and prostate, with an opening behind and to the left in front of the rectum. M. Mercier thought this opening spontaneous, and not the result of the presence of the sound. The instrument, a gum-elastic catheter, was only in place for three days, and the mucous coat appeared to be continued into the abnormal opening. It formed a hernia, was ulcerated, and presented other little pouches. The patient died of peritonitis. The true pelvis contained a litre and a half of pus. The members of the society thought the ulceration due to the sound.

M. Tanchou's patient, a man seventy years of age, was seized suddenly with retention of urine, and was treated with the warm bath and blood-letting. A sound could not be introduced. During the first thirty-six hours, the patient only made a small quantity of water. At the post-mortem old peritonitis was found with false membranes, and purulent deposits in the false membranes. A partition, formed of degenerated omentum, separated the bladder from the rest of the belly, which was healthy. The bladder contained some clots of blood. The prostate was very voluminous. Two little polypi were seen at the entrance of the bladder torn by the sound. The hole or rupture in the bladder, which was situated near the base on the left side, was three or four lines in diameter, and the edges of the opening were thinned; it communicated with two or three gangrenous depôts formed by the urine in the thickness of the false membranes. It is obvious that M. Sasie's patient died suddenly from perforation of the peritoneum; that M. Mercier's patient died of peritonitis, occasioned doubtless by the same event; and that in M. Tanchou's case there was a communication between the bladder and part of the peritoneal cavity which was shut off from the rest by degenerated and adherent omentum.

How these cases show that spontaneous ruptures are always subperitoneal, and do not involve the peritoneum, I am at a loss to conceive. Liston's is the only case in Houel's list which supports his

statement. This case is an excellent instance of a sub-peritoneal rupture. The opening in the mucous membrane was small and admitted the urine into the sub-peritoneal connective tissue, along which it spread anteriorly as far as the umbilicus, and posteriorly nearly as far as the kidneys. The peritoneum was bulged out into a pouch opposite the aperture in the bladder, and had not apparently given way. Some of the cases of rupture following stricture referred to below, were also examples of sub-peritoneal ruptures, although in two the peritoneum speedily gave way. (Compare case X, Note G, p. 126.)

Note B.—Rupture of the Bladder during Labour.

M. Houel makes the following observations (p. 62):—"Rupture can take place in the female during labour, and M. Velpean, in his treatise on the Art of Midwifery, notices them. He admits that the bladder in consequence of excessive distension can be ruptured under the influence of energetic contractions of the abdominal muscles; he mentions three examples: the first is taken from Chapman ('Med. Obs. and Inq.,' vol. iv. p. 143); the second in the 'American Journal' (Feb., 1850); the third due to Mr. Merriman ('Synopsis on Difficult Parturition, &c.,' p. 37), who has seen a female die from a rupture of the bladder without being delivered. Two other examples are found in Trye's work ('Remarks on Morbid Retentions of Urine,' Gloucester, 1784); and M. Wilkinson ('Memoirs of the Medical Society of London,' 1792, t. iii.) reports equally a case of rupture of the bladder in a woman of thirty-three years, in labour for the first time," &c.

On referring to Trye's work, I found the two traumatic cases inserted in the list; I could not discover Mr. Merriman's case in his "Synopsis," and Chapman's case is not in vol. iv. p. 143 of "Med. Obs. and Inq.," the volume containing Lynn's and Hay's cases.

Dr. Blundell makes the following observations: "In these laborious labours, if you have not been attentive to the evacuation of the bladder, it now and then happens that the back part of the body gives way, making an opening into the vagina direct, two or three fingers perhaps being admissible at the opening. Emptiness of the bladder is the best security against these accidents, not of common occurrence; if, however, unfortunately they take place, the best method of treating them is by introducing the catheter into the bladder and keeping it there; a sheep or bullock's bladder being attached to the lower extremity, so as to collect the water. I know of one case in which a very extensive laceration occurred, and where by this method of treatment the aperture healed completely, so that the woman, though the retentive powers were weakened, could on the whole retain pretty well the contents of the bladder. In this case there was a legal investigation, and I examined the woman more than once, as you may suppose, with no small care; and though on the first examination I could with ease introduce both fingers into the cavity of the bladder where the catheter could be felt naked, yet on investigating some weeks afterwards, I found the aperture closed so perfectly that scarcely a trace even of a cicatrix could be detected.

"Where there has been a great deal of pressure in laborious labours, whether from the abuse of instruments or other causes, sloughing may occur, the vagina or rectum being laid open in consequence. When slough of the cervix vesicæ is forming, the patient at first is incapable of passing her urine, so that the catheter becomes necessary; after a few days, however, you have the satisfaction to learn that the water flows under the natural efforts; but no long time after

you are mortified to hear that the retentive power of the bladder is lost; the water at the end of a week or two dripping from the vagina continually. About this time there comes away something which is said to be a piece of skin, and, when washed, immersed in water, and examined, it is found to consist of a portion of the bladder and vagina. Examination at this time detects an aperture in the bladder, sometimes small, but occasionally large enough to admit one or two fingers. The method of preventing these sloughs I have already stated: I have told you already that you should never permit a woman to be in labour too long, especially when the pulse is rising; that you are never to allow the urine to accumulate too largely, and that, more especially when using the instruments, you are always to have these preparations of contusion, lacerations, and slough before your eyes, being on your guard against too much force. When the sloughing of the bladder occurs, I am sorry to say we are not at present in possession of any effectual remedy for it. You should attend to the general health of the patient, in order to give the healing powers fair play; but without denying the possibility of closure, I may be allowed to observe, that I never saw a single case, and I have been called to many, in which the aperture has been completely healed; a great reduction of its dimensions is sometimes observed, so that there is scarcely room for the passage of a catheter, but, almost invariably, a fistulous communication remains. By means of the actual cautery this might sometimes be healed, but the practice is rough.—"Lectures on the Theory and Practice of Midwifery," *Lancet*, April 5th, 1828.

Note C.—Rupture of the Bladder from Stricture and Retention.

As there are twenty cases of rupture of the bladder recorded in this work in which stricture acted as a predisposing cause, it will be worth while to summarize them. Of the twenty cases ten were intra-peritoneal ruptures, nine extra-peritoneal, and one a partial, or mucous rupture (Keal).

Of the ten intra-peritoneal cases, two, viz., Sir E. Home's cases, were primarily extra or sub-peritoneal, the peritoneum giving way some days after the original rent. In one of these cases the primary opening in the bladder was situated anteriorly, and in the other on the left side midway between the "fundus" and the prostate gland. In one (Harrison's) the stricture, if stricture there were, was spasmodic and the rent was behind the superior fundus, and an inch in length. In three the stricture helped to occasion retention, and an injury occasioned the rupture (Ellis, Ewbank, and Partridge). In three the sequence of events was stricture, retention, straining at stool, rupture (Garry, Bangs, and Stoll). All the rents were situated posteriorly, and were of small size. In one case there was a slight stricture—the urethra was torn across from some injury of which the patient gave no account—retention lasted three days, and the bladder gave way while the patient was struggling under ether, the rent being small, and close to upper fundus posteriorly (Gouley).

Of the nine extra-peritoneal cases one was traumatic (Ross), the bladder being ruptured by a kick during retention from stricture; one (Call) reported as a rupture into the rectum, is a doubtful case of rupture of *bladder;* and in one (Ward) the site of the rent is uncertain, a communication forming with the rectum from sloughing, and the patient recovering. In one (Padley) the stricture gave rise to retention and a syphilitic ulcer appears to have perforated the bladder

anteriorly. Of the remaining five, three exhibited the rent anteriorly, two certainly (Arnott and Gouley) and one probably (Williams), one was a sub-peritoneal rent on the posterior surface (Liston), whilst in Mr. Hutchinson's case the rent was behind the prostate.

To sum up, out of the twenty cases one is a partial or mucous rupture of a doubtful character; four are traumatic ruptures, one extra-peritoneal, three intra-peritoneal; two are doubtful instances of rupture of *bladder;* one is a doubtful instance of spasmodic stricture and retention, causing rupture posteriorly into the peritoneum, as it may have been traumatic; one was the result of ulceration. Of the remaining eleven, which exemplify rupture from stricture and retention with or without straining or struggling, in four the rents are primarily intra-peritoneal, being small and situated posteriorly near the upper fundus; in four the rents are in front and (primarily in one) sub-peritoneal, in one extra-peritoneal, low down behind the prostate and to the left side; in one small, situated posteriorly, and sub-peritoneal; and in one on the lateral aspect of the bladder, primarily sub-peritoneal. Where there is straining or struggling the rent is more likely to be intra-peritoneal on the posterior surface. When the bladder gives way from continued over-distension, there is no absolute rule governing the site of the rent. It may be found low down behind the prostate, and to one or other side, as in Hutchinson's, Johnstone's, and Tanchou's cases; behind the upper fundus, as in Dr. J. B. Wilmot's and Dr. McEwen's cases, and in instances of rupture following hypertrophy of the prostate; or in front, as in Arnott's and the first of Sir E. Home's cases.

Note D.—Rupture of the Bladder from Retroversion of the Gravid Uterus.

In his paper on "Gangrene of the Bladder from Retroflexion of the Gravid Uterus," in the "Archiv für Gynäkologie," 1882, p. 260, Dr. Krukenberg adduces the following cases in support of his views:—

120. I. Van Doeveren, "Observat. Acad. Groningæ," 1765, p. 83.

A woman, of about twenty years of age, who had always been healthy, and who had had no children, became troubled after the second month of pregnancy with difficulty in passing water. From day to day swelling of the abdomen and pain increased. The bladder extended as far as above the navel, and was very painful to the touch. The orifice of the uterus was very high, so that it could be no longer reached with the finger. Medical treatment, diuretics. No catheterization. In the night of the twenty-third to the twenty-fourth day of the illness she was suddenly freed from all her sufferings. The pains diminished, and the fever moderated. The abdomen became flaccid and uniformly distended throughout. No tumour perceptible. On the following day sudden death. *Section:* Abdomen full of reddish fluid with a urinous odour. The bladder flaccid, empty, and reaching above the navel, had loosened the peritoneum from the hinder wall of the belly. At the back there was a rupture of the very thin bladder wall an inch in length, with gangrenous edges. The mucous membrane was smooth and of natural colour. The bladder wall, with the exception of the posterior thinned portion, was greatly thickened. The whole pelvic cavity was so closely filled with the uterus, which had reached about the third month of pregnancy, that there was no free interspace between it and the bones of the pelvis. The conjugate diameter was narrowed one inch.

II. Lynn, "Medical Observations and Inquiries," 1771, vol. iv. p. 388. See pp. 18 and 92, case 51.

121. III. Naumburg, "Stark's Archiv," 1796. Bd. vi. S. 381.

A woman, thirty-four years of age, from the end of the third month of pregnancy, could only pass her water guttatim, and never without pain. Not

catheterized. Hectic fever. Death about the fourth week. *Section:* In the cavity of the belly several pounds of urine. The bladder was enormously distended, and its whole inner surface was nearly gangrenous, infiltrated with pus throughout. In its front wall was an abscess with a fistulous opening inwards. On its hinder wall was a small round perforation. Omentum attached by recent adhesions to the whole front area of the belly. Fundus of the uterus low in the pelvis, and could only be replaced in its normal position with a moderate expenditure of force. Four months' fœtus.

122. IV. Saxtorph, "Gesammelte Abhandlungen," 1803. S. 261.

A woman, in the fifth month of pregnancy, had for three weeks only passed water guttatim, and with great pain. Only when the patient lay dying was Saxtorph summoned. *Section:* In the abdomen there was a great quantity of urine. The intestines were red, inflamed, and appeared in a few spots to be almost gangrenous. Fundus of the uterus wedged low in the pelvis. The os uteri was raised high above the pubes. Bladder flaccid, abnormally large, and ruptured on its hinder surface. Fœtus in utero.

123. V. Morean, "Traité Pratique des Accouchements," 1838, t. i. p. 230.

Patient thirty-three years of age. Two easy confinements. Period always regular and free from pain. At the beginning of October (in about the sixth week of pregnancy) she became troubled with difficulty in passing her water. On the 15th of October, whilst she was resting from her occupation, she suddenly experienced a violent pain in the hypogastrium, accompanied with a considerable swelling of the abdomen. After she had passed the night in violent pain, the next morning she felt herself better, although retention of urine remained. Diuretics. Subsequently a slight flow of urine followed, but the difficulty in micturition continued. On the 20th of November (the thirteenth week of pregnancy) she was admitted into the hospital. Complete retention of urine. The catheter drew a thick fluid mixed with blood, and a considerable quantity of pus. The fundus of the uterus retroverted and low in the pelvis. After fruitless attempts at reposition (on the 20th and 21st of November) the uterus was punctured from the vagina on the 21st of November. Transitory improvement. Fresh attempts at replacement. Death at midnight. *Section:* General peritonitis (effusion, false membrane). The bladder was united with the omentum, and presented a gangrenous perforation. Fundus of the uterus of the size of a fist, retroverted, low in the pelvis, adherent to the rectum, contained a three to four months' fœtus. The symphysis separated. The distance of the sacrum from the pubic arch measured four inches and four lines.

VI. Southey, *Lancet*, 1871, vol. i. p. 610. See p. 89, case 6.

Lyda M——, a fair-complexioned, well-nourished girl of sixteen, was admitted into St. Bartholomew's Hospital on the 23rd of March, 1871. Fifteen months previously she had been laid up with what she believed to be "gastric fever." Her catamenia had been irregular for some months past, but she felt certain she had been unwell a fortnight ago. For the last fourteen days she had had sickness, with pain over her loins, and occasional attacks of shivering. Her bowels had been more or less confined all that time, the effort to defæcate increasing her pain. At first she had frequent desire to pass her water, but difficulty in making it; but for the last five days she had suffered complete retention. On the previous day, and on the morning of admission, a little had dribbled away from her involuntarily. An elastic catheter was passed before she was brought up into the ward, and six pints of alkaline and somewhat offensive urine were withdrawn from the bladder. Her face was flushed; her tongue red, raw-looking, and inclined to dryness. Temperature, 100°; pulse, 140, and very feeble; respirations, 30, and shallow. Her breasts were enlarged, and presented a well-marked areola characteristic of about the fourth month of pregnancy. Her abdomen was much distended, full, tender, and dull generally to percussion to about two inches above the umbilicus. Upon making a vaginal examination the external genital organs were found to be much swollen, and somewhat livid looking; the orifice of the urethra was drawn upwards and backwards; the posterior wall of the vagina was prolapsed, and pushed forward like a fleshy mass between the nymphæ; the uterus was enlarged and much retroflexed; the os uteri was swollen and

patulous enough to admit the tip of the finger; and the whole organ, although not larger than seemed compatible with the other evidence as to the date of her pregnancy, was so much displaced from its normal position that the fundus was brought to lie against the coccyx and the os close under the symphysis pubis. Milk and water enema ordered, and at nine p.m. the bowels had been freely open, and a good many scybala had come away. Three pints of high-coloured urine were drawn at the same time with the catheter, and the patient was more comfortable. March 24th: pulse 96, temperature 99°. Patient lying on her back with her legs drawn up; very thirsty; tongue still red and inclined to be dry. The bladder again distended and risen nearly to umbilicus. Great difficulty was now experienced in introducing the catheter, for the posterior wall of the urethra had apparently given way, and the instrument, instead of passing into the bladder, re-entered the vagina. Mr. Savory, however, whose assistance had been solicited, succeeded in introducing a large prostatic catheter into the bladder, whereby four pints of urine were drawn off about two p.m. The catheter was retained. Nine p.m., pulse 120, temperature 101°; urine dribbling away by the side of the catheter. March 25th: pulse 120, temperature 102°. The patient had passed a very restless night. The bladder was emptied and catheter withdrawn. Attempt made under chloroform to replace and retain uterus in position with air-bag frustrated by an expulsive effort of patient as she was regaining consciousness. Eleven a.m., severe rigor; 3.30 p.m., catheterization. March 26th: nine a.m., pulse 120, temperature 100·2°. Bladder emptied, general pain over abdomen. Had been sick two or three times, vomiting chiefly a green bilious fluid. Occasional hiccough. 8.30 p.m., pulse 140, temperature 100·4°. Three pints of high-coloured alkaline, albuminous urine drawn off. Catheter withdrawn as patient said it gave her pain, and felt as if it would come through the bladder. After a rather restless night, she was seized with sudden sharp abdominal pain at eight o'clock on the morning of the 27th, and could not for a few moments be kept in bed. Her pulse became very rapid, and scarcely perceptible; her knees were drawn close up to the abdomen. She passed at once into a state of extreme collapse with hurried respirations, and Hippocratic aspect, dying at one p.m.

Post-mortem.—Fundus of bladder, cæcum, the lower part of small intestines, fundus of the uterus, the sigmoid flexure, and extremity of omentum were all matted together by very old adhesions. A little recent lymph over rest of peritoneum. Upon breaking down the old adhesions, a sort of cavity was discovered behind the bladder and above the uterus, which contained a brown turbid liquid. This cavity communicated with the bladder by a sloughy hole the size of a crown-piece in the posterior wall of the latter. The bladder was very large and thickened; the mucous membrane was strongly injected, and presented great sloughy patches that implicated all its coats. It was dragged upwards and backwards by the enlargement and dislocation of the uterus, the lower part of it being strongly adherent to the fundus of the uterus. The neck of the bladder was much elongated, and a slough upon its posterior aspect opened into the anterior wall of the vagina. Uterus contained a male fœtus of about four months. Pelvic cavity was occupied very tightly by the uterus and the rectum was much compressed. With the exception of some evidences of inflammation in the kidneys, the other viscera were healthy.

Remarks by Dr. Southey.—Dr. Southey observed that the tough adhesions found at the brim of the pelvis above the uterus and behind the bladder, were of old standing; they might perhaps date back to some local peritonitis induced by gastric or typhoid fever, which she said she had had fifteen months previously; but, doubtless, they had interfered with the development of the uterus in the normal direction, and must have altogether prevented its rising into the abdominal cavity. The uterus, as it had increased in size, had compressed both the rectum and the bladder, and when its fundus became dislocated backwards, the cervix and os were tilted forwards, close under the pubic arch, and perhaps the pressure thus brought to bear upon the urethra and neck of the bladder, may in the first instance have led to imperfect evacuation of the bladder, decomposition of the retained urine, and the cystitis which she had described when first admitted. The ultimate retention of urine and enormous

distension of the bladder had led to great elongation of its neck, and through the old adhesions between the lower part of the bladder and the fundus uteri, as the bladder became distended and passed up into the abdominal cavity, the uterus was still further dislocated backwards, being bent no longer upon the axis of its own cervix, but upon the vaginal stem. The sloughing condition of the mucous membrane at the neck of the bladder had first implicated the urethra, and the opening of that slough into the vagina explained the difficulty experienced in the last forty-eight hours in introducing a catheter, since this tended to come back into the vagina. The general peritonitis, which ultimately led to her death, was no doubt caused by the passage of some of the urine first through the slough at the fundus of the bladder into the smaller cavity circumscribed by the old adhesions, and then at last into the general abdominal cavity.

124. VII. E. Schwarz, "Centralblatt für Gynäkologie," 1880, Nr. 6.

A woman, forty years of age, mother of four children, and confinements always normal. At the end of the thirteenth week of pregnancy, after severe exertion, she suddenly experienced pain in the abdomen and retention of urine. Subsequently micturition was very difficult, and only by strong pressure on the abdomen could a greater quantity be obtained. In the seventeenth and eighteenth weeks of pregnancy constant confinement to bed. Great wasting. Infrequent catheterization. At the end of the eighteenth week was admitted into the Klinik. Death, which was imminent, took place at the end of two days. *Section:* In the abdomen 5 litres of brownish-red fluid. Intestines covered with fresh fibrinous membrane. The bladder reached 12 cm. above the symphysis, and to the left and behind the vertex, over the area of a crown-piece, was strongly adherent to the coils of intestine by copious fibrinous exudation. On separating the adhesions an aperture, which would easily admit the fore-finger, was exposed. Muscular coat of the bladder hypertrophied: mucous coat pale; in the posterior wall was the above-mentioned perforation, which on the peritoneal surface was about 3 cm. long, whilst the inner opening was the size of a half-crown, oval, with undermined edges. In the vicinity also was a small sub-peritoneal abscess which had burst into the bladder, as well as one, the size of a shilling, yet intact. The uterus for the most part was contained in the true pelvis, which it completely filled, but a small portion of it projected for about 5 cm. above the promontory. Fœtus in the fourth or fifth month. As urine was found in the abdomen, the rupture, although it was only discovered on separating the adhesions, must be regarded as spontaneous.

VIII. W. Hunter, "Medical Observations and Inquiries," 1771, vol. iv. p. 58. See p. 92, case 50 (Hay's case).

IX. Frankenhauser, "Archiv für Gynäkologie," Bd. xii. S. 352.

The bladder was inverted, and thereby the whole of the upper part, with its peritoneal covering, was passed. After this process had happily terminated the capacity of the bladder was 50 ccm., but on artificial distension the organ held 150 ccm.

(Dr. K. notes that this observation is so brief that he does not think that much use can be made of it.)

