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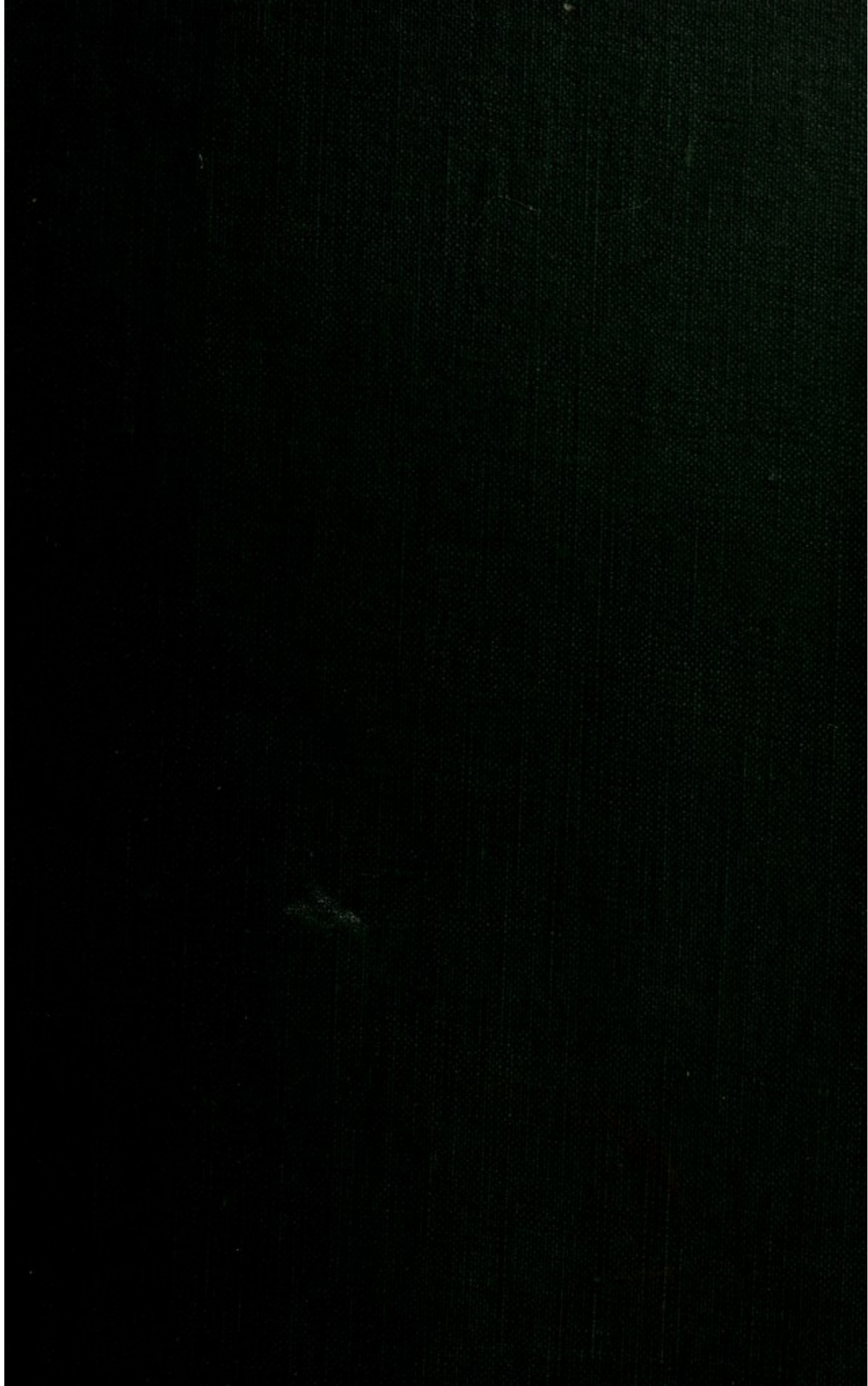
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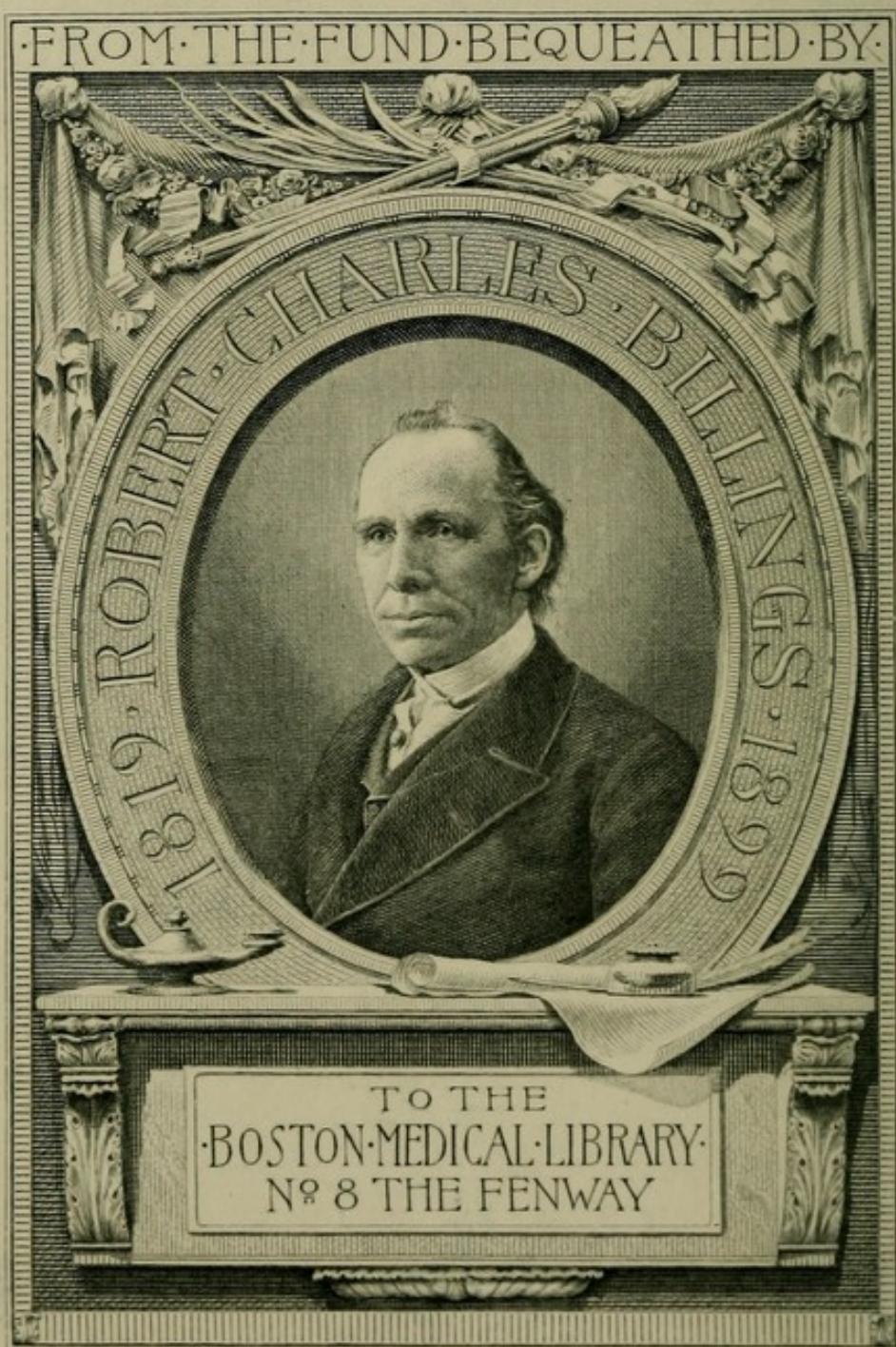
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SURGERY OF THE URETER:

AN HISTORICAL REVIEW.

(1585-1905)

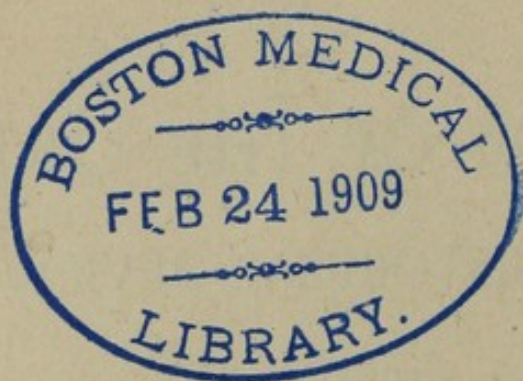
BY

BENJAMIN MERRILL RICKETTS, PH.B., M.D., LL.D.

MEMBER AM. MED. ASSN.; WESTERN SURG. AND GYN. ASSN.; INT.
MED. CONG., 1887; INT. ASSN. RAILWAY SURGEONS; MISS.
VALLEY MED. ASSN.; CINTI. ACAD. OF MED.; OHIO
STATE MED. SOC.; AM. PROCTOLOGIC SOC.; HON.
MEM. MED. SOC. STATE OF N. Y.; HON. MEM.
ST. LOUIS MED. SOC.; FELLOW NEW YORK
STATE MED. ASSN.; MEM. SOCIETE
INTERNATIONALE DE CHIRURGIE;
AM. UROLOG. ASSN. AND
PAN. AMER. CONG.

CINCINNATI,

1908.



7828 / 121

PREFACE.

The object of this review is to place the Bibliography in the most available form. This has necessitated careful consideration of a great many valuable papers; many of equal importance have not been mentioned except in Bibliography, while others were not available.

It was not supposed in the beginning that the literature was so varied or voluminous and by reason of it being so the work has been delayed.

By publishing it as a serial in the St. Louis Medical Review, it will have reached the hands of many practitioners, both general and special, and the indices of Journals and Libraries.

That it may become more useful three hundred reprints have been bound for a few of those who are more especially interested in the subject.

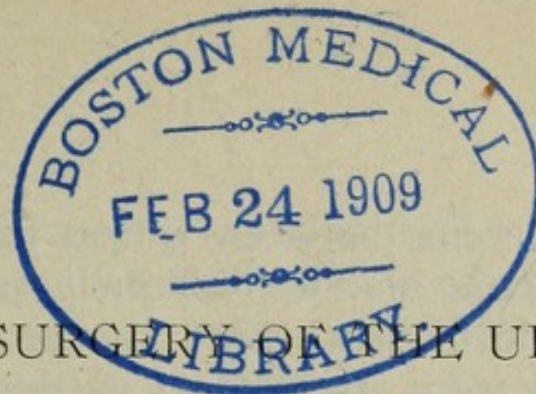
BENJAMIN MERRILL RICKETTS.

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CINCINNATI, O.

May 20, 1908.

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THE SURGERY OF THE URETER:

A HISTORICAL REVIEW.
(1585-1905).

By BENJAMIN MERRILL RICKETTS, Ph. B.,
M. D., LL.D.,
CINCINNATI.

CHAPTER I.

ANATOMY.
(1585-1905).

The ureter is the cylindrical, excretory duct of the kidney, of the size of a goose-quill, twelve or fourteen inches long, extending from the pelvis of the kidney to the base of the bladder, into which it opens by a constricted orifice after passing obliquely for nearly an inch between its muscular and mucous coats; it has a fibrous coat continuous with the capsule of the kidney, and the fibrous tissue of the bladder; a muscular coat, composed of an outer, circular, and an inner, longitudinal, layer, with an additional thin external longitudinal layer in its lower part; and a mucous coat presenting longitudinal folds and lined with transitional epithelium.

It passes obliquely downward beneath the peritoneum, resting upon the psoas muscle, the right ureter lying close to the outer side of the inferior vena cava, over the iliac arteries, behind the ileum on the right side, and the sigmoid flexure on the left; enters the posterior false ligament of the bladder in the male, with

the vas deferens, between it and the bladder, and enters the bladder obliquely about one and one-half inches behind the prostate, and two inches from its fellow; in the female it lies behind the broad ligament, and passes along the upper part of the vagina, and the side of the cervix uteri, being about one-half of an inch distant from the latter.

The blood supply of the ureters is derived from the renal, spermatic or ovarian, and vesical arteries.

The nerve supply of the ureters is derived from the renal, spermatic or ovarian, and vesical plexus.

The following articles on anatomy have been written, and the bibliography appended.

S. Albertus, in 1585, first described the anatomical structure of the ureter; P. M. Dithely, in 1723, described, in a dissertation, rare observations on the valves of the ureters. In 1723, researches were made and published on the valves of the ureters. Guigneux, in 1760, reported on anatomical observations on the ureter; also J. C. Pohl, in 1772, reported on anatomical observations of the ureter. C. Bell, in 1812, before the Medico-Chirurgical Society of London, reported an account of the muscles of the ureters and their effects in the irritable states of the bladder. Dr. Bell says, "I am about to describe a set of muscles which seem not to have been observed by former anatomists. They are attached to the orifices of the ureters, and are seated in the bladder. In health, they are the instruments of a very peculiar organic action, and in disease the cause

of most distressing complaints." He follows with a short historical review of the opinions respecting it, as follows: "Morgagni expresses himself as follows: At the points where the ureters terminate in the bladder, there arises from each of them a thick round compact fleshy body, which takes a direction towards the orifice of the bladder. These two bodies having proceeded a little way, are united, and proceed forward, terminating in the caput gallinaceum." Santorini gives the same description of these parts as Morgagni has delivered.

Lietaud describes these bodies under the term *La trigone de la vessie*. The learned Portal is incorrect in saying that Lietaud was the first anatomist who has given their description.

Portal has thus described the trigone: "At the lower part, the internal tunic of the bladder adheres to a triangular body of cartilaginous hardness, and this body is always prominent in the cavity of the bladder, especially in old men." He proceeds to say, that, at the extremity of the triangle, backwards, the orifices of the ureters open; and at their anterior extremity, there is an eminence slightly protuberant, to which Lietaud has given the name of *luette*.

"The excellent anatomist, Domenico Santorini (in his second table) has accurately represented the *Luette* and *Trigone*. He has the following explanation on the letter i. "*Vesicae urinae osculum cui prominulum corpus praefligitur quod in affectis vesicae sic*

prominet aliquando ut urinae iter prorsus intercludat". This refers to the disease with which Mr. Hunter and Mr. Home have made us familiar.

Sabatier adds: "The trigone and luette are the most sensitive parts of the bladder; which cause extreme irritation when a stone lodges here, while if it lodges in any other part of the cavity of the bladder, it causes little inconvenience." Sabatier says, "The uvula luette which terminates the anterior angle, is very liable to swell, and then it rises in the form of a round tumor which fills the neck of the bladder, and opposes itself to the flow of urine."

In Haller's Elementary Physiology, Tome v, p. 328, we have a description following that of Morgagni under the title *Colliculi ab ureteribus in Urethram producti*.

"Mr. Hunter has described a small portion of the prostate gland which lies behind the very beginning of the urethra; and this he describes as subject to swell out like a point into the cavity of the bladder, where it acts like a valve on the mouth of the urethra. This can be seen, even when the swelling is not considerable, by looking upon the mouth of the urethra from the cavity of the bladder. It is impossible to mistake this; the swelling he describes is the uvula vesicae or luette of Lientaud. Morgagni has very fully described the part of the prostate gland which Mr. Hunter mentions, and which he discovered to be the seat of this dangerous malady.

"The use of these muscles is to assist in the

contraction of the bladder, and at the same time to close and support the mouths of the ureters. The surface of the bladder, where it covers their union on the inside, is endowed with an exquisite sensibility, which is a provision of Nature, for their ready and instantaneous action on the stimulus to pass urine. It is here that is seated that sensibility which produces the natural call to urinate, and here also is the seat of diseased irritations.

“It will be observed that the orifices of the ureters are not closed by the contraction of the muscular fibres around them. They are defended against the return of the urine by the obliquity of their passage through the coats of the bladder. It is well known that the extremity of the ureter enters through the coats of the bladder obliquely, and that in consequence of this, there is a valvular action in the coats of the bladder, which prevents the regurgitation of the urine into the ducts of the kidney.”

Civiale, in 1835, reports on the Neuralgias of the Ureters and Vessels; Broca, in 1850, reports on the Anatomy of the Ureters; Pettigrew, in 1867, reports on the Muscular Arrangement of the Bladder and the Prostate, and the manner in which the ureters and urethra are closed; English, in 1874-5, reports on the Anatomy and Pathology of the Ureters; Tuchmann, in 1874, reports on the Fundus Vesicae in Man, anatomically and physiologically considered. Dogiel, in 1878, reports on the Nerves of the Ureters; De Paoli and Buscachi, in 1888, report on the Ureters; Panta-

lone, in 1888, reports on the Pelvis of the Ureters in Females, anatomically considered; Holl, in 1882, on the Topography of the Ureters; Dogiel, again in 1896, gives contributions on the Anatomy and Physiology of the Ureters; Pettit, in 1897, on the Pelvis of the Ureters; Wertheim, in 1901, gives clinical considerations of the Ureters; Deaver, Surgical Anatomy (1899), on the Ureters; Henry Morris, in 1901, in two volumes on Surgical Diseases of the Kidney and Ureter including injuries, malformations and misplacements; H. A. Kelly, in 1902, on the Structure of the Ureter; Altuchow, in 1903, on the Topography of the Ureters.

