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P. 6/5.

INTERNAL ABDOMINAL INJURIES.

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BEING THE
ANNUAL ORATION

DELIVERED BEFORE
THE MEDICAL SOCIETY OF LONDON

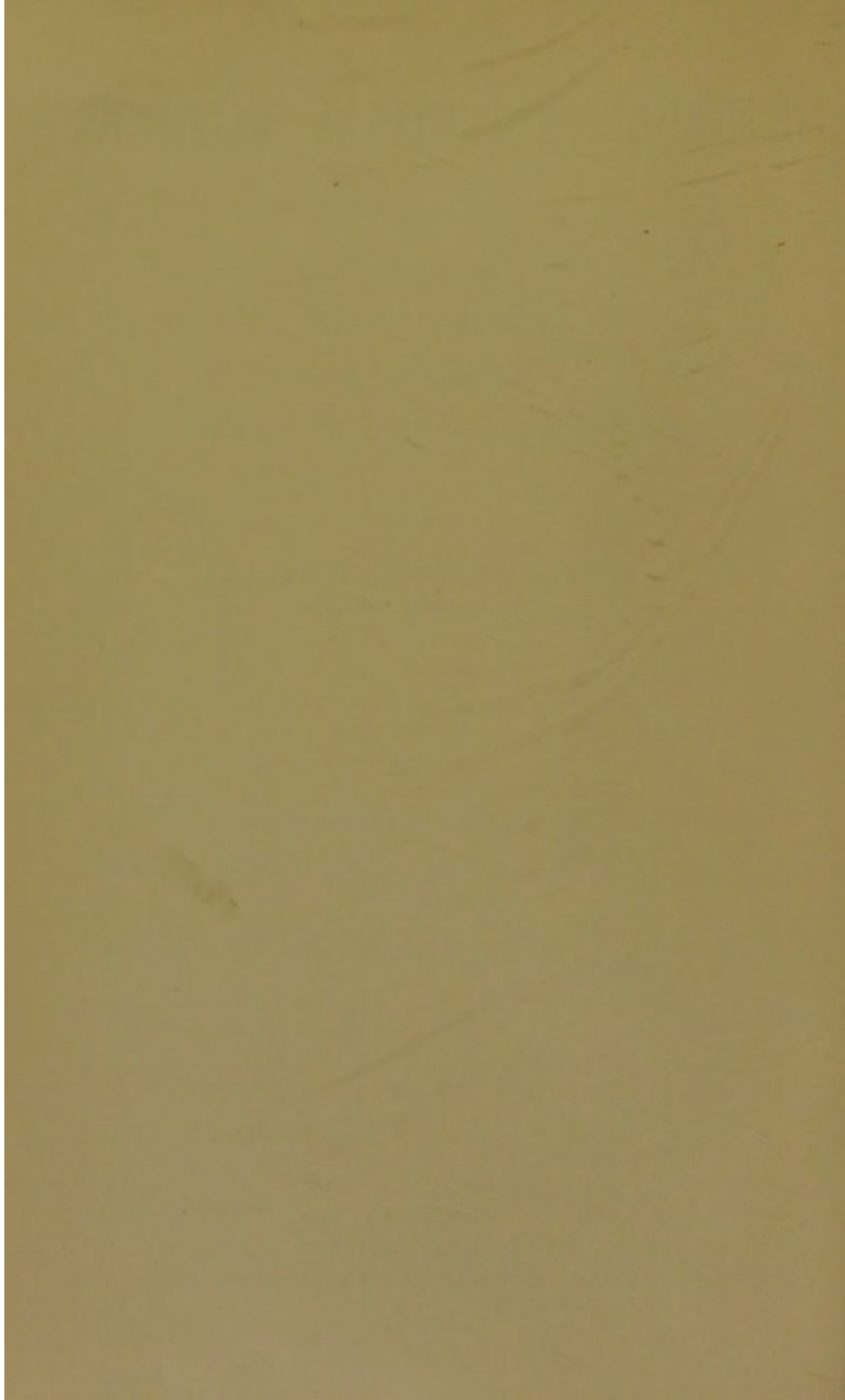
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1910.



INTERNAL ABDOMINAL INJURIES.

By W. H. BATTLE, F.R.C.S.

THE literature on this subject is already so vast that, whilst fully recognising the claim which most of the American surgeons and surgeons on the Continent have to more particular attention from anyone who ventures to write anything on this subject, I have felt compelled to limit my remarks in the main to the work done by British surgeons.

Some four and twenty years have now passed since it was demonstrated to the profession that many, if not all, of the internal injuries which come under observation, particularly in hospital practice, are amenable to treatment, and I have thought that it would be of interest to review the subject in some of its more important aspects, and see what progress, if any, has been made in this country during a period which has been such a wonderful one in the history of surgery. In the limited time at my disposal it would be quite impossible to do justice to the whole subject, the importance and extent of which is shown by the table of abdominal injuries here given, and for which I am indebted to my colleague, Mr. E. M. Corner.

I propose to limit the scope of the subject to a brief consideration of those injuries which come under the heading of contusions without external wound, as they affect intraperitoneal organs, *e.g.*, the intestines, spleen, liver, and bile ducts, and urinary bladder. The kidney and pancreas are so entirely outside the peritoneum that injuries which affect them are not included. In this group are comprised those cases which were so long admitted to our hospitals only to die, lulled to their last sleep by the administration of sufficient opium to keep them quiet and free from pain. That a person who had received an internal injury would necessarily die was quite accepted, and it was only the increased boldness which

came to the surgeon as a consequence of improved wound treatment that enabled a different practice to be followed, and, we contend, many lives saved. The presence of a wound at that time was necessarily considered a reason for operation, and sometimes an adventurous surgeon was led to treat a wounded organ within the abdomen, injury to which had not been apparent before the operation was commenced. Success obtained in these instances gave encouragement, but the frequency with which peritonitis followed opening of the peritoneum, even in clean cases, made it unwise to interfere when there was no wound already. In the event of a fatal result, and death was common, the surgeon was censured for meddling, and accused of causing the death which he had attempted to prevent.

TABLE of Abdominal Injuries admitted to all the London Hospitals who publish reports. St. Bartholomew's (1873-1906), St. Thomas's (1866-1907), Middlesex (1873-1904), University College (1879-1904), Westminster (1880-1903). The total number of cases being about 2,500.

	Per cent.
<i>Simple contusion of the abdomen</i> ...	64
With injury to kidney ...	7·7
„ alimentary canal ...	4·7
„ liver ...	4·5
„ spleen ...	2·6
„ bladder... ..	1·1
„ mesentery ...	0·5
„ omentum ...	0·3
<i>Wounds of the abdomen</i> ...	8·4
Proportions: Non-penetrating...	4·0
Penetrating ...	3·0
Indefinite ...	7·0
Mixed or various ...	5·9

(*E.g.*, rupture of hepatic artery, bullet wound, and multiple injury.)

As a reason for the choice of this subject, I may explain that I have always taken an interest in it, perhaps not greater than that taken by others at St. Thomas's Hospital, but still a considerable interest. Moreover, I was closely associated with some of the

pioneer cases which were under the care of former colleagues, who were amongst the foremost in the treatment of these internal injuries by operation. It was my duty, as well as my privilege, as Resident Assistant Surgeon, to assist Mr. John Croft with his first case of operation for ruptured intestine, his first case of operation and splenectomy for rupture of the spleen (unfortunately not successful); Mr. Mackellar with his operation (the second on record) for ruptured spleen, which possibly failed to be a success because operation could not be performed when first advised; and Sir W. MacCormac with his two successful cases of intra-peritoneal rupture of the urinary bladder.