X. V. Madurowicz, "Wiener Medicinische Wochenschrift," Jahrgang, 1877, Nr. 51 und 52.

A woman, twenty-two years old, who the year before had given birth to a child without difficulty, and whose last menstrual period was at the beginning of February, experienced pain on micturition after severe bodily exertion on the 17th of June, i.e. about the end of the nineteenth week. During the next few days micturition was performed guttatim. Since the 21st of June she had passed no urine whatever, and on the 22nd of June she was admitted into the hospital. The temperature was 38·9 Cent. The bladder reached 8 cm. above the navel, and the catheter gave exit to 3 litres of thick nut-brown decomposed urine. The uterus was retroverted and wedged in the pelvis; it was replaced under chloroform. The catheter was passed every three hours, and the bladder was irrigated twice a day with a one per cent. carbolic solution. Quinine was given thrice daily. Next day the fever diminished considerably, though it did not wholly subside. The uterus remained in its normal position. In spite of

medication the urine became thicker and more offensive, and the vesical pains increased. The use of the catheter was required as the water could not be voided voluntarily, whilst occasionally it passed involuntarily. On the 11th of July shivering occurred, and the temperature was 39·2 Cent. On the evening of the 13th of July (the middle of the twenty-third week and the twenty-first day after replacement of the uterus) a dirty grey, extremely offensive membrane of the thickness of the index finger, and 5½ cm. long, protruded from the greatly dilated urethra, and on the morning of the 14th of July was spontaneously cast off. A small quantity of bloody fluid and stinking urine followed. The pains and fever abated, and the urine quickly became clear. On the 17th of July the patient left the hospital. The membrane, which had a nearly semicircular form, measured 208 cm. square. It consisted of all the coats of the bladder in process of decomposition. The mucous surface was of a deep grey colour, covered with phosphates and lithates, and the peritoneum was dirty white and not thickened.

Dr. Krukenberg refers to two cases of retroflexion of the gravid uterus, in which recovery took place after exfoliation of a portion of the mucous lining of the bladder, together with part of the muscular tissue. These cases are reported by Hausmann and Schatz.

XI. Hausmann, "Monatsschrift für Geburtskunde," Bd. xxxi. Recovery.

XII. Schatz, "Archiv für Gynäkologie," Bd. i. (See Note E.) Recovery.

Dr. Krukenberg further observes that "Spiegelberg ('Lehrbuch der Geburtshülfe,' S. 268) contents himself with the remark that rupture of the bladder, even with the greatest distension, is very rare. Winckel says ('Handbuch für Frauenkrankheiten,' ix. S. 163) that it has only twice been proved by post-mortem examination. Later, E. Schwarz has published such a case, referring to the remaining cases by Von Praag ('Neue Zeitschrift für Geburtskunde,' Bd. 29) and E. Martin ('Neigungen und Beugungen der Gebärmutter'). The latter speaks erroneously of four cases cited by Von Praag (this author really only mentions two), and includes erroneously a case of Delaharpe." ("Schweizerische Zeitschrift für Medicin," 1856.)

125. XIII. Case from the Gynäcological Clinic at Bonn.

The patient, thirty-three years old, had three years previously had a normal confinement. She then menstruated regularly till 18th August, 1881, when she became pregnant. On the 3rd of December (beginning of sixteenth week), during an effort to pass water whilst lying in bed, she experienced severe pain on micturition. When she repeated the effort next morning there was complete retention of urine. Her medical attendant drew off the urine with the catheter, and on the 5th of December drew off a second time urine free from blood; in the interval there had been complete retention. After this the instrument was not used, and the patient had frequent desire to pass water without being able at any time to void more than 50 cm. of urine with severe pain. From the 6th to the 8th of December the urine was temporarily bloody. Nothing special occurred till the 30th (beginning of nineteenth week), when the patient allowed herself to be taken into the hospital at Bonn. She appeared very cachectic, had a weak, rather frequent, pulse, and could only pass thick stinking urine guttatim. Her abdomen was distended with gas, but only slightly tender to the touch. Dulness on percussion reached half-way to the navel. The vagina seemed pressed forward close behind the symphysis. The portio vaginalis was high up in front and the os uteri patent. The gravid uterus was found retroflected. A male catheter drew off half a litre of urine; two litres more escaping when an elastic catheter was pushed high up. The urine was pale, thick, strongly alkaline, and contained epithelium and broken down pus corpuscles. The vesical dulness had now nearly disappeared. Under chloroform the uterus was replaced. The bladder was washed out with antiseptic solutions, and the process was daily repeated, drainage being insured by means of a gum-elastic catheter. On the 6th of January permanent drainage was abandoned. In spite of this the urine escaped involuntarily. Improvement, which had been marked after the irrigations, continued, but still the urine became more offensive, and frequently contained small blackish particles. From 6th to 9th of January, feverish; but from that time till death temperature normal. On the morning of the 10th of January (end of twenty

first week, eleven days since reposition), after retention during night, a gangrenous mass escaped from the urethra, which was dilated to the size of a finger. The expulsion followed strong pressure on the abdomen, and was assisted by very slight traction. Immediately there came away *pleno rivo*, two litres of dark brownish-red, thick, stinking urine; and subsequently the urine was passed involuntarily. The patient was now feebler, jaundiced, bedridden. On the 19th of January (end of twenty-second week) she aborted, and January 21st gradually sank and died. *Post-mortem:* Anterior surface of bladder united to abdominal wall by puriform lymph. Fibrinous exudation as far as liver. On removing intestine two coils with attached mesentery blocked up a defect in the bladder the size of the palm of the hand, having been adherent to the margins of the opening. Dirty purulent mass escaped from bladder, and interior of organ was seen to be covered with a greyish-green exudation. Urethra large enough to admit forefinger easily. The coils of intestine were also covered with like exudation. In the cortical substance of the kidneys there were radiating abscesses. In the interior of the intestine covering the bladder was an ulcer almost reaching the peritoneum, and an almost perforating diphtheritic ulcer on the vaginal wall. The uterus, the size of a fist, was in the pelvis, and the placenta occupied its anterior wall. The left ovary contained a corpus luteum the size of a cherry-stone.

The fœtus—male—weighed 320 grammes and was 25 ccm. long. After birth it had made respiratory efforts for twenty minutes. The heart-beats continued forty minutes. At the end of sixty minutes they were no longer visible. When the thorax was opened the heart again beat vigorously, and only ceased to pulsate after the jugular veins were wounded. Portions of the lungs were cut off and sank in water.

The exfoliated mass from the bladder weighed 115 grammes, measured 370 square ccm. and was 2 to 2½ mm. in thickness. It consisted of all the coats of the organ, and when spread out presented an aperture in the centre. The exact part of the bladder to which it corresponded was not ascertained.

Dr. Krukenburg refers in a note to the following cases also :—

126. XIV. Barnes, Dr. Robert, "Obstetrical Society's Transactions" vol. v. July 1st, 1863.

Case of fibroid tumour situated in the anterior wall of the uterus, and which obstructed labour.

The patient died from rupture of the bladder produced during labour. A tumour of the fibroid kind was found in the anterior wall of the uterus at the lower part; it was very hard. It seemed probable from its situation and from what could be gathered of the history of the case that this tumour had been driven down before the child's head, and jammed against the symphysis pubis, closing the urethra. Two lacerated openings were found in the bladder.

XV. Litzmann, "Archiv für Gynäkologie," Bd.xvi.S.341. (See Note E. p.121.)

Dr. Krukenberg inquires whether the retroflexion of the uterus in these cases took place before pregnancy or suddenly in the course of it, and considers that whatever may be said concerning the older cases, the modern cases support the latter view. In three cases the symptoms supervened suddenly—in one retention of urine from retroflexion comes on after a hard day's work, in a second after severe exertion, and in a third whilst the patient was trying to pass water as she lay in bed.

In the next place, Dr. Krukenberg considers it worth asking whether twisting of the broad ligaments, associated with retroflexion of the gravid uterus, has anything to do with gangrene of the bladder, and comes to the conclusion that it has not. In "Hunter's" (Hay's) case there was no twisting, and yet rupture occurred. A myoma or fibroma was the probable cause of the retention, and the case terminated earlier than all the others, namely, by death on the fourteenth day. On both these points considerable light has been thrown by the observations of Dr. Braxton Hicks and Dr. Goodhart, communicated to the Obstetrical Society in 1877, and contained in a paper in vol. xviii. p. 194, of the Obstetrical Transactions, entitled, "On the displacement of the uterus by the distension of the bladder, as shown by experiments on the dead body." As the result of seventeen experiments made by forcibly distending the female bladder with water, after opening the abdomen and removing the small intes-

tines, it was found that the bladder begins to distend first in a backward direction, i.e. towards the sacrum, and that its upper segment does not begin to be stretched until the lower part has become nearly completely distended. When the intestines were not removed, the bladder, as it filled, pushed them up till they were forced completely above the brim, and therefore the removal of the coils did not affect the results of the experiments. The effect of the vesical distension upon the tension of the round ligaments was trivial, and often nothing at all. This is quite contrary to the condition of the ligaments in pregnancy, where they tend to become stretched as the fundus of the uterus rises up towards the ensiform cartilage. On opening the body in the horizontal position the uterine fundus was found, in the majority of instances, to be towards the back, and this position was attributed partly to the posture of the body, partly to the loss of the support of the intestinal coils, and partly to the effect of opening the abdomen in depriving the uterus of what has been termed by Dr. Matthews Duncan the retentive power of the abdomen. In the natural state the uterus is anteverted. The effect of distension of the bladder was to stretch the uterus along the under-surface and to render it horizontal in position, instead of vertical, or parallel to the floor of the pelvis. In other words, the influence of the distended bladder was nearly always towards retroversion. Where the vaginal portion was more relaxed than natural, this part was distended into the vagina below and in front of the os uteri. After this the upper part filled, and then the cervix was carried back first, followed by the uterus as a whole, in the more or less vertical position. Where the uterus was enlarged, and high in the pelvis, it was driven first against the sacrum, and then pushed upwards, being ultimately carried out of the pelvis. When the cervical attachments were firm there was a tendency to the production of retroflexion, and when the uterus was already retroflected or retroverted the malposition was increased. When, however, the uterus was already retroverted and the vaginal portion distended first, the retroversion was more or less corrected, and then the bladder displaced the uterus backwards.

These experiments were found to tally with the prior experiments of Dr. John Williams, recorded in the *Lancet*, 1873, vol. ii, p. 192[1] and p. 298.[2] Dr. Williams, however, states that the position which the uterus normally and naturally occupies is one of retroversion, unaccompanied by flexion, and he paid special attention to the effect of filling the rectum as well as the bladder. When the rectum is gradually filled whilst the bladder remains empty the uterus is elevated in the pelvis, the cervix having been carried upwards further from the ostium vaginæ, until the long axis of the uterus is perpendicular to the plane of the inlet, or, in other words, occupies the axis of the inlet. "Let the rectum be a little more distended, and the fundus which is unsupported on its anterior surface falls forward and takes a position immediately behind the symphysis pubis. The position is one of complete anteversion without any flexion. When the bladder is gradually filled, whilst the rectum continues distended, the fundus of the uterus is gradually raised from the pubes and pushed backwards and upwards towards the rectum. As distension proceeds the fundus of the uterus becomes separated from the bladder. Meeting with resistance from the distended rectum, the uterus becomes slightly bent forwards, and the "canal of the uterus is in this position of the organ, slightly curved forwards, and this is the only normal position of the uterus in which the canal takes such shape. When the rectum is full and the bladder is full the uterus occupies a higher position in the pelvis than in any other condition of the organs. The fundus is free to move, and is quite unsupported anteriorly, but the cervix is fixed and cannot be moved in any direction. A strain or severe exertion or fall when the uterus is in this position will produce anteflexion. If the rectum is emptied whilst the bladder continues distended the fundus of the uterus falls backwards and downwards into the hollow of the sacrum. The whole organ is borne somewhat further back and descends in

[1] "The physiological changes in the position of the healthy unimpregnated uterus."

[2] "On the mechanism of the production of certain displacements of the uterus."

the pelvis together with the vagina and bladder, to occupy the space left by the contracting rectum. The uterus is situated further from the pubes in this position than in any other, and the position is one of retroversion without flexion, the canal of the uterus being straight." When both rectum and bladder are distended the utero-sacral and utero-vesical ligaments are put upon the stretch, the utero-sacral only being stretched when the rectum alone is distended. These ligaments do not interfere with the antero-posterior movements or ascent and descent of the unimpregnated uterus. From the experiments of Dr. Goodhart it would appear that the round ligaments become tense when the uterus is pushed firmly backwards and downwards into the cavity of the pelvis, simulating a prolapse, but not by traction upwards or by distension of the bladder. The peritoneal folds and reflexions seemed most concerned in keeping the uterus in position.

From these two sets of independent and carefully conducted observations it may be concluded that when the rectum is empty, or nearly so, distension of the bladder, especially in the horizontal position, produces some retroversion of the uterus, and that such retroversion would necessarily be increased by the action of the abdominal muscles, or by pressure from above. The condition of pregnancy produces over heaviness of the body and fundus, and would combine with the foregoing causes in forcing the fundus of the uterus downwards and backwards into Douglas's pouch. How far the small intestines would exercise an opposing influence by their position behind the fundus, and by resisting the pressure of the distending bladder, the authorities at the Obstetrical Society were not agreed. Dr. Snow Beck averred that all his experience was opposed to the conclusions of Dr. Braxton Hicks, and that in the normal state the small intestines prevented displacement of the uterus by distension of the bladder; and Sir Spencer Wells said that the influence exerted by the intestines was at least as great as that of the rectum and the bladder, and that they were usually found occupying Douglas's pouch. On the other hand, Dr. Routh stated that Douglas's pouch rarely contained intestines, and Dr. John Williams observed that the intestines were not in Douglas's pouch once in twenty cases. Exact observations like those of Dr. Williams and Dr. Hicks must be allowed their due weight, and there does not appear to be any just ground for declining to admit the influence of over-distension of the bladder as one of the factors in the production of retroversion of the gravid uterus. Dr. William Hunter inculcated this doctrine. Straining to pass water out of an over-distended bladder, especially if the rectum be not full, and the horizontal position during the act, will operate further in the like direction, and this was the precise condition of things when the symptoms commenced in the case related by Dr. Krukenberg. The small intestines are readily pressed upwards out of the way and cannot offer any efficient resistance.

The occurrence of gangrene and exfoliation of the vesical tissues presents a problem which has not been completely solved. The antecedent conditions are over-distension of the bladder intermittent or continuous, decomposition of the urine, malposition of the uterus, and abnormal pressure or mechanical violence. Over-distension of the bladder stretches, thins, and weakens the vesical tissues, and, if carried to an extreme, produces actual rupture. In the dead subject rupture may occur in two ways. In M. Houel's experiments (probably on male bodies) the mucous coat was the first to give way. In Dr. Goodhart's, on the female bladder, the usual method of rupture was by a direct slit at the fundus. This means, I presume, a slit through all the coats at the apex or the upper fundus. In one or two of the experiments, however, the rupture was sub-peritoneal, the outstretched mucous and muscular coats giving way and admitting the fluid into the sub-peritoneal areolar tissue. There is no evidence that the mucous coat gives way in these cases, and that the gangrene is due to the contact of the urine with the submucous tissues. If urine were admitted beneath the mucous coat, it would probably spread a long way in the perivesical connective tissue, as in Liston's case (Case 72, extra-peritoneal series). Dr. Krukenberg states that May ("Ueber die Reclination der Schwangeren Gebärmutter, Dissertation," Giessen, 1869) has shown that mere intermittent ischuria suffices to set up gangrene of the mucous membrane, but he does not explain the *modus operandi* of intermittent ischuria. A good

deal may be said in favour of the irritating influence of decomposed and ammoniacal urine retained in the bladder in consequence of retroflexion of the uterus or temporary incompetence of the bladder after labour. Urine of this kind sets up violent cystitis, which runs into gangrene.

In addition to the cases already adduced in this note, reference may be made to a few others, which may help to elucidate the question. Dr. Krukenberg mentions two cases in which patients who were the subject of retroflexion died without rupture, and in which, at the post-mortem, gangrene of the whole thickness of the bladder-wall was found. In one the gangrenous part was firmly adherent to coils of intestine, so that if the patient had lived exfoliation without rupture would have occurred. The cases in question are related respectively by Zantl ("Ueber Retroflexion Uteri Gravidi, Dissertation," Munchen, 1878) and by Delaharpe (for reference see p. 113). In the "Obstetrical Transactions," vol. v. p. 186, is the report by Dr. W. Martyn of "A case of face presentation: delivery by forceps; subsequent sloughing, or separation of the mucous lining of the bladder and expulsion of the same." At seven p.m. on April the 19th, 1863, Dr. Martyn was requested to see Mrs. H., who had been in hard labour for twelve hours (her fourth confinement). The urine was drawn off and the forceps applied. Dr. Martyn said to his friend as he was leaving, "Look out as to the state of the bladder." Three days later, when asked to see the patient again, he found her in an alarming state; pinched and anxious face; pulse very quick; belly much distended, tender on pressure; very feverish and restless; insomnia since delivery; and urine constantly draining away. The patient had only passed water naturally once since her confinement, and that was a few hours afterwards. Dr. Martyn introduced a catheter, and drew off two quarts of urine highly offensive and ammoniacal. The urine was drawn twice a day for a week. It continued bloody and most offensive. On May the 6th there was great irritability of the bladder, accompanied by much pain, and the urine was loaded with muco-purulent matter. On the 19th a sloughed mucous membrane of the bladder came into the urethra, and was drawn out. More was passed in a cloth, and appeared to be nearly the whole of the lining membrane of the bladder. Half a chamberful of dirty urine followed. Great irritability of the bladder continued, with much soreness, the patient passing water every five minutes. By degrees this distressing condition subsided, and the patient made an excellent recovery. The specimen passed by the patient measured eleven inches by six or seven. Besides the mucous lining it contained much sub-mucous tissue, here and there parts of the muscular wall, and a patch or two of the peritoneal surface. Dr. Martyn refers to a case brought before the Western Medical Society by Mr. Barnes in which the lining membrane sloughed away whole, and also to a similar case reported by Sir Spencer Wells in 1862, vol. iii. p. 417. The latter case was that of a woman who had been delivered of her first child. Forceps had been applied with considerable force for two hours. Symptoms of cystitis supervened, and the urine became ammoniacal and fetid, and at the end of three weeks from her confinement she passed by her urethra a cast of the bladder, consisting apparently of mucous membrane and portions of the muscular coat encrusted with the saline constituents of the urine. The specimen was referred to Dr. Harley, and his report will be found in vol. iv. p. 13, of the "Obstetrical Transactions." It was found to consist of the mucous and muscular tissues of the bladder, with a small part of the serous coat, but Dr. Harley could not determine whether it had belonged to a human bladder or not. Caution is necessary in accepting cases of the kind as genuine, as women occasionally practise deception, and in the discussion on Sir Spencer Wells's specimen, Dr. Barnes mentioned an instance of a woman who had the broken end of a catheter extracted from her bladder by Mr. Maunder, at the London Hospital, and who came subsequently under his care for retroversion of the gravid uterus. One day, on passing a catheter, the resident accoucheur found it obstructed by a solid substance. Part of it appeared at the orifice of the urethra, and it was drawn out. It was a large sac exactly resembling a bladder. Examined by an accomplished histologist it was pronounced to be, not an exfoliation, but the bladder of an inferior animal surreptitiously introduced. Dr. Barnes would not himself pronounce an opinion on the matter. In Sir Spencer Wells's case the reasons in favour of the genuineness of the specimen are

very strong, and on the face of the record of Dr. Barnes's case it is not clear why the accomplished histologist pronounced the cast-off sac to be the bladder of an inferior animal. Possibly obstetricians were not then so well acquainted with the subject of exfoliation as they are now.

In these cases of exfoliation following labour with or without instruments, considerable influence must be assigned to the strong pressure and bruising to which the bladder is subjected in the process of expulsion or extraction of the child. Dr. Martyn, however, attributed the exfoliation entirely to ammoniacal urine. In these cases, he says, there is long retention caused by the preceding severe labour, the retained urine becomes ammoniacal in a high degree and acts like a caustic on the tissues of the bladder.

Sometimes an amalgamated exudation, or false membrane, is thrown off by the bladder, the mucous membrane remaining entire. Sir Spencer Wells exhibited at the Obstetrical Society, in 1862, a female bladder showing the results of retention of urine after delivery. The case was one of great interest, as it involved the question whether the fatal issue could fairly be attributed to neglect of the bladder by the practitioner in attendance. The patient was a healthy young woman of twenty-two, the daughter of a medical man, in labour with her first child. The labour was not tedious, the child was born an hour and twenty minutes after the rupture of the membranes, and the placenta soon followed. The patient had been unable to pass her water during the day, and two hours after delivery much pain and distressing desire to micturate were experienced, continuing the whole night and preventing sleep. The next morning the abdomen was large and tense below the umbilicus. At night an unsuccessful attempt was made to pass a catheter. The patient passed a most distressing night, and was not relieved till the following night—forty-eight hours after delivery, and sixty hours since she had last made water, - when another surgeon removed five pints of turbid, bloody urine. Some days afterwards a rigor occurred, and two or three days later incontinence of urine. A train of distressing cerebral symptoms followed, and death at the end of eight weeks from the confinement. The bladder contained a mass apparently composed of the whole of the mucous membrane detached from the muscular coat, and covered on both sides with a deposit of the saline elements of urine, but on examination by Dr. Harley the mucous coat of the bladder was found entire, and the mass in the bladder was pronounced to be an exudation from its surface. Drs. Tanner and Chowne defended the medical practitioner, and it is not easy to trace all the connecting links between the unrelieved retention and the fatal issue. In the course of his remarks, Dr. Tanner referred to an interesting pathological specimen (No. 1993) in the Museum of the Royal College of Surgeons, consisting of a membrane removed by Liston from the bladder of a man subsequently to an injury. A man seventy years of age, living in Edinburgh, fell off a scaffold, and was admitted into the infirmary. He suffered from retention and a thick puriform fluid was evacuated by the catheter. At the end of the third week nothing could be drawn by the catheter, and the instrument impinged against a membrane near the orifice of the bladder. Assisted by Knox, Liston cut into the bladder above the pubes, and removed the membranous cast. The man lived three months after the operation.