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CHAPTER II. ANOMALIES.

(1691-1905.)

Congenital anomalies of the ureters are many, as shown by the numerous reports beginning with Hartmann, 1690. There may be more than one originating in the kidney, or there may be none at all.

Each kidney may have one or more ureters uniting to form one common channel to enter the bladder, or the ureter from one may enter the bladder upon the opposite side.

Several ureters may enter the bladder or they may unite to form one common duct to enter the bladder, the peritoneal cavity, or any part of the alimentary tract; or they may make their exit upon the surface of the body, as reported by Duncan, 1805. They may be extremely short or long or small or large in diameter, and accompany each other to the bladder in close proximity.

Hartmann, in 1690, reported anatomical monstrosities of the ureters; Tyson, in 1685, four ureters in an infant; Delius, 1748, on duplex ureter; Duncan, in 1805, reports the following cases of malformation; the first subject consists in the absence of the anterior portion of the urinary bladder, while the posterior portion is protruded forward through the muscles and integuments which commonly cover it, so that the ureters open externally,

and there is a constant involuntary discharge of urine through them. In a case described by Blasius there was but one external aperture, as the ureters united before they penetrated the bladder. Duncan says that Nature seems to have sometimes made other attempts to supply the want of a bladder, either by lengthening the ureters, or by enlarging them so much in particular parts as to resemble small bladders. He also reports a case of Astley Cooper's of a fungous tumor on the lower part of the abdomen, through which the urine was involuntarily discharged, in a female, aged 22 years, having existed since birth, death four days after admission to hospital. Upon necropsy the ureters, which opened through the lower part of the fundus, were uncommonly large and had served the purpose of reservoirs. Renauldin, in 1818-19, reports on the anatomy of organic lesions of the kidneys accompanied by numerous calculi and anomalies; Ruzz, in 1833, on the situation of arteries in the ureters; Lediberger, in 1834-5, on double ureter; Webster, in 1834-5, on congenital enlargement of the ureters, with post mortem; Lever, in 1848-50, exhibited a foetal kidney with cystiform disease with absence of ureters; Hargrave, in 1848, reported on a curious abnormal condition of the kidneys, ureter, and bladders; Parcher, in 1858, reported a case in which the third lumbar vertebra had its place supplied by a thin cartilage having an opening through which passed two ducts or ureters which supplied the cyst with water, no ureters connecting with the bladder;

Lemarchant, in 1861, reported a case of double ureter; Ferrand, in 1862, reported on anomalies of the kidney and ureter; Pollock, in 1864-5, reported on a kidney (left) and its secreting substance, which had almost wasted entirely, owing probably to the opening of the pelvis into the ureter not being at the apex of the pelvis, but at one side, so as to give rise to a sort of valvular aperture, very unfavorable to the passage of urine, the patient, a female, aged 39 years, dying of bronchitis and gangrene of the lung; Bruce, in 1866, exhibited a case of complete absence of the ureter, and even the ridge bounding the trigone of the bladder (on which the ureter normally opens) on the side on which the kidney was found wanting, in a male aged 49 years, death occurring from accidental injury; there were no symptoms of renal affection during life. Fagge, in 1866, reported on a left kidney in which the ureter lay in front of the renal artery and vein at the hilum, and not behind them. Baker, in 1878, says he has been surprised to see how few refer to abnormalities of the ureters in any way, except to mention the fact that cases of double ureters are sometimes met with, and he has failed to find in any such book a description of malposition of the ureters where the bladder was present, or in any other than a rudimentary condition, except that in one the fact is noted that the ureters sometimes terminate in a cul-de-sac. Thus, in Mickel's Anatomy we find "The congenital anomalies of the ureters are; first, their absence; second, their imperforation in

one or several points, from an obstacle; third, their plurality." Again, in Andral's Anatomy: "We sometimes observe cases of malformation of the ureters. Thus, they have been found united by a transverse duct. Again, two ureters may pass from the same kidney, and either open separately into the bladder, or unite before entering it. The latter is generally the case. When the bladder is wanting, or exists only in a rudimentary state, the ureters terminate in some other part. Thus, they have been known in such cases to open: 1, into the umbilicus; 2, the rectum; 3, the vagina; 4, the urethra; and nearly the same facts are mentioned in the Dublin Dissector."

Cruveilhier's Anatomy, Vol. 1, refers to the subject in the following way: "The ureter is generally single on each side, but sometimes double, and that under very different circumstances; for example, when the two kidneys are united into one, a double ureter is almost invariably found; and secondly, when, there being two kidneys, one of them is divided into very distinct portions. In the latter case, the two ureters are often united into one, after a course of a few inches."

Dr. Baker reports the following findings, postoperative, in a case of supposed fistula from the ureter. "Under ether, an incision made through the vaginal membrane down upon the probe $1\frac{1}{2}$ inches from the meatus, found that instead of cutting into a fistulous tract, we had opened a ureter, from which the urine now flowed drop by drop as it had from

the minute orifice by the side of the meatus. A No. 7 uterine probe could now be passed, which was the length of the instrument, up the course of the left ureter. From the point of incision this ureter was now easily dissected out, which was done for a little more than an inch forward and a portion of the way outward. It was then decided to turn the course of this ureter into the bladder as near the point where it should have gone as possible. Dissecting up the vaginal membrane to the left of the median line at a point 1 inch from the internal orifice of the urethra, the bladder was punctured, the ureter was then cut off, enough being left to go through the thickness of the bladder, that the tension might not be too great upon the ureter. The edge of the ureter was then stitched to the lining membrane of the bladder all around the incision through that viscus, vaginal wound closed. A uterine probe passed through the urethra into the bladder could be conducted several inches up the ureter." Dr. Baker further considers the early development of the ureters and kidneys to see, if possible, how some of these abnormalities occur.

According to Kuppfer, *Archiv. f. mikroskop. Anat. Bonn.*, 1866, vol. ii, p. 473, (and confirmed by a number of other observers, including Waldeyer), in the lowest class, or amphibia, the Wolffian body directly bears the hollow bud which gives the foundation of the permanent kidney, while in the upper classes the duct from the Wolffian body gives rise to a second or renal canal from which the bud-

ding formation takes place. This quite agrees with Foster and Balfour Elements of Embryology, p. 163, in their observations on the chick, the result of which was that, between the eightieth and one-hundredth hour of incubation, the permanent kidneys began to make their appearance, the first portion of them to appear being their duct. Near its posterior extremity the Wolffian duct became expanded, and from the expanded portion a diverticulum was constricted off, which was the duct of the permanent kidney, or ureter. The ureter and Wolffian duct, which at first opened by a common trunk into the cloaca, by the sixth day had independent openings. From the upper end of the ureter, diverticula were given off at right angles into the intermediate cell-mass. These lengthening and becoming twisted, formed the tubuli uriniferi, while the mesoblast around their extremities became directly converted into the Malpighian bodies and the capillary network of the kidneys. The formation of the kidneys took place before the end of the seventh day. Dr. Beumer has collected the records of 48 cases recently published in Virchow's Archiv in which one kidney, and in nearly all the corresponding ureter, was absent, and that this number of cases occurred within twenty-five years, shows that this abnormality is not so extremely infrequent. Dr. Rayer, in his work on Diseases of the Kidneys, 1841, mentions a case where there were neither ureters nor kidneys to be found but the calibre of the umbilical vein greatly exceeded that usual in adults. Dr.

#

Bouilland, *Journal Complementaire*, July, 1828, refers to a subject where there was but one kidney situated across the spine, furnished with two ureters; unfortunately the terminus of the ureters was not given. Dr. Cutler presented to the Boston Society for Medical Improvement, April 22, 1878, the specimen of an absent kidney and ureter on the left side. Dr. Beach presented to the Pathological Society of London the case of a five year old child having a third ureter filled with pus, opening below into a pouch near the bladder. Dr. Emmet reported a case where one of the ureters discharged into the upper part of the vagina beside the cervix uteri. Dr. Davis presented to the Museum of the Royal College of Surgeons, Ireland, a case of acephalous foetus; the ureters, particularly the right one, were remarkably dilated, and elongated, then formed two great tortuous tubes, resembling pieces of large intestines as to size, and presented in several situations very close constrictions, and in others complete obliterations. The right tube had no communication with the bladder, the latter was much enlarged and misshapen. The following reports of double ureters were considered: Dr. Bouilland, *Journal Complementaire*, July, 1828, in a subject where two ureters proceeded from the right kidney, and at the termination of about two inches united in one canal; the left kidney was natural. Dr. Thompson, *Medical Times and Gazette*, 1855, showed a specimen of the ureter which was double for a length of about two inches and the chambers of the pelvis did

not communicate; the organ was not diseased.

Dr. Dowling, *London Lancet*: a case on the left side, the ureter arose double, becoming coalesced, however, about $2\frac{1}{2}$ inches from the kidney, from which point it continued on in one canal emptying into the bladder by one orifice.

Dr. Smith, *Dublin Journal Medical Sciences*, vol. lvii, reports a case where there was a double ureter, the union of the two tubes taking place at a distance of about $4\frac{1}{2}$ inches from the kidney.

Dr. Wiegert, *Virchow's Archiv*, Bd. lxx, Hft. iv, reports a case where the left kidney gave off two ureters, which united together at an acute angle after a separate course of about 15 cm. and opened into the bladder in the usual place. Each ureter corresponded to a pelvis of the kidney, so that there was an upper and a lower one; the two pelvis were separated by a thick layer of kidney, yet so that one could not remark the boundary of the two territories of pelvis from the outside. The diameter of the ureters, when slit up, averaged 1 cm. in the ununited as well as in the united portions.

Prof. Barbosa, *Gazette Medica de Lisbon*, 1860, observed the following anomaly in a body: Two distinct ureters existing on the left side, entering the bladder by two distinct orifices. The left kidney was longer by 3 cm. than the right, and the two ureters at their origin in the fissure were each provided with a separate pelvis, the united capacities of which only equaled that which would be required by

a kidney of this size. The two canals, separated from each other by about 3 cm. at their origin, pursued their normal course one before the other. At about 5 cm. from the bladder they united into a single cord, which traversed its muscular tunic. Careful dissection, however, showed this to be only apparently so, each opening into the bladder distinctly about one or two millimetres from the other. During the last 2 cm. of their course, the contiguous walls of the two tubes were so blended together as to constitute one.

Dr. Allen recently observed an elongation of the organ (kidney) and its being furnished with two ureters which took their origin from the upper and lower portion of the hilum, at a distance of about one inch apart and gradually converging, entered the bladder within about $\frac{1}{8}$ inch of each other. (*Phila. Med. Times*, vol. iv, 1874). Dr. Baker concludes as follows:

“1. The ureter may naturally be so misplaced as to give rise to the most troublesome symptoms, foremost of which stands incontinence of urine.

2. In cases where the ureter is so misplaced, it is possible to overcome the difficulty by surgical interference.

3. It is not absolutely essential to the life of an individual that either kidneys, ureters, or bladder exist, as shown by the case of Rayer reported.

4. Contrary to the opinion of most writers, and substantiated by the 48 cases reported by Brunner, where one kidney is absent the

remaining one is not always enlarged, as shown by the case of Dr. Cutler reported.

5. Where the ureters arise double, they are usually given off, one from the upper, the other from the lower part of the kidney, the pelves being distinct and separated by the proper structure of the kidney.

6. Where a ureter terminates in some other part than the bladder, that viscus may be present and well developed, notwithstanding most authorities state the contrary.

7. In most of the foregoing cases the malformation of the ureters was unaccompanied by any troublesome symptoms, and the interesting defects were only discovered at the autopsy.

8. In three of the preceding cases the malformation was discovered during life, having given rise to incontinence of urine by the ureters discharging either by the side of the meatus or into the vagina."

Josias, in 1879, reported a case of congenital absence of the kidney and ureter. Davies-Colley, in 1879, reported a specimen of malformation and disease of the ureter and bladder in a female child eighteen months. Josso, in 1879, reported on anomalies of the ureter; Josso, also in 1879, reported on double ureter. Wilcox, in 1880, reported a remarkable instance of periodic obstruction of a ureter in a solitary kidney. Smith, in 1882-3, reported a case of Bright's disease and urinary calculi with anomalous course of the right ureter and of entrance of the urethra. McDowell, in 1883, reported a case of abnormal course of

the left ureter. Richmond, in 1884-5, reported on abnormal ureters. Davies, in 1885, reported on enteric fever associated with recent syphilis, death, absence of left kidney and ureter. Fox, in 1885, on meningocerebritis necropsy, absence of the left kidney and ureter. Davis, in 1885, reported a case of anomalous ureter. Fenwick, in 1885-6, reported a case of atresia of vesical orifice of left ureter (congenital). Moore, in 1888, reported a case of congenital narrowing of both ureters with dilatation of the kidneys and perinephritic inflammation due to injury. Jackson, in 1888-9, reported a case of cystic degeneration of the kidneys with two ureters. Davenport, in 1890, on a case of incontinence of urine due to malposition of the ureter. Poulalion, in 1890, reported a case of congenital fusion of a renal mass situated uniquely vertically in the lumbar region, upright existence of the same organ with two basins and two ureters, three groups of vascular arteries and veins. Chambers, in 1891, reported a case of anomalous ureter. Westmacott, in 1891-2, reported a kidney with double pelvis and ureter. Auscher, in 1892, reported a case of congenital absence of the right kidney and corresponding malformation of the ureter. Noel, in 1892, reported a case of congenital absence of the kidney and ureter. Spalletta, in 1895, a case of incomplete duplication of the ureter. Colzi, in 1895, contributed to the study of anomalies of the ureter. Soulie, in 1895, reported a case of double ureter in a human foetus. Ramsey, in 1896, reported a case of complete duplication

of the left ureter from the kidney to the bladder. Bulmer, in 1896, reported notes on two cases of ureteral abnormality. Obici, in 1896, reported on anomaly of the ureter. Meslay, in 1896, reported on prostatic double ureter. Brinon, in 1896, reported on congenital dilations of the ureter. Jolly, in 1896, reported a unique case of duplicate bilateral ureters and multiple renal arteries. Fullerton, in 1897, reported a case of duplication of right ureter. Lennander, in 1899, reported on pyonephrosis extirpated from right kidney with two pelves and two ureters. Miller, in 1901, reported an anatomical deviation of the kidney and ureter. Laurens, in 1901, reported on incomplete duplicate bilateral ureters. Theuveny, in 1902, reported on the absence of right ureter with anomalies. Janeway, in 1902, reported a case of double ureter on each side pervious throughout. Bonnet, in 1903, reported on obliteration of the ureter by a congenital valvule. Gould, in 1903, reported that anomalies of the ureters of both kidneys were comparatively rare, and that complete duplication of both ureters was very rare; he reported two more cases in addition to the only eight cases in literature of complete bilateral duplication of the ureters. In one case a child aged six months, each kidney had two pelves and two ureters, which were separate throughout their length, each having its own orifice in the bladder. One ureter on each side had its orifice apparently in the normal position, while the other two ureters had their orifices nearer to the median line and nearer

the prostatic urethra. One of the two pelves of each kidney was larger than the other. The kidneys proper were not remarkable. The other case, a woman aged fifty years, each kidney had two ureters and two pelves. The pelvis draining the inferior half of the left kidney was somewhat larger than that draining the superior half, the pelves of the other kidney were of about equal size. The two ureters of each kidney were separate and patent throughout and each had its own orifice in the bladder. All four ureters were of equal size and of a diameter somewhat smaller than normal. The orifices of the ureters of the right kidney were situated near, but apparently above, the situation of the normal right ureteral orifice, and were about 7 mm. apart. The ureter from the inferior half of the right kidney had its orifice further from the median line. The orifices of the ureters of the left kidney were about 2 cm. apart. The orifice of the ureter which drained the inferior half of the left kidney was situated apparently a little above the situation of the normal ureteral orifice, while the orifice of the ureter draining the superior half of the left kidney was nearer the prostatic urethra. The right ovarian vein emptied into a large branch of the renal vein instead of into the vena cava. No special anomaly of the main renal artery was noted. The kidneys were $12\frac{1}{2}$ and 13 cm. long respectively.

H. Silver (my student), in 1905, at autopsy found two ureters with independent openings in the right kidney, and extending to the blad-

der, into which they entered with but one opening. The ureter upon the left was normal. (Personal communication, B. M. R.)

Byron Robinson, 1904 (*Medical Fortnightly* p. 145). On the distal termination of complete duplicate ureters says: "The termination of the ureter is in the tractus urinarius.

1. The most usual termination is in the bladder.

(A) The chief location of the distal ureteral orifice in the bladder is in the trigonum vesicae.

(a) In the trigone the multiple ureteral orifices are situated in an oblique dorsoventral line closely adjacent, or in other words, one is situated directly over the other in close proximity. This occurred in the majority of the specimens.

(b) The multiple ureteral orifices may be situated closely adjacent, however, more in a transverse line. This occurred in a few specimens.

(c) In multiple ureters the one ureter may have its exit in the normal trigonal location and this is most frequently the distal ureter, while the vesical orifice of the proximal ureter is in most cases located medianward and distalward to that of the distal ureter.