Before the year of which I speak there are few reliable records of recoveries from these injuries; it is true that in people who were examined *post mortem* cicatrices of limited extent were very occasionally found in the liver and spleen, but the history of their formation was not always to be obtained. Most surgeons willingly admit that some of the less severe ruptures of the solid viscera can and do get well without operation; this is within our own experience, but without operation very many are hopeless, whilst ruptures of the intestines are most deadly. Dr. Le Conte (*Annals of Surgery*, vol. i. 1903, p. 526) quotes Petry as giving a list of 160 cases of ruptured intestine where 93 per cent. died and only 7 per cent. recovered after formation of abscess associated with a fæcal fistula. Other collections give an even higher mortality up to 97 and 98 per cent. Le Conte estimated the operative mortality from this cause as from 50 to 60 per cent. in 1903. Every year has added to our knowledge, and I am inclined to think that the results in life saving are not only better now, but that there is prospect of further improvement. Some of our critics are too apt to forget that we are dealing with patients who are not only suffering from a ruptured bowel or other internal organ, but perhaps from two or more of these injuries, or from a severe crush affecting the chest also, or fracture of the pelvis, ribs, or other bones. Injuries which of themselves would be severe without the one which really offers the greatest danger to life.

To those who think our best results are but meagre, I would recommend a perusal of this part of the reports of a hospital before the commencement of the period of which I am speaking, or a paper in the *Lancet*, on the "Recollections of a Hospital Surgeon," written about 1889.

I have prepared a table (No. 2) which shows the various ways in which some patients were injured before they came under observation, and the particular part on which the stress of the injury fell, and do not consider it necessary to discuss this table, which fully explains itself. It is compiled from records of cases to be found in Hospital Reports, British Journals, and the paper by Messrs. Berry and Guiseppi, in the 'Transactions of the Royal Society of Medicine' for 1909, etc.

It has been recommended that the abdomen should be explored in all cases of severe abdominal injury, and that the question of diagnosis may be left until the parts have been actually exposed by operation. There can be no doubt that the exact lesion or lesions may sometimes be difficult or even impossible to define, but an attempt should be faithfully made to come to a conclusion before the abdomen is opened; an operation should not be done "on the chance," but all the symptoms carefully noted and weighed after a systematic examination of the patient.

If it is possible to ascertain the exact part of the body struck by the force which caused the injury, then one can make an approximate guess as to the organ ruptured, for it is generally lying beneath, between that point and the spine, and incision over this area gives direct access to the damaged structure.

The student should be instructed that in all abdominal injuries it is advisable to follow a certain routine in the examination of the patient. To ascertain when the last meal was taken, when the bladder was emptied, and if the patient was in good health before the accident. To inquire as to the position and extent of pain, and then examine the abdomen carefully for dulness, and see if this is fixed or shifting. By this time he will have found out if there is rigidity of the muscular wall, whether it is general or local, and will know the amount of tenderness, its position, and extent. He should note also the state of the pulse and the temperature.

Further, that the patient should be re-examined nearly every hour, and no morphia given, unless it has been decided to operate, when it is permissible.

I have already, when writing on the subject of traumatic rupture of the intestine without external wound, directed attention to the similarity there is between these injuries and perforations of the intestinal canal which constitute such a large part of the "acute abdomen." In the perforations from disease there is the initial

"peritonism" at the moment of perforation, which corresponds to the injury and the symptoms immediately following the injury, in the case of rupture; the effect of the escape of intestinal contents is much the same in the production of a spreading peritonitis in the two, but the peritonitis in the healthy person appears to be more rapidly fatal; probably in him the fluid containing bacilli is in a more concentrated form as little escapes, whilst the healthy peritoneum is unprepared and unable to cope with the vigour of the invasion. When it is recognised that in about 50 per cent. of these cases there is a period of repose before the development of the more characteristic symptoms, then our house surgeons will treat these patients with the same respect as they do now a man who gives a history of chronic indigestion and a recent acute pain in the stomach.

With regard to the symptoms which may result from rupture of the intestine, there has been much written on the subject by various authors, and it is comparatively easy to take a series of cases and analyse the recorded symptoms in each. The result obtained will be fairly accurate as regards the obvious manifestations of the injury, such as shock, vomiting, pain, and perhaps rigidity, which are common to nearly all injuries in which the viscera are damaged. There is, however, such a difference of opinion between those who examine the abdomen as to (what are to some) comparatively unusual signs, that little reliance can be placed on statements which vary so greatly. Yet these minor symptoms may be most valuable with a clear history, for in all, I repeat, it is important to diagnose the lesion as early as possible, before the onset of peritonitis. I do not propose to reconsider the value of all the individual symptoms in detail. Mr. Berry has done so in the paper to which I have alluded. His conclusions in the main confirm those expressed by Mr. John Croft and Mr. Makins, though founded on a more recent review of the subject. From the practical point of view we need not consider those cases which are admitted with intense shock, from which they never rally, patients in whom there is evidently a gross lesion, but one which it is beyond surgical skill to attempt to remedy, unless it is wished to expel the last remaining spark of life. The others can be arranged in fairly typical groups, as they present themselves clinically.

In the first of these there is shock, vomiting, acute abdominal pain, with great tenderness over the part struck, and board-like

rigidity of the abdominal wall. All these symptoms are present, but they vary somewhat in their intensity; at one time shock is the main thing, at another it is the pain, and so on. With these there should be found a certain amount of localised dulness on percussion. This group forms about 50 per cent. of all cases.

In the second group there is no evident shock, and perhaps the patient walks to the hospital, or goes home, congratulating himself that he has had a "narrow escape"! He may have vomited soon after the accident which made him feel faint, but there are no marks of injury on the abdominal wall, or they are but slight. He has considerable local pain, and there is rigidity of muscle, sometimes confined to the side of the abdomen which was struck. There is tenderness on pressure, and perhaps localised dulness, but the man feels that he will soon get over it, and probably remains under treatment with reluctance, or neglects to call in medical advice on his return home.

In a case which I read before the Pathological Society in 1885, in which there had been extensive laceration of the small intestine, the patient, a man of 25, an ostler, had been kicked by a horse at 5 P.M. the day before admission to hospital. He seemed unable to move for half an hour, but then went on with his work until 6.30 P.M. He had food on reaching home, but vomited it almost immediately, and was restless during the night. However, he returned to work in the morning at 6 o'clock. Was unable to resume his work after a slight breakfast, because of the onset of pain and vomiting. He passed into a state of extreme collapse, and died $27\frac{1}{2}$ hours after the kick. There was an extensive rupture of the small intestine, and peritonitis.

This group forms about 35 per cent. of the total number of cases.

In a third group the symptoms are rather indefinite; there is a history of abdominal injury, probably of the kind which sometimes produces a rupture of the intestine, but the shock is trifling; there is no vomiting, local pain is slight or absent, there is little tenderness, no rigidity of muscle, whilst percussion gives no change in note. After a variable time there may be a rising pulse with that change in facial aspect which indicates to the experienced eye the presence of grave peritoneal inflammation. It may not be easy to say at what moment this commenced, but "a change has taken place." It may develop after an attack of vomiting, as in the case

under the care of the late Mr. Walsham. This surgeon, who was patiently waiting for a definite symptom, in a case of this kind, found a complete change after the patient had vomited, and operating at once, gained a well-merited success. In yet another patient, the onset of serious symptoms may be sudden and unexpected, possibly dependent on the giving way of a portion of contused bowel.

In some instances, especially where there is a definite history of the kick of a horse, it will be judicious to operate at once, as recommended by Mr. Bernard Pitts, without waiting for symptoms.

Should the escape of intestinal contents be very restricted, possibly in consequence of the smallness of the perforation, the symptoms may be limited to occasional sickness, with uneasiness in the abdomen, gradual distension and general tenderness, caused by a slowly extending inflammation of the peritoneum, which may become localised, and result in the formation of an abscess. It must be remembered that meteorism may follow an injury to the abdomen without any rupture of the intestine or internal organ.

A rigid condition of the abdominal muscles is a very important sign, it practically always means serious underlying damage. Cases in which it is present may, in rare instances, recover, but it is a sign which should be regarded as of great value, and in most as an urgent indication for operation. Mr. Croft was the first who compared it to the protective contraction of muscles round an inflamed hip joint. Hartmann has also shown its value.

Dulness on Percussion.—No deduction regarding this sign can be drawn from published cases. In the large majority the condition of the abdomen on percussion is not mentioned, and appreciation of the slighter degrees of abdominal dulness is not universal.