In gangrene affecting other parts or tissues of the body blocked vessels play a conspicuous part in its causation, and it can scarcely be doubted that in these remarkable cases of exfoliation of the whole bladder-wall there must have been some obstruction in the afferent or efferent vessels of the viscus. That tedious and instrumental labours should occasion such a lesion is perfectly intelligible, and it is quite possible that an over-distended bladder, accompanied and caused by a retroversion of the gravid uterus, may have its circulation so interfered with by the unwonted and unnatural pressure that it may lose its vitality, especially when attacked by inflammation arising from the presence of ammoniacal and decomposing urine. The pressure of the retroverted gravid uterus may act upon both the vesical arteries and veins as well as directly on the bladder itself. In the fatal case of retroversion related by Hunter, and referred to in the note on p. 92, the os uteri made the summit of the tumour upon which the bladder rested, and the fundus uteri was so firmly wedged in the pelvis that it could not be taken out till the symphysis pubis had been divided and the ossa pubis had been torn asunder to enlarge the space within the bones

of the pelvis. Thus situated the uterus, one would think, must interfere both with the afflux and efflux of blood; and it would be quite worth while, in future fatal cases of rupture of the bladder from gangrene of its coats caused by retroversion of the gravid uterus, to dissect out the vesical vessels, and ascertain their exact condition and the influence exerted over them by the retroverted uterus.

Note E.—Rupture of the Bladder from Extra-uterine Pregnancy.

In the "Archiv für Gynäkologie" for 1882, Dr. Groedel relates:—

127. I. A case of Tubal Pregnancy—Rupture of the Bladder.

On 15th August, 1880, he was asked to see the wife of a musician who had been ill for a long time, and whose sufferings of late had very much increased. The patient, who was four months pregnant, had had difficult urination for some weeks, and for the last few days pain over the whole abdomen. Since she was thirty-two she had been confined three times, eight, seven, and six years ago respectively; the first time with forceps, the second easily, and the third with considerable hæmorrhage. On the last occasion a large piece of placenta came away at the end of six weeks. She quickly recovered her health, but since her last confinement her menstruation had been irregular, and often very copious; since that time she had frequently suffered also from pain in the left side, and a sensation as if something would come down. About four months previously menstruation ceased. She thought she was pregnant, though for two months a little blood appeared. Four weeks ago a new ill befell her, from which she had never suffered before. When she wanted to urinate she could not, but all at once the water would come quite suddenly. Then for a certain time it escaped spontaneously. A few days later the state of the water altered: it became thick, smelt badly, and was stained with blood, and within the last eight days of a blackish-grey colour, and very offensive. During the last week very little urine had escaped, and with very great pain. At this time also the whole belly became sensitive and painful. On examination the patient was feverish, with frequent pulse, and abdomen sensitive, even to light pressure. Above the navel, chiefly on the right side of the median line, there was an elastic tumour, which he regarded as a pregnant uterus, at about the fourth or fifth month, placed higher up than usual. The urine was strongly alkaline, and contained an enormous quantity of albumen and sediment, which made up nearly one-third of the whole amount, and microscopically showed the constituents of the urine, mixed with the products of very severe gangrenous cystitis. The colour of the urine was dirty brown, almost black, the odour wholly carrion-like and putrescent. Between five and six the patient, who had dropped asleep, and had a dreadful dream, awoke, and getting out of bed fainted and fell. She was found by her husband senseless on the floor, and without signs of life, and was lifted into bed. At this moment, happily, Dr. Groedel arrived to pay his evening visit. The patient was extremely collapsed, and complained of most horrible pain in the lower belly. The abdomen was greatly distended and tense, but the tumour felt the day before had disappeared. Examination per vaginam showed that the uterus was within reach, with the cervix to the right and the fundus to the left, and did not contain any fœtus, a fact which was demonstrated afterwards with the uterine sound. A doughy swelling could be felt in Douglas's pouch, and beyond this nothing was demonstrable. Dr. Groedel's diagnosis was tubal pregnancy, with ruptured cyst, the connection of the bladder lesion with this condition not being clear to him. The abdomen was then covered with cold compresses. Dr. Groedel's colleague, Dr. Abbée, was asked to see the case, and concurred in the diagnosis. Injections of morphia were given without relief. Knowing diseased state of bladder, the consultants thought that it might have ruptured and contributed to the mischief. Attempts were therefore made to pass a catheter, and at last a male silver catheter was introduced. Only a few teaspoonfuls of urine escaped. The tumour in Douglas's pouch was then punctured with a fine trocar, giving exit to about a litre of clear, yellow fluid, which was considered to be peritoneal. A firm, balloting

body could now be felt, which might be the fœtus, but whether it was in an uninjured or a ruptured cyst could not be determined. Nothing further was deemed advisable, as the patient became conscious, and the pain less. Cold applications to the abdomen were continued, and the patient was left at midnight in a tolerably satisfactory condition. At four a.m. she was sensible and quiet, but from that time the pains became more severe than they were before the puncture, and when Dr. Groedel arrived she was completely moribund, had occasional convulsions, and died in the course of the forenoon. The post-mortem had to be performed quickly on the following day, and was confined to the contents of the abdomen. On opening the belly the bladder was exposed, enormously distended, but empty. An incision into it showed a small portion of the anterior wall strongly hypertrophied, the remaining portions being very thin, and covered with mucous. Half-way up the posterior wall, towards the left, there was an ulcerated spot, the size of half-a-crown, resembling a perforating ulcer of the stomach. There was a small quantity of decomposed urine in the bladder, and a large amount in the abdomen. On drawing the bladder to one side a tumour the size of a man's head was found. It extended deeply in the pelvis, was easily movable, and was connected with the uterus pressed over to the right. The fundus of the bladder was on the left, and at its lowest part glued to the tumour. Some centimetres higher up, above the tumour, there was a perforation, almost circular, and the size of a pea, in the hinder wall of the bladder. The tumour itself was a cyst formed out of the left Fallopian tube, and it contained a fœtus of four months.

In commenting on the case, with a view of reconciling the appearances after death with the symptoms during life, Dr. Groedel points out that the case was one of tubal pregnancy at the end of the fourth month, and that as rupture of the sac very commonly occurs in such cases about that period, he had suspected from the first that this had happened in his case, partly on account of the sudden collapse, and partly because of the disappearance of the tumour on the right side, noticed at the first examination, and considered to be the gravid sac. The post-mortem, however, showed that the sac really lay deep in the pelvis on the left side, and quite intact, whilst it was the greatly distended bladder which had formed the tumour on the right side, and it was owing to a perforation in this tumour that the alarming symptoms were caused. The small quantity of urine obtained from the bladder is thus explained; but it is not clear why the fluid let out on puncture of Douglas's pouch had only the characters of peritonitic exudation, and did not show the presence of urine. Hypertrophy of the bladder was first caused by the sac pressing on the urethra; then followed dilatation, thinning of bladder-wall, purulent putrescent cystitis, and ulceration, ending in perforation. Whether the actual rupture was entirely spontaneous or the result of the fall must be left undetermined.

In reference to the occurrence of rupture of the bladder in women, Dr. Groedel refers to the article by Winckel, on "Krankheiten der weiblichen Harnröhre und Blase," in Billroth's "Handbuch der Frauenkrankheiten." Of eighty-six cases of rupture there referred to, only eleven occurred in women; some from violence, and in others from over-distension with disease of the bladder-wall, and retroflexion of the gravid uterus. Of undoubted cases of this latter sort, determined by post-mortem examination, are the cases mentioned by (1) G. V. Doeveren, 1765; (2) Lynn, 1767; and (3) Winckel. In others only retention of urine was the result of retroflexion. Winckel himself saw one such case in which, at a post-mortem on a woman who died in consequence of retroflexion of the gravid uterus, there was found a greatly distended bladder filled with thick stinking urine, and in fundus of bladder was quite a collection of greater and smaller losses of substance. The cases of (4) Madurowicz and (5) Schatz are then summarized. The latter described a case in which, from a similar cause, puncture of the bladder and uterus was necessitated, and a large part of the vesical mucous membrane necrosed and was passed. Additional cases belonging here are:—

(6) Moldenhauer, "Archiv für Gynäkologie," Bd. vi. S. 108.

(7) Brandeis, "Archiv für Gynäkologie," Bd. vii. S. 189.

(8) Frankenhauser. (See Note D.)

128. Quite recently, (9) Ahlfeld (Sitzung der Medicinischer Gesellschaft, in Leipzig, am 30sten December, 1879) referred to a case in which there was retroflexion of the gravid uterus, followed by difficult urination, as the woman one day fell over a bucket. Then a severe peritonitis supervened, of which she died on the third day. On catheterization the instrument passed into the abdominal cavity and only bloody urine escaped slowly. Post-mortem showed large rent in anterior bladder-wall.

129. H. Litzmann, "Zur Fest-Stellung der Indicationen für die Gastrotomie bei Schwangerschaft ausserhalb der Gebärmutter" ("Archiv für Gynäkologie," Bd. xvi., 1880, S. 336).

A female, thirty-five years of age, had already borne four children naturally. In June, 1877, she menstruated for the last time. A month later she suffered greatly from sea-sickness, and noticed suddenly a copious discharge of clear watery fluid (urine?). Three days later some blood-stained fluid escaped from the vagina. Subsequently she suffered frequently from slight bloody discharge. At the end of September she first noticed movements of the child. About Christmas she was sick, and had a watery discharge from the vagina. She thought she must be about to have a miscarriage. A midwife passed a hair-pin up the vagina, and thus let out a quantity of blood. A medical man who now saw the patient found a tumour of considerable size in the abdomen, which he took for the pregnant uterus. Subsequently the patient suffered a good deal, and was confined to her bed. The tumour increased in size, and there was a discharge from the vagina, at first of a bloody fluid, and later of a very offensive fluid. The urine escaped involuntarily. She vomited after taking food. She failed rapidly, and was admitted into the hospital on February the 9th, 1878. The abdomen was enlarged, and apparently contained a fully pregnant uterus. No fœtus could be felt, and no fœtal pulse could be heard. *Per vaginam*, a fluctuating tumour could be felt presenting in Douglas's pouch. The neck of the uterus, and the os uteri could not be felt. Under chloroform the shape of the abdominal tumour suggested that it was a distended bladder. The introduction of the catheter showed that such was the case. A large quantity of clear urine was drawn off. The use of the catheter was repeated. A tumour was detected in the pelvis apart from the uterus, but its nature could not be made out. On February the 12th the pelvic tumour was punctured with trocar and cannula. Blood only escaped. The urine drawn off often contained blood. On February the 15th the patient died.

Autopsy.—In the abdominal cavity there was a considerable quantity of dark-brown urinous fluid. The intestines were covered with lymph and pus. The bladder was much enlarged. On the posterior wall, some centimetres above the reflexion of the peritoneum, was a perforation the size of a pea. Externally the opening was covered by a fibrino-purulent membrane; on the inner surface the adjacent tissue was much discoloured. Elsewhere on the inner surface there were several other discoloured softened spots yet covered by peritoneum. The uterus showed no changes calling for note. The left Fallopian tube was short. The right half of the pelvis was occupied by a rounded tumour, which was free above and covered by peritoneum. It pushed the rectum to the left, and was adherent to it as well as to the uterus and right broad ligament. The right Fallopian tube passed horizontally outwards from the uterus for about 4 cm., and then enlarged abruptly and became incorporated with the tumour. The latter was clearly an extra-uterine fœtal cyst. The placenta occupied the greater part of its cavity. It contained also a shrivelled fœtus. The whole cyst was shelled out from Douglas's pouch.

Note F.—Rupture of the Bladder in the Female.

The liability of the female in comparison with the male to rupture of the bladder will be best displayed by a statistical summary of the cases recorded in this work.

Of 288 undoubted instances of rupture, 240 were males and 48 females.

Of 151 fatal simple intra-peritoneal ruptures, 123 were males and 28 females.

106 of the 151 cases were due to violence; 99 were males and 7 females.

45 of the 151 cases were idiopathic; 24 were males and 21 females.

Of 30 fatal complicated intra-peritoneal rents (all but one traumatic), 26 were males and 4 females. The single idiopathic case was in a female.

Of 89 fatal extra-peritoneal ruptures, 77 were males, 9 females, and 3 doubtful.

78 of the 89 fatal cases were due to violence; 71 were males and 7 females.

11 of the 89 cases were idiopathic; 9 were males and 2 females.

Of 8 ruptures of uncertain seat due to violence, 6 were males and 2 females.

Thus violence was responsible for 221 fatal cases, out of which nineteen only were females. On the other hand, out of 59 fatal idiopathic cases no less than twenty-three were females. Of the 40 cases set down as recoveries, thirty-four were males and six females. Of the 40 cases, twenty-nine were due to violence; eleven were idiopathic (all extra-peritoneal); and five were females. Of the 6 recoveries in the female, four were cases of rupture of the bladder into the vagina, owing to the accession of labour and the use of instruments whilst the bladder was distended. There is not a single reported recovery in the female from intra-peritoneal rupture of the bladder. Cases of retroversion of the uterus in which portions of the entire bladder-wall have exfoliated, are the nearest approach to recoveries of this kind; but there is this notable distinction that the intestine or omentum becomes glued to the bladder before exfoliation, so that the cavity of the bladder is completely shut off from the cavity of the peritoneum, and no urine finds admission into the peritoneal sac. In all the cases hitherto reported in which urine has entered the cavity of the female peritoneum, death has ensued very generally at an early date after the rupture.

Of 49 cases in the female, six recovered and forty-three were fatal. Of the 43 cases, nineteen were due to external injury and twenty-four were idiopathic. Of the 24 idiopathic cases, seven were due to labour; three to ulceration, one from erysipelas, one a month after delivery, and one from disease; three to retention; nine to retroversion of the gravid uterus; two to extra-uterine pregnancy. All but one of the 24 cases were intra-peritoneal ruptures. One was a partial rupture.

From this summary it will be seen that whilst males are far more exposed to rupture of the bladder from external injury, the female is equally liable to suffer from rupture from internal causes. Labour, retroversion of the uterus, and extra-uterine pregnancy, in the female, occupy the place of stricture and hypertrophy of the prostate in the male. Indeed, if we took into account all the cases of vesico-vaginal fistula due to neglect of the bladder in labour, the female surpasses the male in liability to rupture, or solution of vesical continuity.

Note G.—Additional Cases of Rupture of the Bladder.

I. Sacerdoti. Case of rupture of the bladder and urethra successfully treated by external urethrotomy. "Gaz. Med. Italiana," Prov. Venete, "Medical Record," 1882.

A boy of thirteen fell across a beam of wood, striking his perineum, in the first instance. Great discoloration over the inguinal, scrotal, and perineal regions, a wound on the inner and upper part of the left thigh, and a globular tumour in the suprapubic region were the objective signs. No urine could be passed. The desire to pass water was very urgent, and on pressing the tumour urine was squeezed out of the thigh. The bladder could not be reached, either through the urethra or by following up the track of the urine. A rupture of the bladder, with extensive extravasation of urine, was diagnosed, and external urethrotomy was performed. A catheter was introduced on the second day to draw off the urine as secreted. On the eighth day an abcess opened at the seat of the wound in the thigh, but gradually all adverse symptoms disappeared and the patient was discharged cured. Antiseptic treatment was adopted throughout.

Remarks.—There is no evidence that the bladder was ruptured in this case.

Possibly the abstract may be defective, but as the case here stands there is no proof of anything more than a ruptured urethra.

II. Denonvilliers. Recovery. Houel (op. cit. pp. 72, 76, and 78) refers to a case under M. Denonvilliers in 1847, in which there was a rupture of the bladder, anteriorly communicating with a circumscribed sub-peritoneal pouch containing urine. He says that M. Denonvilliers was fortunate enough to obtain a cure by introducing a sound into this accidental pouch and washing out the bladder and cavity with warm water. In his table of cases, M. Houel gives only a fatal case under M. Denonvilliers in 1843, in which there was a similar condition of things—a rupture anteriorly, and a sub-peritoneal pouch containing urine. Not knowing whether the two cases might not in reality be one and the same, I did not originally include M. Denonvilliers' case in the list of recoveries. The fatal case is Case 21 in my list of extra-peritoneal ruptures.

U.S. 8. III. Proksch, on syphilitic ulceration of the bladder (Vierteljahres-Schrift für Dermotal und Syphilis, 1879, Heft 4), gives six cases of syphilitic ulceration of the bladder, all the satisfactory instances he had found recorded during the last 400 years. The cases include one by Morgagni, two by Ricord, one by Virchow, one by Tarnowsky, and one by Vidal de Cassis. In the last case, at least, perforation of the bladder occasioned the death of the patient. Whether the perforation involved the peritoneum or not is not stated in the abstract in the "Medical Record," for April 15th, 1880, from which this note is derived.

I.P. 130. IV. Erskine Mason. Rupture of the bladder. Operation. Death. "New York Medical Record," July 22nd, 1876. See also the London "Medical Record," September 15th, 1876.

Man, thirty-two years of age, admitted into Bellevue Hospital on May 13th. On May 10th arrested for intoxication and confined in the station-house. Shortly after, he was unable to pass water and applied for assistance. Instead of receiving any he was deluged with cold water. Subsequently he was taken to the City Prison, where his urine was twice drawn off. When seen at the hospital he was perfectly rational, with small, feeble pulse, anxious countenance, and swollen abdomen, the upper part being tympanitic, and the lower dull. He complained of vesical tenesmus. The scrotum was somewhat discoloured, giving rise to the possibility of injury to the perineum, and consequent rupture of the bladder. There were no other marks of external injury. Twenty ounces of pure urine were evacuated by the catheter. No stricture. By rectal examination, the forefinger detected a distinct swelling, containing fluid, to the left of the prostate. *Diagnosis:* Rupture of the urethra behind the triangular ligament, with effusion into the peritoneal cavity. As the only hope rested in an operation, the usual one for lithotomy was performed. As soon as the incision had been made the forefinger was passed into the bladder, and came in contact with and passed through a rent in the posterior wall of the viscus. The bladder was firmly contracted, and no urine flowed through the incision. A silver catheter was then passed through the rupture into the peritoneal cavity, and ten ounces of a somewhat turbid fluid were drawn. The patient sank and died twelve hours after the operation, and on the fourth day from the commencement of the trouble. The necropsy, made a few hours after death, revealed the general peritonitis with a considerable quantity of urine in the cavity of the abdomen. The intestines were matted together by recent adhesions. In the posterior wall a rent was discovered, one and a half inches in length, edges everted, and presenting a sloughy appearance.

In conclusion, Dr. Mason gives a statistical account of operations for rupture of the bladder, comprising four recoveries out of seven cases. The recoveries included the case of Dr. W. J. Walker, Boston, 1845 (see p. 52), operated on twenty-four hours after the accident; Dr. Willard Parker's case, operated on a few hours afterwards (see p. 54); and two cases of his own; the first case, occurring in 1871, operated on on the third day (see p. 67 et seq.), and the second, occurring in 1873, operated on a few hours afterwards. Of the two fatal cases, the first was operated on twenty days after the accident, and lived fourteen days; and the other is given above.

Remarks.—The details of the operation in the foregoing case yield strong confirmation of the correctness of the opinion expressed by the author in regard

to the diagnosis in Dr. Erskine Mason's first case of recovery, criticized in the text (pp. 67—70). In the fatal case, where there was an undoubted rent through the posterior wall of the bladder, and urine was effused in the cavity of the peritoneum, no urine escaped through the perineal incision, and a catheter was required to remove it. Exactly the same absence of escape of urine was noted by Mr. Partridge when he cut into a ruptured bladder, and this is what we might *a priori* expect in these cases. The bladder also will in all probability be contracted, as in Dr. Mason's case, and readily admit of exploration with the finger, either through a median or lateral incision.

I.P. 131. V. Erskine Mason, "Transactions of New York Pathological Society," vol. iii. p. 194. Intra-peritoneal rupture; lateral cystotomy.

Boy, eleven, kicked in perineum by a playmate. He had some pain, and for a few hours afterwards was unable to pass his urine; then the bladder was evacuated voluntarily several times during the remainder of the day. After this he again had retention which continued for forty-eight hours, necessitating the use of the catheter, which was introduced twice daily for six days, till his admission to the hospital. During this period no pain was complained of, and no bloody urine had shown itself. Dr. Mason saw him July 10th. He was then running about the ward and only complained of inability to pass his urine without assistance. A No. 12 (French) bougie was passed, and a large silver catheter also introduced with ease and drew off some clear urine. Daily use of catheter became imperative. Urine was sometimes clear and sometimes turbid or dark, and not unfrequently it had an offensive odour, and on the 12th July some blood made its appearance in the fluid, and pain was felt in the hypogastrium. A poultice was applied over the bladder, and the organ was washed out. July 19th: While in the warm bath a small quantity of urine was passed voluntarily. During the afternoon of July 20th, without any notable change in the vesical symptoms, the patient rolled his head upon the pillow, became drowsy, with dilated pupils, and cyanotic face, and fell into a stupor which lasted half an hour, when he awoke and appeared as bright as usual. July 25th: Suffering more pain. House-surgeon introduced catheter and felt obstruction for first time. Dr. Mason had a similar experience, and suspected rupture of the bladder. On passing his finger into the rectum, Dr Mason encountered a swelling in the neighbourhood of the ramus of the ischium. The patient was then etherized, and the bladder was opened as in the operation for lithotomy. Bloody urine flowed out, and the organ, which had been very much distended, collapsed at once, but by passing the finger into the bladder a soft and curious swelling was felt. The operation was performed at five o'clock p.m., July 25th, and at nine the bladder had again become distended, when the house-surgeon passed a catheter and relieved him. The instrument was used until the 26th, when the patient was again etherized for the purpose of examining the wound, and the finger being passed in pushed something before it. July 27th: Abdomen tympanitic and more pain. Warm fomentations gave relief. 28th: A large quantity of pus was discharged from the wound, attended with a feeling of great relief, and from that time till death the urine flowed freely through the artificial opening. On August 8th he was attacked by pyæmic diarrhœa, to which he finally succumbed. A few days before his death he also had a good deal of cough, and developed the usual symptoms of pyæmic pleurisy. *Autopsy:* Pleuritic adhesions on right side. Right kidney, ureter, and renal pelvis contained pus. Wall of bladder thickened; mucous membrane covered with pus; in lower and posterior portion a large rupture, one of the torn edges of which was infiltrated with pus, and projected into the cavity of the viscus. There was also a rupture of the urethra just in front of the neck of the bladder, some pelvic peritonitis, and anterior portion of rectum bound down so that Douglas's *cul-de-sac* was bridged over and filled with urine. On passing the finger through the wound, one portion of the rent was seen to fold directly over the neck of the bladder, and to be covered with granulation tissue.