(d) In complete duplicate ureters the trigonal orifice of the proximal ureter has its exit distalward and medianward to that of the distal ureter. This is of practical importance in ureteral catheterization and surgical intervention.

(e) In complete bilateral duplicate ureters

the location and distance of the vesical orifices from each other and the opposite sides may not correspond. They vary but have their exit mainly in direct axis.

(B) In complete duplicate ureters the exit has been reported to be located in the vesica urinaria external to the trigone; however, it did not occur in any of our 11 specimens.

Blind or caecal ending ureters.

2. The distal ureteral orifice may terminate in the urethra.

(a) In the prostate; six authors report cases.

Erlach (1888) reported a case in which the right ureter was duplicate. One ureter opening normally in the bladder and the other in the urethra immediately distal to the orificium urethrae internum, demonstrated at the necropsy. There was no history of incontinence. This class includes such cases as Wrany's (1870), where the ureter opened into the trigone opposite the urethra; also Wrany's case in which the ureter opened into the neck of the bladder, as well as Zaluska's case (1869) where the ureter opened 1-10 of an inch proximal to the border of the caput gallinaginis. Civiale (1843) reported a ureteral opening adjacent to the verumonatum. Walter (1800) mentions a case where the ureter opened closely adjacent to the caput gallinaginis. Weigert (1876) and Bostroom (1884) report that ureters opened near the colliculus seminalis. Hoffman (1827) reported a case of a ureter opening on the side of the colliculus seminalis. Lillienfield (1856) reported a

case in which the subject a man sixty-five years of age dying of typhoid fever, had a duplicate right ureter and the proximal ureter ended blind closely adjacent to the caput gallinaginis.

3. The ureter may terminate in the mesonephros—the second ureter or Gartner's duct. Tangl reports a case.

4. It may terminate in the allantois. La Goutte reports a case.

The ureter may terminate in the tractus genitalis.

1. It may terminate in the vagina.

The ureter may terminate in different localities of the vagina. Dr. F. H. Davenport (1890) observed a case in which the ureter opened in the dorsal wall of the external urethral orifice. Dr. W. F. Baker (1878) reported a case in which the ureter had its exit about two lines to the left and distal to the urethral orifice. There is no mention whether either of the above ureters was duplicate. Baum reported a case where one of the duplicate ureters had its exit closely adjacent to the orificium urethrae externum; the other ureter opened into the vesica urinaria. F. Tangl reported a case of a woman sixty-seven years old with a partial duplicate right ureter which ended as a caecal or blind canal on the ventral make a fist on the right, that a little encourvaginal wall. There was a bilocular uterus with a single cervix. The left kidney was extremely atrophic, the right had chronic interstitial nephritis. Emmet, Depaul, and Albarren report cases.

2. It may terminate in the pudendum.

Walter, Kolisko, Elach and Welser report cases. Massari (1879) reported a case of a four year old child with a preternatural anus where the left ureter had its exit immediately distal to the prepuce of the clitoris. The renal organ was a fused or horseshoe kidney; the right ureter was normal. The child suffered constant urinal leakage, the vagina was duplicate, uterus normal; demonstrated by autopsy.

3. It terminates in the uterus, Foster and Wraney report cases.

4. It may terminate in the oviduct.

5. It may terminate in the vesicula seminalis. Effinger, Hoffman and Weigert report cases.

The ureter may terminate in the tractus intestinalis.

It may terminate in the rectum. The termination of the ureter in the rectum is liable to accompany malformations incompatible with life. Olshausen reports a case where the intestine, uterus, bladder and the ureter opened into a cloak closed by skin. Morris reports the ureter of a child opening into the rectum.

Decherd reports a case of complete bilateral duplication of the ureters in a male negro who died of amoebic dysentery. Dissection of the pelves and calices show that the upper ureter drains the upper third of the kidney while the lower one drains the lower two-thirds. The upper ureter drained less of the kidney than the upper segment of the bifid pelvis. The two upper ureters opened into the

bladder by the two mesial orifices, the lower ones by the two external.

Harbinson reports a case of double ureter in a female about sixty years of age who had died of phthisis. Kidneys larger than usual, quite healthy and normally placed. From each kidney ran two ureters with separate pelves attaching them to the kidneys. The pelves were situated, one superiorly to the other, and on making a section of the kidneys no communication was found between them. The blood vessels divided so as to give a separate blood supply to the parts of the kidneys drained by the separate pelves. On the right side the ureters ran gradually approaching each other and apparently becoming one at 5 inches distance from their origin; however, on dissecting them apart, it was found that they ran separately in a common connective tissue sheath for a further couple of inches. Just before reaching the pelvic brim they became one and ran into normal course to the bladder. On the left side the two ureters ran separately to near the pelvic brim; from this point they ran side by side, invested in a common sheath to the bladder, the wall of which they entered in the normal position. On making an opening in each and passing a fine probe it was found that both continued separate through the bladder wall and opened into this viscus by distinct openings. The posterior opening corresponded to the normal one, forming with that of the other side and the urethra, the triangular "trigone" of the bladder. The anterior one was placed in the line of the side

of the triangle one-third of an inch nearer the urethral opening. I may incidentally mention that in this body the caecum lay in the right side of the pelvis with the vermiform appendix in the right side of Douglas's pouch while the ileocaecal valve was in front of the right sacroiliac synchondrosis; there was also a marked sigmoid hepatic flexure of the colon. In the *Journal Am. Med. Assn.*, 1904, *xlii*, Levison reports a case of bilateral duplication of the ureters in a male aged sixty-five admitted to the County Hospital, presenting symptoms and signs of advanced pulmonary tuberculosis; death ten days after admission.

Autopsy: From each kidney arise two fully developed ureters, each having a separate pelvis, but the two ureters on each side enter the bladder through a common orifice. The distance between the two ureteral orifices is considerably increased. One of the ureters passing from the right kidney is widely dilated throughout. At its beginning it is 4 cm. wide, becoming more narrow lower down, but still remaining three or four times the normal diameter of the ureter."

Remarks.—Judging from the number of cases of bilateral duplication of the ureters reported, the condition must be one of extreme rarity. Gould has recently found 8 cases in the literature, to which he adds two. Dechtel reports one case, making in all 11 cases previously reported. Unilateral duplication of the ureters is somewhat more common but still of sufficient rarity to be of interest.

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CHAPTER III.

PHYSIOLOGY.

1830-1905.

Physiology of the ureters has been thoroughly considered both experimentally and surgically.

Its purpose is purely mechanical, in that it serves to carry the renal secretion to the bladder and to prevent its return from the bladder.

Blandin, in 1830, was among the first to call attention to the ureters as canals of this character.

Donders, in 1852, called attention to its peristaltic motion, and Vulpian, in 1858, to its contractility.

James, in 1878, mentioned physics as applied to both the bladder and ureters, and Fenwick, in 1886, spoke of the suction of the ureters.

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CHAPTER IV.

EXPERIMENTAL.

1818-1905.

Experiments upon the ureter have concerned its pathology, biology, physiology, anatomy, and surgical possibilities. This work has been based upon both animal and man, and has aided materially in the advancement of surgical technique, which has accomplished so much in matters pertaining to the ureter.

Strauss and Germont, in 1882, reported on histological lesions of the kidney of the guinea pig in a series of ligatures on the ureter. Zamshin, in 1887, made researches on the functions of the ureters in a woman with rectovaginal fistula. Poirier, in 1891, reported on some phenomena of the ureteral injections. Reed, in 1892, successfully implanted the ureters of a rooster into its rectum, while Ricketts, in 1899, and Frank, in 1901, were equally successful in implanting the ureters of dogs into the alimentary tract at various points to determine the possibilities and comparative percentage of renal infection. They found that renal infection was less likely to occur as the implantation was made nearer the sphincter ani.

Crile, in 1905, has succeeded in transplanting the kidney of a dog into the neck by anastomosing the renal artery and vein with the thyroid artery and vein, and inserting the ure-

ter into the oesophagus. The kidney continued to live and functionate indefinitely, while the urine escaped into the alimentary tract.

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CHAPTER V (a).

URETERECTOMY.

1847-1906.

1. Ureterectomy.
2. Uretero-Lithotomy.
3. Ureterorrhaphy.
4. Uretero-Ureteral Anastomosis
5. Uretero-Colon Anastomosis.
6. Uretero-Vesical Anastomosis.
7. Miscellaneous.

Ureterectomy.—Removal of the ureter in part, or in its entirety, is most desirable in malignancy and tuberculosis; it is occasionally resorted to in nephrectomy for tuberculosis associated with tuberculosis of the ureter. Also for fistula resulting from disease, rupture, or otherwise. The distal end should always be ligated; silk being the most desirable material for this purpose.

Dr. Elliot, in 1887, reported a case of nephroureterectomy; retroperitoneal extirpation of a kidney with its ureter; specimen showed a ureteropyelonephritis. In speaking of the amount of urea daily excreted he says that it is interesting to note that the average daily amount excreted in the first five days of the second week after the operation was 340 grains. Thus, at the beginning of the second week after the operation, which was severe and followed by a critical illness, we find the remaining kidney secreting as much urea as both were doing

when in comparatively good health just before the operation. Moreover, the average amount of urea for five days, five weeks after the operation, was 405 grains, an amount greatly exceeding anything that both kidneys had ever done while under observation. These facts suggest caution in accepting the dictum of the so-called "conservative renal surgery," that any part even of a diseased kidney should be left if possible. The only cases of nephro-ureterectomy I have been able to find in the literature are reported by Kelly in the *Johns Hopkins Hospital Bulletin* for February and March, 1896. Kelly reports three cases of his own, and refers to another. They were all done in different ways, and were all successful. The first case was done by a laparotomy, transperitoneal. The second case was a retroperitoneal operation by a long lumbar incision like the one here reported. The third case was also retroperitoneal, by a short lumbar incision and a vaginal incision through which the lower end of the ureter was removed. The case referred to was reported by Dr. Reynier, February 24, 1893, in *la Semaine medicale*. The patient, a man 20 years old, had his kidney removed on April 7, 1892, for ureteropyelonephritis; at a later day, five inches of the ureter were removed by enlarging the lumbar incision; the patient not being cured, an effort was made, but without success, to reach the lower end by a pararectal incision. Later, the lower portion was removed by an incision parallel to the inguinal canal; result good. Bovee, in 1900, on ureterectomy, says surgery of the kid-

ney is practically of recent date, although during the sixteenth, seventeenth and eighteenth centuries, the practicability of nephrectomy had been discussed, and Zambecarius, in 1670, and Roonhuysen, in 1672, had proved by experiments on animals that one kidney could do the work of both. It may be fairly stated that Simon's successful nephrectomy, in 1869, though done in an emergency and for an indication not now recognized, marks the beginning of the surgical treatment of this very important organ. Surgery of the ureter was the logical sequence to renal surgery. Yet, strangely enough, Gigon had thirteen years previously published a case of calculous anuria, recommending and carefully describing the technique of ureterectomy—called by him "ureterotomie," and practically followed years later by LeDentu and Pozzi.

The interest in this subject has not lagged, and at the present time nephrectomy for injuries and diseases of the ureter is called for extremely rarely.

Now calculi are removed from ureters by incision; injuries to it closed by suture or drainage; strictures relieved by delicate plastic operations, curing many cases of hydronephrosis in this way; resections for complete section of it, either accidental or intentional, are easily and safely done, about twenty cases bearing evidence of this; and even its entire removal has been practised nine times with very gratifying results. It is furnishing the surgical world today with the richest field for excellent surgery. By the term ureterectomy is understood

the partial or complete removal of the ureter. If removed with the kidney, it is primary, and if at a time subsequent to nephrectomy, it is secondary ureterectomy. The partial removal is often done with nephrectomy, part of the pedicle being formed from the upper end of the ureter, but this paper does not refer to such cases. Total removal was first done by Poncet, in 1893, and the first partial operation by Tuffier, in 1891. Since then the total operation has been done by McCosh (2 cases), Kelly (2 cases), Gerster, Hartmann, Morris, and myself;—in all, 9 cases. The partial operation has since been done by Reynier, Kelly, Postnikow, Schiller, Morris (2 cases), Elliot, Pouisson, Abbe, and Sommers;—in all 11 times. The complete operation was primary in four cases, Kelly two cases, and McCosh and Morris each one. Partial primary ureterectomy was done 8 times by Tuffier, Kelly, Postnikow, Schiller, Elliot, Morris, Abbe, and Sommers. But one of these 12 cases of nephroureterectomy was fatal (Morris's partial). Mine, a total secondary operation, death also occurred, giving the 20 operations a mortality of 20 per cent. In my case, that of a man at forty-eight years, the upper end of the ureter was surrounded by calculi and thickened pus, it was one inch in diameter, and filled with cheesy pus and calculi, the incision was extended to the inguinal canal and removed, in pieces, the whole of the duct, its distended lumen ended abruptly about $\frac{1}{2}$ an inch from the bladder, the remainder being a solid cord. Death in seventeen hours. Diagnosis "Caseous tuber-

culosis of the ureter." *N. Y. Med. Jour.*, lxxix, 1904.

Witherspoon writes on an operation to reach the lower ureter by an extraperitoneal route, and states the advantages as follows:

1. "It is extraperitoneal and avoids the danger of peritoneal infection."
2. The opening is directly over the route of the ureter and allows a good view of that structure through a very small cut in the abdominal wall.
3. It allows of a thorough palpation through the peritoneum, of both kidneys and ureters, and at the same time, of an exposure of the ureter on the side of the incision for extraperitoneal operation upon its lower end. Many times a decided doubt exists as to the full extent of the trouble, and in these cases a thorough palpation of the entire urinary tract may be of value.
4. The field of operation is bloodless and no forceps is in the way.
5. Drainage is usually necessary after opening the ureter, which may be carried through the lower end of the rectus and does not leave the bright prospect of hernia, which a para-Poupart incision does.
6. The dissection is not difficult and can be carried out by any reasonably prepared surgeon, as it does not require the skill of a specialist.

The routes which have been proposed to the present time for the operation upon the lower ureter are:

1. The intravesical (suprapubic, perineal, and transurethral).
2. Intrarectal, or transrectal, used by Cesi, in 1889. Patient died thirty-six hours later.
3. Iliac, or para-Poupart, incision.
4. Sacral route, proposed by Cabot in 1892, and worked out on cadaver.
5. Pararectal route, used by Morris in two cases. Incision from a point opposite the third sacral spinous process to a point one inch and a half beyond the tip of coccyx.
6. Perineal route, proposed by Fenwick in 1898. Used where the stone could be felt through the rectum.
7. Transperitoneal route. This is too dangerous a route to be attempted.

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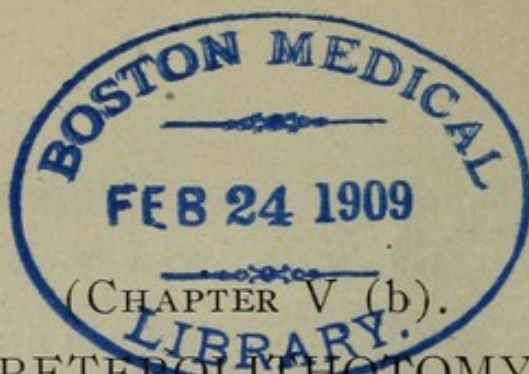
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URETEROLITHOTOMY.

1800-1905.

Ureterolithotomy—removal of concretions from within the ureteral canal—has been an established procedure for more than a century, Thomas being one of the first to do it. Concretions may be removed from any point in the ureteral tract in this way.

Extraction of ureteral concretions may also be made with forceps, intravesical through the bladder into the ureter. This is the most recent method and has been employed by Lewis, Young, Otis, and others, to whom great credit should be given for so high a degree of excellency in this field of surgery.

Concretions may be removed from the upper half of the ureter with forceps, introduced into the ureter from above, after the kidney or ureter has been opened.

Cullingworth, in 1884, reported a case of impaction of a large calculus in each ureter immediately above the vesical orifice, causing dilatation of the ureters and abscesses in the kidneys, the kidney on the right side forming a large abdominal tumor. Abdominal section with a view to nephrectomy; removal of calculus from right ureter; death (from uraemia). At autopsy, the right kidney and ureter though still large, were no longer sufficiently distended to form a noticeable tumor, the kid-

ney measured $5\frac{1}{2}$ by $2\frac{1}{2}$ inches. It contained numerous abscesses and two small calculi; the diameter of the ureter close to the kidney was 2 inches and its narrowest part an inch. The sutures in the ureter had not given way, and there was no evidence of leakage. Left kidney enlarged $6\frac{3}{4}$ by $2\frac{1}{2}$ inches its pelvis and calces forming a large and irregular abscess cavity. The left ureter was greatly dilated, and, at its lower end, half an inch from the entrance to the bladder, was a calculus, similar in shape to the one removed from the right ureter, and somewhat longer, its length being 3 inches. Morris, in 1884, reported on a calculus impacted in the ureter, and the feasibility of removing it by surgical operation. He says that in the whole number of 34 volumes of the *Transactions of the Pathological Society of London*, there are only eight cases recorded of impacted ureteral calculus, Morris reports a case of calculus at the lower end of the ureter. Dr. Rawdon reported a case in which a calculus impacted in the lower end of the ureter was detected with finger in the rectum during life; and its presence there was verified after death. *Brit. Med. Journ.*, February 1, 1879. Sir Spencer Wells has reported a case of urinary calculus which was discharged per rectum: He conjectured that "perhaps the calculus had never been in the bladder, but had passed from the ureter downwards behind the bladder." (*Trans. Path. Soc. London*, Vol. v. p. 202.)