Mr. Bernard Pitts thinks that dulness over the seat of contusion may be caused by collapsed intestine, as a result of the temporary paralysis following the injury. It has been ascribed to escape of intestinal contents; this may be so, but it is rare to find much feculent fluid present when the abdomen is opened soon after an injury, although blood may be found which has come from a rupture of the mesentery or a tear of the omentum. An extensive extravasation of blood under the peritoneum of the anterior abdominal wall will also cause dulness which does not move with alteration of position, but this is a rare complication. If there is a history of

localised contusion, such as that produced by a kick, and in addition to dulness under the part struck there is also fluid in one or both flanks, the mesentery is torn, and whatever the opinion as to state of the gut, the indications for operation are evident—first, to prevent further bleeding, and, secondly, to repair the injury, which may have placed the gut in danger of gangrene by deprivation of its blood supply. When the injury has been less localised, such as that resulting from a fall or from being run over, it is possible that there may be a complication in the shape of rupture of one of the solid viscera in addition to damage of the bowel and its mesentery.

It has been observed that local tenderness is usual, but there may also be a sharp superficial tenderness extending from this towards a dependent part, indicating the direction taken by fluid of great irritative properties, in its course to the flank or the pelvis. In one patient with rupture of the splenic flexure this sign was present, and was caused by the escape of offensive fæcal fluid from the bowel through minute tears in the peritoneum, and its spread down to the pelvis along the inner side of the descending colon, and at the operation some of it was sponged out of the pelvis. A similar tenderness may be found in examples of the recent rupture of a jejunal, or of a stercoral ulcer; it is found sometimes at the margin of a spreading inflammation started by a diseased appendix, and more generally diffused, in acute hæmorrhagic pancreatitis. Even when other symptoms are slight, this alone should indicate caution in prognosis.

There is another symptom which may possess more importance than has hitherto been accorded it, and that is, a marked rise of temperature within a short time of the injury. It was present in one of my patients before the bowel gave way (on the second day); here, 103° was recorded within a few hours of the injury, whilst the usual local signs were still absent. There is probably some absorption through the lymphatics from the lacerated parts of the gut and mesentery, for it is not found in many of the cases in which the opening is of large size and the escape of feculent fluid presumably greater; whilst in the case to which I have alluded, the rupture was a secondary one.

I quite agree with Mr. Berry in his estimate of the uselessness of the loss of liver dulness as a sign of ruptured intestine. It is rarely seen, and if one may judge by published reports of cases, much invaluable time has been lost waiting for it to develop. It does not

require a large amount of gas in the peritoneum to produce this symptom, but the contraction of the injured section of bowel prevents the escape of intestinal contents including gas, the condition of the gut not being quite the same as it is in the perforation from disease.

Emphysema of the sub-peritoneal tissue is met with mostly in cases of rupture of the duodenum during the course of an operation for that lesion, the gas may make its way through the inguinal canals, and distend the scrotal tissues when operation has been delayed. It is also found when the large bowel has been ruptured behind the peritoneum. The crackling which is felt by the fingers in these circumstances may assist in the localisation of the rupture after the peritoneum has been opened. The only cases in which blood was found in the vomit were those in which the duodenum had been ruptured.

It is not advisable to say much about general treatment in these cases of internal injury, no hard-and-fast rule can be laid down. We must be guided by general principles, but are in a very much better position than formerly, because of the recognised usefulness of saline fluid, injected into the subcutaneous tissue, passed into a vein, or allowed to enter the rectum continuously. We must not forget, however, in injuries of the solid viscera that hæmorrhage is the chief danger to life, so that there must be no more delay before the operation to arrest it is carried out, than is absolutely required.

It is recommended by some surgeons that when there is rigidity of the abdominal wall, warm applications should be made to the part, so that if the rigidity is due to injury of the abdominal wall alone, it may have a better chance of passing off, and the patient be saved a possibly useless operation. It is hardly necessary to say that this treatment should not be continued for any great length of time, if there is any possibility of rupture of the intestine, because peritonitis is known to begin within six hours in many of these cases.

I must refer again to the paper by Messrs. Berry and Guiseppi, which possesses unusual value because it is founded on a definite series of cases treated under almost exactly similar conditions as regards surgical aid and nursing of a skilled character. In this it is shown not only that the mortality is less when early operation is performed, but that the best results are obtained when it is done

between 7 and 12 hours after the accident. This is practically the same conclusion as that to which Siegel came, and is explained by the fact that the shock is passing off, and peritonitis is still localised, if it has commenced.

By operation in cases of ruptured intestine is here understood—abdominal section, a search for the injured gut, and its repair by suturing. In some it may be necessary to excise the contused and lacerated part, and perform an anastomosis. The formation of an artificial anus in the small intestine is to be much deprecated. In about 10 per cent. there is more than one lesion; forgetfulness of this fact may lead to serious trouble. The surgeon had better satisfy himself on this point before he begins to apply sutures.

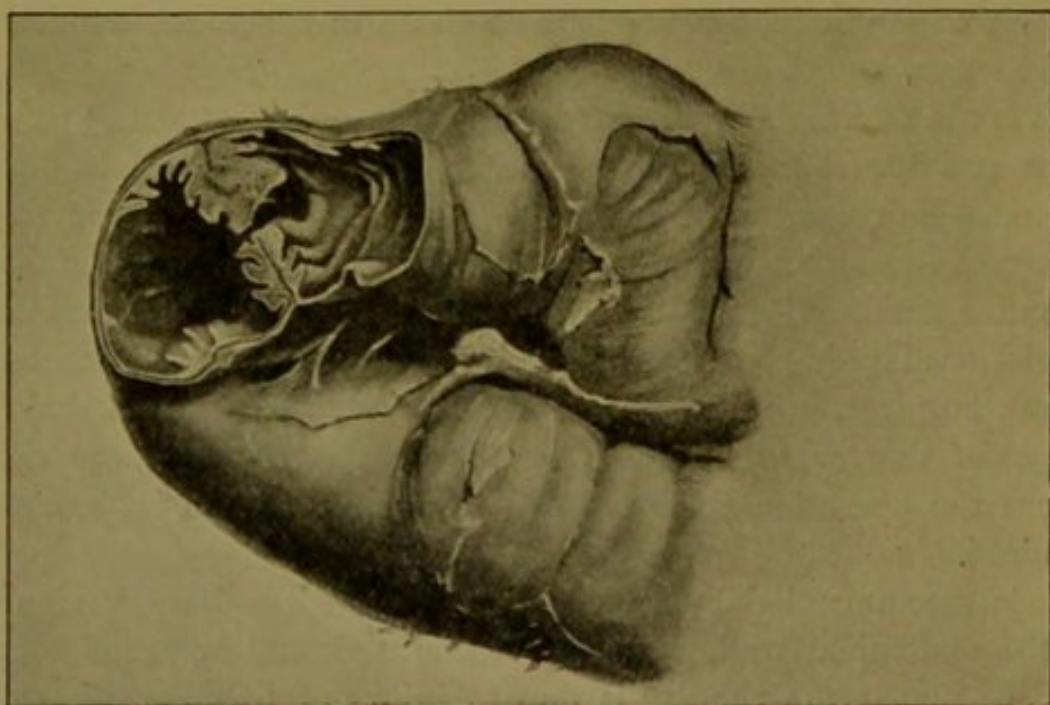


FIG. 1.—The portion of bowel resected in the first case successfully treated (Croft).

It appears to me that some of the more recently published cases of recovery in this branch of surgery have shown an advance in the after-treatment, founded on the principles which guide us in perforative peritonitis. The patient has been placed in the "Fowler position," drainage employed, and saline fluid administered continuously by the rectum. Messrs. G. H. Edington, W. Sheen, and W. G. Nash recorded successes in 1908, whilst last year Dr. Radcliffe introduced the saline into the cæcum after appendicostomy at the rate of two gallons in 24 hours. The effect of this is instructive as the patient recovered, "perspired, passed urine

freely, and at the end of the time had some incontinence, passing fæces with a moderate quantity of saline fluid. Moreover, what was more interesting, there was fluid continuously welling up through Kieth's tube, so that the pad over the tube had to be changed every half hour."

Table No. 3 shows the result as regards actual recoveries, but does not show how many were relieved by operation. In Mr. Croft's first case, the patient died a month later after resection of the artificial anus which had been formed in the first instance. Another patient, also in the series from St. Thomas's, lived for a month, and still another, some six days, dying ultimately from peritonitis due to the giving way of a stitch inserted at the first operation.