Remarks.—It is to be regretted that there is not a more circumstantial history of the original accident in this interesting case, and that nothing is said concerning the state of the bladder at the time. Judging by the history, we may fairly infer that, if the bladder was injured by the kick, it did not

sustain more than a partial rupture, and that the peritoneum gave way at a later period. It may even be doubted whether there was any rupture at all at the time of the accident, for there was neither pain nor blood in the urine till after his admission to the hospital, and till he began to run about the ward with a full bladder. In all probability the complete rupture occurred about the 25th of July, by which time the bladder and rectum had become adherent, shutting off Douglas's pouch from the general peritoneal cavity. Notwithstanding this, and the early performance of cystotomy, death ensued a fortnight after the operation.

I.P. 132. VI. W. Williams, M.D. "Medical Times and Gazette," October 30th, 1875. Large quantity of urine drawn from peritoneum.

J. D., fifty, admitted July 28th, with acute pain in abdomen. He had been kicked four days previously over the region of the distended bladder, and had since suffered severely, and been unable to pass water. The catheter was daily used without relief, affording passage only to a small quantity of urine. There was considerable collapse, with cold, livid extremities, small, weak pulse, furred tongue, and much restlessness. There had been no vomiting, and the bowels were reported as regular. Abdomen uniformly distended, very tender to touch, dull on percussion at all points. A medium-sized catheter was introduced without difficulty. The flow of urine suddenly stopped after a small quantity of urine had been drawn, owing to the plugging of the eyes of the catheter with colourless, semi-solid matter, resembling peritonitic exudation. By means of a large instrument, 200 ounces were voided clear, but with similar clots. No improvement of the symptoms resulted, but the size of the abdomen was diminished. Death occurred on the 29th. The post-mortem disclosed diffuse peritonitis, matting of intestines, and extravasation of urine from ruptured bladder. The bladder was small, and contracted in the lower part of the pelvis, and had at the summit a ragged oval opening, one and a half inches in diameter, with firm, thickened edges, covered by deposit. The organ had not capacity for more than three ounces.

Remarks.—The chief features of interest are the very unusual admixture of semi-solid clotted exudation with the urine, and the great quantity of urine withdrawn from the peritoneal cavity. It will be observed that this quantity allows for the secretion of two pints daily, and that, consequently, absorption by the peritoneum could scarcely have taken place to any considerable extent in the present case.

I.P. 133. VII. Fleming, Ch. "Clinical Records of Injuries and Diseases of the Urinary Organs," p. 221.

A fine young fellow was thrown down whilst wrestling, and severely crushed over the region of the bladder by the knee of his opponent, who fell upon him. The catheter drew off one or two ounces. There was a suprapubic tumour, supposed to be a collection of urine, and he was tapped with a trocar and cannula without result. He died in a few days, and a rupture of the fundus was found. The bladder only contained a small quantity of bloody urine. The tumour in the hypogastric region was formed of blood partly coagulated, which had gradually forced its way between the peritoneum and bladder, and travelled upwards.

Remarks.—I take it that this is an intra-peritoneal rent, and that fundus means the superior part of the bladder, although we have here another illustration of the inconvenience of using the word in this way. The case is instructive as showing that a collection of blood may readily form in these cases in front of the bladder, separate it from the pubes, push the peritoneum backwards, give rise to dulness on percussion, and be mistaken for a collection of urine. A fuller report of the symptoms and post-mortem would have been advantageous.

I.P. 134. VIII. Tausky, Dr. "New York Medical Record," 1882, vol. i. p. 326.

Wm. McG——, thirty-two, was injured in the abdomen, as he thought, by some one falling upon him as he lay intoxicated in a saloon. After a visit to the Northern Dispensary, where a rupture of the bladder was diagnosed, he was admitted into St. Vincent's Hospital on February 26th, 1881. He complained of retention of urine. A catheter was used, and drew off a quantity of bloody urine. It was necessary to use the catheter every six hours to relieve his distress. After a few days the urine began to assume its natural colour, but on standing for some time would show a deposit of blood. The amount

drawn each time was considerable. The instrument, a silver catheter, had to be introduced up to the rings before the urine could be drawn, and even then it required some manipulation after the instrument had passed the normal distance, until the instrument would suddenly pass further and the urine would flow. The man died of asthenia, March 3rd, 1881, at three p.m. *Post-mortem:* Intestines slightly injected, and surface of transverse colon a little roughened, peritoneum slightly injected and thickened. A considerable quantity of fluid with ammoniacal odour in peritoneal cavity. Tissues in abdominal wall infiltrated, and recti muscles sloughy below. Bladder, two inches in diameter, contracted, and presenting a bluish aspect, almost gangrenous; horizontal rupture, commencing a little to the right of the fundus, and passing to the left nearly to the neck; the edges appeared not of recent origin, and at various parts the inner and outer edges had cicatrized: mucosa inverted. Upon and under the mucous membrane were a number of small cysts filled with bloody serum.

IX. Stoll. "London Medical Repository," 1822, vol. xvii. p. 60.

Rupture of the bladder from prostatic enlargement and retention.

In an analytical review of James Wilson's "Lectures on the Male Urinary and Genital Organs," the following remarks occur:—"Respecting rupture of the bladder, Mr. Wilson says:—'In the cases which I have examined, I never have met with the appearance of an opening actually formed from the bladder bursting from distension; the appearances have either marked ulceration or the death and consequent sloughing of the part through which the urine had escaped.' This is certainly true to a considerable extent, more especially as it concerns cases in which disease had previously existed for any considerable time, accompanied with much obstruction to the discharge of urine. But a sudden arrest of this evacuation may arise, either from an inflamed prostate gland or from any other cause.

"Stoll relates the case of a coachman, who complained of slight dysuria, but on the third day from the commencement of this complaint he discharged his urine copiously. He drank freely of malt liquor on the evening of the same day, and then for the first time complained of ischuria. The surgeon who attended him could not pass the catheter. On the second day of the retention of urine, while straining at stool he felt something burst in the abdomen. The consequent symptoms were unequivocal; he died two days afterwards. The examination of the body displayed the prostate gland swollen, inflamed and gangrenous in some parts; the peritoneal sac filled with urine, and inflamed throughout, with spots of incipient gangrene where it covered the small intestines; and exhibited the bladder ruptured in all its coats at the fundus, where it is covered by peritoneum.

"Other instances could be given in opposition to the opinion of our author; we will, however, merely remark that such occurrences have not been rare in the course of badly-managed parturitions, arising from the mechanical pressure at the neck of the bladder during the simultaneous contractions of the uterus and the abdominal muscles. Such cases are recorded by Mr. Hey, Van Doeveren, Osiander, and others."

(N.B.—Stoll's case must be identical with Case 11 in Stephen Smith's table, assigned to Mr. Scott, and attributed to stricture and retention. Case 5 in the list of intra-peritoneal rents.)

I.P. 135. X. Dr. L. Bolton Bangs. "New York Medical Record," July 31st, 1880.

Rupture of the bladder from stricture and retention.

Male, forty-two, of temperate habits, fifteen years previously had been thrown forward on the pommel of the saddle whilst on horseback, and his urethra sustained an injury. Frequent and painful micturition and diminution in the size of the stream of urine occurred within two years after the accident. For this condition he consulted Mr. Syme, who dilated the stricture, and directed him to go on using an instrument constantly. During the next year or two there were occasional attacks of retention, relieved with the catheter. Then he grew gradually worse, and had several hæmorrhages from the bladder, difficulty of micturition, mucus in his urine, and frequent attacks of retention in the year or two which preceded his death. For a month before death no instrument could be made to pass the stricture, and fourteen days before there was

hæmorrhage which lasted a week. At 8.30 a.m. one morning, Dr. Bangs was summoned in great haste to the patient. He had been straining to pass water when he felt something give way in his bowels, and was attacked with violent pain. When seen an hour afterwards by Dr. Bangs, he was lying on his back with his knees drawn up, with pallid face, cold extremities, and tender abdomen, and was drenched in sweat. The temperature was over 102°, and the pulse 120 and very feeble. Dr. Bangs found an impassable stricture four and a half inches from the meatus. Death took place ten hours after the accident. At the post-mortem general peritonitis was found, and the intestines were matted together and agglutinated to the back of the bladder. On lifting them up a pouching of the bladder was seen to the left of the median line on the posterior wall. Beneath the line of reflexion of the peritoneum, and at the apex of the pouch, was a minute irregular opening communicating with the cavity of the bladder. At and around the opening the pouch consisted of peritoneum only. The bladder was removed from the body and opened in front. Half an ounce of purulent, bloody urine was found in its cavity. The coats of the bladder were notably hypertrophied, and three-quarters of an inch thick; the mucous coat was brownish, soft, covered with a layer of muco-pus. On the posterior wall, one inch to the left of the median line, midway between the base and summit, was an irregular circular ulceration, with complete destruction of the mucous, sub-mucous, and muscular coats. The peritoneum was thickened, except in the inferior segment, where it was extremely thin. Five small calculi were found in the bladder, and some concretions and collections of pus in the prostate gland.

Remarks.—This case bears a strong resemblance to Liston's as regards the pouching of the peritoneal coat over the seat of rupture, but in this instance a small aperture formed at the apex of the peritoneal pouch, whereas in Liston's the pouch remained entire. The case also supports Houel's view that ruptures from obstruction of the urethra are, at least in the first instance, often sub-peritoneal.

I.P. 136. XI. Dr. Peabody. "New York Medical Record," July 31st, 1880, p. 131.

Male, twenty-three, with bladder presumably full, fell downstairs upon his back. From this time there were severe pain in the abdomen, and frequent vomiting. Next day he was admitted into the New York Hospital with peritonitis. The temperature varied between 100° and 102°, and the pulse between 112 and 120. He had retention of urine, and when the urine was drawn with the catheter it contained a good deal of blood. The patient steadily sank, and died three days after the accident. *Autopsy* (twenty-two hours after death): General peritonitis; 350 cc. of reddish fluid, with many flakes of lymph in the peritoneal cavity. Half an inch to the right of the median line was a rent in the bladder, with granulating edges, two inches long, and extending to within an inch of the anterior abdominal wall.

I.P. 137. XII. Warren. "Cincinnati Lancet and Clinic," quoted in Dr. Stein's paper, "Annals of the Anatomical and Surgical Society," July, 1882.

Rupture of the bladder from hypertrophy of the prostate and retention.

Male, sixty-seven, had suffered for years from attacks of retention depending on enlarged prostate. The last attack existed for days. Symptoms of peritonitis supervened, followed by death. *Post-mortem:* Intra-peritoneal rupture; prostate much hypertrophied.

I.P. 138. XIII. Dr. Stephen Smith, 1855. "Transactions of New York Pathological Society," vol. iii. p. 202.

"There was a rupture of the bladder in a man, thirty-eight, from a kick on the abdomen, which was followed by severe pain, and an immediate and ineffectual desire to pass water. He rolled in agony, but after a restless night was able to sit up and only complained of retention of urine. His pulse was natural; there was no sign of fatal injury, nor tenderness of the abdomen. He walked one half mile to the dispensary, and nearly a pint of clear urine was drawn off with with great temporary relief; but he soon began to retch and vomit, and passed bloody urine in small quantities for four days, when complete retention of urine again occurred. A catheter was easily passed and a pint of urine withdrawn, followed by ability to evacuate the bladder voluntarily. The vomiting per-

sisted, but there was no tenderness of the abdomen. Death on the sixth day. *Autopsy:* A gallon or more of serous fluid without urinous odour was found in the abdomen. There were no signs of peritonitis. The bladder was firmly contracted, and had a vertical rupture, one inch in length, in the centre of the upper part of the posterior wall. The rent was patulous. There were a few ecchymosed patches on the mucous membrane of the bladder, and no other morbid appearances."

E.P. 73. XIV. Dr. W. T. Bull. "Transactions of New York Pathological Society," vol. iii. p. 198.

Rupture of the bladder from over-distension, treated with the aspirator.

M. K., fifty-eight, Irish, admitted to the House of Relief of the New York Hospital, February 6th, 1877, had always enjoyed good health, never had any venereal disease, and, though not a steady drinker, had indulged in occasional "sprees." During the last two years he had been obliged to urinate several times during each night. On the evening of February 3rd, he drank a great deal, and on the following morning was unable to pass his urine. A physician treated him with spts. æth. nitr. until the afternoon of the 5th, when a second doctor passed a gum-elastic and afterwards a silver catheter. Both instruments seemingly entered the bladder easily, but only about an ounce of *bloody* urine flowed out. On being brought to the hospital (about forty-eight hours from the time of his last urination) a No. 8 silver catheter was introduced easily, and ℥j of bloody urine withdrawn; then a Nélaton's catheter was passed in, with no more satisfactory result, and as the bladder or distended sac reached to the level of the umbilicus, a No. 3 needle of the aspirator was plunged in just above the pubes, and Oij of normal urine evacuated. It was noticed that while the needle was pointed nearly vertically downwards, the urine escaped scantily; but when the instrument was inclined to either side, the urine flowed freely. A silver catheter was now passed while the needle was in place, but the two instruments could not be made to touch one another. The patient seemed quite relieved, exhibited no bad symptoms, and refused to remain in hospital; but on the following day (February 6th), about twenty hours later, he returned, having been unable to make water. A silver catheter was passed with the same negative result as on the day before. He complained of a feeling of distension, but of no acute or well-localized pain; but aspiration was resorted to at once, and again late in the evening, bloody urine being obtained as usual. February 7th: The patient had some fever, thirst, and loss of appetite. The bladder (?) was aspirated three times in the twenty-four hours, and washed out with cold water. Ordered quinine, with belladonna suppositories, and ice in the rectum. Dr. Bull then examined the bladder with Thompson's searcher, which entered the bladder, and a little bloody urine escaped; but the beak became quite immovable, and could not be made to pass more deeply than about eight and a half inches. Rectal examination revealed no marked enlargement of the prostate, which, however, felt warmer than normal, and was slightly sensitive to touch. February 8th and 9th: Tenderness developed itself at the site of the punctures, some pain was felt in the abdomen, and opium was ordered in addition to the treatment prescribed the day before. Aspiration was employed four times in the forty-eight hours. The urine contained clots, and was very black-coloured indeed. Before the last aspiration about ℥ij of water were withdrawn by the catheter, and during the night of the 8th the patient passed about ℥j more voluntarily. February 10th: General condition much worse; delirious at night; whole abdomen tympanitic, catheterized three times, and about four ounces of urine were obtained each time. February 11th: No urine to be reached either by catheter or aspirator, as clots constantly obstructed both instruments. Towards the left lumbar region the abdominal wall was discoloured as if by infiltration of urine. The abdomen was more distended and tympanitic; the patient was sinking, and died at 3.30 a.m. Aspiration was used in all twelve times.

Autopsy.—General peritonitis, intestines glued together by lymphy exudation. Only a little fluid free in the peritoneal cavity, but a sac containing about one and a half pints of bloody urine was found beneath the anterior abdominal wall, limited above by the peritoneum, which was dissected from the muscular walls as far as two-thirds the distance from the pubes to the umbilicus, and

extending on either side to Poupart's ligament. The cavity contained organized blood clots; and on the left side diffuse infiltration of urine had occurred beneath and into the abdominal muscles as far as the lumbar region. The bladder was contracted, slightly columnar, and showed a slight degree of general cystitis. On its anterior wall to the left, and just below the point of attachment to the peritoneum, was a circular rupture, large enough to admit a lead pencil. There were no signs of ulceration about the opening, which was quite regular in its outline. The prostate was slightly enlarged, and the urethra was healthy. On the left side there was a double ureter. Both kidneys were fatty; the liver likewise. The heart, lungs, and spleen were healthy.

Remarks.—Probably in this case there was a diverticulum, or tunicary hernia, which gave way from over-distension of the bladder. The case was a favourable one for treatment, and that the aspirator failed is a fact which tends to show that it is not a reliable method in extra-peritoneal ruptures. The instrument may be most useful as a temporary means of withdrawing extravasated urine, as shown by the great relief in the first instance. Had more active measures been pursued when it was found that the urine was outside the bladder, very likely a recovery might have taken place.

E.P. 74. XV. James R. Wood, 1851, "Transactions of the New York Pathological Society," vol. iii. p. 201.

Rupture of the bladder from injury, originally small, and closing by adhesive inflammation; but reopening again after straining. It had opened behind the peritoneum.

E.P. 75. XVI. James R. Wood, 1851, *op. cit.*

Rupture of the bladder after an injury. An abscess formed in the lumbar region, discharging pus and urine. When urine passes into the cavity of the peritoneum, death generally takes place in twenty-four hours; when it is extravasated behind it, abscesses form, and the patient may live some time.

E.P. 76. XVII. John P. Batchelder, *op. cit.*

Rupture of the bladder in which urine was extravasated behind the peritoneum. The patient lived several months.

I.P. Comp. 26. XVIII. S. E. Seelye, M.D., of Montgomery, Ala., "American Journal of the Medical Sciences," 1868, vol. lv. p. 111.

Fracture of pelvis at symphysis pubis, and rupture of bladder.

A. M——, thirty-two, labourer, was injured on 2nd July by the falling of a mass of earth on to his back when partially bent while using the pickaxe. The mass prostrated him without crushing him beneath it. He was picked up and carried to his quarters, and as he was not thought to be seriously hurt the physician in charge of the hands, Dr. F. M. Hereford, was not sent for until the next morning. The abdomen was tympanitic, somewhat painful, but not very tender upon pressure; pulse 120, feeble; decubitus on back, with knees drawn up. He had passed no urine since the injury, but had emptied his bladder just before; he referred all pain to the sacrum. There was some fulness and slight ecchymosis in the perineum. Dr. Hereford introduced a catheter with some difficulty, but no urine flowed through it. Dr. Seelye then saw the patient with Dr. Hereford. The catheter had been left in the urethra, and on withdrawing it about half an ounce of urine and some small coagula followed it. Under chloroform, a No. 8 catheter was passed, and could be felt per rectum beyond the prostate; it could not be depressed between the thighs. No urine flowed through it until it was withdrawn, when about half an ounce to an ounce followed the instrument. He was treated with full doses of opium, combined with calomel, and relays of hot poultices to the abdomen. Urine dribbled away from time to time. The distension of the abdomen increased. The pulse became more rapid and feeble, and he expired on the night of the 6th.

Post-mortem (on 7th, twelve hours after death).—Abdominal cavity filled with an amber-coloured fluid, perfectly transparent and free from flocculi, probably from four to six gallons. The peritoneum healthy in all parts; neither redness nor patches of exudation marked any portion of it. At the symphysis pubis the bones were separated so as to receive closely my two fingers. There was a ragged rent in the collapsed bladder at the anterior part of the fundus, about one inch in extent. Right kidney ecchymosed. No counter-fracture in any part of the pelvis.

Remarks.—This case proves that a rupture of the bladder on the anterior wall may occur from the same violence, and at the same time as a separation of the innominate bones at the symphysis pubis, even when the viscus is empty or nearly empty. The force which rends the pubic bones asunder may tear the anterior wall of the bladder. This is not surprising when we recall the attachment of the bladder to the back of the pubes by means of the pubo-prostatic ligaments. Dr. Seelye and Dr. Hereford found the case obscure during life, because they could not understand how an empty bladder could be ruptured without fracture of the pelvic bones, especially by means of force applied to the patient's back, and, therefore, they did not make the diagnosis with certainty, although the lesion was taken into consideration. The case, therefore, is a valuable addition to the series, and may be found useful to others.

In the record of the post-mortem no mention is made of any considerable quantity of urine having been found extravasated. Taking this in connection with the large quantity of amber-coloured fluid in the peritoneal cavity, I cannot help concluding that this fluid was composed largely of urine, and that a communication with the peritoneal cavity escaped notice at the post-mortem examination. It is not likely either that the secretion of urine would be suppressed for four days, or that the secretion of serous fluid by the peritoneum, after the injury, would be so large as to constitute a traumatic dropsy. Hence I include the case in the intra-peritoneal series.

E.P. 77. XIX. Bennett, Dr. E. H., "Dublin Journal of Medical Science," 1881, vol. lxxii. p. 76. Rupture with ability to micturate.