In conclusion, Dr. Morris says that the cases in which an exploration of the bladder

should be made with the view of performing the operation on the ureter are:

1. In hydronephrotic or pyonephrotic enlargement of the kidney associated with bladder symptoms, with the hope of reestablishing the natural drainage through the ureter.

2. Before nephrectomy is resorted to for hydronephrosis or pyonephrotic tumors, which have been opened or tapped through loin without benefit.

3. Before nephrectomy is resorted to in cases of suspected renal calculus, in which no renal tumor exists, and where, after digital exploration and puncture of the kidney through the loin, no stone is found.

4. In cases of sudden or rapid suppression of urine, or anuria occurring after symptoms which have given rise to suspicion of stone in one or other or both kidneys. A kidney which has undergone compensatory hypertrophy may become blocked by a calculus which has been forced by the superimposed urine to the lower end of the ureter and which cannot pass the vesical orifice of the ureter. Such a kidney may be, probably is, the only one the patient has to depend on; and in this case, death must ensue if the obstruction is not removed. If no stone can be felt through the bladder, life may yet be saved by giving a vent to the pent-up urine by lumbar nephrotomy.

Goodlee & Ralfe, in 1888, reported a case of suppression of urine caused by impaction of calculi in both ureters relieved by operation; Ricketts and Ricketts, in 1889, made an abdominal section for rupture of left ureter re-

sulting from two large calculi; death. Cabot, in 1890, reported a successful case of ureterolithomy in a woman with stone lodged in the middle portion of the ureter and weighing 190 grains. Fenger, in 1894 on the operation for the relief of valve-formation and stricture of the ureter in hydronephrosis or pyonephrosis concludes as follows:

1. Exploration of the ureter as to its permeability should be done from the renal wound by a long flexible silver probe (a uterine probe) or an elastic bougie, either olive-pointed or not. If the bougie passes into the bladder, the examination is at an end. The size of bougie, that will pass through a healthy ureter is from 9 to 12, French scale.

2. If the pelvic orifice of the ureter can not be found from the renal wound, it should be sought for by opening the pelvis, pyelotomy, or by incising the ureter, ureterotomy.

3. A longitudinal incision, half an inch to an inch long, in the posterior wall of the pelvis can be made while the kidney is lifted upward against the twelfth rib. This procedure is easy if the pelvis is dilated, but may be impossible if the pelvis is of normal size.

4. A stricture in the ureter, if not too extensive, can be treated by a plastic operation like the Heinecke-Mikulicz operation for stenosis of the pylorus; namely, longitudinal division of the stricture and transverse union of the longitudinal wound. This method of operating for ureteral stricture seems to me preferable to resection of the strictured part of the ureters (Kuester's operation) for the fol-

lowing reasons: It is more economical operation and preferable when the elongation of the ureter is not sufficient to permit the two cut ends of the ureter, after excision of the stricture, not only to come in contact, but even to permit of closure and invagination without stretching.

5. Resection of the upper end of the ureter and implantation of the distal end into the pelvis has been performed in an important and interesting case by Kuester, and the result was brilliant success. His method was to split and unfold the end of the ureter, and to implant it into the opened pelvis to which it was united with sutures.

6. In a similar case of stricture in the end of the ureter, especially if the ureter were not elongated or the kidney movable, I should prefer the plastic operation already described, as it is easier of technique, and as it proved successful in my case of traumatic stricture in the ureter below the pelvic orifice.

7. The ureter is accessible through an extraperitoneal incision, a continuation of the oblique incision for lumbar nephrotomy, from the 12th rib down along, and one inch anterior to the ilium, and along Poupart's ligament to about its middle. This incision gives access to them upper three quarters of the ureter, and down to within an inch and a half or two inches above the bladder.

8. The vesical and lower pelvic portions of the ureter may be reached, as Cabot, of Boston, has pointed out, by means of the sacral operation or Kraske's method modified by

osterplastic temporary resection of the os sacrum. In woman, the vesical portion of the ureter is accessible through the vagina.

9. The vesical orifice of the ureter may be reached from within the bladder by suprapubic cystotomy in man, or by dilatation of urethra, or superpubic or vaginal cystotomy in woman. Wainless, in 1903, reported a case of stone impacted in the ureter, with operation, and recovery.

The case was of special interest, on account of the kinking of the ureter, the impingement of the stone on the renal pelvic brim, the method of removal by incision of the pelvis of the kidney, and transfixion of its posterior wall in order to reach the looped-up ureter, which it seemed impossible to otherwise incise.

Dobson reports a case of ureterolithotomy in a male aged twenty-five years: who had suffered from renal colic for four months, and during the latter attacks, the kidney had become enlarged. Haematuria and pyuria were absent, but the urine contained albumen. On palpating the abdomen, a calculus was felt in the ureter just over the common iliac artery. Retroperitoneal exposure of the ureter was made by an incision internal to the spine of the ilium, and a calculus which was rough, angular and imbedded in the wall of the ureter, was extracted through a longitudinal incision one centimetre in length. The permeability of the ureter was assured by passing a bougie up into the kidney and down into the bladder. No sutures were placed in the ureter, but the wound was drained. The escape of urine

ceased on the fifth day, and the patient made a good recovery.

Schmidt (*Amer. Journ. Obstet.*, xlix, 1904) reports a case of female, age thirty-five years, who had calculus removed from the ureter. She had suffered a sudden typical attack of renal colic and at intervals of about a year, these attacks have been repeated. In all but the first attack, considerable pain followed in the right iliac region. Some four years ago, a surgeon made a ventral fixation to relieve this condition. Skiagraphs taken shortly after this time showed a stone $\frac{5}{8}$ inches long and $\frac{1}{8}$ inches in diameter in the lower portion of the right ureter. One year ago, the stone was shown in the same position. With the object of removing this body, the right ureter was catheterized. About 7 cm. from the ureteral orifice, a slight obstruction was felt. The catheter was allowed to remain for two hours in order to make examination of the urine from the two kidneys, in case an operation became necessary. At the end of this time, 15 c.c. of aboline were injected into the pelvis of the kidney and 5 c.c. injected as the catheter was being withdrawn. Colicky pains were immediately felt, these continued intermittently for eight days, when the stone was passed from the urethra.

Amer. Journ. Obstet., 1, 1904.

Buvee presented a paper before the Amer. Gyn. Soc. of Boston, on ureterolithomy as follows:

History.—In 1856, Gigon recommended opening the ureter through the loin to remove

ureteral calculi. In 1870 Bryant, at Guy's Hospital, incised and explored the renal pelvis through a loin incision. In 1882, Bardenheuer incised and explored the ureteral pelvis for calculi, and sutured the wound made in it. In 1884, Henry Morris proposed rapid dilation of the female urethra, and urethrotomy just in front of the prostate in the male, and then proceeding transvesically to remove calculi from the very lowest portion of the ureter. At the same time Emmet did vaginal ureterotomy, removing calculi with the curette.

In 1885, Cullingsworth planned and performed uretrolithomy through the lumbar incision. In 1887, Ceci removed a calculus from the lower portion of the ureter by the rectal route. Desault, in 1887, used and recommended his kiotome for incising the ureterovesicular junction in order to facilitate transvesical extraction of calculi from the lower portion of the duct; and in 1888, Richmond, of Missouri, succeeded in removing a stone lodged near the exit of the ureter by means of rapid urethral tenaculum. In 1886, Israel reported removing calculi from the upper part of the duct. Bergmann, Kirkham, R. B. Hall, Twyman and others did this operation previous to 1890.

Size and Number of Calculi.—The sizes of ureteral calculi vary from the merest particle to dimensions of several inches. According to Henry Morris, Le Dran quotes a case in which there were several calculi, weighing together three ounces, impacted in the middle

part of the ureter. In one of my cases the calculus weighed 1,310 grains, and had diameters of 2, $3\frac{1}{4}$ and $1\frac{1}{2}$ inches respectively. This is larger than any I have found recorded. Sometimes several are present, Morris having removed nine from the lower part of one ureter. In some autopsies both ureters have been found filled by a large number of impacted calculi. To find two or three at different points along the duct is far from uncommon.

Routes.—The routes for reaching and extracting ureteral calculi are the transperitoneal and the extraperitoneal.

The latter may be subdivided into loin, inguinal, vaginal, rectal, sacral, perineal, and transvesical.

For removing the calculus from the ureter the different procedures have been:

1. Pushing the stone in a reverse direction to its passage and extracting it through the wall of the duct at a more favorable point, or through the kidney structure:

2. Dilation of the portion of the duct below the calculus and removing the stone through the bladder.

3. Longitudinal ureterotomy at the point of lodgement of the calculus; and

4. Intraureteral injection of sterilized vaseline as recommended and employed by Schmidt of Chicago. Crawford, (*Amer. Med.*, 1904, viii, p. 971), reports on the operative technic in stone in ureter with one case operative as follows: Free suprapubic opening into the bladder and found this viscus ab-

solutely free of any foreign body. On having an assistant elevate the floor of the bladder through the rectum, found the left ureter very slightly patulous and by insinuating the point of finger through the meatus, discovered a stone of very large size for that location. Meatus not dilated by forcible instrumentation but with the point of the index finger introduced.

Fowler, (*Ann. of Surg.*, xl, 1904, p. 943), reports two cases on the iliac extraperitoneal operation for stone in the lower ureter in the male and concludes as follows:

Extraperitoneal ureterolithotomy is a highly successful operation. The mortality should even be less than that for nephrolithotomy, and with an operation combining such small risk with so great technical simplicity, this part of the urinary apparatus will be as fearlessly and as successfully exposed as the other portions which have long been considered more easily accessible.

The intravesical portion of the ureter is most readily and most satisfactorily reached by suprapubic cystotomy. This gives the best exposure. The operation on the ureter can be carried out under guidance of the eye.

Calculi in the intravesical or intramural portions of the ureter then are best reached by suprapubic intravesical route; calculi impacted in the juxtavesical and paraischial portions should be removed by the iliac extraperitoneal route.

Fowler reports the case of a man on whom Agnew made a lithotomy October 30, 1887,

removing a stone weighing three ounces, and on whom Cantwell made a nephrectomy, September 21, 1897.

About January 10, 1905, the third operation was made in the form of a suprapubic cystotomy for the removal of a ureteral calculus four inches long and about one-half inch in diameter.

This concretion protruded from the ureter into the bladder. The patient left the hospital on February 5, 1905, able to follow his old trade and habits.

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CHAPTER V (c).

URETERORRHAPHY.

1832-1905.

Ureterorrhaphy, suturing the ureter, is done to close lacerated or incised wounds by accident, spontaneous rupture, or surgical intervention.

The material used for this purpose is small sized silk or catgut with a correspondingly small needle; the greatest objection to silk being the accumulation of the urinary salts upon the sutures if they should project into the lumen of the ureter, while catgut will disintegrate before such an accumulation can take place.

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CHAPTER V (d).

URETEROURETERAL ANASTOMOSIS.

1891-1905.

Ureteroureteral anastomosis is resorted to for the purpose of reestablishing the ureteral canal after the ureter has been severed by disease, accident, or surgical injury. Several kinds of devices have been employed for the purpose with more or less satisfaction, but the more rational method is by suture. Bovee, in 1897, writes on the subject as follows: Conclusions:

1. "Ureteroureteral anastomosis is a perfectly feasible procedure.

2. Ureteroureteral anastomosis whenever possible is far preferable to any other form of ureteral grafting, to nephrectomy, and to ligation of the ureter.

3. It should be done preferably by lateral implantation or by oblique end-to-end anastomosis, though the transverse end-to-end or end-in-end methods may be safely employed.

4. That constrictions of the calibre of the ureter do not usually follow attempts at suturing in closure of complete transverse section of the duct.

5. That nephrectomy for transverse injuries of the ureter *per se* is an unjustifiable operation.

6. That simple ligation of the ureter to

produce extinction of the function of the kidney is too uncertain to justify its practice.

7. That drainage is not necessary if the wound be perfectly closed and the tissues throughout are aseptic."

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CHAPTER V (e).

URETERO-COLON ANASTOMOSIS.

1888-1905.

Uretero-Colon anastomosis was first employed by Tuffier, and is most desired when the ends of the ureter can not be properly approximated; the proximal end is sutured with silk, in an incision made into the gut, and the distal end occluded by ligature. It is an operation that should not be made except in extreme cases, as infection of the kidney will ensue within one or more years.

Uretero-rectal anastomosis was first employed by Fowler, and is less frequently followed by kidney infection than any other uretero-intestinal method employed at this time. It is resorted to in cases where the bladder is removed for cancer, exstrophy or hypertrophy. Kidney infection is less frequent if the implantation is made near the internal sphincter ani. The presence of urine in the rectum does not cause irritation of the rectal mucous membrane.

Fowler says the advantages claimed for this method of operating are as follows:

1. "An efficient permanent valve, with a mucous surface applied to the open mouths of the ureter, is provided. This valve is so situated that it is closely applied to and occludes

the open ends of the ureters as the rectum becomes filled with urine, or when fecal matter descends from above."

2. "Placing the ureters in the submucous space of the rectal wall for a distance of three or more centimetres above the point where these enter the cavity of the rectum affords an additional safeguard against renal infection. In this situation the circular muscular fibres of the bowel-wall compress the ureters and secure occlusion at this point during the act of defecation."

Simon.—In 1851 a loop of thread passed in an ingenious manner, was made to ulcerate through contiguous portion of ureter and rectum in a case of exstrophy of bladder in a boy 13 years of age, communication resulted and continued though urine escaped by skin and the patient died of suppurative pyelitis at the end of one year.

Smith.—In 1871 Smith grafted each ureter into colon on corresponding side, for exstrophy of bladder; operation on left side 14 months after right; death 24 hours, necropsy. left kidney hydronephrotic from stenosis (probe passed along ureter would not enter bowel) obstruction at point of graft on right side kidney showed chronic changes.

Muster.—For cancer of prostate involving bladder Kuster did cystotomy, liberating bladder from peritoneum; then median perineal incision 8 cm. long; cut and isolated urethra below prostate; returning to hypogastrium, cut ureters and lifted bladder and prostate together; transplanted ureters into rectum; su-

tures did not hold; death on 5th day of peritonitis and ascending pyelonephritis.

Chapit.—Sept. 13, 1892, Chapit operated for fistula communicating with vagina and a point high in ureter following vaginal hysterectomy. Ureter dilated, anastomosis is made with posterior surface of descending colon, drain in post-peritoneal space; one year later, no infection had occurred.

Chapit.—Tubercular cystitis and vesical fistula following operation, ureters implanted into rectum 3 months apart, suppression of urine; death same day.

Maydl.—Report of 5 cases done by his plan for ectopia vesicae, one of which died of prolonged narcosis; four cured.

Duplay.—For tubercular and other bladder disease author operated on two cases both of which died; method not explained.

Kossinski.—In 1894 performed vaginal hysterectomy and cystectomy for cancer successfully, and implanted ureters into bowel.

Rein.—Ectopia vesicae Maydl operation suturing in 2 layers. Momentary results good, but according to Boari, abscess formed some time after, and the patient died.

Rosegotti.—Maydl operation for ectopia vesicae; success.

Trendelenburg.—Tubercular left kidney and bladder; removed them and successfully grafted right ureter into Colon.

Vasilyeff.—For malignant disease of bladder performed a successful Maydl operation.

Tuffier.—Alveolar epithelioma of bladder in a man, performed cystectomy with rectal

graft of ureters; death. Details surrounding illness and death not given.

Leet.—Implanted one ureter into rectum; death from irrelevant cause at some later time; autopsy showed no dilatation or infection.

Bergenhem.—Removed bladder and successfully implanted ureters into rectum—by Maydl's method.

Schibkler performed an unsuccessful Maydl operation, and Krynski a successful Maydl operation for ectopia vesicae.

Chalot in a case of cancer of uterus removed uterus and implanted both ureters obliquely into rectum, the right an inch below the left; success.

Trombetta performed a successful Maydl operation for ectopia vesicae, and Wolfler did two successful Maydl operations for ectopia vesicae.

Casati.—Vesical tuberculosis. Boari button used for grafting left ureter into colon. Death in 35 days.

Boari.—(loc cit) vesicovaginal fistula with complete destruction of urethra; successful graft in rectum with button.

Herzel performed a successful Maydl operation for ectopia vesicae in a boy of 5 years, removing bladder and inserting both ureters into sigmoid, right at upper and left at lower end incision, and Mikulicz. Maydl operation for pyenephrosis; defective continence and death in 4 months.

Roswell Park performed a Maydl operation for ectopia vesicae; death.

Fritsch.—Had a fatal case of rectal implantation of ureter.

Fowler performed his operation successfully in a case of ectopia vesicae.