The most difficult to treat of all the intestinal ruptures are those of the duodenum, they are accompanied by very much shock, and severe local pain; the lesion is difficult of access, and even difficult to find. I do not know of any successful case so far, if we except those of Messrs. Godwin and Moynihan, which were at or near the duodeno-jejunal junction; where access is easier than it is higher up.

The mortality attending this lesion during the period under review, when the patients are placed under the best conditions, is shown in the table (3). These are all hospital cases—102 operations with 21 recoveries—in these are included all the cases submitted to operation, whether successful or not, and a truer estimate is obtained than can be gained in any other way. Even here the proportion of successes is higher if only the cases for the last ten years are taken.

I have not made a separate heading of rupture of the mesentery, because it is usually a complication of the more severe lesion, rupture of the intestine. The symptoms are also similar, and although a surgeon may be certain there is a laceration of the mesentery, he cannot be certain there is no accompanying lesion of the intestine.

Intra-peritoneal Rupture of the Urinary Bladder.—Intra-peritoneal rupture of the bladder is still a very fatal injury, in spite of the fact that surgeons do not fail to operate whenever the lesion is diagnosed, or there is reason to fear that has occurred. In 1886 Mr. Rivington wrote: "No indubitable case of recovery after intra-peritoneal rupture of the bladder is on record,"

and in the same year Ullman collected 143 cases, and of these only two had recovered. In that year, 1886, Sir W. MacCormac operated successfully in two instances; abdominal section being performed, and the rent in each case sutured. This was nearly 100 years after Benjamin Bell proposed that the abdomen should be opened and the bladder sutured for this injury.

The patient probably presents himself at the hospital with a statement that he has had an injury to the lower part of his stomach; that since that time he has been unable to pass urine, or has done so in small quantities, and that it is blood-stained. I shall always remember the first patient on whom Sir W. MacCormac operated so successfully, the "pioneer case," when he first came to St. Thomas's Hospital:—

Going into the casualty department about noon in the pursuance of my duties as Resident Assistant Surgeon, I found a big, strong, healthy-looking labourer, standing up near the couch readjusting his clothes, whilst the dresser of the week was turning away with a porringer containing urine of normal appearance. He had a No. 8 catheter in his hand. Noticing that the amount of urine which had been drawn off (about $1\frac{1}{2}$ oz.) was small in quantity for a man of his appearance applying for relief of retention, whilst the size of the catheter suggested the absence of stricture of the urethra, I made a few enquiries, and learned that the patient had not been able to pass urine since the previous evening, when running after his boy, he had hurt himself against a post in the alley. Throughout the night the abdominal pain had been severe; he had wandered about his room, whilst his frequent efforts to pass urine had failed absolutely. He partly undressed and laid down again upon the couch for examination. Percussion showed the presence of such a large quantity of free fluid in the peritoneum, that in the absence of symptoms of hæmorrhage it could only be urine which had escaped through a rent in the peritoneal part of the bladder. The abdomen was rather distended. A catheter was again passed in the ward, and 95 oz. of urine escaped through it; it was obvious that this quantity could not have been retained in the bladder, and renewed examination of the abdomen now showed great diminution in the amount of free fluid. The rent in the bladder measured four inches in length.

I have dwelt on this change in the dulness found in the abdomen after an instrument has been passed, and fluid withdrawn by it,

because it has not received attention adequate to its value as an aid in diagnosis. Another useful sign would be a contracted state of the bladder, rendering movements of the catheter difficult, whilst perhaps only an ounce or two of blood-stained fluid came away.

Of intra-peritoneal rupture of the bladder it must also be remarked, that shock is most unreliable as a symptom: in Sir W. MacCormac's second case, the patient, a heavy man, who had fallen from a height of 20 feet in a sitting position, presented no appearance of shock and so few signs of injury that the house surgeon, a most able and careful man, did not find justification for his admission until he applied again on the following day. This is all the more interesting, as this house surgeon had been on duty with the first case. Yet the rent in the bladder was two inches long.

The result of injection of sterilised saline in measured amount into the bladder, which is allowed to flow out again, may be tried, but the forcing of air into the peritoneum may give a serious addition to any shock already present, and nothing is gained by it. In the majority there will soon be rigidity of the lower abdominal muscles, followed by the symptoms of peritonitis. At times these symptoms are delayed. Dr. Quick's case, which was successfully operated on by Dr. Thompson on the 11th day, is an extreme proof of this. Dr. Quick's patient performed his work as a labourer an entire day after the accident incurred during intoxication, and was not compelled to take to his bed until the second day was well advanced. Here, the laceration admitted the end of a thumb.

The symptoms of peritonitis may be very insidious in their onset, and in this class of case more than in any other, the pulse will prove an invaluable guide. Failing strength, rapid pulse, and later, vomiting, may be the only symptoms of extensive mischief. Ashurst states that amongst the patients who were intoxicated at the time of the accident the mortality was over 43 per cent., whilst amongst the sober it was less than 28 per cent.

Operation is the only treatment permissible; this must consist of coeliotomy, with cleansing of the peritoneum, and in the opinion of most authorities the application of sutures, which must not penetrate the mucous membrane. It has recently been suggested that a plug should be placed over the laceration in the bladder without suturing of the rupture, and the pelvis drained through a suprapubic opening. There may be instances when this would be

the only available procedure on account of the desperate state of the patient, and it has been successfully employed.

Intra-peritoneal Rupture of the Urinary Bladder.

- 1886. Ullman, 143 cases with two recoveries.
- 1901. Alexander and Jones, 54. (Before 1893, a mortality of 63·5 per cent. after 32 operations; between 1893 and 1903, a mortality of 27·5 per cent. after 22 operations.)
- 1906. Ashurst, 110, between 1893 and 1903, a mortality of 42·72 per cent.
- 1907. Quick, 29, between 1893 and 1903, a mortality of 24·1 per cent.

Rupture of the Spleen.—Rupture of the spleen is mostly met with in malarious districts, where it is so commonly diseased; it may also occur during the course of an attack of typhoid fever. In this country it is nearly always the result of a severe injury, and none of the recorded cases of operation have been for rupture of a diseased spleen, so far as could be ascertained by the naked eye. In one instance which Dr. Wheen has found, in our medical publications, there was evidence of disease of the blood on examination.

We cannot enter to any extent into consideration of rupture of the diseased spleen, for although it would be interesting, it would be chiefly so from a medico-legal point of view. Much of interest on this subject can be found in papers by Dr. D. G. Crawford, in the 'Indian Medical Gazette' (1902 and 1906). Some of the accounts given by medical men in charge of hospitals in tropical countries, or by those attending hospitals where patients are admitted from malarious districts, are quite startling. A patient with a large spleen, "turns in bed," is playfully "dug in the ribs" by a jocular friend, someone throws a grain of mustard seed at him, or flicks him with a cane, and death ensues in a period of time measured by minutes. Playfair gives seven to eight minutes as the average duration of life, after rupture of a malarial spleen, and the late Surgeon-General Coull-Mackenzie said that 68·9 per cent. of his cases died under half an hour. If the abdomen is examined after death, it is found to be flooded with blood, as if the sac of an aneurism of the abdominal aorta had burst into the peritoneum. There is rarely time for more than a guess as to the cause of the

symptoms—none for treatment. Rarely is the rupture of a malarial spleen survived even for a few days.