On the 18th of May a sailor, twenty-seven, struck or kicked in belly in a drunken brawl, was admitted into the hospital in a state of collapse, which passed off after a vomit. No mark of external injury. Too drunk to answer questions rationally. He made an effort to pass water, and emitted about two ounces of bloody urine. In half an hour's time the man had emptied his bladder freely. He passed more than a pint of urine stained with blood, and no exploration of the bladder was deemed necessary. Next morning he could pass water freely. The urine was bloody to a slight extent—just smoky. At this time (as he micturated freely) Dr. Bennett did not suspect a rupture, and abstained from using an instrument for fear of renewing the hæmorrhage. The case went on for three days before it was deemed necessary to pass an instrument. On the 24th a palpable tumour appeared in the hypogastric region. As the patient had recently passed water there was no reason to suspect that the bladder was distended, and the first idea was that the tumour was extravasated blood. The catheter drew off only a few drops of water without blood. There remained a tumour of considerable size, which extended to within an inch of the umbilicus, and was perfectly firm and hard. On passing the finger into the rectum the tumour was found projecting back and filling the hollow of the sacrum. At this time the diagnosis was an extra-vesical bloody tumour. It was so firm and dense that Dr. Bennett thought a large extravasation of blood had occurred, and that it was best to avoid active interference. His temperature was never above 100°, and remained normal for two or three weeks afterwards. His pulse was slow, and there was no febrile disturbance for many days. He had tenesmus and constipation. He continued in this condition for many days, eating his meals well, and so far his state appeared favourable. He was out of bed and about the ward for many days, and his case was a matter of considerable clinical interest. In the second week the urine became fetid. Hence the bladder was washed out daily for about four weeks. When the bladder was washed out, and after removing urine it was found that by shifting the instrument there was a place to the left of the hypogastric tumour from which the urine could be pressed. It was not till that condition occurred that the question of ruptured bladder arose. Dr. Bennett's colleagues were unanimously against Dr. Bennett's diagnosis. It was found possible to press the urine from a cavity which was not that in which the instrument rested first, and that the cavity could be injected with a disinfecting solution. The tumour could be pressed and handled, and was free from redness and tenderness. On the 13th of June he lay on his back and declared that the pain he suffered was so great that if the bowels were not relieved he would burst. By the use of a long tube relief was obtained on two or three occasions. After continuing in

his former condition for a day or two, his case assumed the aspect of a case of intestinal obstruction, but he was suddenly attacked with profuse diarrhœa, which could not be checked, and he died exhausted in a couple of days. He had survived five weeks.

Post-mortem.—On cutting through the abdominal wall at the hypogastrium, an immense cavity was opened, containing a mixture of urine and the fluid contents of the intestine. The whole of the pelvis was also filled with fetid urine and fluid fæces. The colon passed over the top of the tumour had become intimately adherent to it, and had ruptured into the cavity. The bladder was collapsed, flat, lying at the bottom of the pelvis, and resting on the rectum with a round hole the size of a florin in its anterior wall. The whole of the areolar tissue of the pelvis came away in one piece from the adventitious cavity; and both the bladder and the lower third of the rectum were stripped of their areolar tissue. The intra-peritoneal aspect of the colon was perfectly healthy, for he had never had any peritonitis. The rupture of the colon was secondary. It became adherent to the urine, containing cyst, and towards the end of the case, perhaps owing to the passage of the tube, the colon, which had thinned away to an extreme degree, ruptured into its cavity, and, that having occurred, the fatal phenomena, accompanied with diarrhœa, set in.

Dr. Bennett remarks: "Of all the features in the case the absence of the phenomena characteristic of rupture of the bladder in the first instance, and the retention of the power of urinating were most remarkable. The man never required a catheter to relieve him of urine, and it was merely used for the purpose of washing out the bladder. The extremely small amount of disturbance affecting the case for many weeks was also remarkable."

E.P. 78. XX. Matthew Hall, "Provincial Medical and Surgical Journal," May, 1844, p. 59.

Stout man run over in the evening by a waggon. Hæmorrhage from the penis; bones of the leg extensively fractured. Extreme collapse; hardly perceptible pulse; much pain in back on slightest motion; slight distension of the hypogastrium, more manifest in right iliac region; right ileum very movable with crepitus. He rallied, and the next morning he complained of constant inclination to make water, though the hypogastric region was not fuller, and nothing could be detected in the cavity of the abdomen. Catheter passed, but no urine obtained; slight hæmorrhage from penis followed withdrawal of catheter. Catheter passed a few hours later without result. Apparent extravasation of urine, as hips had acquired greater rotundity. Mr. Teale, of Leeds, saw him, and made some incisions in the distended parts, and a little urine escaped. The man sank and died at five p.m. on the following day, forty-five hours after the accident.

Post-mortem.—Separation of symphysis pubis. Right fractured end of pubes had entered bladder below reflexion of peritoneum, causing a perforation two inches or more in length. A second laceration existed towards right side. Several more fragments of bone were quite detached in the pelvis, two or three were in the cavity of the bladder, which was much contracted. Multiple fractures of pelvis.

I.P. Comp. 27. XXI. Professor Faye, "Schmidts Jahrbucher," 1860, Bd. cvi. H. 193.

Rupture of the uterus and bladder.

Woman, twenty-four years of age, for the first time in labour. The mouth of the womb was dilated nearly an inch, but the liquor amnii had not yet been discharged. In the course of three hours it was perceived that an arm was presenting, and that above the symphysis a hard part of the child lay; and this at the discharge of the liquor amnii was recognized as the head in the first position. The next morning the head was placed with the forehead to the back and the large fontanelle to the front. The labour pains were very feeble. Eight ounces of blood were abstracted, and occasionally two grains of ergot of rye were given, but the pains did not become stronger. At the end of twenty-four hours from the commencement of labour turning and extraction were performed. The child was born dead. The patient was much weakened, and had a sensitive and distended abdomen, but her condition was not critical. The next day pains were experienced in the left iliac region, with greater tenderness and swelling of the

belly. The pulse was 128; there was severe cough, and the patient was faint, but not collapsed. Calomel was given as a laxative, quinine and opium were administered, poultices applied to the abdomen, and later ether was exhibited. During the next day or two the patient had more evacuations, the abdomen was less distended and sensitive, but the cough was still troublesome. On the fifth day after delivery the strength failed, lochia were offensive and dark green, and under quiet delirium death ensued on the following day.

Section (sixteen hours after death).—"In the lowest part of the abdominal cavity there was a thick sero-purulent fluid. The uterus was on the left side of the wall of the abdomen, covered with recent exudation; a small quantity of matter was found in the broad ligaments. The uterus was not entirely contracted, about six inches long, and in its anterior wall, at the junction of the body with the cervix, was a horizontal rent two and a half inches long, with ragged edges. The margins of the rent were adherent to the posterior wall of the bladder, in the neck of which there was an opening lying between the edges of the rupture of the uterus. A communication between the two could easily be proved after the parts had been removed from the pelvis. The mucous membrane of the bladder was of a blackish colour, covered with some exudation. The mucous membrane of the uterus was brownish-black, and covered with an offensive deposit. The superior aperture of the pelvis was half an inch shorter in its long diameter than normally."

U.S. 9. XXII. Dr. John W. Gouley, "Transactions of the New York Pathological Society," vol. iii. p. 202.

"Rupture in the upper posterior portion" (*sic*).

"There was *a rupture of the bladder from direct violence near the bas-fond*, and also on the right side, in a man aged forty-five. After a debauch he was found lying in a shed with great pain, and a large swelling in the hypogastric region, supposed to arise from a distended bladder; but only two or three ounces of dark urine could be drawn off, and the swelling did not abate. Fever, vomiting, constipation, and signs of peritonitis set in, and either no urine or only a few ounces could be evacuated. Morphine (one-fourth grain) was given every three hours; but the abdomen enlarged, and became hard and resistant as high up as the umbilicus. A very little urine was passed occasionally; there was a uniform tense swelling of the whole abdominal region; dusky redness of the lower half of the abdomen, not unlike phlegmonous erysipelas, and the integuments of the abdomen seemed uplifted to their utmost capacity. *Autopsy:* Slight adhesions of the peritoneum to the intestines near the umbilicus; ecchymosis of the subcutaneous tissues down to the pubes. There was no bruise on the surface, but a bloody fluid with a strong urinous odour escaped from the incision. There was slight peritonitis in the pelvis, and a small quantity of dark fluid in the abdomen without the odour of urine. The rupture was three-fourths of an inch in diameter in the right upper and posterior part of the bladder."

Remarks.—This case would be valuable if all obscurity were removed from the description. In the account of the autopsy there is no account of a rupture near the bas-fond, and the description altogether is compatible with the existence either of two ruptures—one intra-peritoneal and the other extra-peritoneal—or of a conjoined intra-peritoneal and extra-peritoneal rent. It is clear that very little urine had escaped into the peritoneal cavity, but that a great deal was extravasated into the perivesical connective tissue, for it formed a tumour in the hypogastric region, noted during life, and flowed out from the abdominal incision after death.

E.P. 79. XXIII. Dr. Thomas Markoe, "Transactions of the New York Pathological Society," vol. iii. p. 200.

Ulceration of bladder and rupture into the rectum.

"There was a rupture of the posterior wall of the bladder into the rectum, and a recto-vesical fistula, in a man who had retained his urine until his bladder burst. There were two stones in the bladder, which was thickened. The vesical fundus and lower part of the prostate gland presented an irregular excavated ulceration, filled with cretaceous matter, and from the bottom of the prostate there was a long clear fistula extending into the rectum. A small calculus lay in the excavation in the prostate, and had caused the ulceration and fistula. The other stone was large. The neck of the bladder was thickened and indurated."

E.P. 80. XXIV. John W. Lodge, October, 1865, "American Journal of the Medical Sciences."

Fracture of pubic bones with laceration of bladder.

E. H. G——, twenty-three, was injured by a mass of sand which caved in on him while he was at work in a quarry on the 8th of April, 1865. He was taken to the General Hospital. The next day he had continuous desire to micturate, none having passed since the accident, twenty-four hours previously. On catheterization the instrument passed very readily to membranous part of the urethra; and was then deflected abruptly to the right side, and four ounces of blood passed through it. Symptoms of urinary infiltration in scrotum, perineum, and thigh supervened. In the afternoon there was no urine. The catheter brought away blood, and the stomach was very irritable. Dr. Gross passed a catheter with difficulty in the evening, and drew off eight ounces of urine and blood. The man lived for two weeks, during which time a good deal of sloughing of the perineum and soft parts occurred. In the account of the post-mortem a good deal of attention is paid to the fractures of the pubic bones, but, curiously, there is no description of the rent in the bladder.

XXV. John A. Lidell, M.D., "American Journal of the Medical Sciences," 1867. vol. liii. p. 359.

Fracture of pelvis; very extensive contusion of the bladder; death on the third day; autopsy.

J. R——, twenty-two; injured by falling of a brick house on March 27th. Great shock, and reaction did not fully occur; intense pain in the pelvis; unable to pass any urine, which was drawn off at intervals. He lingered till the 30th, when he died. *Autopsy:* Fracture of both pubic bones. Bladder externally reddish-brown, nearly empty, not contracted, containing small quantity of natural urine. Walls of bladder much thickened, measuring from one-half to three-quarters of an inch, due to sero-sanguinolent infiltration of the tissues constituting its walls. On section the cut surfaces presented a reddish-brown colour; mucous membrane blackened, and reddened in patches and points, but not softened; no lymph or pus on peritoneal investment, but a little colourless serum in peritoneal cavity. Intestines distended with flatus.

XXVI. Robert Eminson, September 8th, 1834, "Medical and Surgical Journal," vol. vi. p. 219.

Contusion of the bladder.

Young man, fell off a waggon laden with at least a ton weight of coals, and the fore and hind wheels of the waggon passed over his abdomen. The wheels left their track traceable easily enough by the abrasion and tumefaction of the integuments. The patient made several ineffectual attempts to pass his urine, the injury to the abdominal muscles being probably the chief cause of his inability to evacuate the accumulated contents of the bladder. He was distressed with pain in the hypogastric region, which was much enlarged, and of a high temperature; the pulse had risen considerably; there were great sickness, repeated rigors, and a violent reaction. On the introduction of the catheter, which passed with the greatest facility, a large quantity of blood and urine was drawn off, giving instant relief. He was bled to approaching syncope. Purgatives were given, but the excessive sickness prevented their retention, and an enema was subsequently administered, which answered well, and also afforded much ease. He was ordered to take *no liquids*, in order that the bladder might be kept in as complete a state of rest as possible, and to be confined to the antiphlogistic plan of treatment altogether. Leeches were applied over the bladder; also the spirit lotion. The accumulation of a small quantity of urine in the bladder gave rise to excessive pain, and as the catheter could not be borne, Mr. Eminson was under the necessity of drawing off the contained blood and urine every three or four hours. Notwithstanding these active measures the pain increased, the sickness became more severe, the abdomen tympanitic, and the pulse and other symptoms of fever augmented. These symptoms were particularly severe on the second day after the accident, and they were met by copious and repeated bleedings, regulated, however, not by any specified amount of weight or measure, but proceeding on the ground

of stopping only when the unfavourable symptoms vanished, let the amount abstracted be what it might. Leeches were again applied to the abdomen, and hot fomentations frequently used. On the third day the bladder recovered its lost function, and the patient was able, with tolerable ease, to evacuate its contents, which had now become free from blood; the stomach became reconciled, and every other part of the case appeared equally favourable, so that in less than a week the man was conveyed to his friends, and no longer remained under Mr. Eminson's care.

XXVII. Dr. A. W. Stein, "Annals of Anatomy and Surgery," 1882.

Rupture of ileum mistaken for rupture of the bladder.

Man, sixty, stamped upon and thrown down a pair of stairs, was brought to the hospital in a state of profound collapse. There were marked signs of injury over the abdomen, and the least motion of the body caused him to groan and to cry out with pain. After he had made several ineffectual attempts to urinate, a catheter was passed, and withdrew a quantity of dark, bloody urine. The entire appearance of the case led to the diagnosis of rupture of the bladder; but in ten hours the man died, and the autopsy revealed a laceration of the ileum, and no injury to the bladder.

Mr. Fleming mentions a very similar case.

I.P. 139 (?). XXVIII. Dr. A. W. Stein, "Annals of Anatomy and Surgery," July, 1882.

A specimen in Dr. Stein's possession shows extensive laceration in a contracted bladder whose walls, in some places, are three-quarters of an inch thick. The man had long suffered from stricture of the urethra, and had received a kick in the abdomen, causing the laceration.

XXIX. Heinrich Fritsch, M.D., "Diseases of Women," translated by Isidor Furst, p. 115.

"I have operated on a peculiar case, in which the forceps were applied in a roomy pelvis. No urine had been evacuated for twenty-four hours. Immediately after the rather difficult forceps operation, a large quantity of urine was said to have gushed from the vagina. Nothing further could be learned."

I.P. 140. XXX. Segallas, "Biennial Retrospect of Sydenham Society," 1873, lxxiv. p. 323. Reference given to "Marseille Medical," 1874.

Rupture of the bladder from retention, due to an abscess of the prostate gland, caused by gonorrhœa.

Man, twenty-eight years of age, suffering from a second attack of gonorrhœa, for which he had not been treated, was suddenly seized with retention. There was no stricture. Retention continued for three days, during which he did not apply for medical advice, when, on his making a violent attempt to urinate, he suddenly felt something tear in his belly. At first this gave relief; but soon severe pain set in, and obliged him to go to hospital. A catheter was introduced without difficulty, but removed very little urine. The percussion sound over the abdomen was tympanitic. He died in four days, of peritonitis. The cause of retention was a large abscess in the prostate. The mucous membrane of the bladder was easily stripped off, and the muscular coat was somewhat hypertrophied. In the anterior wall was an oval hole, with ragged and blackish edges. The wall of the bladder, for about two inches round, was thin, and of a blackish colour, it was also gangrenous at several other points. In Douglas's pouch there were found several ounces of a tolerably clear fluid, having but little resemblance to urine. The author believes that most of the urine originally effused into the peritoneum was absorbed.

I.P. Comp. 28. XXXI. S. A. Cusack, "Dublin Hospital Gazette," July 15th, 1859.

Rupture of a nearly empty bladder, occasioned by a displacement of the pelvic bones close to the symphysis pubis; perineal incision.

J. D——, a very fat man, fifty-six, fell from a plank a distance of twenty-five feet to the ground, on November 26th, 1858. He had made water an hour before the accident. He was taken to the hospital and placed in a soft bed. A full-sized gum-elastic catheter, was introduced into the bladder, but no urine flowed through it. On withdrawing it it was found to contain a small quantity of semi-fluid blood, with the odour of urine. Next morning there

was a most extensive ecchymosis over the pubes and left inguinal region; the perineum and scrotum were also distended and elastic with blood. There was very great pain on pressure, directly over the pubes; so much so that it was thought there must be a fracture in that situation. The abdomen was tender and tympanitic; pulse 115, very feeble; tongue brown. He did not complain of pain, or desire to make water. A full-sized elastic catheter was readily introduced, but no urine flowed, nor could any urine be obtained by altering the direction of its point. The presence of the fluctuation or not in the abdomen could not be determined by manual examination, owing to the great thickness of fat over the abdominal parietes. He vomited several times during the afternoon. He slept well the following night. The vomiting ceased, but the pulse became scarcely distinguishable at the wrist. The abdomen was more tender and tympanitic; and, as there were signs of extravasation of urine, an incision was made through the superficial and deep layers of perineal fascia, as in the lateral operation for lithotomy, laying open the triangular ligament freely, and passing a blunt-pointed bistoury into the pouch of urine which lay in the cellular tissue above the prostate. A few incisions were at the same time made into the œdematous patch on the abdomen. A good deal of urine drained from the perineal incision during the day. Towards evening his mind began to wander, and he became drowsy, probably from the re-entrance of urea into the blood; and he died at half-past two a.m. on the following morning (November 29th), the immediate cause of death being a mixture of coma and syncope.

Post-mortem (at eight a.m.).—Areolar tissue over lower part of abdomen infiltrated with urine. Fracture or displacement of left ileum, left os pubis fractured, so as to leave the whole of the interosseous cartilage adherent to the right pubis, and displaced upwards and slightly backwards an inch and a half, having, by its displacement, caused in that situation a laceration of the peritoneum and coats of the bladder, through which three fingers could be introduced into its interior. The finger passed through perineal incision could be introduced nearly all round the prostate and neck of the bladder, which had been dissected from the surrounding parts by the extravasated urine. Two pints of turbid urine, diffused through peritoneal cavity, had not decomposed to any extent. Intestines moderately distended with gas; very soft, easily torn; their peritoneal surface slightly red. Edges of rent in bladder covered with recent lymph, but not united.

Mr. Cusack makes some very judicious remarks at the termination of the history of his case. He advocates opening the abdominal cavity, and carefully washing out the whole of the effused urine, either by pouring water into the abdomen, or performing the operation in a tepid bath. He shows that the operation, proposed by Mr. Harrison, of puncturing the recto-vesical *cul-de-sac* would be unlikely to prove effectual, "as any one may ascertain for himself, by introducing a cannula through the rectum into the peritoneum, when death has taken place from ascites, or the abdominal cavity has been injected with water. Nor indeed is it reasonable to suppose that when, as is usually the case, the bladder had been full at the time of the accident, the whole of the effused urine should locate itself in the pelvic portion of the peritoneal cavity. In the present instance it had not done so; nor was there any adhesive inflammation between the bowels tending to confine it in that direction." Mr. Cusack further suggests that, after the abdomen has been opened, fine sutures might be used for closing the rent in the bladder, and he concludes thus: "The treatment which I have here proposed is, I think, well worthy of trial; it may, at first sight, appear hazardous, but when the universal fatality of the present treatment—or rather want of treatment—is remembered, I think, should a favourable case occur for its trial, I would be disposed to give a more favourable prognosis of a patient whose abdomen had been stitched up, after having been carefully washed with pure water, than of one whose peritoneum was distended with two or three pints of putrid urine."

XXXII. and XXXIII. Dr. Bell, "Edinburgh Medical Journal," October, 1872.

Two recoveries after laceration of the bladder by a fractured pelvis.

"Dr. Bell showed a boy, at the Medico-Chirurgical Society of Edinburgh,

who some months previously met with an accident in a pit, fracturing his pelvis. The portion fractured was driven into the bladder. He attended for some time a hospital in the west, and was dismissed as incurable. He came to my house some time ago. I found that the lad could only make his water through a wound on the left side of the abdomen. It came out of the wound in a full stream. I probed the bladder, and found that it went straight in. No instrument could be passed through the urethra. By a little patience I succeeded in establishing a communication through the urethra into the bladder, and then found the cause of the difficulty in doing so distinct enough. There was a portion of the pelvis pressing down on the urethra. For three weeks no water has come out of the wound in the abdomen, and it is now healed. Such a case is excessively rare; but singularly enough I was not long after called to deal with a similar case, only the wound was on the other side. That patient is getting better, but he is not able yet to be exhibited."

I.P. 141. XXXIV. George Langstaff, "Museum Catalogue."

Rupture in a woman from over-distension.

Preparation 1382. Urinary bladder from a woman which burst in consequence of neglected retention of urine.

The coats of the bladder were highly inflamed, and sphacelation had taken place to the extent of two inches, at its inferior and anterior parts. The urine escaped into the abdomen, which induced peritonitis, and the patient died on the fourth day from the commencement of the attack.

The preparation is now in the Museum of the Royal College of Surgeons, No. 1967. The "College Catalogue" says: "The bladder is inverted, the greater part of its mucous membrane is destroyed by ulceration, and appears to have been acutely inflamed. The margins of the rupture are irregular and shreddy, as if sloughing had taken place." The seat of the rupture is described as near the entrance of the ureters. The preparation shows that the peritoneum is implicated.

XXXV. G. Langstaff, "Museum Catalogue," 1381.

Injury to pelvis and contusion of bladder.

Bladder and prostate gland of a man who was injured by the wheel of a cart passing over the ossa pubis, separating the ossa pubis. The patient suffered greatly after the accident from retention of urine, which required to be drawn off, and it was generally mixed with blood. About four months after the accident he was able to walk, and attended to his business; but he continued to have great difficulty in voiding urine, and occasionally required the use of the catheter. He died of pneumonia and cynanche trachealis. The preparation shows that the bladder is greatly enlarged, the muscular and mucous coats thickened, and near its fundus lymph is deposited in considerable quantity between the serous and muscular coats; it is organized and formed into a tumour. The anterior part of the bladder adheres very firmly to the periosteal covering of the internal surface of the ossa pubis. There are several calculi in the prostate gland.

E.P. 81. XXXVI. G. Langstaff, "Museum Catalogue," 1390.

Communication of the bladder with the rectum, due to calculi.