Kummel removed bladder of a woman in 1892 and was unsuccessful with rectal grafts of ureters.

Frank performed two successful Maydl operations for ectopia vesicae.

Schnitzler performed two operations of rectal graft of ureters for tubercular and other diseases of the bladder; one died.

Tuffier successfully modified a Maydl operation for exstrophy in boy of fifteen.

Pressat performed a successful sigmoid graft of ureter, and Boari a successful Maydl operation (with additional piece of bladder mucosa) for exstrophy.

Crespi performed a successful operation according to Boari, Dec. 8, 1896.

Cappello performed a successful Pozza operation for exstrophy, while Pozza modified Maydl's operation in a successful case for exstrophy of bladder by grafting a considerable portion of the trigonum with vesical end of ureters.

Ewald.—Had two successful cases of grafting ureters into sigmoid for ectopia vesicae.

Peters operated for ectopia vesicae and rectal prolapse to knees in a child 5 years of age; extraperitoneal lateral implantation of ureters into rectum; rectal tolerance at once; 5 weeks after operation patient urinated every 3 to 5 hours during daytime and 4 to 5 hours at night.

Cameron operated in a case of ectopia vesicae of 19 years duration.

Wood performed Fowler's operation for vesica ectopia; death 2 months later from kidney infection; high graft.

Herzel reports 2 such cases successfully operated.

von Eiselberg reports 7 Maydl operations with 3 deaths.

von Winiwarter. One of ectopia vesicae; successful Maydl operation and Allen, ectopia vesicae; successful Maydl operation.

Gersuny.—Divided rectum from sigmoid flexure; closed upper opening in rectum and implanted into it the ureters and a part of the bladder wall, thereby forming a new bladder, end of flexure carried down through Douglas's pouch and through the sphincter, where it was sutured successfully.

Nove-Josserand.—For ectopia vesicae did a successful implantation by method differing from Maydl's in that the removal of the bladder is not done until after the graft is made.

Beck.—(Personal communication) Inserted ureteral ends with trigonum into rectum for ectopia vesicae; successful.

Beck.—Grafted both ureters into sigmoid with total exclusion of bladder for tuberculosis of bladder from infection of it after operation for tubercular fistula in ano. Tunnelled bowel-wall and left portion of ureters hanging free in bowel to prevent infection. Operation has been done eight months, and no evidence of infection exists.

Albarran.—Ureterocolostomy in continuity

of ureter done in 1899; death. Autopsy showed the kidney connecting with colon was tubercular and the other ureter was obstructed with tubercular mass.

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CHAPTER V (f).

URETERO-VESICAL ANASTOMOSIS.

1886-1905.

Uretero-Vesical Anastomosis more nearly approaches nature than any other method. The elasticity of both the ureter and bladder make it possible to unite them even when the proximal end of the ureter is very short. Life is less endangered and more extended by this than any other form of anastomosis, and it should be given preference.

Krug reported in 1894 a successful case of implantation of the severed ureter into the bladder; the patient, 30 years of age, had large multiple fibroids, intra-ligamentous. Her condition was complicated by the presence of many abscesses all over the peritoneal cavity, not only of the ovaries and tubes, but also between the intestines. Hysterectomy was performed, and during the course of the operation, I severed the left ureter. The ureter had an anomalous course, running in front of the tumor near the parietes. Ureter implanted into the bladder, bowels moved on third day; entire convalescence smooth. Cystoscopical examination proved the patency of the implanted ureter.

Boldt, in 1899, reported a case of implantation of the ureter into the bladder per abdominal section for the cure of uretero-vaginal

fistula, the patient made a good recovery, the opposite kidney assuming the requisite functions as well as could have been expected.

Reynolds, in 1901 reported a case of vesical implantation of the ureter by Dudley's forceps method after the failure of several plastic operations.

Bovee in 1900 writes a critical survey of ureteral implantations and reports the following cases of bladder implantation or ureter for ureteral injuries during abdominal operation:

Tauffier, in removing a broad ligament cyst, accidentally cut off the ureter, and successfully transplanted it into the bladder intra-peritoneally.

Westermarck did a successful transperitoneal graft.

Dunning injured ureter during removal of an abscess from the pelvic structures; transperitoneal implantation into bladder; success.

Matas (personal communication) in removing a large fibroid of the uterus in 1895 found urine spurting from a completely severed ureter one and a half inches from bladder. Successful intraperitoneal bladder graft.

Lannelongue made an unsuccessful bladder-graft of the ureter.

James performed an extraperitoneal bladder graft for stricture of ureter. Fistula resulted, requiring a second operation; successful.

Veit did an extraperitoneal operation by bringing severed ureter out of abdominal incision at point where it passed abdominal wound, where it was fixed by two sutures between fascia and peritoneum, skin incision being carried

to symphysis and bladder opened extraperitoneally on anterior surface; ureter cut obliquely and sutured into bladder. Recovery.

Pozzi injured ureter during operation and grafted into bladder; nine months later did herniotomy and found ureter size of femoral artery, which he considered due to reflux from bladder when urine was held too long.

Schwartz. Case of transperitoneal graft of ureter in bladder. Recovery.

Baldwin. Operation for sarcoma of fundus uteri cut out one and a half inches of ureter. Could not make ureteroureteral anastomosis, as loss was too great. Performed bladder graft, and as tension was great, sutured bladder to broad ligament. Recovery.

Baldy. Ureter imbedded in inflammatory tissue. It was severed and grafted into bladder intraperitoneally. Success.

Penrose.—Cancer uterus abdominal operation lower portion of ureter involved and resected. Grafted successfully into bladder.

Krug. Same as Baldy's case. Success.

Delagenier, a successful case.

Futh, a successful case.

Polk. Same indications as case of Penrose. Return of disease and secondary operation, at which he found ureter dilated as the duct was too much constricted at lower end.

Fullerton.—A successful case of grafting a double ureter.

Graupner.—Same as Krug's transperitoneal; successful.

Lotheissen.—Same as Krug's transperitoneal; successful.

Veit.—Operation on adnexa; bladder-graft successful. Olshausen. Operation of adnexa; bladder-graft successful.

Podres.—Operation of adnexa; bladder-graft successful.

Hanks.—Transperitoneal operation on one case; successful.

Noble.—An unsuccessful intraperitoneal operation.

Wertheim.—Operation May 30, 1899 for intraligamentary ureteromyoma. Accidental severing, ureter implanted into bladder by means of a sling and knoted silk sutures. Success.

Israel.—Resected bladder for cancer and removed lower end of ureter. Implanted stump at a new place. Recovery.

Schuchard. For bladder resection; success.

Poppert.—For bladder resection; success.

Krause. For bladder resection; died.

Westermarck.—For bladder resection; success.

Albarran.—For bladder resection; success.

Verkoogen.—For bladder resection; death in two hours.

Kuster.—For bladder resection, two cases.

Bardenheuer.—For bladder resection; success; patient died five months later from other trouble.

Wertheim.—Operation Dec. 5, 1895, for papilloma of bladder and involvement of left ureter. Removal of tumor part of bladder wall, and ureteral orifice; implantation ureter into the bladder-hole; death in 42 days.

Wertheim.—Removal of tumor with portion

of uterus seven cm. of ureter and portion of rectum, leaving stump of ureter 2 cm. long. Implantation with great difficulty. Fistula established; death occurred shortly after.

Cases of implantation of bladder or ureter for uretero-vaginal and other ureteral fistulae.

Novaro.—Did two successful cases for uretero-vaginal fistula after vaginal hysterectomy.

Martin.—Case failed by vaginal route and was successful by the abdominal extraperitoneal graft.

Kaysar.—Thirteen days after hysterectomy, urine noticed coming through abdominal incision; cut down and performed bladder graft. Sutures drawn out of urethra and fastened to dressings; flow gradually stopped; catheter a demeure; imperfect result; operation repeated 5 months later. For 5 days fastened a weight of 200 grammes to sutures. Success.

Ferguson.—Transperitoneal successful for uretero-abdominal fistula after abdominal operation.

Calderini.—Uretero-vaginal fistula transperitoneal graft; success. This case was in both ureters.

Sokoloff.—Successful transplantation after forceps delivery.

Bazy.—Three successful cases, one requiring a second operation. All for uretero-vaginal fistula following vaginal hysterectomy.

Trendelenburg.—A successful case.

Boldt.—Successful transperitoneal case for uretero-vaginal fistula.

Mackenrodt.—Three cases by the Fritsch-

Kelly method and the first died from nephritis unconnected with the operation.

Latheissen.—Transperitoneal success.

Albarran.—Abnormal attachment of ureter; successful.

Colzi.—Congenital abnormal orifice of ureter in vagina. Incised above and outside labium; detached genitals from arch of pubes cutting away some of the bone from the lower surface of arch to reach base of bladder; abnormal ureter cut across and sutured into place; success.

Rouffart.—Two cases transperitoneal after uretero-vaginal fistula; one died.

Bushbeck.—Transperitoneal operation for ureterovaginal fistula, the second failed and nephrectomy was done.

Tuffier.—One successful case after forceps delivery.

Amann.—Two such cases; success.

Sanger.—One such case; success.

Baker.—Extraperitoneal vaginal; successful.

McMongale.—For uretero-vaginal fistula after laparotomy; success.

Witzel.—Extraperitoneal; vaginal had failed; success. His method is as follows: The bladder was detached and drawn out, the thickened ureter was severed at about the middle of its course through the broad ligament, the lower end closed by sutures, and the upper end brought to the upper part of the incision at the brim of the pelvis, drawn down beneath the peritoneum above the innominate line by a pair of long forceps started upward

near the peritoneum, the incisions in the pelvic peritoneum and median line of the abdomen were closed and the remainder of the operation done extraperitoneally, the bladder was then brought above the middle of the iliac fossa where it was fastened with catgut sutures. The obliquely cut ureter was now inserted into the bladder incision, the mucosa of the bladder and ureter being united by fine catgut and another row outside of it attached to ureter and vesical walls, an oblique channel through the bladder was formed by uniting the bladder walls over the ureter on both sides.

Davenport.—Case similar to Colzi's; success.

Baumm.—Same as Davenport's accessory ureter opening into urethra incontinence suprapubic extraperitoneal misplaced ureter divided proximal end in bladder; recovered.

Amann.—Another successful case for ureterocervical fistula, bladder raised by sound and oblique grafting done; success.

Krause.—Intraperitoneal (following vaginal hysterectomy) cut off ureter, split the end and spliced into bladder, suture through each, hip of ureter brought out and sutured to external meatus urinarius; successful.

Kelly.—Uretero-vaginal fistula after vaginal hysterectomy; loosened bladder from attachments and spliced extraperitoneally; success.

Kelly.—Uretero-vaginal fistula after vaginal hysterectomy; did extraperitoneal operation on wrong ureter, in the first case, by wrong direction of catheter. It failed and he closed

both uretero-vaginal fistulae by plastic operation. The second was done by the Fritsch method and the patient died from pyelonephritis (probably).

Dudley.—Annals Surg. lxxix, 1904, reports a case of uretercystotomy for accidental wound of the ureter in vaginal hysterectomy in a woman 70 years of age, where vaginal hysterectomy for carcinoma of the corpus uteri was performed. With a long slender forceps, the bladder wall was punctured from within outward at the point nearest to the cut end of the ureter. Then, after splitting the cut end of the ureter and denuding the bladder mucosa on either side of the punctured opening, author drew the ureter into the bladder and stitched it there by means of fine chromic catgut sutures. By this means, the split end of the ureter was held widely apart by means of sutures so that it could not easily contract and form a stricture. The tightly fitting ureter made the punctured bladder wound water-tight.

The special advantages of the method as already pointed out are two-fold: 1. A water-tight wound around the ureter where it enters the bladder. 2. Security against contraction of the end of the ureter where it enters the bladder. These advantages in a similar case would lead author named to repeat the operation if the bladder happened to be opened, and he would be inclined to make an artificial vesico-vaginal fistula for this purpose if the bladder was not open.

Lange.—Hysterectomy for cancer by another surgeon, pyonephrosis with right ne-

phrotomy nine months later, a month later median incision and both ureters implanted in fundus of bladder; silk suture brought out urethra and tied over short piece of drainage tube, the right failed and two months, superpubic cystotomy and successful anastomosis, five months, left pyonephrosis and nephrectomy: success.

Wertheim.—Uretero-uterine fistula, following removal of ovarian cyst. Operation January 3, 1896, extraperitoneal changing to intraperitoneal implantation of ureter into bladder. Death in 35 hours.

Schauta.—Vaginal fistula bladder implantation nephrectomy five months later: success.

Benkiser.—Supernumerary left ureter opening into vagina ureterocystotomy; success. This was probably a vaginal operation.

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CHAPTER V (g).

MISCELLANEOUS SURGERY OF URETER.

1841-1905.

Gerster in 1878 reported a rare form of imperforate anus, malposition of left and obliteration of the ostia of both ureters, with consecutive hydronephrosis of a confluent kidney, operation; death, necropsy. Operation as follows: An incision was made extending from the base of the scrotum to the apex coccygis, the perineal muscles were divided whereupon the contractions of the levator ani became visible; this and the fascia pelvis were also incised, but no intestine presented itself at the bottom of the wound; now the knife was laid aside and the subsequent tissues were separated by the aid of a forceps and the nail of the index-finger to the depth of two inches. "My endeavors says Gerster, to expose the viscus were mainly directed toward the left side of the sacral excavation, and at length a ruffled bulging, gut-like, whitish body, of about the calibre of a small finger, was encountered, being secured by two loops of silk ligature. This was well brought down and incised. Immediately several drachms of a whitish turbid alkaline-smelling fluid—intermixed with white farina-like corpuscles, es-

caped, and it became evident that some portion of the uro-poietic tract was opened. Death 21 hours after operation." Autopsy—The kidneys forming one confluent body, the portion corresponding to the left side being smaller and much less developed than the other. An isthmus of renal substance half an inch wide, connects the two sides of the organ which is situated directly over the spine and aorta. Progressed state of hydronephrosis, two separate, very distended and elongated ureters of the calibre of a small finger originate from the anterior surface of the kidney; their walls are greatly thickened, the right ureter and corresponding part of kidney are filled with a whitish turbid urinous fluid, in which there are suspended small corpuscles resembling grits. The left ureter same as the other, but empty and collapsed; at a distance of half an inch from the ostium, and incised opening is visible in this organ (where it was cut into at the operation). The attachment of the right ureter to the bladder is to be found at the normal site, its ostium being nearly or altogether obliterated (The finest probe could not be passed through it.) The left ureter does not reach the bladder at all, but attaches itself to the medio-posterior and inferior surface of the rectum and is also obliterated at the ostium the rectum a short blind sac is distended by gas and meconium to a diameter of 2 inches and is attached to the upper part of the os sacrum by a short kind of mesentery from which it depends into

the pelvis anteriorly to the insertion of the left ureter and at a distance of $\frac{1}{2}$ inch from it is to be seen a cylindrical band of tissue $\frac{1}{8}$ inch long and $\frac{1}{8}$ inch wide, connecting the rectum with the bladder there, where the insertion of the ureter is normally situated; a residue of the embryonic cloaca. The finest hair probe cannot pass through the canal perforating this cylinder, but the voiding of meconium through the urethra seems to be conclusive proof of the existence of a passage, however small, through it.

Hunter in 1884 presented before the New York Obstetrical Society an instrument for occluding the ureter. The instrument consisted of a catheter with a fenestra near the end, on the right or left side according to whether the right or left ureter was to be occluded. At the fenestra was a rubber balloon, covered during the introduction of the instrument by a slide, and when in position, distended by quicksilver introduced through the catheter by means of a syringe.

Fenwick in 1888 reported on the value of inspecting the orifices of the ureters by electric light in the diagnosis of "symptomless" hematuria and pturia. He reports three cases and says, these three cases are sufficient to illustrate the value of inspecting the orifices of the ureters by electric light and of excluding the kidneys as a source of the hematuria moreover, the same advantage can be gained in pyuria, and the many methods and instruments advised and devised for obtaining urine

direct from either kidney must now be partially superseded by the electric light. The ureteral orifices are not difficult to find, they are very rarely displaced, and still more rarely are they absent. A little tact in manipulation and knowledge of the cystoscope will bring them into view and amply repay the operator for examining them.

Van Hook in 1893 wrote on the surgery of the ureters a clinical literary and experimental research with the following conclusions:

1. The extra-pelvic portion of the ureter is most readily and safely accessible for exploration and surgical treatment by the retro-peritoneal route.

2. Hence all operations upon the ureters above the crossings of the iliac arteries should be performed retro-peritoneally except in those cases in which the necessity for the ureteral operation arises during laparotomy.

3. The intra-pelvic portion may be reached by incision through the ventral wall, the bladder, the rectum, the vagina in the female, the perineum in the male, or by Kraske's sacral method.

4. The ureter is not only exceptionally well protected from injury, but by its elasticity and toughness resists violence to a remarkable degree.

5. The histology of the ureters furnishes most favorable conditions for the healing of wounds.

6. Longitudinal wounds of the ureter at any point heal without difficulty in the ab-

sence of septic processes, under the influence of ample drainage.