Dr. White Hopkins, who spent some years in Sarawak, has kindly permitted me to show you a weapon which I have called the "lethal cross," but the real name of which is "larang" (meaning forbidden) in Malay. It is used by the Chinese only in Southern China, and generally in the Malayan countries and islands, Malay States, Java, Sumatra, Celebes, etc. The weapon is unknown in Northern China for the reason that an enlarged spleen is not so plentiful as in the southern or tropical portion, fig. 2. It is heavy and made of an iron bar 16 inches long, with a cross piece, the ends of which turn towards the point. The blunt end terminates in a nut which gives it a knobbed appearance. The longer part, beyond the cross, is carried up the sleeve, so that the deadly blow is

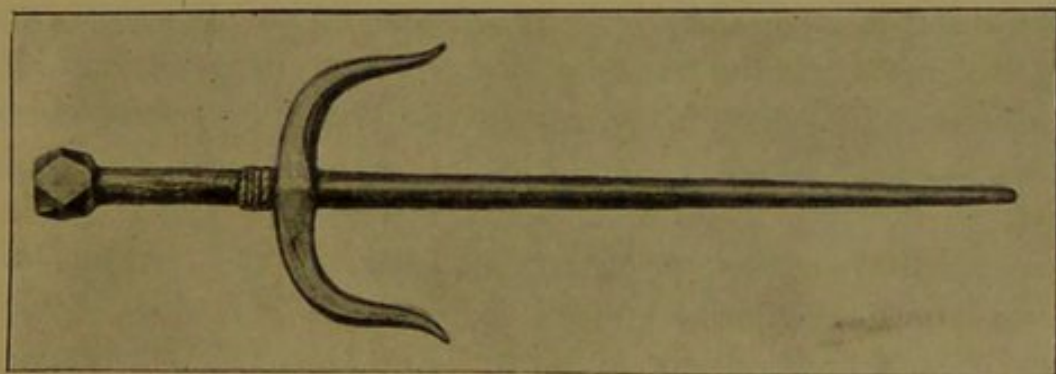


FIG. 2.

struck by the shorter and thicker end. It is carried with the shaft up the arm of a long sleeve, clutched between the second and third fingers at the cross, leaving the knob extending. It cannot be seen in consequence of the size and shape of the sleeve. The Chinaman waits for his victim at night, and accosting him, deals him a sudden and unexpected blow in the abdomen, not being particular as to the exact part which he strikes. The victim without a groan falls dead on the spot. His pockets are rifled, and nothing more is known of his assailant.

Dr. White Hopkins adds, "from my experience in Sarawak, an enlarged spleen amongst the Chinese is found in about 90 per cent. I would go further, and say that every Chinaman has an enlarged spleen. But the ratio of enlargement would be as follows:—The whole of the abdomen involved with a hard nodulous enlargement would be 60 per cent., perhaps more; a partial enlargement,

occupying three-quarters of the abdomen, would be about 25 per cent., and the remainder, from a half to a quarter enlargement." If a Chinaman is found with a larang upon him he is at once tried and imprisoned, because it is known what intention he has. It is rarely found, except in the case of intoxication, or the finding of a Chinaman in close proximity to a dead man.

I do not know of any other instance in the history of the peoples of the world, in which advantage has been taken by the criminal of the pathological opportunities of the district in which he lives.

Rupture of a normal spleen is found as the result of considerable violence, and is met with clinically under two conditions. From its position under the shelter of the ribs, where it is well guarded in the adult, it is a comparatively rare injury. It is not surprising to find that amongst the published cases there is an unduly large proportion of young people, whose ribs are more elastic and yielding, no less than 15 out of 23 being under 20 years of age, nearly all of whom were "run over" in the streets. It was formerly held that there must be adhesions between the spleen and diaphragm before rupture can take place, but this theory has been disproved in recent years. Every rupture of this organ is not fatal, healed cicatrices have been found during necropsies by Ayres, Neville Jackson, D'Arcy Power, and others. There are some cases in which life is said to have been much prolonged after this injury, but unfortunately, the condition of the abdomen, as given in the report, does not always carry conviction that the diagnosis was correct. Statistics are, therefore, of little value, but Edler computed the mortality at 82.3 per cent. in the uncomplicated cases.

The symptoms produced by this injury may be immediate and alarming, or they may be delayed in their development. Barrallier summed them up in these words: "*péritonisme*," "*l'hémorrhagie*," "*syncopie*," but probably referred to the rupture of a malarial spleen. Rupture of the malarial spleen may be compared to the rupture of an aneurysm, and that of a normal spleen to the wound of a large artery.

The amount of shock varies very considerably when a healthy spleen has been ruptured, and does not help in the diagnosis, but I am inclined to think it greater when the spleen,

rather than when the liver, has been ruptured, unless the laceration of the latter is deep or extensive. There may be no local evidence of contusion, but if the injury was to the splenic region, more especially if the overlying ribs are broken, then the great probability is that the spleen has been torn.

Pain may be severe, but on the other hand it may be absent, and there may even be no tenderness. The chief reliance must be placed on the presence of blood in the peritoneal cavity soon after an injury, and the general effect of the loss of this blood on the patient. It is strange that in so many of the recorded examples of rupture of the spleen, there is no statement as to the presence or absence of dulness in the abdomen during the progress of the case or, in fact, any note to show that those in charge were aware of the very large accumulations of blood which were revealed at the *post-mortem* examinations. In one or two cases, in which operation was performed abroad, it is stated there was no dulness, and a paragraph or so later on, that a great deal of blood escaped when the peritoneum was incised. In ruptured spleen, there is the shifting dulness of the effused blood, whilst the immediate neighbourhood is occupied by a fixed clot which gives the impression of an increase in size of that organ. All these cases should be closely observed and frequently examined, and operation performed, if there is rapid increase of the effusion or of the symptoms of loss of blood.

Many of the successful cases have presented a less urgent group of symptoms, there being apparently a smaller amount of intra-peritoneal hæmorrhage at the commencement, but occasional recurrences during the following days, by any one of which the state of the patient may be rendered precarious.

The clotting of the blood in and around the laceration appears to close the vessels for a time, but secondary hæmorrhage has been known to prove fatal three weeks after the accident.

If the patient survives, and no relief is afforded during the first day or two, to the other abdominal signs and those depending on loss of blood are not infrequently added increasing distension, vomiting, pain, restlessness, and other symptoms of peritonitis, which has for many years been known to follow large effusions of blood into the peritoneum.

It is advisable in these cases to remove the spleen, and empty the

peritoneum of the blood which has invaded it, through an incision over the left upper abdomen. The use of a plug of gauze is sometimes useful, but with such a soft vascular organ, efficient pressure may produce sloughing. In one case, read before the Clinical Society, that of a big heavy man, where the spleen was very adherent to the diaphragm, I passed a ligature round the splenic vessels and so arrested the hæmorrhage. Saline infusion was most useful in this case, but he only survived operation four days. Dr. Wheen has tabulated the successful cases of excision for this injury, done by British surgeons, and it is interesting to find that a recent President of the Medical Society, Mr. C. A. Ballance, not only obtained the first operative success, but has the credit of 3 out of the 23 recoveries which have been published in this country.

It is worthy of note that, in the examples of ruptured spleen during the course of typhoid fever, operation has mostly been performed for supposed perforation of the small intestine. A laparotomy of the lower abdomen having been first performed, and then a second incision made over the spleen, when it was found to be the source of the symptoms.

Rupture of the liver is an extremely fatal accident, and the symptoms which ensue are usually marked and serious. Shock is present, frequently passing into collapse and death. Short of this there are vomiting, rapid pulse and respiration, pallor, etc. In this accident rigidity of the abdominal wall is very evident, so that it may appear board-like. Tenderness becomes localised to the hepatic region, and there is shifting dulness in the flanks with the ordinary symptoms of loss of blood, according to the amount of it which is effused; the man becoming restless with a rapid weak pulse, sighing respiration, and what is called "air hunger." Jaundice may be a late symptom, and is therefore of no use in the *early* diagnosis, which is so very important.

There is, as might be expected, much variation in the size of the rupture, which is usually on the convex surface of the right lobe; the combined statistics of Mayer and Ogston give 3 right lobe to 1 left lobe as the proportions.

Shock in this injury may not be evident when the patient first comes under observation.

When leaving the Royal Free Hospital some years ago, I saw a woman of 59 brought in, who had been run over in the street a few minutes earlier.

She was excited, and resented examination. There was no mark on the abdomen, no dulness in the flanks, or rigidity of the muscles. It was difficult for us to induce her to remain in the hospital, yet three hours later the abdomen was full of blood, and she did not survive operation to arrest the bleeding for very long. The liver was extensively torn, and the kidney showed a recent laceration; there were other injuries also.