Patient, sixty-four years of age, very corpulent, had lived luxuriously for many years. Symptoms denoting calculus came on; the urine was voided with difficulty, and it was frequently mixed with pus. Sir William Blizard sounded the patient without detecting a stone. About a month after the sounding, two calculi, about the size of a horse-bean, were voided with the urine. The patient had suffered for a length of time great difficulty in voiding fæces; an abscess formed within the rectum, which burst, and an immense quantity of pus was discharged, which afforded for a time great relief. After this the urine was noticed to flow through the rectum as well as by the urethra, proving that an ulcerated opening had formed between the bladder and the rectum. The urine was voided in this way for six weeks, when it began to be discharged, though with great difficulty, by the natural passage. Subsequently he had some severe nephritic attacks.

The preparation showed, among other changes, blocking of the left ureter by two large calculi, and destruction of the left kidney.

The bladder was very capacious and the mucous surface near the prostate

ulcerated. A small sinus, admitting a bristle, existed between the bladder and the rectum. There was an abscess in the right lobe of the prostate communicating with the urethra, and containing pus, prostatic calculi, and a urinary calculus; and there were calculi in the left lobe of the prostate.

I.P. 142. XXXVII. G. Langstaff, "Museum Catalogue," prep. 1404.

Rupture of the bladder from over-distension.

There is no history attached to this specimen, but it tells a good deal of its own tale. There was probably a stricture or obstruction of the urethra, with enlargement of the prostate, leading to retention of urine, with unsuccessful efforts to pass a catheter. The bladder sloughed at the fundus, and urine was admitted into the peritoneal cavity. Examination of the body showed severe peritonitis and a considerable quantity of urine in the peritoneal cavity. The left ureter was blocked by a calculus. The bladder was contracted, its muscular coat very thick, and the mucous highly inflamed; its fundus had sloughed to a considerable extent. The prostatic and membranous parts of the urethra were highly inflamed and slightly ulcerated; and in the lateral part of the urethra on the left side was an opening large enough to admit the point of a very large bougie, which Langstaff thinks was made by attempting to pass a catheter. Probably he knew more about the case than he cared to relate.

I.P. 143. XXXVIII. G. Langstaff, "Museum Catalogue," prep. 1405.

Rupture of the bladder from the enlargement of the prostate gland.

A man, seventy years of age, who had generally enjoyed good health, although he had at various times voided biliary calculi. He had experienced great difficulty in voiding urine for a considerable length of time; but about two years previous to his death the disease had increased, and there was occasional blood in the urine. The patient had been under the care of several able surgeons, and it was ascertained that there was an enlargement of the prostate gland, and that he was afflicted with what was supposed to be a hydrocele. He went into the country, where he was seized with retention of urine; a surgeon was called in, who made several attempts to draw the urine, but without effect. The patient was put into a warm bath; after this the urine began to dribble away, which seemed to afford relief; fomentations and various other means were used, but the patient complained of great pain in the region of the bladder and kidneys. The urine continued to pass away guttatim, vomiting came on, pain was felt over the whole of the abdomen, and the brain became affected. A physician was consulted; it was imagined to be a case of peritonitis, and treated accordingly. The patient died forty-eight hours from the commencement of the attack. I was requested to inspect the body. If the state of the prostate gland had been detected, and the symptoms denoting retention of urine, probably the life of the patient might have been saved by drawing off the urine by paracentesis above the pubes. The bladder exhibited a laceration at the fundus, which allowed of the escape of urine into the abdominal cavity. It had been enormously distended with urine; its coats were highly inflamed, the muscular fibres elongated and very flaccid. The prostate gland was enlarged to three times the natural size, but the enlargement had originally taken place in the lateral lobes, the middle one not having increased in the same ratio. The left lateral lobe projected into the prostatic part of the urethra near the verumontanum, which accounted for the difficulty the patient experienced for many years in voiding urine.

E.P. 82. XXXIX. "Museum Catalogue of Royal College of Surgeons."

1968. Partial rupture of the female bladder from over-distension during labour.

A uterus and bladder some time after parturition. The uterus has contracted to about six inches in length; a portion of placenta or coagulated blood adheres to the upper and right side of its cavity. The bladder, having been distended by urine during the whole period of parturition, has had its mucous coat at one part extensively torn. At this part the submucous tissue is exposed with long sloughing shreds; and in many other situations there are smaller lacerations which look like superficial ulcers of the mucous membrane of the bladder. The organ contracted but little after distension, its walls not being more than a line in thickness. The patient's death was thought to be due to retention of urine.

XL., and XLI. Dr. Jos. Grüber, of Vienna, "Wochenblatt der Zeit-

schrift der k. h. Gesellschaft der Aerzte zu Wien." Translation in "Dublin Hospital Gazette," September 1st, 1858.

Dr. Grüber says: "As to rupture of the diseased bladder, the event is not a rare one, occurring as it does in the ulcerative process of syphilis, tuberculosis, croupous inflammation." . . . "Further, it may be complicated with rupture of an intestine, as in a case reported by McLean, in which the cæcum was found lacerated." . . .

"In simple rupture of the viscus, the physician can easily, by a superficial examination, be deceived, and suppose that peritonitis or enteritis exists. The mistake may occur, because in many cases, immediately after the event, urine comes away voluntarily or involuntarily, and symptoms referable to the bladder follow. Vomiting, constipation, fever, remarkable pain in the abdomen, and meteorismus supervene generally—symptoms which we are wont to recognize as belonging to peritonitis, and which may lead to error if the history of the case and the effects of catheterism be not attended to. Inordinate distension suffices to cause rupture, an instance of which was noticed in the person of the famous astronomer, Tycho de Brahe, who died from this lesion in the year 1601, in the Royal Palace of Prague."

"The effect of concussion is exemplified in the case which is here given:—

"A man, aged thirty-two, had been previously in good health. On the evening of the 4th of June he drank an unusual quantity of spirituous liquor, and retired to bed at eleven o'clock. In the middle of the night he was awoke by an urgent desire to pass water, and on attempting to descend from a so-called 'two storey-high bed,' he fell from a height of about six feet, his belly striking against the edge of a wooden box. Although he felt pain in the abdomen, he was able to rise and to pass urine without difficulty. The character of the urine could not be ascertained. The pain continually increasing in severity, he was brought into the hospital on the following morning. On admission the patient complained of severe pain in the abdomen, and of ischuria. His skin was covered with cold sweat; he was anxious and restless, but his consciousness perfect. Pressure of the abdomen caused extreme pain; there was disposition to vomit, but no actual vomiting. Pulse 96. On introducing a catheter, which was accomplished without difficulty, about two ounces of urine were drawn off, which was of an acid reaction, specific gravity 1022, and of a dark red colour from the mixture of blood. From the history and present symptoms, the diagnosis arrived at was "ruptura vesicæ urinariæ, cum extravasatione urinæ;" and a treatment was adopted calculated to moderate the expected peritonitis, viz. leeches and cold applications to the abdomen. On each introduction of the catheter some urine of normal colour came away at first, but always towards the end coagula of blood. To free the bladder from the coagula, tepid water was once injected through the instrument. The patient finally died in convulsions, after eighty hours' suffering.

"The post-mortem was performed by his *Magnificence* Professor Rokitansky. In the abdomen there was much brown, turbid, flocculent fluid. The peritoneum, especially that covering the small intestines, was red, and presented streaks of injection. The bladder was contracted, and contained some ounces of bloody urine. In the posterior wall, and toward the right side and summit, a rent of an inch and a half in length through the peritoneum, with purulent edges; below which was a second, only engaging the mucous and muscular coats. The fluid which was in the cavity of the abdomen was examined by Dr. Heller, and found to contain the constituent parts of urine." Placing a patient labouring under similar symptoms in the half-sitting posture, and inclining to the left, and thus preventing a further effusion of urine into the peritoneal sac, is suggested.

I.P. Comp. 29. XLII. Wm. McLean, "Edinburgh Monthly Journal," 1848, p. 739.

Case of laceration of the cæcum and rupture of the bladder from external violence.

P. A——, sixty, labourer, of dissipated habits, was run over by a loaded cart, which he was driving, on the 7th of October, 1847. Immediately on receipt of the injuries he passed both urine and fæces involuntarily. At five p.m. he was cold, with weak tremulous pulse, urgent vomiting and hiccough, and cold perspi-

ration all over the body. He lingered till seven o'clock the next morning, and then expired.

Autopsy.—The peritoneum was thickly covered with effused blood. The belly contained about a pint of fluid mixed with blood. On turning over the intestines the cæcum came into view, when it was found torn in two separate places, to the extent of two inches; the one tear being distant from the other about three inches. There was a rent in the fundus of the bladder about an inch long. On examining the liver it was found in a very diseased state, being easily torn with the fingers. Throughout the whole tract of the intestinal tube there were traces of high vascular excitement.

E.P. 83. XLIII. John Taylor, M.D., "Edinburgh Monthly Journal," May, 1849, p. 748 *et seq.*

Fracture of the pelvis; laceration of bladder; absence of blood from urine.

J. P——, labourer, fifty-eight, was buried in the ruins of a stone wall which fell on him, on the 22nd of January, 1849. He fell backwards, and when extricated was lying with his back flat against a mound of earth, the lower part of the body being twisted, so that the pelvis rested on its side, the mark of one hip and trochanter being impressed on the soft earth. He was able to stand without support. Some hours after the accident he was lying on his back in bed, complaining only of pain in the left shoulder. He was cold, and somewhat collapsed; his pulse sixty-four and small. He had sustained a fracture of the left clavicle. 23rd: He passed a tolerable night, but complained of his other bruises, especially of the right thigh in the neighbourhood of the trochanter. The pulse was sixty-four and small; the tongue clean and moist; skin natural heat; the bowels had not been moved. 24th: Had passed a restless night, and complained much of pain in the abdomen, which had commenced about midnight without any rigor. On examining the abdomen it was found swollen and painful to pressure over the hypogastric region, conveying somewhat the impression of the bladder being distended, but being somewhat more diffused, and the abdominal parietes feeling hard and doughy. On inquiring when he had passed water, he said he had passed none since the accident, and had no urgent desire to do so, but felt a general uneasiness and restlessness. As Dr. Taylor had no catheter the urine was not drawn off just then. Mr. Spence was called in, and when the catheter was passed it entered the bladder without difficulty, and drew off about seven ounces of perfectly clear urine. The bladder was felt to be empty per rectum. No great relief was afforded by drawing off the water. 25th: Uneasy night; breathing hurried and oppressed; pulse seventy and small; tongue moist and furred towards the back part; no urine passed naturally; four ounces of clear urine drawn by catheter. Four p.m.—three ounces of clear urine drawn. Ten p.m.—had passed a little urine naturally with an effort; catheter again introduced, and three ounces of clear urine drawn. 26th: Patient still very restless and depressed. Features anxious and contracted. His bowels had been freely emptied by injection the previous evening, and he had also passed a little water once since the last report, but had failed in doing it again though he had made several attempts. The scrotum and penis showed evidence of infiltration with urine. Free incisions made; catheter drew off eight to ten ounces of perfectly clear urine. The incisions gave vent to a quantity of urine. From this time he gradually sank without material change in symptoms. The urine was regularly drawn off three times a day. It never was in large quantities, and always clear except on the last occasion, when it was found to contain a few grains of chocolate-coloured flocculi.

Post-mortem.—A small quantity of serous fluid was found in the abdominal cavity, but no trace of peritonitis. There was effusion of blood under the peritoneum over the last lumbar vertebra, and the promontory of the sacrum. Bladder empty and contracted, inclining to left side. Two lacerated wounds in bladder at anterior and superior part below the reflexion of peritoneum, nearly in the same line—one two inches, and the other one and three-quarter inches above the prostate, the distance between them being one and three-quarter inches. There was infiltration of urine in the connective tissue of the pelvis. The wounds in the bladder had been produced by perforation of the organ by one of the fragments of the fractured right os pubis. The upper ramus of the os pubis on both sides was fractured, but the fracture on the left

side was so covered by soft parts that it could not have effected the laceration. Both obturator arteries and veins were torn; the left obturator nerve being stretched but not torn.

E.P. 84. XLIV. Mr. Hinds, "Provincial Medical Journal," 1849, p. 608.

Perforating ulcer of bladder into vagina; granular kidneys.

The patient was M. J ——, forty, mother of two children. She suffered from leucorrhœa pain in the loins, and constant desire to pass water. At the post-mortem an opening was found on the posterior wall of the bladder below the fundus the size of a sixpence, with sloughy margins communicating with the vagina.

Recovery. XLV. Dr. Tomkins, Yeovil, "Prov. Med. Journal," 1851, p. 593.

Rupture of the bladder from external pressure. Recovery.

An excavator was thrown from a height of more than twenty feet, and fell on his back, a large quantity of earth coming down upon his abdomen. It required the united efforts of nine men to remove the earth from the patient's body. The patient had on a pair of new corduroy trousers which were not torn; but he sustained an extensive lacerated wound in perineum, through which three fingers could be passed with ease, and a laceration of the bladder detected. The wound was as clean cut as if made by a knife, and laid open the posterior part of the urethra. There was so free an opening for the escape of urine and discharge, that the case did perfectly well. In two months the wound had healed, and in three the bladder was able to retain eight to twelve ounces of urine. The exact site of the bladder rupture is not given.

Cases from St. George's Hospital.

Through the kindness of Mr. Pick I am able to introduce the following cases, occurring since 1865 at St. George's Hospital. For the headings and remarks I am responsible :—

I P. 144. XLVI. (1). T. P. Pick.

Traumatic rupture of the bladder in female. Important medico-legal question.

Louisa P——, aged twenty-four, admitted on June 30th, 1883, applied at the hospital, stating that six hours previously she had been violently kicked in the abdomen by a man, and that since she had suffered very severe pain and had voided some bloody urine. Upon admission the whole of the abdomen was tender on pressure, and there was very great pain complained of on the left side in the course of the ureter. No increased amount of pain in the hypogastric region. There was a slight bruise in the left groin, and another on the right arm. She had an anxious expression of countenance, but was not collapsed. A catheter was passed, and two or three ounces of bloody urine withdrawn. Soon after admission she began to vomit, and symptoms of general peritonitis set in. On July the 2nd the vomiting still continued, the abdomen was distended and tympanitic; the pulse small; features swollen; tongue dry and furred; temperature 101° F.; respirations shallow. She died the following morning, three days after the injury. Up to the time of her death the chief pain was always referred to the position of the left ureter.

Post-mortem (twenty-one hours after death).—Body well nourished. Ecchymosis on right arm and in left groin. The thoracic viscera were healthy. The abdominal cavity contained about two pints of amber-coloured fluid, in which were floating a number of flakes of lymph. The intestines were glued together by recent lymph, and some of the coils of the small intestine were also adherent to the bladder. On the posterior wall of the upper part of the bladder, about one inch from the summit, was a transverse lacerated wound, about two inches in length.

The defence, which was set up at the police court by the man who was stated to have inflicted the injury, was that the accident had been caused by the woman falling backwards against a low wall, some two and a half or three feet high, whilst in a state of intoxication. It was proved by independent evidence that the woman was drunk. The prisoner was acquitted.

Remarks.—As the question of the possibility of the bladder rupturing from a fall on to the back has arisen in a court of law, I subjoin the cases recorded in this work in which the bladder has ruptured where violence has been applied to the back.

I. *Falls on back :—*

1. Fergusson (I.P., case 29).	Female, 35. Blow on head, and fall backwards.	Clean longitudinal rent of two inches at upper and back part.
2. Spence (I.P., case 27).	Male, 32. Fall backwards on to stairs, striking back of head.	Rent half an inch on posterior aspect of superior fundus.
3. Wilmot, S. G. (I.P., case 88).	Male, 30. Slipped; strong effort to save himself; fall on to his back with great violence.	Large transverse rent posteriorly on level with brim of pelvis.
4. Peabody, Dr. (I.P., case 136, Note G, p. 127).	Male, 23. Fell downstairs, striking upon back.	Vertical rent posteriorly, two inches long.

5. In Mr. Heath's case (I.P., case 76) " the patient was 'larking about' with his companions, one of whom threw him violently on his back by putting his leg behind patient and forcing him backward by his elbow, which hit him in the stomach." Either the blow from the elbow or the fall backwards might have caused the rupture, the bladder being full. Perhaps the rupture was the combined effect of both forces. The rent was in the mid line of the posterior wall of the bladder, two inches in length, and accords with either cause.
6. In Dr. Gillespie's case, I.P. 109 (see p. 29), there was first of all a wrestling match, the adversary falling on the top of the patient, and shortly afterwards a fall backwards on to the nates. Vertical rent of one inch posteriorly.

II. *Blows on back :—*

1. Watson (I.P. Comp., case 4).	Male, 27. Caught in a steam-engine, and received severe blow on back.	Injury to pelvic bones and articulations. Transverse rupture admitting three fingers at fundus.
2. Lente (I.P. Comp., case 5).	Male, 18. Caught between rail-cars. Severe blow on back.	Separation at symphysis. Rupture at fundus admitting thumb.
3. Hawkins (E.P., case 13).	Male, 32. Piece of timber fell on back.	Extensive injury to pelvis and dislocation of hip. Rent in forepart of bladder, size of little finger. Peritoneum stripped out.
4. Seelye (I.P., case 139, Note G, p. 129).	Male. In stooping position, fall of earth on to back.	Separation close to symphysis pubis, and nearly empty bladder torn in front.

U.S. 10. XLVII. (2). T. P. Pick.

Patrick E——, 28, labourer, admitted April 5th, 1867, was jammed between a large piece of timber and a wall. On admission, much collapsed; catheter passed some distance down the urethra, but could not be passed into bladder. April 6th: All the symptoms of ruptured bladder; pulse 130, feeble; tongue furred; complained of pains in the hips, thighs, and abdomen. April 7th: Pulse 144; constantly sick; great abdominal pain and tenderness; had passed no water since accident; quite sensible. April 8th: Surface pallid and cold; pulse 140, feeble. No urine had been passed. Died on the fourth day. No post-mortem examination.

I.P. 145. XLVIII. (3). T. P. Pick.

Intra-peritoneal rent; slight symptoms.

D. G——, forty, while drunk, two evenings before admission, fell on to his abdomen, and ever since had suffered from pain. Early on the morning of his admission, not being able to pass any urine, and having passed none since the accident, he applied to a medical man for relief, who passed a catheter, but only drew off a little blood. About midday he walked up to the hospital, and complained that he could not pass his urine. A catheter was introduced into his bladder, and about two ounces of bloody urine were drawn off. About two p.m. a catheter was again passed, and about eight ounces of bloody urine withdrawn. He complained of nothing but a slight pain in the abdomen. When seen the next morning he complained of no pain, but had not passed any urine. About noon he was attacked with vomiting, became collapsed, and died at once. At the post-mortem examination a rent, about three inches long, was found in the bladder near its fundus.

XLIX. (4). See No. 46, Extra-Peritoneal Series p. 103.

James C——, forty-two, labourer, admitted August 22nd, 1876. At four

a.m. this morning fell through the open door of a loft, about seven feet, on to some granite pavement. Quite sober when brought in. Is not certain when he passed water previous to the accident. Apparently a healthy man.

On admission in state of collapse, with small, weak pulse. Prominence of left anterior superior spine of ileum. Great pain on pressure over that point, and a sensation of crepitus in the pelvis at a point corresponding to centre of Poupart's ligament. Great pain in and distension of abdomen. Inability to move left leg, but no shortening or deformity. About three ounces of very bloody urine drawn off on admission. Tongue dry; moans continually; syphon catheter introduced. 23rd: About four ounces of bloody urine have come through catheter since its introduction; but none since two a.m. this morning. No. 8 catheter passed, and about an ounce of bloody urine drawn off. Belly more distended than on admission, but less than last night. Much less pain on pressure. Resonance over bladder. Respirations almost entirely thoracic. Pulse 108, weak; temp. 99·6°. Perineal section was performed, and a piece of gum catheter tied in wound; about half an ounce of bloody urine evacuated. A vertical incision was then made in linea alba, just above symphysis pubis. On cutting through abdominal wall a cavity was opened, and three or four ounces of bloody urine were evacuated. A piece of flexible tubing was inserted and tied in. 24th: Urine flows through both tubes, and is not quite so bloody. Slept fairly well Pulse 116, weak; belly more distended, but not so painful; respiration still thoracic: temp. 99·4° F. 26th: Constant sickness since yesterday. From this date got weaker; abdomen became much distended; diarrhœa; and he gradually sank, and died September 3rd. Duration, 13 days.

I.P. 146. L. (5). T. P. Pick, No. in Register 1100/79.

Intra-peritoneal rupture; absorption of urine by peritoneum (?).

J. R——, forty-five, conductor, admitted July 2nd, 1879. Sixteen hours before admission, whilst he was engaged in a street fight, was kicked in the abdomen. He had been drinking, and at the time took no notice of the injury, and started to walk home. A quarter of an hour afterwards he felt an acute pain across the umbilical region, and was obliged to sit down on a doorstep for some time. He ultimately, however, walked home. During the night he fell ill, and frequently attempted to vomit. Several times he tried to pass water, but nothing more than a little blood came away. Just before coming to the hospital a surgeon had been called in, and had passed a catheter, but only a little blood had been drawn off.

On admission patient did not look at all ill. The tongue was furred; pulse 88, soft; skin dry and rather pungent. There was pain and tenderness above pubes; the abdomen was somewhat distended, but the muscles were soft, and moved freely during respiration. A No. 8 gum catheter had been tied in, but through it no urine came; a little, however, it was thought, dribbled by its side. There was continual nausea.