7. In all injuries where the urine is septic before the operation, or where the wound is infected during the operation, drainage must be effected.

8. The chemic composition and reaction of the urine must be studied in all injuries to the ureter, the urine being rendered acid if possible and the specific gravity kept low.

9. The pelvis of the ureter is—*caeteris paribus*—the most favorable site for wounds of the ureter since scar contraction is not so likely there to be productive of ill results.

10. In aseptic longitudinal wounds of the ureter occurring in the course of laparotomy, suture may be practiced and the peritoneum protected by suture.

11. Transverse wounds of the ureter involving less than one-third of the circumference of the duct should be treated by free drainage (extra-peritoneal) and not by suture.

12. In transverse injuries in the continuity of the ureter involving more than one-third of the circumference of the duct, stricture by subsequent scar contraction should be anticipated by converting the transverse into a longitudinal wound and introducing longitudinal sutures.

13. In complete transverse wounds of the ureter at the pelvis, sutures may be used if the line of union be made as great as possible.

14. In complete transverse injuries of the

ureter in continuity, union must not be attempted by suture.

15. In complete transverse injuries of the ureter in continuity, union without subsequent scar contraction may be obtained by the writer's method of lateral implantation as described.

16. In complete transverse injuries of the ureter very near the bladder, the duct may be implanted, but with less advantage, into the bladder directly.

17. At the pelvis of the ureter continuity after complete transverse injury may be restored by Kuester's method of suture, providing the severed ends can be approximated by slightly loosening the ureter from its attachments.

18. Rudygier's method of ureteroplasty in such injuries may be tried if other methods can not be utilized. The primary operation should at least fix the ends of the tube as nearly as possible together.

19. In both transperitoneal and retroperitoneal operations the ureteral ends can be approximated by my method even after the loss of about an inch of its substance.

20. The use of tubes of glass and other materials for the production of channels to do duty in place of destroyed ureteral substance must be rarely satisfactory and even if temporarily successful, the duct is almost sure to be choked by scar contraction.

21. The implantation of the cut ends of a ureter into an isolated knuckle of bowel is ob-

jectionable; 1. Because the bowels is not aseptic; 2. Because the operation is too dangerous.

22. If this is not possible, the ureter if injured in vaginal operations should be sutured to the base of the bladder with a covering of mucous membrane as far forward as possible with a view to a future implantation or formation of vesico-vaginal fistula with kolpoplekisis.

23. In injuries to the pelvic ureter during laparotomy where the continuity can not be restored and where temporary vaginal implantation in the male the proximal extremity of the duct should be fastened to the skin at the nearest point to the bladder.

24. In ventral ureteral fistulae opening near the bladder, the ureteral extremity may in some instances be planted directly into the bladder without opening the peritoneum.

25. In such cases where the ureter will not reach the bladder, a flap may be raised from the anterior vesical wall and reflected upward extra-peritoneally, to meet the ureter and form a tubular diverticulum.

26. Such a flap may be so elongated by a preliminary operation to transplant the peritoneum back of the fundus or be accurately suturing it there at a single sitting, that median ventral fistulae of the ureter may be cured if they open at any point an inch or more below the umbilicus.

27. Symphysectomy is a valuable and justifiable preliminary step in these plastic vesical operations.

28. It is legitimate when both ends of a cut ureter open upon the abdominal wall to try Rydygier's method.

29. Implantation of one or both ureters into the rectum is absolutely unjustifiable under all circumstances-because: 1, the primary risk is too great; 2, there is great liability of stenosis of the duct at the point of implantation; 3, suppurative uretero-nephritis is almost absolutely certain to occur either immediately or after the lapse of months or years.

30. Ligation of the ureter to cause atrophy of the kidney is unjustifiable.

31. Extirpation of a normal kidney for injury or disease of the ureter is absolutely unjustifiable except where the ureter cannot be restored in one or either of the ways cited.

Fenger in 1894 reports a short resume on the surgery of the ureter with the following conclusions:

Accidental wounds and subcutaneous ruptures of the ureter have not as yet been objects of direct surgical procedure upon the ureter at the seat of lesion. It will be advisable, however, when as soon as the diagnosis can be made, or when lumbar opening of a peri-ureteral cavity containing extravasated urine is made, to look for the seat of rupture, and, if practicable, to restore the continuity of the canal.

Catherization of the ureters from the bladder for purposes of diagnosis of diseases of the kidneys has given valuable information affecting the decision for or against operation on

the kidney. The procedure is reasonably practicable in the female by the methods developed by Simon, Pawlik and Kelly.

In man, catheterization is practicable only through epicystotomy. The danger of this operation is steadily decreasing. The old mortality, which varied from 27 to 20 per cent., has been reduced in the more recent series of operations (Ultzmann).

Ultzmann 9, 1 death: Albert has had 20 cases with 1 death; Assandelft 102 cases with 2 deaths; Bergman 10 cases; Von Iterson 12 cases; Trendelenburg 6 cases and Antal 3 cases, all without a death. Therefore, this procedure is justifiable in selected cases.

Catheterization of the ureter from the bladder as a curative measure for the evacuation of hydro or pyo-nephrosis has occasionally been performed successfully. (Pawlik). It is more difficult and more uncertain than nephrotomy, and the attempt to find and remedy the stenosis of the ureter from the pelvis of the kidney.

Dilatation of strictures of the female ureter by elastic bougies or catheters has been tried from the bladder by Kelly with temporary success and from the pelvis of the kidney by Alsberry successfully. Consequently, this procedure is of use in isolated cases.

Permanent catheterization of the ureter from the bladder, through a fistula or in the case of an implanted ureter is often tolerated only for a limited time, and must be employed with caution for fear of causing ureteritis.

Uretero-lithotomy by longitudinal incision for the removal of a stone is a safe operation heals without stenosis. In extraperitoneal by the extraperitoneal method. The wound operations suturing is unnecessary. Drainage down to the wound is sufficient.

Intraperitoneal ureterectomy should be done only when access outside of the peritoneal cavity is impossible and should be completed by carefully suturing, covering with a peritoneal or omental flap and drainage.

Opening of the peritoneal cavity to locate the seat of the stone may occasionally be necessary, but when the diagnosis is once made, ureterotomy for the removal of the stone should be done through an extraperitoneal incision and the abdomen closed.

In valve-formation or stricture of the ureter causing pyo-or hydro-nephrosis or a permanent renal fistula, nephrotomy should be followed by exploration of the ureter in its entire course from the kidney to the bladder.

Exploration of the ureter as to its permeability should be done from the renal wound by a long flexible silver probe, a uterine probe, or an elastic bougie either olive-pointed or not. If the bougie passes into the ureter, the examination is at an end. The size of the bougie that will pass through a healthy ureter is from 9 to 12 French scale.

If the pelvic orifice of the ureter cannot be found from the renal wound it should be sought for by opening the pelvis by pyelotomy or ureterotomy.

A longitudinal incision half inch to an inch long in the posterior wall of the pelvis can be made while the kidney is lifted upon and against the twelfth rib. This procedure is easy if the pelvis is dilated, but may be impossible if the pelvis is of normal size.

Operation for valve formation should be done through the wound in the pelvis. If the opening cannot be seen or found from the pelvis, ureterotomy should be performed immediately. Below the pelvis a small incision should be made in the ureter and a probe passed up into the pelvis; the valve should be slit longitudinally and the incised borders so treated as to prevent reformation of the valve.

A stricture in the ureter, if not too extensive, can be treated by a plastic operation on the plan of the Heinecke-Mikulicz operation for stenosis of the pylorus, namely: longitudinal division of the stricture and transverse union of the longitudinal wound. This method of operating for ureteral stricture seems to me preferable to resection of the strictured part of the ureter (Kuster's operation) for the following reason: it is a more economical operation and preferable when the elongation of the ureter is not sufficient to permit the two cut ends of the ureter after excision of the stricture not only to come in contact but even to permit of closure by invagination without stretching.

Resection of the upper end of the ureter and implantation of the distal end into the pelvis may be useful in rupture or division or

stricture of the upper end of the ureter as described by Kuster.

In a similar case of stricture in the upper end of the ureter, especially if the ureter were not elongated or the kidney movable, I should prefer the plastic operation proposed by me, as it is easier of technique and as it proved successful in my case of traumatic stricture in the ureter below the pelvic orifice.

The ureter is accessible through an extra-peritoneal incision. A continuation of the oblique incision for lumbar nephrotomy from the twelfth rib down along and one inch anterior to the ilium and along Poupart's ligament to about its middle, gives access to the upper three-fourths of the ureter and down to within two or three inches above the bladder.

The vesical and lower pelvic portions of the ureter may be reached as Cabot has pointed out by means of the sacral operation, or Kraske's method modified by osteoplastic temporary resection of the sacrum. In woman the best proportion of the ureter is accessible through the vagina.

The vesical orifice of the ureter may be reached from within the bladder by suprapubic cystotomy in man or by dilatation of the urethra, supra-pubic or vaginal cystotomy in woman.

Uretero-uterine fistulae can be treated satisfactorily by plastic closure of the vagina or nephrectomy. Implantation of the ureter into the bladder is, under favorable circum-

stances, the operation of the future for this condition.

Uretero-vaginal fistula and congenital urethral or vaginal terminations of the ureter should be treated by vaginal plastic operation for displacement of the proximal end of the ureter into the bladder. If these attempts fail and the kidney is not infected, extra or transperitoneal implantation into the bladder should be done; and finally as a last resort, nephrectomy.

Complete transverse wounds in the continuity of the ureter should be treated by uretero-ureterostomy after Van Hook's method of lateral implantation, if possible.

Complete transverse wounds of the upper end of the ureter should be treated by implantation of the ureter into the pelvis of the kidney as devised by Kuster.

Complete transverse wounds of the ureter near the bladder should be treated by implantation into that viscus either by slitting the ureter or by invagination.

Loss of substance of the ureter too extensive to permit of uretero-ureterostomy or too high up to permit of implantation into the bladder, may be treated by implantation on the skin or into the bowel.

Implantation into the bowel is objectionable on account of the infection which is almost certain to follow sooner or later.

Implantation on the skin in the lumbar region or the abdominal wall, however, is much less dangerous than the primary operation.

Implantation into the rectum should not be resorted to when implantation into the bladder is possible.

Reed, in 1895, wrote an article reviewing ureteral surgery. He says it is astonishing when you look over the literature pertaining to the ureter that prior to 1880, when an article was written by Emmett, we are unable to find anything else on this subject. Following Emmett, we find an article by Staples, written in 1884, and another by Galland of Paris in 1885. From this on, reference to the surgical treatment becomes more frequent until up to the present time there have been written more than eighty different articles pertaining either directly or indirectly to the surgery of the ureters. That the ureter opens up a legitimate field of surgery is beyond a question. That the proper surgical treatment of the ureter may make a nephrectomy unnecessary, or even save life is without controversy. After briefly reviewing the progress made in the last few years in the surgery of the ureter, we are led without further light to the following legitimate conclusions:

1. That where it is possible a traumatism of the ureter should be repaired by plastic operation which has for its object the union of the distal and proximate ends of the ureter.

2. Where it is possible to reach the superior portion of the bladder, it is advisable to implant the distal end of the ureter into the bladder.

3. Where it is impossible to either unite

the distal or proximal end or implant the distal end into the bladder, we would advise as a matter of choice the implantation of the ureter into the alimentary canal rather than into the vagina or the making of a fistulous opening through the skin.

Davis, in 1900, in an article on the treatment of injuries to the ureters, says that, when division of the ureter occurs, the following would seem to be the rational mode of choosing the method of repair:

1. When possible to perform uretero-ureteral anastomosis; this is the preferable procedure; end-in-end anastomosis, as employed in this case, seeming to me simpler and better.

2. When the distal portion is too short for uretero-ureteral anastomosis, implantation into the bladder should be performed.

3. When there is too much loss of substance to permit uretero-ureteral anastomosis and the proximal end cannot be brought down to the bladder even with the assistance of a diverticulum of the bladder as devised by Van Hook, the procedure with the least objection is probably implantation into the colon.

Gibson in 1900, on a case of uretero-vaginal fistula, with notes of a case for which uretero-cystotomy was performed, says "As regards the causation in this case, there is no doubt but that it was the silk ligature which controlled the hemorrhage from the adhesions mentioned in the case reported that had also been passed around the right ureter. There seems to be reason to believe that had the su-

ture been of less persistent material than silk, e. g., cat-gut, that the ureter would have remained intact till the suture was absorbed, and then resumed its function. I shall not use silk in tying anywhere in the region of the ureter in future.

The other methods of treatment that have been adopted for uretero-vaginal fistula are: (1) Some form of plastic operation by which an artificial vesico-vaginal fistula is made close to the ureteral fistula and then both orifices are encircled in a ring of vaginal denudation and so the urine flows from the ureteral fistula into a loculus in the vagina and then through the vesico-vaginal fistula into the bladder, the drawback to this operation is that you run the risk of adding to the patient's discomfort by giving her in addition a vesico-vaginal fistula, as these delicate operations conducted through a mucous canal are sometimes unsuccessful; (2) partial or total colpocleisis (3) nephrectomy.

The objections to the above-mentioned plastic procedure, "hold good in regard to colpocleisis. Nephrectomy, unless the kidney is diseased beyond recovery, is not to be thought of.

Although not exactly coming under the heading of ureteral fistula, a word may be added in regard to wounds of the ureter occurring during operations. If the ureter is wounded above the true pelvis, it will be impossible to get the proximal end so freed as to reach the bladder and so allow uretero-

cystostomy to be performed. In such a case, two methods reported of procedure are open: (1) To perform uretero-ureterostomy. This is the operation, devised by Van Hook of Chicago, by which the upper end of the divided ureter is sutured into the lower. It has been successfully performed by Kelley of Baltimore.

(2) Implantation of the ureter into the bowel. This is a bad procedure, for not only is it apt to lead to septic peritonitis immediately after the operation, and even if this danger is avoided ascending renal infection is likely to take place. In connection with cases where a large piece of ureter has been cut away, as has occurred where it is spread out over a large fibroid, an interesting case is published by Feuth. In his case the above accident occurred and instead of performing nephrectomy, he firmly ligated the divided ureter. Beyond a dull pain in the region of right kidney, and the bladder containing blood, there were no symptoms. These both gradually disappeared and the patient made an uninterrupted recovery. The kidney underwent cystic degeneration and in seven months from operation its place was taken by a large fluctuating tumor, which, however, gave rise to no unpleasant symptoms and about which the patient was perfectly ignorant. In cases therefore in which it is impossible to do uretero-cystostomy or uretero-ureterostomy and the patient's condition will not permit of a nephrectomy, it is advisable to ligate the divided

ureter, postponing the nephrectomy to a later date or avoiding it, if possible, altogether.

Dr. Coe, in 1902, reported cases illustrating ureteral surgery, says: Although my experience in ureteral surgery is too limited to permit any deductions with regard to operative technic, the cases recorded seem to be sufficiently instructive to justify me in briefly referring to them. They at least serve to illustrate the fact that in complicated cases, especially with intraligamentary tumors, it is sometimes impossible to identify the displaced ureters before they are injured and therefore that every suspicious cord, adhesion or supposed blood-vessel should be carefully inspected before it is clamped or ligated, and again after it has been divided. When it is established beyond a doubt by the escape of urine that a ureter has been divided, nothing except the absolutely desperate condition of the patient should deter the surgeon from at once attempting to repair the injury instead of resorting to the unsurgical makeshift of suturing the end of the ureter in the abdominal wound or to the serious procedure of removing a healthy kidney from a patient already depressed by a long and bloody operation.

The well-known difficulties attending secondary operations for the cure of ureteral fistulae, even in the hands of experts, would seem to render it imperative that an attempt should invariably be made to secure immediate repair. As regards the method to be adopted in the individual case no fixed rules can be

formulated. Each must be studied separately. The technique is now sufficiently familiar, at least theoretically, but the opportunities for its application are so rare that few surgeons have an opportunity to acquire such confidence and dexterity in dealing with this complication as with others which occur in connection with abdominal surgery.

Noble in 1902 reported clinically upon ureteral surgery with nine cases.

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CHAPTER VI.

DIAGNOSIS CATHETER AND CYSTO- SCOPE.

1875-1905.

Polk, in 1884, in a clinical lecture, says of catheterization of the ureter: The bladder must be empty, the abdomen free, the woman to be put in the knee-chest posture, and the perineum raised so as to distend the vagina with air. The lines are then seen starting from about the points at which we know the ureteric orifices to be situated and running upward and outward, the course of each corresponding to that of the ureter. There is no doubt that in cases of relaxed and distended vagina these lines can be brought out, but in such as present contrary conditions, you will as often fail to find them. But, granting that they may be recognized in all cases, the great defect in the method is the difficulty at ending the determination of the question as to the actual entrance into the ureter. The depth to which you may carry the instrument is but a poor guide. Many bladders are so elastic as to be carried before it even so far as the synchondroses. Given a case in which catheterization of the ureter is demanded as a means of diagnosis, (and every renal tumor requiring extirpation is such a case. Pawlick's method is too uncertain. Should the

patient be a woman, open the base of the bladder, pass your catheter through the urethra, and by means of your finger passed through the artificial opening, you can always insert the instrument into the canals. You collect urine first from one kidney, then from the other, and are in the only sure position to determine the state of the two organs. Should both be diseased, you spare your patient a fatal operation. Should one be sound, by operating you prolong life.