The records of cases which are published give no reason for thinking that there is any special disease of the liver that predisposes to rupture, although it is stated by a Russian veterinary surgeon, Dr. Grymer, that rupture of a lardaceous liver is a comparatively frequent cause of death in horses. Hæmorrhage is the most common cause of a fatal ending, yet Dr. Homer Gage considered that 14 per cent. proved fatal from peritonitis, caused by the continued presence of blood in the peritoneum. Dr. Hogarth Pringle, who contributed a paper to the 'Annals of Surgery' (a paper which is full of interest to the surgeon) on traumatic hepatic hæmorrhage, considers that, if the severe cases are to be got through at all, the operation must be an immediate one for the majority. That some of these cases can be saved is shown by the statistics of Ferrier and Auvray, and by the cases which are published in the literature of this country, though these are few in number. He suggests that when the peritoneum is opened, the hepatic and portal vessels should be immediately grasped with finger and thumb, and held by an assistant whilst the effused blood is cleared from the peritoneal cavity and the necessary manipulations are carried out on the liver. He has practised this in two cases, and says that perfect control of the bleeding areas of the liver was obtained and a clear field for operating.

There can be no doubt that at the operation the first thing is to arrest the hæmorrhage, which appears to increase directly the peritoneum is opened. In these cases the incision should be a large one, the operator quick and decided in his movements, and the immediate arrest of hæmorrhage the first care. There is a difference of opinion as to whether the laceration should be closed by means of suture, or whether the surgeon should be satisfied with the careful plugging of the laceration from which the hæmorrhage comes. Dr. Hubbard recommends that in some instances the packing of the wound shall be done through the pleura, after a flap has been made from the chest wall.

If the hæmorrhage from the area affected has been placed under effective control, the application of sutures by means of the blunt and pliable needle may be possible, but everything depends on the condition of the patient.

A consideration of this subject would be incomplete without mention of ruptures of the biliary passages which occasionally follow an abdominal injury, as when patients have been run over or kicked on the stomach in the hepatic region. At first there is usually shock with faintness, perhaps local pain and vomiting, and a slow accumulation of bile takes place in the peritoneal cavity, with production of limiting peritonitis and the deposit of much plastic lymph. Jaundice may appear early or late, and bile is absent from the fæces. There is no indication for immediate operation, and when operation is performed, it is usually for the evacuation of the fluid which has accumulated on the right side of the abdomen. The abdomen is asymmetrical, for the bile is never generally diffused in the peritoneum. Only one example of this injury has come under my immediate care, and in this the impression given by the slowly increasing collection of fluid was that it was very heavy. Possibly this may have been due to the fact that the patient preferred to lie over on the right side and could not be induced to lie on the back. In this case, also, wasting, abdominal distension, and jaundice were symptoms, and cœliotomy did not do much, if anything, to relieve. The opening in the common duct can very rarely be found, and most of the patients who have recovered have been treated by tapping, which has been repeated on more than one occasion; but if it is considered best to incise the peritoneum, it may be possible to suture the duct at least partially, if it can be found.

Henlin is said to have recommended abdominal section in these cases in 1767.

Erhardt's experiments are of interest as showing the effect of the bacillus coli (which is present in the common bile duct) on the peritoneum, when mixed with the bile after its escape from the biliary passages, both in the production of a plastic peritonitis and the prevention of cholœmia.

In conclusion, I would suggest that all these cases of intra-peritoneal injury should be examined at intervals for some weeks after they have apparently recovered.

It is not my intention to say anything about the secondary consequences of these injuries as they manifest themselves in later

life, when no operation has been performed ; it is, however, a subject of much interest.

Mortality after Rupture of the Liver.

Mayer	Out of 207 cases, 86·6 per cent. fatal.
Edler (1887)	...	„ 547	„ 85·0 „
Fraenkel	...	„ 31	„ 45·0 „
Tilton (1905)	...	„ 25	„ 62·5 „

Thöle-Dantzig gives the mortality after operation—

If performed during the first 12 hours, 55 per cent.

If performed during the second 12 hours, 67 per cent.

Beyond, 78 per cent.

CASES OF RUPTURE OF INTESTINE WITHOUT

No.	Year.	Reference.	Age.	Time after injury.	Special Symptoms.
1	1888	Atkinson, 'Lancet,' vol. i, p. 1295.	28	Struck table in falling; 1 hour.	Collapse; retracted; some dulness; not much pain; no rigidity; 6 hours after acute sy.; rigid; operation 10 hours after.
2	1890	W. Cheyne, 'Brit. Med. Jour.,' April, 1890.	18	Struck by coster's barrow.	Walked a mile; great pain but little tenderness at first; peritonitis.
3	1891	W. A. Lane, 'Med. Press and Circ.,' 1891, vol. ii, p. 181.	35	Pole of wagon ...	Abdomen very tender; rigid; pale; collapsed; sweating; slight bruise.
4	1894	Thelwall Thomas, 'Brit. Med. Jour.,' 1894, vol. i, p. 1355.	55	24 hours; struck herself while carrying.	Immediate vomiting and severe pain; distended and very tender; rigid.
5	1895	Alexis Thomson, 'Ed. Hospital Reports.'	18	Kick from horse before breakfast; 4 hours.	Collapsed; intense pain and vomiting; no visible bruising; belly prominent and very tender; tympanic; dull towards pubes.
6	1899	Walsham, 'Lancet,' vol. i, p. 26.	13	2½ hours; run over	Collapse marked; not hard or very tender; after vomiting hard and board-like and pain intense; pulse 100.
7	1899	Nash, 'Dub. J. M. Sc.,' p. 138.	27	Fall on bar; 17½ hours.	Stomach full; tympe. much distended; liver dulness nearly gone; very tender; 101°; much wind.
8	1899	Knaggs, 'Lancet,' 1904, vol. i, p. 832.	21	Run over by bus ...	Some collapse; duodeno-jejunal junction; next morning collapse with peritonitis.
9	1900	" "	13	Wall fell on her; 35 hours.	Pain and rigidity developed
10	1901	Moynihan, 'Brit. Med. Jour.,' 1901, vol. i, p. 1136.	6	Cause not stated; duration?	Collapse; incr. fluid
11	1903	Burrows, 'Lancet,' 1905, vol. i, p. 424.	9	Run over; 24 to 26 hours.	Walked home; examined; no trace of serious injury; vomiting and pain soon came on, at operation; rigid; tender; p. 128; tympe. liver note; moderate distension.
12	1904	Mole, 'Bristol Med.-Chir. Jour.,' p. 38.	35	Struck by pole of swing-boat; 4 hours.	No food for 8 hours; collapsed; hard; tender; vomiting.
13	1905	Webb-Jones, 'Lancet,' 1905, vol. i, p. 569.	11	Struck by swing; 22 hours.	Great pain; rapid pulse. In 18 hours; restless; vomiting; anxious; tender; rigid; 140 pulse.
14	1905	Godwin, 'Lancet,' vol. ii, p. 1108.	42	Run over	No shock; walked into ward; pain; in 6 hours more pain; vomiting; loss of liver dulness; rigid; tender; slight dulness in flanks.
15	1906	Mole, 'Bristol Med.-Chir. Jour.,' p. 34.	16	Struck by arm of crane; 6 hours.	Some shock; rigid; rising pulse, 136; no vomiting; ? internal hæmorrhage.
16	1908	G. H. Edington, 'Glas. Med. Jour.,' December, 1908.	12	Crushed	Fell and vomited; lay on sofa 5½ hours; bandage; severe pain and vomiting; no food for 5 hours; slight distension; operation put off till 10½ hours after; now abd. board-like and patient restless.
17	1908	W. Sheen, 'Brit. Med. Jour.,' 1908, vol. i, p. 1288.	55	Struck a handle ...	Continued work for half an hour; fainted; severe pain 3 hours' time; tender; bowels acted; very hard; general pain; operation 43½ hours; frequent vomiting, &c.
18	1908	" "	28	Bicycle	G. p.; travelled following day from Bristol to Cardiff...
19	1908	" "	40	Crushed	Operation 14 hours, directly seen
20	1908	W. G. Nash, 'Lancet,' 1909, vol. ii, p. 268.	14	Kick from horse ...	Pale, sweat, vomiting; examined 10 hours later; p. 138; very rigid; flanks dull; pain; operation 12 hours; no food for 3 hours.
21	1909	Dr. Radcliffe, 'Lancet,' 1909, vol. ii, p. 1027.	33	Blow from end of plank.	Could not walk far; board-like abd.; scaphoid, hard; much pain; very tender and vomited; operation 7 hours.