July 3rd: A very restless night had been passed; the abdominal pain was much greater; there was frequent vomiting, the vomit containing a little black blood. About one pint of urine had been passed through the catheter; it was *quite clear and free from blood.* The pulse was 128, small and hard; temp. 100° F.; the tongue dry and brown. July 4th: Great weakness; pulse 146, thready; temp. 101° F. A small quantity of normal urine was passed; frequent vomiting; there was more abdominal distension, symptoms of general peritonitis setting in; some bruising about the umbilicus. July 5th: In very great pain; very frequent vomiting of dark, grumous, stinking material; occasional delirium. Some urine containing blood came through the catheter. July 6th: Quite unconscious; vomiting as before; pure blood came through catheter. Died at four a.m.

Post-mortem.—The peritoneal cavity contained blood and clots; the bowels were inflated, but uninjured, and they contained no blood; the blood clots were for the most part in the pelvis; the omentum was ecchymosed; behind the bladder the peritoneum showed an extensive rent, consisting of two limbs, an horizontal one measuring three and a half inches, and a vertical one two inches in length—both were covered with adherent clot, and the lips were held in good apposition by means of a little lymph. Corresponding to this injury to the peritoneum, a laceration was found in the posterior wall of the bladder.

There was no smell of urine, and there was a complete absence of inflammation of the sub-serous tissue.

Remarks.—The quantity of urine passed and drawn by the catheter was small, and no urine is mentioned as being found in the abdomen. If this account contains the whole truth, urine must have been absorbed by the peritoneum in considerable quantity, unless it was suppressed.

Specimens from Museum of St. George's Hospital.

I.P. Comp. 30. LI. (6). T. P. Pick.

Series xii. 1. Extensive rupture at the apex of the bladder, in connection with fracture of the pelvis, from a patient, aged thirty-five, who lived two days after the accident. On the admission of the patient into the hospital, a catheter was passed into the bladder, and a large quantity of bloody urine was drawn off. He was then in a state of collapse, from which he never rallied, but a fair quantity of urine continued to be secreted. At the post-mortem examination about an ounce of turbid fluid was found in the cavity of the peritoneum, between the bladder and rectum; but no lymph was found, either in the neighbourhood of the rupture or in any part of the peritoneum.

E.P. 85. LII. (7). T. P. Pick.

Series xii. 2. Rupture of the forepart of the bladder, immediately behind the pubes, caused by a man jumping on the abdomen of the patient when he was on the ground. The patient, aged fifty, was admitted into the hospital the day after the injury, with an anxious countenance, and great pain and tension over the lower part of the abdomen, accompanied by retention of urine. A catheter was passed, and a pint of bloody urine drawn off. The patient appeared to be going on pretty favourably for a few days, at the end of which time three distinct tumours, presenting evident but deep-seated fluctuation, made their appearance. One of these tumours was in the mesial line and the other two in the iliac regions. On the 12th day after his admission a free incision was made into the lower part of the left iliac region, and about three pints of fetid pus let out. This was followed by a marked amendment, which, however, lasted but a few days. The wound put on an unhealthy appearance; and the urine, which hitherto had always passed through the urethra, now flowed freely through the wound in the left iliac region. The patient lived twenty-two days after the accident.

At the post-mortem examination the peritoneum was found extensively stripped from off the parts in the neighbourhood of the bladder, as well as from both iliac fossæ, and from the wall of the abdomen as high as the umbilicus. The cellular tissue in these various regions was in a sloughy state, and filled with large quantities of foul matter. The bladder presented, in its forepart, a rupture of about an inch in length, the greater part of which was covered over by lymph and sloughing, cellular tissue firmly attached to the margins of the laceration, so that, at first sight, it had the appearance of one of the sacculi so often met with in connection with this organ. At the lower part of the rupture, however, an opening through which the little finger was easily passed into bladder existed. The bladder itself was very much contracted, and its mucous membrane (which was of a dark colour), was, in many places, covered with lymph containing a sandy deposit.

E.P. 86. LIII. (8). T. P. Pick.

Series xii. 3. Rupture of the lower part of the anterior wall of the bladder in two places, owing to the falling of between two and three hundredweight of iron upon the abdomen. The openings in the parietes of the bladder presented sloughy margins, and urine had been effused into the areolar tissue between the bladder and anterior wall of the pelvis, causing it to slough. The urine had also made way through both thyroid foramina, and caused softening and sloughing of the adductor and obturator muscles. The accident was accompanied by partial separation of the pelvic bones at the symphysis, and fracture through their bodies, and descending rami on both sides. There was also extravasation of blood into the peritoneal cavity and subperitoneal tissue. The patient, Charles R——, aged twelve, lived six days, suffering much pain. The urine contained blood.

Recovery 40. LIV. (9). T. P. Pick. Rupture of bladder (?).

Susan L——, thirty, was admitted in 1867. In crossing the street she fell, and the fore-wheel of a heavy waggon passed over her abdomen. There is no history of the state of the bladder at the time of the accident, or whether she had been drinking or not. On admission she was in a state of profound collapse, but some hours later rallied somewhat, and blood was found oozing from the vagina; a catheter was passed into the bladder, and about half an ounce of almost pure blood was drawn off. At five p.m. the urine drawn was full of blood—quantity not stated; at 9.45 p.m. half an ounce drawn full of blood. The next day she rallied, and complained of great pain across the lower part of the abdomen; her expression was very anxious, and her pulse fluttering. During the day the pain continued; she was repeatedly sick, and in the evening aborted of twins; vomiting, with swelling of and great tenderness in the abdomen, existed for five days; the urine, at first loaded with blood, became clearer. On the fourth day the urine dribbled away. These symptoms gradually subsided, and about three weeks after admission an abscess formed on the left side, just below the false ribs. This burst, and with it almost all pain ceased. It continued discharging freely for about four weeks, and then healed. A second small abscess formed below and to the right of the umbilicus. Whether urine came out with the pus is not stated. After this the patient gained strength, no further mischief set in, and she was discharged at the end of eleven weeks.

Remarks.—This case is not reported fully enough to enable me to offer a confident opinion on the nature of the injury, but the bladder was at least bruised severely, perhaps lacerated to some extent, very probably near the neck.

I.P. 147. LV. "Cooper's Surgical Dictionary," article, Bladder, by James Lane; also, "Catalogue of Museum of University College," 1450.

A patient, under the care of Mr. S. Cooper, was thrown in a wrestling match, his opponent's knee striking the hypogastric region. The bladder was full at the time. The patient tried to micturate immediately after the accident, but could only succeed in passing, with great pain, a small quantity of urine mixed with blood. A catheter was introduced, and a small quantity of blood withdrawn. Peritonitis supervened, and the patient died the day after the injury. After death urine was found in the peritoneal cavity. The posterior wall of the bladder, near its summit, showed an irregularly oval rent, slightly exceeding an inch in length, and the peritoneum is torn to an equal extent. Both the mucous and muscular coats are healthy. A thin layer of lymph has been formed in the recto-vesical fold.

I.P. 148. LVI. Same reference as preceding. No. 1451 in Catalogue.

The patient was a man twenty-eight years of age, who, after drinking freely of gin, ran hastily from the public-house, and struck his abdomen against a post. He fainted, and was brought to the hospital in great pain. A catheter withdrew a small quantity of clear urine. It is not stated in the MS. catalogue how long he lived. The urine subsequently withdrawn by catheter is noted to have been on one occasion bloody. The rupture in the bladder is transverse, occupying its posterior surface closely below the summit, the peritoneum being torn to a corresponding extent. The mucous membrane protrudes through the aperture, and is turned back so as to form the edge of the opening. A layer of lymph has been formed on the peritoneum, and appears to have united the edge of the mucous membrane to that of the peritoneum. The bladder is quite healthy.

LVII. Geo. King, Bath, "Prov. Med. and Surg. Jour.," 4th Sept., 1841, p.70.

Sloughing of the bladder after labour. Recovery.

Mrs. D——, in labour with eighth child, was delivered by craniotomy after the unsuccessful use of forceps. The patient went on well until six days after delivery, when Mr. King was sent for. In the night there had been copious discharge of colourless fluid, which proved to be urine. There was a large triangular opening in the neck of the bladder. Ultimately the opening closed.

LVIII. John Elkington, "Provincial Medical and Surgical Journal."

Sloughing of bladder after labour. Recovery.

Mrs. G——, twenty-eight, five children, had a very severe labour necessitating craniotomy. She went on well, and passed her urine regularly and without

difficulty for some days; then she became restless and complained of aching pains about the pelvis. On the tenth day there were slight rigors, and on the next day pus and urine were discharged per vaginam. An opening into the bladder, through which the finger passed readily, was found at the upper part of the vagina. In the course of time it contracted, and nearly if not entirely closed. The sloughing portion of the vagina measured three inches in length, one and a half inches in width, and one-eighth of an inch thick, and was shown at the Birmingham Pathological Society.

LIX. E. J. Shearman, M.D., "Prov. Med. and Surg. Jour.," Dec. 30th, 1843.

Perforation of the bladder by mistake for the child's head in parturition.

Female, thirty-five, in labour with fourth child. The practitioner in attendance had, as he thought, perforated the head of the child, but could not deliver the patient. On examination it was found that the os uteri was dilated, but the liquor amnii was still in the membranes. A rent was found in the anterior part of the bladder, admitting three fingers, and made by the perforation, the bladder having been mistaken for the head of the child. The delivery was effected with forceps, but the communication with the bladder remained throughout the remaining period of the patient's life. This, though strictly a wound of the bladder, is here introduced on account of the interest of the case.

Recovery 39. LX. Sir James Paget, "British Medical Journal," 1856, p 932.

Fractured pelvis; laceration of the bladder, rectum, and perineum. Plastic operation.

Two years previously to the operation a young man had been rolled over and mangled by the wheel of a waggon. The pelvic bones were broken, and the bladder torn across. The perineum was laid open, and the rectum injured. The patient recovered, and the urine and fæces had one common outlet for several months, which was compared to the cloaca existing in birds and monotremes. The inside of the bladder, with the openings of the ureters, could be seen bulging into the gap. An operation was performed, and the rent in bladder and perineum sewn up by Mr. Paget. A week later the case was progressing favourably.

E.P. 87. LXI. G. D. Pollock, "British Medical Journal."

Male, eight, riding in a cab, slipped left leg between the spokes of one of the wheels. His leg was severed from his thigh, his femur and pelvis fractured, and the whole length of the sciatic nerve, nineteen and a half inches above the knee-joint, torn out, and remained attached to the leg. The floor of the bladder was perforated by one of the broken pelvic bones, and the opposite wall of the bladder was bruised by the end of the fragment. Primary amputation was performed. The boy lived two days.

I.P. 149. LXII. E. Stanley, "British Medical Journal," February 7th, 1857.

Peter H——, twenty-eight, had been drinking, and was intoxicated. He received a kick on the abdomen in a quarrel. Ten ounces of urine were removed by the catheter, and some blood escaped on the withdrawal of the instrument. On admission he had an anxious aspect, and during the next few days he exhibited increased anxiety, and became weaker, though no distinct symptoms of peritonitis showed themselves. The urine was retained, and he complained of pain when it was allowed to remain in the bladder. Hence the catheter was passed every four hours. As soon as the bladder was nearly emptied the handle always twisted to the right side. Towards the end of the case the abdomen became more tender and tympanitic, and the legs were drawn up, but no fluid could be detected in the peritoneum. Death on sixth day.

At the post-mortem examination no distinct traces of peritonitis could be found. The peritoneum contained a quantity of turbid fluid, which was lost before examination. The bladder was firmly contracted behind the pubes, and showed a rent an inch long at the upper and back part. In the mucous coat were three lateral fissures below the opening. The rectus abdominis was loaded with the trichina spiralis.

I.P. 150. LXIII. Mr. Terry, Jun., Northampton, July 25th, 1857.

Male, over whose abdomen a cart-wheel passed. A pint and a half of bloody urine was drawn with the catheter. Four days of vomiting, and death on fourth day. There was a large rent in fundus into peritoneal cavity.

E.P. 88. LXIV. Stanley E., "British Medical Journal," August 8th, 1857, p. 661.

Martin M——, eight, injured by an iron gate falling on to his abdomen. He had passed urine a short time before the accident. He was brought to the hospital immediately, and suffered only from the pain resulting from contusion. The catheter withdrew the next day a large quantity of urine mixed with blood. The third day he had tympanitis, sharp pulse, furred tongue, and constant vomiting. He was sinking on the fourth day, and died on the sixth. Calomel and opium and mercurial inunction were tried without result.

Post-mortem.—Peritoneal cavity quite healthy. Ramus of right pubic bone broken in two places, viz., near the symphysis, and at its outer end. Four small rents in the bladder, through mucous and muscular coats, the edges of which were ulcerated. The peritoneum was entered. The bladder was contracted, and did not contain urine. No traces of injury to bladder by the broken bones (?). Cellular tissue of pelvis dark and partly sloughing.

Remarks.—It is observed that the symptoms were more like peritonitis than in the other cases, and might be called symptoms of false peritonitis. The injury to the bladder must, I think, have been caused through the fracture of the pelvis, although the bones may have resumed their normal position.

I.P. 151. LXV. A. Willett (Max Bartels).

Adult; fall; acute intestinal obstruction led to the diagnosis of rupture of the intestine. The catheter drew clear urine. Death in twenty-four hours. *Post-mortem:* Much bloody fluid in the cavity of the pelvis. Great intra-peritoneal rent, through which coil of intestine passed, and became nipped. General peritonitis. (See p. 38.)

E.P. 89. LXVI. "Taylor's Medical Jurisprudence," third edition, vol. i. p. 675: Reg. v. Dixon, Durham Lent Assizes, 1846.

Prisoner kicked deceased in pubic region from behind. The man died of peritonitis in thirty-five hours. The bladder was ruptured near the neck for half an inch, immediately above the prostate gland. Extravasation of urine. Peritoneum not lacerated.

E.P. 40. LXVII. Jonathan Hutchinson, F.R.S. (Mr. Tay's Notes).

Stricture; retention of urine; rupture of bladder; plentiful discharge of urine.

W. Rine, aged forty-five, a stoker, was admitted into the London Hospital, under the care of Mr. Hutchinson, March 11th, 1882. He had applied at the hospital at five o'clock the same morning, being unable to pass his urine. No catheter could be passed into the bladder; but while it was still apparently engaged in a stricture about the bulbous portion, urine came freely through it. About half a pint, or rather more, came away. The patient seemed quite relieved, and went home again. He then drank some gin and ginger beer, and afterwards some tea. Shortly after this he was seized with severe pain in the abdomen, near the umbilicus. He returned to the hospital about ten o'clock. A catheter was again tried, but it could not be passed any further than before, and this time no urine came. The abdomen was distended and tympanitic, excepting over an area extending about three inches above the pubes in the middle line. He was then admitted, and a warm bath ordered, and also two drops of croton oil on sugar. He did not obtain any relief, and at twelve o'clock Mr. Tay was asked to see him. The man seemed at this time very ill. He had a very anxious expression of face, and was in great pain. He made repeated efforts to pass urine, the abdomen was now very definitely distended. The area of dulness above the pubes did not extend for more than three inches, and on examination, per rectum, there seemed no evidence of distension of the bladder in that direction. Efforts were made to pass a catheter, but without any success. The bladder was then aspirated above the pubes, but only about an ounce of fairly clear urine was withdrawn. Half a drachm of tincture of opium was ordered, and hot fomentations were applied over the abdomen. It was noticed on rectal examination that the posterior limit of the prostate could not be made out so well as usual. At five p.m. the symptoms remained unaltered. There had been no action of the bowels, and he seemed in great distress; quite as much owing to his bowels not having been opened as owing to his not having passed any urine. The dose of laudanum had been repeated. Seven p.m. he seemed a little easier. He had an enema of castor oil and

turpentine, which acted moderately, and he passed a little urine while at stool. The hot fomentations were continued. The opium was left off, as his pupils were contracted, and he seemed drowsy. A little later than this Mr. Tay saw him again. His abdomen was in much the same state as before, but he now complained of pain low down on the left side, so that he could not flex the thigh on the pelvis. There was slight tenderness over the whole abdomen. He had vomited once. There was no swelling of the scrotum, or penis, or perineum. Nine p.m., the abdomen measured thirty-seven inches in circumference at the umbilicus. At eleven p.m. four leeches were applied above Poupart's ligament on the left side. March 12th: He was very restless during the night, but dozed at intervals. His bowels have not been opened, but he has passed about five ounces of clear, amber-coloured urine. His abdomen is less tense and tender, though he still complains of pain when he moves, or passes any flatus. The abdomen measured thirty-eight and a half inches. There had been no more vomiting. The enema of castor oil, &c., was repeated. 13th, Monday: After the enema, he passed a fair quantity of fæces. His urine comes away very fairly. During the night he has been greatly disturbed by constant desire to pass a motion. He got out to the stool some ten or eleven times. The abdomen still measures thirty-seven inches. The tenderness over lower part of left side of abdomen has much diminished. There is some œdema of the scrotum, probably due to the trickling of the urine, and the pressure of the vessel for catching the urine. Mr. Hutchinson saw the patient. He thought that the bladder was still distended, and the urine passed mere overflow. He tried to pass a catheter, but did not succeed. 14th: Since yesterday morning the patient had voided some seventy ounces of urine. The abdomen still distended, and measures thirty-eight inches. Had a fairly good night. 16th, Thursday: Patient passed a solid motion last night. His urine comes away in fair quantity, especially when at stool. There is some œdema of the abdominal walls and of the scrotum, the skin of the latter being quite sore. The abdomen still tender on palpation. The area of dulness above pubes remains the same. 17th: Patient in great pain. Abdomen very tense and tender over sigmoid flexure. This fresh attack of pain and swelling came on this morning about six o'clock. Has passed a small quantity of urine this morning. Calomel, gr. ii., Pulv. Opii., gr. ½, ordered every four hours, and an enema of castor oil and turpentine was ordered. The aspirator was again used in the evening above the pubes; but no urine whatever removed. 18th: The enema has not acted. No motion since 16th. Abdomen measures thirty-eight and a half inches. Œdema of scrotum less. Has vomited eight or nine times this morning. Vomited continually yesterday afternoon, and during the night. Vomited matter greenish-yellow, and sour smelling. 20th, Monday: The patient looks decidedly worse. There is a distinct sense of resistance over the lower part of the abdomen on the left side. An ill-defined tumour can be made out. Over this region the skin is œdematous. The scrotum is less œdematous. The urine voided is ammoniacal, and contains stringy mucous. Under the microscope, pus cells, blood cells, crystals of triple phosphate and bacteria are seen. Patient passed a motion yesterday. The vomiting continues. Mr. Hutchinson saw him in the afternoon, and as he did not now pass water at all satisfactorily, and as there was a definite area of dulness above the pubes, he thought it advisable to make an incision in the middle line above the pubes, and then puncture the bladder with trocar and cannula. Nearly a pint of urine (dark coloured, and ammoniacal) was withdrawn. An india-rubber catheter was passed through the cannula, and left in the wound, and the cannula was withdrawn. 21st: Some sixty ounces of urine have come away through the catheter since yesterday. The patient has passed several small motions. He has vomited, but not so frequently. The flow of urine having ceased through the catheter, some weak, lukewarm carbolic solution was injected. This did not return. 22nd: Patient has vomited repeatedly during the night, and has also been freely purged. Some more fluid injected through catheter could not be removed again. On the left side there is a distinct swelling now; moderately well circumscribed. It extends about three inches above Poupart's ligament, and to midway between pubes and umbilicus. 23rd: Had a quieter night. About sixty-five ounces of urine have escaped since Tuesday morning.

Some more fluid was injected by catheter, but it could not be withdrawn again. Abdomen measures thirty-eight inches. In the afternoon, Mr. Hutchinson saw him, and aspirated the swelling above Poupart's ligament. Some dark-coloured, urinous-looking fluid having been withdrawn, an incision was made above Poupart's ligament, and about eighteen ounces of ammoniacal, blood-stained urine let out. An india-rubber tube was inserted. About an hour later the patient had a rigor. 24th: He had a bad night. A quantity of blood-stained urine came through the wound. Was frequently purged. Vomiting less. 25th: Much weaker. Has passed twenty-five ounces of urine through the tube. 27th: Much weaker. Vomiting continues, and diarrhœa. Urine escapes through wound in groin. 28th: He died.

A post-mortem was obtained. When the abdomen was laid open the intestines were found all matted together, especially in the neighbourhood of the bladder. The latter was opened where the puncture had been made. A sound was then passed through the opening made above Poupart's ligament. After a little manœuvring it passed low down through an opening into the bladder. The parts were so matted together that nothing definite could be made out, beyond the fact that the opening was in the floor behind the prostate, between the rectum and the bladder, rather to the left side. There was a large cavity, apparently outside the peritoneum, the collection of urine finally presenting above Poupart's ligament.

Temp. March 11	98—103	Temp. March 20	98·4—98·4
12	100—100	21	97·8—101
13	99—100	22	98·4—100
14	99·8—101	23	99·8— 99
15	99·8—101	24	98— 99
16	99— 99	25	100—102
17	101—101	26	98—100
18	99·5—102	27	100
19	98·4—100—103 (11 p.m).	28	99—100

Remarks.—This was undoubtedly a very obscure and difficult case to diagnose and treat. As to the date of the rupture, after careful consideration of the facts, I conclude that it was March 11th, after drinking the gin, ginger beer, and tea. He was then seized with severe pain in the abdomen, made repeated unsuccessful efforts to pass water. His abdomen became very definitely distended, but the area of dulness reached only three inches above the pubes. Examination by the rectum showed no evidence of distension of the bladder in that direction; but the posterior limit of the prostate was ill-defined, only an ounce of urine could be obtained by aspiration, and for two days there was very little urine passed. In another case of the kind an exploratory perineal section would both remedy the stricture and enable the surgeon to make a diagnosis, but even then it would be difficult to reach the urine effused behind the prostate. The duration of the case was at least seventeen days. The estimate of twenty-three days, stated on page 10, was made after hearing the case related at the Hunterian Society.

Note H.—Recent Papers. Dr. Stein, Mr. Stokes, and Dr. Beck.