Harrison, in 1884, reported on a study of the dead subject relative to catheterism of the ureters and exploration of male bladder as follows: Lateral lithotomy was performed, the incision into the bladder was extended in front by opening into the membranous urethra with a probe-pointed bistoury, and behind, by cautiously extending the cut into the prostate, to almost the extreme limit of the gland. On subsequently removing the parts, it was found that in this way a considerable opening could be made into the bladder without exceeding what I should regard as a safe limit. Though the opening just described permitted a free access to the bladder for the finger, yet no part of the mucous lining could be inspected even with the employment of suitable retractors. With the assistance of the latter instruments, and by forcible pressure downwards with the hand over the pubes a small portion of the fundus of the bladder could be brought within sight but orifices of the ureters could not be seen nor could any instrument such as a probe introduced into

the bladder through the wound be made to enter them. The cavity of the abdomen was then opened by a median incision above the pubes sufficient to permit of the introduction of three fingers over the fundus of the bladder. By thus pressing the bladder down towards the perineal wound, the whole of the mucous surface could be brought into view, including the orifice of the ureters and the trigone. In one subject, by reason of some enlargement of the prostate, the view of the latter was imperfect. With the object of improving this, the following experiments were resorted to:

(1) Endeavoring to elevate the part by two fingers introduced up the rectum.

(2) By the introduction of a lever up the bowel and

(3) By the whole hand passed into the rectum.

By the first two methods employed, the view of the trigone was not improved, while the hand in the bowel by occupying the whole space obscured everything. When, however, there was no enlargement of the prostate, it was found possible with the hand introduced into the rectum, to bring all parts of the mucous surface of the bladder into sight, including that immediately behind the pubes. It was found quite easy to catheterize the left ureter. The right required a little more looking for. By a bilateral section of the prostate, the search for the latter was facilitated, but the conclusion we came to was that with a natural prostate, this additional inci-

sion was by no means necessary. It seemed not only possible to bring the whole of the mucous membrane of the bladder into view and within reach of manipulation, and to catheterize the ureters, but further, with the hand in the abdomen, to command all hemorrhage from the parts through which the deeper incision would probably pass. The latter point could only be verified on the living subject. It seemed, however, to us a reasonable inference to draw. Abdominal vesical surgery has recently made such important and almost unexpected advances that it does not appear unreasonable to consider, in their application to cases otherwise unprovided for, those operations on the dead subject which have just been described, and were repeatedly verified.

Kelly, in 1892, published an illustrated article on the ureteral catheter, and speaks simply of a few improvements which he has made in Pawlik's valuable instrument, securing what he believes a perfectly satisfactory ureteral catheter. The catheter thus made is a slender metal tube 30 centimetres in length, and 2 millimetres in diameter. At the end which is introduced into the ureter, it is slightly curved for 2 centimetres, and terminates in an olive-shaped point, 1.5 millimetres in diameter. Any further diminution of the size of this point renders it liable to pierce the bladder in the attempt to catheterize the ureter, while, if it is larger, it is difficult to introduce into the ureteral opening. I found that the long slit of Pawlik's catheter, which lets the

urine into the catheter, would frequently catch and cut the mucous membrane of the urethra as it was being carried into the bladder. I have replaced this in my own instrument by several perforations in a little gutter counter-sunk on the concave side of the shaft near the point of the instrument. The opposite end of the catheter at the handle is provided with a lip curving downward to facilitate the discharge and collection of the urine in a finely graduated tube. During the introduction of the catheter, this end of the tube is plugged with a short metal rod. Otherwise the urine would continually escape from the bladder while the orifice of the ureter was being sought. This little rod is attached by a fine chain to the catheter to prevent its being lost. I have placed a fixed metal handle 4 centimetres from the end of the instrument, 6 centimetres in circumference, and flattened on the side toward which the point is directed. This enables one to conveniently hold and direct the instrument in its introduction, and is better than the split movable wooden handle previously in use. The catheter thus constructed is altogether a convenient instrument, and its introduction one of the most delicately pleasing gynecological manipulations. I often thus introduce two catheters at the same time—one into each ureter—when by hanging a little test tube on the end of each, urine is simultaneously collected from both kidneys.

Gaither, in 1895, on catheterization of the ureters in the male, says: In one instance, a man with suspected pyelitis, although the

ureters could be brought into plain view and the catheter was repeatedly put against the mouth of each, it was found impossible to introduce it. Both ureters were surrounded by a circular ulcerated area with a radius of about 5 millimetres. Cocaine anaesthesia was used, but the patient suffered considerable pain, and after about ten minutes of futile effort, refused to allow the examination to proceed further. He would not submit to an attempt under chloroform, and left the hospital without a positive diagnosis having been made. Possibly there was a stricture at the mouth of each ureter, but the appearance on one side was that of an exceptionally patulous entrance. This was the only case in which it was impossible to catheterize the ureters if the vesical and renal conditions were favorable. On several occasions, the ureters could not be located at the first attempt even after diligent and protracted search, and the possibility of this embarrassing complication must be considered in estimating the chances of a successful catheterization. If general anaesthesia is used, the operation can be more easily and quickly accomplished. No great amount of skill is necessary, but one must have knowledge of the appearance of the normal bladder through the cystoscope, the position of the ureters, etc., which can only be acquired by considerable experience. Consequently the operation will probably not become popular among surgeons generally. In chronic nephritis, the catheterization of the ureters is of the greatest value in establishing a correct

prognosis. If the disease is found to be in one kidney, with the other normal or slightly involved, the outlook is favorable. This condition would explain some cases which are seen clinically in which the urine is loaded with albumen and tube casts, but which go on for years without developing serious constitutional symptoms. The information obtained from catheterization will prolong many lives by preventing the surgeon from operating when evidence of advanced disease on both sides is presented, and also by urging an immediate operation when one kidney is normal, with a pyelitis or pyelo-nephritis on the other side exhausting the patient's vitality more each day. If one kidney is slightly diseased, and the other considerably, it will influence the operator to perform a nephrotomy instead of a nephrectomy, thus leaving one kidney to aid its less crippled fellow and possibly turning the balance on the side of life. By following the methods which are now opened to us, the percentage of fatal results after operations on the kidneys should be still further lowered. The time has arrived when no renal surgery should be attempted until after the surgeon has obtained accurate and positive knowledge of the conditions of each kidney by means of the catheterization of the ureters.

Shoemaker, in 1895, writing on an improvement in the technique of catheterization of the ureter in the female, says, that while much advance was made in the difficult matter of ureteral catheterization by Pawlik, Si-

mon, and others who used the tactile method, there can be no doubt that to Dr. H. A. Kelly belongs the credit of a practical suggestion which made the procedure feasible in nearly all cases. This suggestion consisted in the elevation of the pelvis, thus causing distention of the bladder with air, when a catheter or speculum was in the urethra, to allow its entrance; the gravitation upward of the pelvic contents raises the base of the bladder, and so disposes the trigone and the region of the ureteral orifices, that these can be seen by direct light from a head-mirror through a simple tubular speculum open at both ends. Suitable dilatation of the urethra is promised. Dr. Shoemaker says, in catheterization of the ureter, and especially in passing a flexible instrument to the kidney of the detection of obstruction or the draining of collections, it is of very great importance that traumatism be avoided. It is sufficient to use cocaine for all ordinary cases. If the lesion is not more than 10 millimetres above the meatus of the ureter, nothing more than a temporary frequency of urination or slight pain will be encountered, providing everything is aseptic. Lubricating oils should be replaced by boro-glyceride and the patient should lie down for a few hours afterwards unless accustomed to the operation. When using a catheter of small calibre with eye in the end, it is sometimes observed that some of the urine escapes by the side of the catheter, a fact to be borne in mind is estimating the relative secretion of the two kidneys. It is safer to wash out the

bladder with boric acid solution before and after the manipulation, while particular care should be taken that the mouth of the urethra and surrounding parts are made clean before beginning. Cases are not numerous where the use of the ureteral catheter is necessary, but its field is important, and likely to increase; certainly all cases should submit to this examination prior to a nephrectomy. The writer has now under observation a hydro-nephrosis from obstruction in the ureter due to old pyosalpinx, which was removed. Serious danger has threatened from rupture in cases of hydro-nephrosis. Catherization has shown that nephrectomy is forbidden by the condition of the other kidney. The diseased ureter has now become pervious however, the stricture is under course of dilatation and the sac is being well drained, with great relief to the patient.

Valentine, in 1896, reported an article on ureteral catheterizations, concluding as follows:

I. That there is no object in comparing Nitze's and Casper's ureter-cystoscopes. They are certainly distinct instruments, one often proving most satisfactory when from any individual peculiarity the other fails. I should not consider myself safe without both. The personal obligation under which I am to both Dr. Max Nitze and Dr. Leopold Casper prevents my entering into the question of priority of invention which produced such an unfortunately acrimonious dispute while I was in Berlin. The solution of this question

is I think very gracefully reached. by Dr. Meyer when he says: "It seems, we have a right to call this new important instrument Casper-Nitze's ureter cystoscope."

2./ There is not the slightest intention herein of criticizing Dr. Meyer's able work or of inviting a controversy. If this leads the many friends of the New York Medical Journal to read Dr. Meyer's article a second time, much benefit to many sufferers from obscure renal and ureteral cases will doubtless result.

Meyer, in 1897, wrote on catheterism of the ureters in the male with the help of the ureter cystoscope, with a report of seven cases. Dr. Meyer says: "I further wish to mention the necessity of good assistance when catheterizing the ureters. I believe it is impossible to do good ureteral work in the male without the trained hand of a capable assistant. I have so far always had and needed the help of my office nurse. She thoroughly knows what I want, how to fix the cystoscope and catheter when I pull out the mandrel, how to steady the instrument when the catheter is in situ, etc. All these points to be observed when carrying out the work may at first seem cumbersome and superfluous, yet I deem them absolutely essential for successful ureteral work in the male.

"In summing up these remarks I should say that repeated disappointment in the early time of ureteral work in the male should not discourage the cystoscopist. On the contrary, it should stimulate him to further trials (efforts). The reason for his failure should be

sought rather in lack of experience in intra-vesical cystoscopic work, and also perhaps in lack of proper assistance, than in the imaginary defect of the instruments used for this purpose. Both of the ureter cystoscopes now in our hands are useful and do not need special improvements."

In order to be successful in using Casper's instrument, one will do well, I believe, to follow the rules I have laid down in my former article repeatedly referred to, rules which I have found practical by personal experience. They are, briefly, repeated and revised and extended after my additional experience, as follows:

1. Wash and cocainize the bladder according to well-known rules.

2. Fill the bladder with from five to seven ounces of clear fluid.

3. Introduce the instrument. For this purpose the ureter catheter should be pushed down to the internal opening of the canal of the cystoscope; the lid of the latter should be pulled out about 1-3 inch.

4. As soon as the beak has entered the bladder, the catheter should be gently pushed forward into the vesical cavity by about $\frac{1}{2}$ to $\frac{3}{4}$ of an inch, and then the lid should at once be pushed back into place, i. e., it should be fully closed.

5. After the interior of the bladder has been satisfactorily inspected, and the ureteral openings have come into view, approach one of them.

6. Let the ureteral opening appear at the

very end of the cystoscopic picture farthest away from the middle of the bladder, but keep it under your direct inspection with the prism as near to it as possible.

7. Push the catheter gently forward if the beak's direction is a proper one, i. e., if it is parallel with that of the lower end of the ureter. I am sure the ureteral catheter will almost invariably easily enter the mouth when conducted by a trained hand.

8. Allow the catheter to proceed not more than one or two inches into the ureter, and withdraw the wire mandrel. Then as a rule urine will begin to flow drop by drop at intervals or continuously.

By faithfully adhering to these rules in my work, I have invariably been successful. Of course the number of patients thus treated is not yet very great, but so far I can repeat conscientiously that whenever, whether in a male or female, I have been able to see and approach the ureteral opening, I have also succeeded in introducing the catheter into the same. I have specially added the words "so far" because I have no doubt that I may probably encounter cases in the future in which my attempts will not be crowned by success, although the uretral openings can be well seen and approached. But up to date, there has been only one among all my cases, male and female combined, that of a lady patient of Dr. E. F. Cushier and Dr. Robert F. Weir of this city, in which I have failed in my repeated attempts, although I saw the opening very distinctly before me. However, in this

patient, I afterward also failed with Kelly's method in repeated sittings. There was no catheter or probe small enough, metal or flexible, to enter the mouth. The reason for this was partially as has been primarily well ascertained with the cystoscope, that the ureter emerged, not as is usually the case, at the innermost end of the ureteral intravesical fold, i. e., nearest the trigonum, but about 1 cm. away from it, upwardly. The consequence was that the ureter catheter, in order to pass on would have had to turn in a sharp angle right after its entrance into the ureteral mouth. This seemed not feasible. Besides, the mouth of the ureter was constricted evidently congenitally. Such strictures we have to put on a basis with the congenital narrowness of the external meatus so often found in the male. By chance I nevertheless succeeded in determining the question at issue, viz.: Is the opposite kidney healthy? I may add this here, because the case really was a perplexing one. There had been an intermittent renal pyuria for the last 2 years. The right kidney was large, easy palpable, slightly painful to the touch. At the third sitting it struck me at once that when washing out the bladder, the water returned clear from the beginning. I concluded that on this day the ureter of the diseased side was most probably temporarily obstructed. Cocainization of the bladder was somewhat prolonged on account of making preparations for the following work. It may have taken in all six or seven minutes. During this time, the patient who

had taken a great deal of fluid before coming to my office discharged five ounces (!) of urine into the bladder. Instead of drawing off 50 cc. of the cocaine solution and perhaps 10-20 cc. of the meanwhile admixed urine, I measured 200 cc. (50 cc. of a two per cent. solution of cocaine had been injected by me). On viewing the bladder after Kelly's method, I saw that the ureter of the presumably diseased side which emptied within the centre of an irregular ulceration did not discharge a drop of fluid. Examination of the 200 cc. of mixed cocaine solution and urine proved the latter to be perfectly normal. In other words, there was a well working healthy opposite kidney. Dr. Weir successfully removed the diseased kidney. The operation as well as the specimen thus obtained proved to be of unusual interest.

Whether we should advise patients to take a large amount of fluid before examination is still a mooted question. In the male, I believe it is a wise plan to drain one kidney after the other, if possible; of course always in the same sitting. That is to say, we can generally not leave the catheter first introduced into our ureter. The proper plan is to liberate it, catheterize the opposite side, leaving the catheter there in situ and then remove the cystoscope. There will be a few urethrae found in the male of sufficiently wide calibre to allow properly moving the cystoscope with the catheter at its side within the urethra. It may often be possible under general narcosis. The latter, however, seems to me should, for

obvious reasons, be avoided as much as possible in this procedure. We drain the kidneys separately for renal disease. And ether as well as chloroform is detrimental to the renal tissue. So far, I have never used or needed general anaesthesia for my ureteral work. This as mentioned above has been office work throughout.

In the male we are therefore limited in the time. The sooner the patient gets through, the better. The more fluid he has taken before the examination, the more rapidly his kidneys will work. Of course due weight must be given this point in drawing conclusions from the urinary analysis. However, as both kidneys have been subjected to greater work at the same time, mistakes can be avoided by a competent analyst.

In the female the case is different. Both kidneys may be drained for hours, provided we do the work at the patient's home or at the hospital. The urine from each can be separated, collected in proper bottles put in the bed. We certainly can state the fact. Urinary analysis will be more satisfactory without diluting the renal secretion too much by previously ingested fluids.

With reference to finding out the amount of work done by each kidney within a given time, I formerly counted the drops that were discharged through the ureter in a certain number of seconds, and also counted the intervals between the different discharges. I have discarded this method since I have distinctly seen jets of urine at the ureteral opening enter

the bladder with the ureter catheter in situ. The urine evidently often drains alongside the catheter besides passing through its lumen. The catheters which accompany Nitze's ureter cystoscope are of more use in this respect than those of Casper's instrument. The former have an end hole behind a scoop-shaped lengthening of the material of which the catheter is made; the whole thus forming a sort of bougie. The latter carry the eye at the side. Nevertheless, I believe that timing the number of drops discharged through the ureteral catheter is an unreliable observation.

My whole ureteral work with a cystoscope according to Nitze's principles, has so far been done with Casper's instrument, this for the simple reason that the first specimen of Nitze's reached me in a damaged condition. Before it was exchanged by the factory more than half a year elapsed. I shall certainly try it the first opportunity that offers.

Whether in the female one should make use of a cystoscope constructed on the Nitze plan or of Kelly's instrument, is really a matter of taste. The manipulation with the imported ureter cystoscope certainly is a very gentle one. It is also very comfortable for the patient. She rests on her back in the position used by us for bimanual vagino-abdominal palpation.

A trained cystoscopist should, in my opinion, be master of all methods "that have proved useful and can be made use of for this purpose." In many instances he may, even in the female, succeed with the one method or

instrument, when the other failed for any reasons whatever.