* Says two others under Colleagues recovered. ? ileum.

INTERNAL WOUND. (BRITISH JOURNALS.)

Lesion and situation, &c.	Treatment.	Result.	Remarks.
Cecum; surrounding ecchymosis ...	Sutured chc.-gut; drainage	D.	Lived 3 days; Gen. p.
Cecum	Laparotomy; artificial anus.	D.	Lived 9 hours.
Small intestine; two ruptures; $\frac{1}{2}$ inch hole in mesentery.	Resection end to end; union	D.	Third day.
Strid serum, &c., small gut—? ileum	Suture, green catgut; drainage.	C.	Explored for hernia.
Ileum, 3 ft. from valve; small rent of mesentery; another, 5 ft. from valve.	Suture and drainage ...	C.	Fluid and gas in p.; had no foul smell; operation lasted 1 hour.
Ileum	Sutures	C.	Waited until 11 p.m. for sy.
Cecum high up; gut near greatly dilated.	Sutures; no drainage ...	D.	Peritonitis and paralysis of gut; reopened.
Sutured c. with difficulty, rent 1 inch long; peas, &c., in abdominal cavity.	Double cont. Lemb. ...	D.	Shock, 1 hour.
Small gut, much feculent fluid; hole size of pea.	Suture; drainage	C.	Two years later infected abscess.
Complete rupture of duodeno jejunal anastomosis.	Jejunum implanted into stomach; duodenum closed; Murphy's button.	C.	Died 104th day after operation from perforation of duodenum by Murphy's button.
Fuse peritonitis and gas; jejunum 1 ft. from wound; almost complete division; bile.	Circ. suture; no drainage.	D.	Peritonitis.
Cecum	Suture	C.	
Sigmoid flexure	Double layer; drainage ...	C.	
Jejunum and jejunum. Omentum torn, much contusion; undigested food in peritoneum.	Suture; lavage; drainage	C.	Serous discharge for a few days.
Cecum complete	Circ. suture	C.	Wound of mesentery.
Ileum brown fluid; no faecal odour; almost complete rupture with tear of mesent.	Suture of ends; saline p. rect.; latl. anastomosis; drainage wide tube; Fowler position.	C.	
Transverse ac. p.; hole in sigmoid flex; feces coming out; median incision difficult to find.	Double suture and irrigation; faecal fistula above ileocaecal valve c. tube.	C.	B. acted both ways; fistula closed later.
Cecum and g. p.	Tube tied in	D.	Died very soon.
Small intestine lying loose for 4 inches; mesent. torn; much blood; rectus muscle ruptured	End to end	D.	7 hours.
Cecum	Double layer of suture drainage.	C.	Continuous saline, 10 pints in 22 hours.
Jejunum 2 feet from duoden. deeply congested; brown fluid, gas, amph.	Suture cont. Lemb.; appendicostomy.	C.	Drainage of pelvis; second incision, altogether 3 incisions; 2 gallons in 24 hours; faecal fistula.

TABLE

CASES OPERATED ON AT SOME OF THE OTHER LONDON HOSPITALS SINCE

Year.	Reference.	Age.	Duration.	Special Symptoms.
1907	University College Hospital.	27	Struck by iron girder swung by crane
1908	Charters Symonds, Guy's, unpublished	29	Kick	Vomited at once. T. 96°, R. 64, on admission. Vomited a little all night. Rigid l. rectus. Operation 18½ hours after.
1909	Sir A. Fripp, Guy's, unpublished.	24	Tail-board fell on him, crushing him against a wall.	Shock followed by distension. Vomited 3 d.; improved for a week; then symptoms of obstruction; vomited again; incisions.
1909	St. Bartholomew's Register.	32	Kick of horse, 13 hours	Wandering about; immediate operation
1910	Sir A. Fripp, Guy's Hospital.	9	Crushed	Rigid abdomen; colicky pains; rising pulse; operation 14 hours.

CASES FROM ST. THOMAS'S HOSPITAL IN ADDITION TO

1878	St. Thomas's Hospital Reports.	34	18½ hours; jumped upon.	Walked to hospital; severe local pain; vomiting; rigidity; some dulness over part injured; T. 103° before operation.
1889	..	13	15 hours; kick from horse.	Fainting followed by pain; vomiting; rigidity of muscles; slight dulness in left loin; T. 103·6° before operation.
1890	..	8	23½ hours; fall on anvil from height 12 feet.
1891	..	61	24 hours; crush ...	Shock, slight; rigid only at first; vomiting in 21 hours.
1891	..	23	14½ hours; kick from horse.	Much collapse; very rigid; tender abdomen; vomited in 8 hours; T. 101° after 8 hours; starved.
1892	..	64	7 hours; falling box struck him.

CASES OF OPERATION FOR RUPTURE OF THE LIVER

1904	Monsarrat, 'Lancet,' 1905, vol. i, p. 794.	28	Crushed	Great pain; pallid; abdomen distended, painful and resistant; dulness in left flank. On admission, agonising pain across the back.
1906	Smith, S., 'Bristol Med. Clin. Jour.,' p. 240.	14	Fell on kerb	Liver pain; conscious; pale; looking very ill; 2 days later abdomen rigid and tender; no increased dulness.
1907	Edmunds, A., 'Med. Press and Circ.,' vol. i, p. 204.	7	Fall in road; hanging on cart.	Slightly collapsed; no symptoms on third evening; pale; R. hurried; P. rapid; abdomen becoming distended; L. dulness gone
1906	Solly, E., 'Brit. Med. Jour.,' vol. ii, p. 198.	14	Ran into cart when riding bicycle.	Pain and vomiting; no abnormal dulness; 4 hours later dulness in hypog. and some distension.

—continued.

THE PUBLICATION OF THE LIST BY MESSRS. BERRY AND GUISEPPI.

Lesion and situation, &c.	Treatment.	Result.	Remarks.
Jejunum; also of liver	Enterectomy; plugged ...	D.	Died 19 days after accident. Fæcal fistula formed, so no evident discovery of the ruptured gut.
Jejunum; undigested food present in peritoneal cavity.	Washed with saline; no drainage.	C.	Vomited 4 days.
Jejunum	Adhesions separated ...	D.	G. p.; blood-stained fluid.
Cæcum—partial rupture (peritoneal and muscular coats only); adherent loop kinked and obstructed.	Lat. anast; no drainage ...	D.	Lived 12 hours.
Jejunum; opening size of threepenny bit; large amount of thin fluid; nearly general peritonitis.	Purse-string catgut suture; drainage, wound and in loins.	C.	

THOSE RECORDED BY MESSRS. BERRY AND GUISEPPI.

Cæcum; commencing peritonitis; mesentery and omentum torn.	1st, artificial anus; lavage prolonged operation. 2nd, resection; enterorraphy 4 weeks later.	D.	Rapid wasting; exhaustion, &c.; suturing good.
Cæcum; local peritonitis, with matting of gut.	Resection; circular enterorraphy; suture of mesentery; excision of piece of omentum.	C.	Importance attached to rigidity of muscles.
Cæcum	Resection; circular enterorraphy.	D.	Sutures gone; general peritonitis.
Cæcum; faeces in hernial sac	Exploration	D.	Collapse; general peritonitis.
Transverse colon, small opening; confusion of omentum.	Suture, lavage	D.	Collapse; no peritonitis.
Jejunum	No operation	D.	

WHICH WERE SUCCESSFUL—FROM BRITISH LITERATURE.

Rupture of left kidney; liver; anterior smf.; 4 inches in length.	Laceration packed; peritoneum cleansed; kidney sutured.	C.	Gauze removed next day; agonising pain in lumbar region; signs of free fluid.
Small rupture; bleeding ceased; some free blood.	Blood removed; Liver sutured.	C.	Rupture of liver, ? also of pancreas.
Large free blood—furious gush from rt. hyp.; tear towards post smf. of L.	Incision post rect.; packed quickly and done firmly.	C.	Incision also at right angles; packing removed 5th day.
Large quantity of free blood; 2 large rents in the l. lobe.	Washed sterilized saline; gauze; 4 sutures each rent; drainage in pelvis.	C.	Pelvic drainage removed next day.