I. Dr. Stein's paper.

When this work was in the press, I came across a valuable and careful paper by Dr. A. W. Stein, surgeon to the Charity Hospital, New York, in the "Annals of Anatomy and Surgery," for July, 1882. Dr. Stein's paper is founded on the records of 219 cases, 196 of which were fatal. His views and my own tally in most particulars, but I do not agree with him in attributing to the promontory of the sacrum the chief influence in determining ruptures on the posterior wall of the bladder, for the simple reason that I cannot see how the promontory of the sacrum can produce a *vertical* rent in a part of the distended bladder which is situated entirely beyond the promontory. A transverse rent corresponding in the distended state of the bladder to the promontory may fairly be assigned to its influence (as in Wilmot's case), but such cases are uncommon.

A brief summary of the points urged by Dr. Stein may not be unacceptable. Dr. Stein divides ruptures of the bladder into three classes, the intra-peritoneal, extra-peritoneal, and sub-peritoneal. The long duration and the unpronounced symptoms at the commencement of some of the fatal intra-peritoneal cases may have been due to the fact that they were primarily sub-peritoneal. The evidence pointing to rupture is not always unequivocal. Standing and walking, and ability to micturate, are not inconsistent with rupture. Patients with ruptured bladders may have no difficulty in passing water, and indeed may pass a considerable quantity of water. In some cases it occurred that after the first catheterizations the patient regained the power of voluntary micturition. The absence of difficulty in voiding urine has been met with both in extra-peritoneal and intra-peritoneal ruptures. Thus Stone's patient, with an extra-peritoneal rent one and a half inches long, passed his urine for three days after the injury as naturally as ever, and Grüber's patient, who died from an intra-peritoneal rent of the same length, was able, immediately after the fall, to pass water without any difficulty. To these must be added the remarkable case recorded by Dr. Bennett (see p. 130).

The retentive power of the bladder in some cases has been due to plugging or temporary closure of the aperture in the bladder, to valvular protrusions of the coats, and to adhesions. Nor should the absence of blood be taken as necessarily negativing rupture. The urine may be clear throughout.

It is as important to determine whether the rupture be intra-peritoneal or extra-peritoneal as it is to diagnose the existence of a rupture. Peritonitis is also a symptom in some extra-peritoneal ruptures, and especially of sub-peritoneal rents. There is a difference in the kind of swelling of the abdomen in intra-peritoneal and extra-peritoneal rents. In the intra-peritoneal form the swelling is uniform and symmetrical; in the extra-peritoneal it may be confined to one side. In doubtful cases Dr. Stein strongly advocates exploration of the bladder by median incision. He gives four cases of recovery after intra-peritoneal rupture, viz., Walter's, Chaldecott's, Thorp's, and Erskine Mason's. Dr. McDougall's cases he does not include, though his table of references shows that he was acquainted with them. Of the four adduced he only admits Walter's case as unequivocal, throwing doubt on the genuineness of a peritoneal rent in the other three, and quoting Mr. Willett's strictures on the case related by Dr. Mason. With regard to treatment, he speaks highly of constant catheterism according to the method of aspiration devised by Chiene for the cure of obstinate perineal fistulæ, and also favours laparotomy. With regard to cystotomy he observes that present experience scarcely justifies the dogmatic assertion that "for rupture of the bladder cystotomy is the thing to do." It has not been proved to be more efficient than catheterism as a means of drainage. Sometimes the urine collects in Douglas's pouch. When a collection is detected there the sac should be punctured, the fluid evacuated, and the cavity washed out. Dr. Stein refers to the experiments of Dr. Vincent on suturing the bladder, and also to those of Fischer ("Archiv für Klin. Chir." Bd. xxvii., H. 3), and gives the hint emanating from Vincent that in the application of sutures the bladder may be made more accessible by distending the rectum with a colpeurynter. He then discusses the question of "Suturing the bladder to the abdominal wall." This was done as early as 1716. "Joh. Jacob Wozt ('Unterricht von den tödtlichen Wunden des gantzen menschlichen Leibes,' Dresden, p. 417) recommended suturing the injured bladder to the abdominal wall, but I am not aware that the suggestion has ever been carried out until recently by T. G. Thomas of our city. In the course of a laparotomy for the removal of a large multilocular ovarian cyst, an incision had to be made through the anterior wall of the bladder in order to determine the upper limit of the viscus, which was adherent to the tumour. After the removal of the cyst the lips of the vesical incision were drawn up and clamped between those of the abdominal wound by means of silver sutures. A Sim's sigmoid catheter was kept in the bladder. The sutures were removed on the tenth day, and at the end of three months the patient went home entirely well." With a view of further testing this, Dr. Stein made three experiments on dogs. The bladder of the dog is covered on all sides with peritoneum, and therefore the operations were intra-peritoneal. The bladder was opened and stitched to edges of wound.

In all the cases the dogs recovered from the operation, adhesions formed between the bladder and abdominal peritoneum, and the fistulæ rapidly closed.

II. Mr. Stokes' paper.

In the first volume of the "Transactions of the Academy of Medicine of Ireland" is a paper by Mr. William Stokes on penetrating wounds of the bladder. Mr. Stokes relates the case of a lad of sixteen whose bladder was transfixed through the rectum from base to apex by one of the long handles of a pair of forger's tongs on which he had fallen in the act of vaulting. The patient died in seventy-four hours of peritonitis, due to the rupture near the summit, and to the admission of urine and its retention in the peritoneal cavity. After adducing Prescott Hewett's, Birkett's, Bryant's, and Tufnell's cases of single wound in the bladder, Mr. Stokes discusses the question whether, in cases of rupture, the urine or the injury itself is the cause of peritonitis, but without arriving at any definite conclusion. According to Mr. Stokes, normal acid urine is quite innocuous to the peritoneum, as shown by the frequent recoveries after intra-peritoneal gunshot wounds, by the cases of recovery after intra-peritoneal rupture treated and recorded by surgeons of eminence, and by Menzel's experiments ("Medical Record," May 15th, 1878). Unfortunately however, urine undergoes decomposition in the peritoneal cavity at a variable period after its admission into the sac, and then its whole nature is suddenly changed, and it becomes an intense irritant. I do not myself think that this view accords entirely with the symptoms exhibited by persons into whose abdominal cavity a quantity of healthy urine is suddenly admitted. It is, of course, difficult absolutely to separate the amount of shock and pain occasioned by the violence applied and by the rupture and contusion from the effects due to the outpouring of the urine itself; but clinical records leave very little doubt in my own mind that the urinous bath is intensely irritating to the peritoneum, as well as most pernicious to the system, when absorbed by the lymphatics which open on to the surface of the serous membrane. There is nothing to hinder absorption until the mouths of the lymphatics are closed either through contraction excited by the urine, or by the exudation of lymph. That ordinary urine, not in a putrid state, is anything but innocuous is clearly indicated by the fact that patients with intra-peritoneal rupture often die after a few days of intense suffering and constitutional depression, and that at the post-mortem the peritoneum may be found free from obvious inflammation, but containing urine so inoffensive and undecomposed as to be mistaken for serous exudation. It is not the presence or absence of inflammatory products that constitutes the test of innocence, but the effect on the system and the issue of the case. Recoveries from gunshot wounds involving the peritoneum, and Menzel's experiments, prove nothing so much as the necessity for immediately finding a vent for urine which gains admission into a closed cavity from which it is unable to escape. As for the reported cases of recovery after intra-peritoneal rupture—which Mr. Stokes reminds me that I had not the opportunity of observing, although he admits that my views may be correct—I see no other way of arriving at a sound conclusion concerning their validity, than by collating their records with a large number of fatal cases of the lesion, and in this manner I am inclined to think that a very fair estimate may be formed, even by a surgeon at a distance from the scene of action. More especially so here, because several of the cases whose genuineness as intra-peritoneal ruptures I have ventured to call in question are based entirely on the idea that the bladders of the patients were full at the time of the injuries, and it is tolerably certain that if the distinguished surgeons whose cases are in question had approached them from my point of view of want of repletion of the bladder they would have formed exactly the same opinions as I have formed concerning them. If surgeons were always right in their diagnoses, the fact that I did not observe these cases would put me out of court; but I find that even in Dublin nearly the whole of a distinguished surgical staff may arrive at an erroneous conclusion concerning the existence or not of a ruptured bladder, with the case before their eyes. In the present instance I am in company with those who before and after me have thrown doubts on some of the reported recoveries; as to Thorp's case in company with Birkett, Max Bartels, Vincent, and Stein—as

to McDougall's cases with Max Bartels—as to Chaldecott's case with Eben. Watson, Max Bartels, and Stein—and as to Mason's case with Willett, Max Bartels, and Stein.

III. Dr. Beck ("Centralblatt für Chirurgie," No. 44, November 3rd, 1883) relates two cases of traumatic rupture of the bladder.

E.P. 90. I. Soldier, intoxicated, fell from a window a considerable height from the ground. When seen next morning he had pain in the abdomen, especially over the region of the bladder, and great desire to pass urine, but none came. By means of a catheter about 400 grammes of partly coagulated blood were removed, and this manipulation was frequently repeated. Abdomen tympanitic; some dulness in the inguinal region. Diagnosis: "Intra-peritoneal rupture of urinary bladder." Second day, considerable œdema of penis and scrotum. Till fifth day urine bloody; but on sixth day spontaneously clear. Apparent amendment, followed by relapse, on the following day. Death on thirteenth day, with antecedent lung symptoms.

Post-mortem.—No peritonitis. Extra-peritoneal rupture of anterior wall, 7 cm., plugged by fibrinous coagulum; mucous membrane partly ulcerated; infiltration of urine in connective tissue, reaching behind as high as the kidneys. Left lung hepatized in the lower third; in left pleural cavity moderate pleuritic adhesions.

I.P. 152. II. Dragoon, horse reared, and fell on to him, the patient being struck by the saddle. Moderate symptoms of shock; severe pain in region of bladder; great desire to micturate, without passing anything. Some bloody urine was drawn by the catheter, and this manipulation was repeated every hour. By the evening the urine was no longer bloody. Next morning patient was much worse, percussion of abdomen showed some dulness. Beck saw him twenty-four hours after accident. Diagnosis: Intra-peritoneal rupture of bladder. Patient's general condition contraindicated any operation. Death in forty hours.

Post-mortem.—Extravasation of blood in abdomen. Intestine contused; peritoneum rather dull; some coils of intestine lightly adherent in abdominal cavity, which contained 200 to 300 grammes of urinous, slightly feculent fluid. One and a half cm. from apex, on the posterior wall, a triangular rupture, base upwards, varying in extent in the different coverings of the bladder, being greatest in the peritoneal, and least in the mucous coat.

After explaining the anatomical conditions and symptoms of rupture, Beck laid stress upon the amount of blood removed as indicative of the seat of rupture. If blood escapes copiously and permanently, it indicates extra-peritoneal rupture, owing to the venous plexus anteriorly being wounded: if it escapes scantily it has to do with intra-peritoneal rupture. Œdema of the scrotum and penis present in the first case, is in favour of extra-peritoneal rupture, for owing to interference with the venous plexus there is set up disturbance of the dorsal vein of the penis. Urine, in cases of rupture of the bladder, escapes only at the moment of injury, not subsequently, if the bladder firmly contracts. The stagnant urine easily decomposes. As regards treatment, Beck recommends the withdrawal of urine as soon as secreted, by keeping in the catheter; in intra-peritoneal rupture laparotomy, in order to let out the urine, disinfection, and stitching up the bladder. As it is difficult with a contracted bladder to stitch peritoneum to peritoneum the continuous suture should be used. In extra-peritoneal rupture, in addition to retention of the catheter, injection and washing out should be practised, to prevent the urine becoming alkaline, and when any impediment to the exit of urine ensues a median incision.

In the discussion which followed Beck's paper, Kuster advocated operation and drainage. Maas, of Wurzburg, mentioned cases under his own observation, and insisted on the primary importance of retaining the catheter. The right moment for laparotomy is very difficult to seize. Healthy urine ought not to decompose in the abdominal cavity, as experiments on injecting urine in lower animals showed; but it frequently did decompose, owing to infection from contused intestine, or the bladder rupture. Suturing the bladder deep in the pelvis is a very difficult procedure, and not very necessary, as if the urine is carried off the rent may heal spontaneously. In regard

to the locality of rupture, Maas found that ruptures made for the sake of experiment occurred for the most part anteriorly at the point of reflection of the peritoneum. Beck doubted whether fresh urine could be left in the abdominal cavity without injury. Englisch, of Vienna, reported a case observed by himself, and insisted on necessity for catheter retention. If infiltration of urine followed extra-peritoneal rupture he made free incisions over the symphysis. In intra-peritoneal rupture he should, when decomposition of urine and peritonitis set in, perform laparotomy, and disinfect. He should not attempt to stitch the bladder, as it is difficult to carry out, and not very necessary.

SUMMARY OF CHIEF CONCLUSIONS.

1. Distension of the bladder is a necessary condition of the occurrence of an uncomplicated intra-peritoneal rupture.

2. Rupture of the bladder anteriorly may occur when the viscus is empty, or contains but a small quantity of urine, (*a*) in cases complicated with fracture of the pelvic bones; (*b*) when the innominate bones are forcibly separated at the symphysis pubis; (*c*) when great violence is applied to the hypogastric region, as when the wheel of a heavily-laden waggon passes over the abdomen, or a mass of earth falls upon the part. The first cause (*a*) is common, the bladder being wounded rather than ruptured; the second cause (*b*) is rare, and as this conclusion rests on one case (I.P. 139, Dr. Seelye, p. 129) it should be accepted with caution; in the third group (*c*) the bladder is dragged backwards, through the influence of the structures connected with it, peritoneum, fasciæ, ureters, hypogastric arteries, and the rupture will be found at or near the neck, i.e. just above the prostate gland. The peritoneum may be extensively stripped off the abdominal walls.

3. Ruptures of the bladder according to seat fall naturally under two heads, *extra-peritoneal* and *intra-peritoneal*, the former including (*a*) *partial* ruptures, or ruptures of the mucous coat only, or of the mucous with part of the muscular, and (*b*) the important group of *sub-peritoneal* ruptures: according to causation they may be divided into *traumatic* and *idiopathic*.

4. Idiopathic ruptures include all cases in which no external violence has been applied to the abdomen, as, for example, ruptures of the distended bladder due to muscular action in lifting weights, &c. (though this group might, with equal advantage and propriety be included in the traumatic series); ruptures from over-distension, due to various causes, as, e.g., stricture, enlargement of the prostate, hysteria, retroversion of the gravid uterus, extra-uterine fœtation, labour, and alcoholism, and, perhaps, immediately determined by muscular action, as straining to pass water, or straining at stool; ruptures in the fœtus; ruptures due to ulceration, the result of certain diseases, fever, erysipelas, syphilis, tubercle, cancer, and calculus.

5. In the traumatic ruptures the site of the rent will be determined by the degree of distension of the bladder, by the nature

and mode of application of the violence, and the position of weak spots in the bladder-wall.

6. In the idiopathic cases rupture is often preceded by some change in the organ itself. Thus, long-continued obstruction to the passage of urine, whether from stricture or enlargement of the prostate gland, occasions hypertrophy of the muscular fibres of the bladder, and the formation of "tunicary herniæ," or diverticula of the mucous membrane, which protrude through the muscular fibres, commonly either at or near the summit of the bladder, or posteriorly at the level of the insertion of the ureters. As these pouches are sometimes immediately under the peritoneal tunic, and sometimes unconnected with the serous covering, ruptures due to stricture or hypertrophy of the prostate may be either intra-peritoneal or extra-peritoneal. A second condition occasioned by obstruction of the urethra, especially when instruments have been passed, is inflammation of the mucous membrane of the bladder, determined, perhaps, by decomposition of retained urine. The inflammation may end in ulceration, softening, sloughing, or gangrene of some spot in the bladder-wall, often near the summit of the bladder, and then straining to pass water will readily cause rupture. Examples of rupture following softening, sloughing, or gangrene may be found among the cases of rupture from retroversion of the gravid uterus, and one or two of the prostatic cases. A third effect of obstruction is thinning and weakening of the vesical tunics.

7. In rupture during labour the distended bladder is placed between two forces, the contraction of the abdominal muscles and some part of the child's body or the forceps of the medical practitioner. The rupture may either be into the peritoneal cavity or into the vagina. Rupture may also occur, sooner or later after the completion of labour, from the injury sustained by the bladder during the process and from subsequent neglect.

8. Each kind of rupture has its own form of rent in the bladder-wall. The ordinary form of uncomplicated rupture from blows, kicks, and falls is a lacerated rent, one inch to three inches, vertical, oblique, or transverse. (*a*) The more or less vertical rent at the upper part of the posterior wall of the bladder, commencing near the urachus, is the most typical, and results from the application of sudden and equable force to the hypogastric region, but it may also be caused by a fall backwards through the pressure of the abdominal muscles, and by their strong contraction upon a distended bladder; (*b*) in retroversion of the gravid uterus the opening is either a rent with gangrenous edges, or a sloughy hole or a gangrenous perforation; (*c*) in cases of stricture and of retention, where the rupture follows over-distension and straining, the aperture is usually a small perforation, or a short rent of about half an inch, or a triquetrous opening, or a round hole lined by mucous membrane; (*d*) in cases of hypertrophy of the prostate the opening may be smooth and rounded, or a narrow rupture with thinned or sloughy edges.

9. That the bladder can rupture from over-distension is clear from experiments on the dead subject, which also show that the rent may either be sub-peritoneal or a small slit through all the coats at the superior fundus. That it has ruptured from over distension in the living body is certain, but in these cases, either the viscus was not in its normal condition or the over-distension had been assisted by the action of the abdominal muscles. It is scarcely possible to meet with an unequivocal case of rupture from simple over-distension. In the "Catalogue of the Museum of University College" it is stated that rupture from over-distension in the living "never occurs, since before such an event could occur the pressure in the kidneys would become sufficient to arrest secretion." This may be correct physiologically, but, practically, it would be unsafe to rely upon over-distended bladders preserving their continuity.

10. In considering the question of rupture in any traumatic case, it is most important to establish the facts that the bladder was full at the time of the injury and that force sufficient to produce rupture has been applied to the hypogastric region.

11. The typical primary symptoms of rupture are a feeling of something giving way, pain, shock, inability to stand or walk, desire but want of power to micturate, and removal *from the bladder* with the catheter of blood only, or a small quantity of bloody urine. The deficiency of urine and the loss of power to micturate often continue throughout.

12. When all the indications in (10) and (11) are present, together with symptoms of extravasation or peritonitis, the diagnosis will be easy; but some of them are frequently absent, and in exceptional cases nearly all may be. Thus, when the sufferer is under the influence of alcohol, or is insane, he may feel nothing, and be unable to give any information to the surgeon, who must find out everything for himself. Even desire to micturate is not always felt, and, when, it is, the patient may be able to expel urine, or urine mixed with blood. When the catheter is passed, clear urine in fair quantity may be drawn, both at the outset and daily through the illness. The surgeon must be on his guard against these deceptive conditions.

13. The ability to micturate has been observed both in intra-peritoneal and extra-peritoneal cases, and in both sexes. It seems to be relatively more frequent, and in greater perfection in the extra-peritoneal cases. Sometimes the patient has passed water, with or without difficulty, immediately after the accident and not subsequently, sometimes in small quantities throughout the illness, sometimes on the second or third day, and sometimes at a later period. When passed it is generally passed with difficulty, and the amount will be less than it ought to be. Occasionally there will be incontinence of urine, and very rarely, as in Bennett's case, the patient will pass water naturally every day, and be independent of the catheter.

14. The ability to micturate may be thus explained. (*a*) In the

intra-peritoneal cases the rent may become temporarily closed in more ways than one, and about the fourth, fifth, or sixth day the edges may become agglutinated, and kept together by the adhesion of omentum or bowel; (*b*) in the extra-peritoneal cases the opening may either be small, and become closed for a time, or being placed in the anterior wall may allow the urine to return through the bladder into the urethra. If the muscular fibres at the orifice of the bladder do not close the urethral opening, as happens occasionally when there is a rent close above the prostate gland, incontinence of urine occurs. If the opening be higher on the anterior wall, and of some size, and the urine, instead of being extravasated diffusely, is collected in a sort of sacculus, the action of the recti and the other muscles of the anterior abdominal wall may press the urine through the rent in the bladder, and the urethral muscular fibres relaxing, micturition will appear to be natural. When the bladder is ruptured it generally contracts, and is incapable of holding more than a few ounces of urine, but in this condition it may become a passage through which urine may be forced by the contraction of the muscles of the abdomen.

15. The records before us appear to me strongly to indicate the necessity for bolder action in the future in treating cases of ruptured bladder. The chances of recovery entirely hinge upon the promptitude of the surgeon in adopting efficient measures. In doubtful cases an exploration with the finger through a perineal incision would be perfectly justifiable, and could scarcely introduce any fresh element of danger. As the bladder is usually contracted in cases of rupture, the whole internal surface would be readily reached by the finger. If the diagnosis of intra-peritoneal rent be clear at the outset the urine cannot too soon be evacuated by a suprapubic incision, and the peritoneal cavity carefully cleansed. Dr. Walter's case and Vincent's experiments afford great encouragement. At the same time a perineal opening may be made with advantage. Whether the rent in the bladder should be sewn up or not, with or without paring of the edges, must be left to be determined by future experience. For myself I am disposed to think this difficult procedure unnecessary provided a free perineal exit be secured for all urine secreted after laparotomy. If the diagnosis of extra-peritoneal rent be clear, supra-pubic incision should be made early, and a perineal opening is equally indicated.

16. In the female the bladder is readily explored with the finger through the dilated urethra, and suprapubic incision, either extra-peritoneal or intra-peritoneal, according to the nature of the case, should be combined with vaginal cystotomy.

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