TABLE I—continued.
SUCCESSFUL CASES OF SPLENECTOMY FOR TRAUMATIC RUPTURE. (BRITISH ISLES.)

Date.	Surgeon.	Age	Sex.	Nature of injury.	Operation.	Result.	Remarks.
1895	Ballance, C. A. ...	10	M.	Struck by cricket ball 5 days before	Spl en e c t o m y. Spleen exten- sively ruptured.	Recovery...	Splenisculus left behind.
1895	Ballance, C. A. ...	45	F.	Run over by hansom cab	Spl en e c t o m y	"	Both radii fractured. Blood in urine on admission. Splenic colon greatly bruised.
1895	Pitts, B. ...	36	M.	Fell 7 feet, striking side	"	"	
1897	Ballance, C. A. ...	14	"	Fell 10 feet on to stones	"	"	
1893	Morison, R. ...	16	"	Bicycle accident; abdomen crushed against handle bar.	"	"	
1899	Bolton, P. ...	12	"	Horse stepped on left side of abdomen.	"	"	
1899	Heaton ...	9	"	Wheel of cart passed over abdomen	"	"	Only one-third of spleen attached to gastro-splenic omentum, the other two-thirds lying in abdominal cavity in little pieces. A large intussusception of splenic flexure of colon exposed and reduced.
1901	Brewer ...	14	"	Fell over the handle bar of bicycle on to a rock.	Rent in spleen from top to bottom. Packed to control furious hæmorrhage.	"	Third morning, peritonitis. Abdomen washed out.
1902	Beaumont, J. ...	17	"	Wheel of cart passed over abdomen	Spl en e c t o m y	"	Fractured left olecranon, and scalp wound in addition.
1902	Sheild, M. ...	25	"	Thrown from horse	"	"	
1902	Keetley, C. B. ...	25	F.	Run over by van	"	"	Taken to hospital, but sent away as there was no sign of injury. Later in day taken to hospital with abdominal pain. Spleen found torn horizontally, but not involving hilum. Little blood in peritoneum.
1904	Burrows, H. ...	4	"	Knocked down by a horse	"	"	Developed sterile effusion into left pleural cavity after operation.
1905	English, C. ...	47	"	Struck side against table	"	"	Fractured left femur.
1906	Simpson ...	27	M.	Fell 20 feet	"	"	
1906	Harrison ...	16	"	Fell 8 feet and struck side on plank	"	"	
1907	Miles ...	38	"	Blow on abdomen	"	"	Right lobe of liver torn (rent $1 \times 1\frac{1}{4}$ inch). Stitched with catgut.
1907	Ray ...	19	"	Kick by horse	Tamponage for rent in spleen. Single rent of $1\frac{1}{2}$ inch.	"	
1907	Roughton	7	F.	Run over by van	Spl en e c t o m y	"	
1907	Legg ...	12	"	Fell and struck side on kerbstone	"	"	
1908	Gerrard ...	33	M.	"Kick" ...	"	"	Spleen not enlarged macroscopically, but "crescents" found in blood.
1908	Alexander	34	"	Fell on abdomen whilst "drunk"	"	"	
1909	Rendle ...	11	"	Fell 10 feet on to a large stone	"	"	
1909	D'Arcy Power ...	7	"	Fell 10 feet on to a large stone ?	"	"	Some "bruising" of liver as well.

CASES (BRITISH ISLES) OF LAPAROTOMY FOR RUPTURED (TRAUMATIC) URINARY BLADDER (INTRAPERITONEAL).

Date.	Surgeon.	Age.	Sex.	Nature of injury.	Condition of bladder (and other injury).	Operation.	Result.	Remarks.
1886	MacCormac	33	M.	"Run against post"	4-inch rent	Sutured	Recovered.	Death 7 hours after operation from hæmorrhage from incision into peritoneum for exploration purposes previous to laparotomy.
1886	MacCormac	37	"	"Fell in sitting posture"	Rent of 2 inches	"	"	
1887	Teale...	25	"	"Kicked in abdomen"	1-inch rent	"	"	
1887	Holmes	24	"	"Kick on abdomen"	2-inch rent	"	Recovered.	Died 4 days later of pneumonia. Recovery.
1887	Walsham	22	"	"Blow on abdomen"	Rent 1½ inches long	"	"	
1889	Morrison	25	"	Distended cystic bladder gave way. ? trauma.	½-inch hole in summit of bladder.	"	Died 4 days after.	
1892	Lane, W. A.	37	"	Run over by wagon	1½-inch rent. Fractured pelvis.	"	Died 4 days later of pneumonia.	After developing signs of uræmia and pulling wound open and exposing intestines. Suprapubic drain; extra-peritoneal rupture also.
1894	Murphy	24	"	Run over by horse	"Bladder split apex to trigone."	"	Recovery.	
1895	Walsham	38	"	Man fell across patient's abdomen.	2½-inch tear	"	"	
1896	Heaton	28	F.	Fell on to abdomen	3½-inch rent	"	"	After developing signs of uræmia and pulling wound open and exposing intestines. Suprapubic drain; extra-peritoneal rupture also.
1898	Littlewood	28	M.	"Fall"	1½-inch rent	"	"	
1898	Dalziel	20	"	Horse fell on abdomen	Tear of bladder (intraperitoneal), and also involving prostate and base of bladder.	Rent of bladder sutured to skin opening.	"	
1900	Bloomer	35	"	Fell on to kerbstone	Rent in bladder admitted two fingers.	Sutured	"	After developing signs of uræmia and pulling wound open and exposing intestines. Suprapubic drain; extra-peritoneal rupture also.
1900	Alexander	33	"	Blow on abdomen	3½-inch rent	"	"	
1903	Daly	33	"	Felt severe pain after carrying a weight. ? drunk at the time. ? trauma.	Rent admitted one finger.	"	"	
1903	Marnock	52	"	Fell on steps. Operation 24 hours later.	Small tear in median line.	"	"	After developing signs of uræmia and pulling wound open and exposing intestines. Suprapubic drain; extra-peritoneal rupture also.
1903	Robinson, H. B.	5	F.	Wheel passed over abdomen.	In addition to intraperitoneal rupture there was separation of R. os pubis epiphysis.	"	"	
1904	Grimsdale	26	"	During first stage of labour. (No trauma.)	Small hole surrounded by bruised area.	"	"	
1905	Murray	23	M.	Kicked at football	2-inch rent	"	"	After developing signs of uræmia and pulling wound open and exposing intestines. Suprapubic drain; extra-peritoneal rupture also.
1905	Murray	50	"	Drunk. No history of trauma obtained.	1½-inch rent	"	"	
1906	Murray	24	"	Kick on abdomen...	2-inch rent	"	"	
1907	Harrison	33	"	Horse rolled on	3-inch rent in bladder and fractured rib.	"	"	

TABLE II.—*Cause and Situation of Rupture of Intestine.*

	Duodenum.	Jejunum.	Ileum.	Large Intestine.	Intestine. Total.	Spleen.	Bladder.
Run over in street	12	27	11	7	57	5	3
Kicked by horse	1	13	8	2	24	2	4
Crushed	6	5	5	3	19	—	—
Struck by moving object ...	4	13	7	2	26	3	2
Fall on hard object... ..	1	5	7	1	14	5	4
Fall of weight on abdomen	—	6	5	—	11	1	3
Fall from height	1	4	—	1	6	6	2
Other causes, mostly unknown.	1	7	—	—	8	1	4
	26	80	43	16	165	23	22

TABLE III.—*Rupture of the Intestine, Results of Treatment.*

St. Thomas's Hospital, since 1886.		Berry and Guiseppi (London and other Hospitals, 1893-1907 inclusive).	
	Cured.	Died.	
Small intestine—			
No operation	—	6	37
Operation	5	20	49
Large intestine—			
No operation	—	1	5
Operation	5	1	6
	10	28	97

St. Thomas's Hospital... .. 31 operations, 10 recoveries.
 Other hospitals... .. 66 „ 11 „



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