In the male we have no choice. As explained at length above, Kelly's method for catheterism of the ureters is here a technical impossibility. We need instruments which carry the electric light into the bladder and enable us at the same time to inspect and catheterize the ureteral openings by looking through a telescope and guiding the catheters through a separate channel.

With regard to the indication for catheterism of the ureters, it is, in my opinion, our duty to try and separately collect and analyze the secretion of each kidney "in the male as well as the female" in all so-called obscure urinary diseases, provided the analysis of the bladder urine points to a renal lesion. It becomes our solemn duty to establish the presence, the health, or disease, if possible, also the working power, of the opposite kidney, if nephrectomy has to be done.

If physicians will come to appreciate the importance of this now feasible examination, and make it a point to have cystoscopy and catheterism of the ureters in the male as well as in the female, added to the other means at their disposal for arriving at a definite diagnosis, then the so-called obscure urinary diseases will at least become a thing of the past also in the male, and our diagnosis in the majority of cases will, instead of being mere guess-work, be put on a strictly scientific basis.

Casper of Berlin, in 198, on catheterization of the ureters in both sexes says:

"1. Catheterization of the ureters may be of great value when there is doubt whether there is an affection of the urinary apparatus or not especially in large abdominal tumors where it is doubtful whence they originate. Such cases have been recorded in literature—two by Pawlik, two by Albarran. I have observed three such cases.

2. In some doubtful cases of an affection of the urinary apparatus, the catheterization teaches us if the bladder or the kidney and ureter are the seat of the affection. It is true that in most of these cases, the diagnosis can be arrived at by other means especially by cystoscopy, but in cases where the contents of the bladder is cloudy, and where there is only a small focus of suppuration in the kidneys, it may happen that we are unable to determine if the urine which flows from the ureter is clear or cloudy. Clear liquid may impress us as cloudy, and *vice versa*. But the urine we collect through the catheter introduced into the ureter can easily be examined macroscopically and microscopically. We are thus enabled to state with the utmost accuracy if there is any suppurative process or not. I have a record of three such cases. In one case which I have published, a nephrectomy had been performed by a colleague because he had observed cloudy urine flowing from the ureters. At a cystoscopic examination I found the secretion of both kidneys clear and normal.

3. If a disease of the kidneys has been diagnosed, the catheterization of the ureters will always show us which kidney is the seat of the disease, and may enable us to state the nature of the malady. This applies only to exceptional cases, for in the majority of cases, we shall be able to say by other means, in which side the malady is localized.

But we know that pain is often deceptive as a diagnostic factor, the pain being localized in the healthy kidney, while the other one contains a calculus. On the other hand, we know from a number of cases that a healthy kidney may be larger through a compensatory hypertrophy than the diseased one. If not for the catheterization of the ureters, we might in these cases locate the seat of the affection on the side which is healthy.

A number of cases have shown that the catheterization of the ureters enable us to recognize the nature of the disease. I impress upon you again, as I stated in the beginning, that the catheterization was only employed, and this ought to be done in all cases where the other diagnostic methods were used without result. As to stones in the pelvis, not much is to be expected. Albarran and myself have occasionally felt a stone in the pelvis with the metallic head of the ureteral sound. But, on the other hand, the fact that we do not feel a stone by no means proves that there is none.

On the other hand, the catheterization of ureter proves more satisfactory in stones being in the ureter, and here it renders ser-

vices far better than any other method. The stones can be felt very plainly, but not only can their presence be diagnosticated, but, and this is of the utmost importance for the treatment, also the part of the ureter in which they are located. I have had three cases of stones in the ureters where I could positively determine the seat of the stones by means of the catheter. In two of them there was absolute anuria.

An entirely new and remarkable observation is that of spasms of the ureter, which I could demonstrate in a case of hysterical oliguria by means of the ureteral catheter. I had previously reported occasionally spasms occurring in the ureter which may simulate a displacement of the ureter at least to the unexperienced eye. In the case of typical hysteria, the spasm of the ureter was found at the same time when there was a period of oliguria.

No urine flowed spontaneously from the ureteral catheter after an injection of liquid into the contracted part of the ureter; however, secretion of the urine took place. These spasms must not be confounded with the formation of folds in the ureters, which may likewise be an obstacle to the ureteral catheter, but these valves can generally be passed if the catheter is skillfully introduced. To the same category belong the cases of real stricture of the ureter, or what is the same thing, distortion or bend of the ureter. They form an impediment to the secretion of urine; generally not to such extent that the latter stops

entirely. Part of the urine flows; the other part being retained in the pelvis. In other cases, there is a decreased renal secretion of urine due to the change in the ureter.

These cases can easily be distinguished from spasms of the ureter, as, in the latter, not a drop of urine flows through the catheter. These obstructions are often the cause of hydronephrosis and pyenophrosis where they may not be due to gonorrheal or tuberculous infection. In a case of a characteristic pyonephrosis, I was able to demonstrate a distortion of the ureter which could be passed only with great difficulty. All other etiological factors could be excluded, and the pyonephrosis was due to the distortion of the ureter. The positive diagnosis of pyelitis, pyelonephritis and pyeonephrosis by means of catheterization of the ureters can be made at the time when we cannot diagnose the disease by any other method. The urine thus obtained shows pus cells which, in a healthy pelvis or in a healthy kidney, are either not found at all, or only in exceedingly small number. The amount of albumen in the urine which was obtained through the catheter gives a clue to the degree of change in the parenchyma of the kidney following a supuration of the latter. It is needless to state that in deciding this question, all other causes of albuminuria must be considered, and that repeated examinations must be made.

The manner in which the urine flows out and in which the liquid that is injected into the catheter flows in, shows with absolute cer-

tainty if there is a sac or not. In the former case, the urine will flow continually until the sac is empty, and in a greater amount; while in pyelitis, the amount of urine and the way the latter flows out of the catheter will be found the same as in normal kidney or pelvis. If the renal pelvis is not dilated, the patient will feel pain as soon as a small amount of liquid—30 to 50 g.—is injected. If there be a sac, large amounts can be safely injected according to the size of the pouch. I have in a similar case injected 300 g. of water without any inconvenience to the patient.

Catheterization of the ureters is of no great diagnostic value in tuberculosis of the kidneys, since in this affection a diagnosis can be arrived at by other means, but I may mention the case which I have published, where tubercle bacilli were found in the "kidney urine"—an abbreviation which I adopt for the urine obtained through the ureteral catheter—after a careful and repeated examination failed to reveal them in the urine of the bladder. This can be easily explained since bacilli originating in one kidney are comparatively lost in the bladder contents which represent a mixture of urine from both kidneys.

In fistulae of the ureters, the ureteral catheterization enables us to diagnose which ureter is the injured one, and where the lesion is situated. Some cases which I and others have published, prove the value of the method for this purpose.

4. In conclusion, ureteral catheterization is of great diagnostic value, and I am inclined

to believe that herein lies its main usefulness—in determining the condition of the healthy kidney when the other one had been found diseased.

It is necessary to mention the cases where a nephrectomy has been done, although the patient only had one kidney, or those cases where this operation proved fatal because the other kidney was not in a condition to discharge the necessary functions of urinary secretion. Since the catheterization of ureters enlightens us about the condition of the other kidney, it is obvious that the indications and contraindications for nephrectomy can be placed on a sounder basis than heretofore.

If a repeated examination shows that the urine of a kidney is clear, normal, free of albumen or of cylinders, and contains a normal amount of urea, the conclusion is warranted that his kidney does its work well, and that it is capable of performing the function for the diseased one after the removal of the latter. On the other hand, we know that a kidney the urine of which contains a large amount of albumen or of pus blood or cylinders, and a smaller amount of urea, will not be able to do the work for both since the urinary secretion is impaired to such an extent that compensation cannot take place.

The conclusions which were arrived at after Ashard's and Cataigne's experiments as to the passing of methylene blue through the kidney are open to criticism. This will be a fruitful field for further researches. We shall, I believe, with our present knowledge of the con-

dition of the urine, be able to reduce the mortality in cases of nephrectomy, since this operation is to be considered as contraindicated where we have cause to assume that the other organ is not in a condition to do the work for both kidneys.

In conclusion, without being too sanguine or enthusiastic, I claim that the diagnosis of diseases of the kidneys has been-rendered considerably more certain and exact through the catheterization of the ureters.

Vinneberg, in 1900, reporting a case of nephrectomy for ascending tuberculosis, with some remarks on cystoscopy and catheterism of the ureters in women, says: He has used the ureteral catheter over one hundred times in fully fifty patients, and has never as yet seen any ill results excepting some pain of variable severity for the twenty-four hours following the event. Thus far, I have not met with a single instance in which the patient had any febrile disturbance, so far as I know, consequent upon catheterism of the ureters. I have always carried out the procedure without an anaesthetic, in the knee-chest posture, and the patients have been able to go home from my office shortly afterwards.

Diagnostic Purposes of Catheterism of the Ureters:

1. To determine in a given case of urinary affection whether the bladder or kidney is affected.
2. To determine which kidney is the one involved.
3. In a case of pyonephrosis to ascertain

the function of the other kidney by withdrawing the urine directly from it.

4. To determine the presence of a calculus in the ureter or pelvis of the kidney (Howard A. Kelly).

5. To determine abnormal congenital conditions of the ureter as a double ureter with an opening into the urethral canal or at the side of the meatus.

6. To determine the presence of ureteritis (Kelly, and case reported by the writer later on).

7. To detect the presence of stricture of the ureter and its location (Kelly and the writer).

8. To determine the seat of obscure pain in the side (Kelly).

Therapeutic Uses of Catheterism of the Ureters:

1. To cure certain cases of pyonephrosis by irrigations of the pelvis of the kidney with various medicated solutions. (Kelly and Casper).

But as Israel pointed out in the discussion that followed Casper's paper, the cause of pyonephrosis, in which the irrigation treatment could be of any possible benefit, are very limited in number. The following conditions are essential to success.

(a) The pus collection must be limited to one sac in the pelvis of the kidney.

(b) The pus must be fluid and non-viscid;

(c) It must be non-tuberculous;

(d) It must not be due to the presence of a calculus lodged in the pelvis of the kidney;

(e) There must not be a non-permeable stricture of the ureter;

(f) There must not be any perinephritic suppuration.

The absence of any of these features in a given case of pyonephrosis is very rare, as Israel was able to demonstrate by a large collection of specimens.

2. The dilatation and cure of stricture of the ureters when not due to tuberculous ulceration (Kelly).

3. The removal of small calculus lodged in the ureters and obstructing the flow of urine (Kelly & Casper).

4. In radical operation for carcinoma uteri, the introduction of catheters into the ureters prior to the operation forms a valuable guide to avoid injuring the ureters.

Gross, in 1902, on the diagnostic and therapeutic value of ureteral catheterization says: Ureteral catheterism has secured its well-earned place in therapeutics, and concludes as follows:

Diagnostic Value. To determine:

1. Whether the bladder or the kidney is the seat of affection.

2. The presence or absence of a kidney.

3. Which kidney is involved.

4. The site of the lesion.

5. The functional capacity of each kidney.

6. The presence of strictures in the ureter and their exact location.

8. The diagnosis and site of ureteral fistulae.

9. The presence of a pyoureter.

10. A differential diagnosis between diseases of the kidney and the surrounding organs.

11. At times a tuberculosis of the kidney.

12. The diagnosis of a pyelitis, pyelonephritis, pyonephrosis, hydronephrosis, movable kidney, neoplasms of the kidney, renal lithiasis.

13. Abnormal congenital conditions of the ureter. Therapeutic Value:

1. To cure pyelitis and certain cases of pyonephrosis and hydronephrosis.

2. To drain pocket formations.

3. To dilate strictures of the ureters.

4. To dislodge small calculi of the ureter.

5. To drain the kidney after nephrotomy.

6. To prevent injury to and stitching together of the ureter in certain operations.

7. To prevent and cure renal fistulae.

8. As a guide to certain operations on the pelvis of the kidney.

There is comparatively little or no danger of infection if one carefully disinfects his instruments and thoroughly irrigates the urethra and bladder.

The fact that it takes practice and skill should not discredit the method, considering its importance as a therapeutic and a diagnostic factor.

Van Der Poel, N. Y. M. Journal, 1904, writing on ureteral catheterism as a routine method of diagnosis in renal disease, offers the following conclusions:

I. The cystoscope is more easy of introduction than are the separators or segrega-

tors; is less painful during the bladder manipulation, and much less so during the collection of the urines. Hence as a rule:

II. With ureteral catheterism, we can collect the urine during as long a time as may be thought necessary, the patient not requiring any supervision.

III. A cystoscopic examination of the bladder can be made at the same time, which in some cases is useful; in others indispensable.

IV. We are much more certain of the exact results, especially when the two urines are of a similar character, whether clear blood or purulent (Albarran): and,

V. It is the only method by which we are fairly certain that there is no bladder contamination.

Jour. A. M. A., xlii, 1904.

Schmidt writes an extensive illustrated article on the problems of the technic of ureteral catheterization and says:.

While the rapid development of kidney and ureteral surgery in recent years has put ever-increasing demands on refined diagnosis, it is remarkable that one of the most necessary and expedient means for this aim, ureteral catheterization did not become popular among the surgeons. Surely to a great extent this was due to the lack of a complete and authoritative treatise concerning the appropriate instruments and to the absence of a practical discussion and minute explanation of the technic. There is a large number of surgeons who, though anxious to catheterize ureters, still

have neither the time nor the material nor the intention to work through all the failures, mistakes and disagreeable experiences connected with the adoption of a rather new and peculiar instrumentation. Others, after studying the pertinent literature, are disappointed because in actual application they find out that a great many of the instructions laid down are either not explicit enough, or faulty, or are simply advertisements for certain obsolete or inadequate instruments. The tireless ambition of some authors to be mentioned as pioneers in new methods produces so-called original articles on endovesical operations, ureteral catheterization, and so on, which, through their author's experience, represent nothing else but the reproduction of half-digested and misinterpreted remarks made by experts, or, at best, conclusions based on the fact that the author was made half-way familiar with one, and only one method. Happy on account of having chanced occasionally into a ureteral opening, with unconscious self-criticism, he will praise the method which was demonstrated to him as the only correct one and so on. For a broad discussion of ureteral catheterization, it is necessary to be thoroughly familiar with cystoscopy in general, and to have had experience with the different instruments and methods on various patients with different sensitiveness, different conditions of the bladder and under different circumstances.

The various principles on which the instruments are built are discussed and criticized ac-

according to the demands made on them.

Casper's latest cystoscope for ureteral catheterism.

Nitze-Albarran single-barreled and double-barreled cystoscope.

Schifka's modification of Casper's instrument.

Bierhoff's modification of double-barrel Nitze-Albarran cystoscope.

Brenner's ureteral cystoscope.

The Tilden Brown double-barreled catheterization instrument.

The Bransford-Lewis instrument of direct view.

Snell's cystoscope with movable tube. And Kolischer-Schmidt's modification are illustrated and described.

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CHAPTER VII.

PROLAPSE.

1862-1905.

Prolapse of the ureter may be congenital or acquired, usually congenital.

Bloomer reported thirteen cases of prolapse, ten of which were congenital. Acquired prolapse is usually the result of calculus, which is in the prolapsed portion. Either form of prolapse is infrequent, but it may occur at any age, in either sex, and vary in degree from a slight prolapse into the bladder to an extension through the outer opening of the female urethra.

It is usually gradual, caused by relaxation of its attachments, but it may be produced suddenly by trauma.

Smith, in 1863, before the Pathological Society of London presented a case of prolapsus of ureters into bladder. (Specimen case):

"The bladder was much hypertrophied; the ureters were each about an inch in diameter and their walls were greatly thickened; the kidneys were enormously dilated, being each about nine inches long; their secreting structure wasted and their distended pelves containing purulent urine; the left kidney had within it two irregularly-shaped calculi."

"On opening the cavity of the bladder, one or two mucous caculi were found protruded outwards between the muscular fibres. The

vesical ends of both ureters were found to be prolapsed, forming pendulous pouches into its cavity. The openings of the ureters were reduced to mere pinhole apertures situated on the most prominent part of each pouch (through these, bristles have been passed in the specimen); the pouch formed by the left ureter was the larger, that formed by the right enclosed a stone about the size of a cobnut which hangs pendulous into the bladder."

"This particular condition of ureters, so far as I know, has not been met with before. At first sight, the prolapsus might be thought to be due to the escape of a stone from the kidney sticking at the vesical end of the ureter and gradually by its weight and by the pressure of urine from above carrying down with it the lower end of the ureter into the cavity of the bladder. But the fact that the prolapsus of the left ureter which is greater than the right, neither contains a stone nor is its orifice large enough to have allowed one to escape, compels us to seek some other explanation. Nor could the muscular force of the bladder in its efforts to expel the urine have produced this condition of the ureters, since that would act in an opposite direction to the force which could pouch-out a ureter into the cavity of the bladder."

Caille, in 1888, reported a case of prolapse of the inverted lower portion of the right ureter through the urethra in a child two weeks old. Necropsy: Both ureters dilated. The right ureter was double with double insertion into the hilus, both branches converging in

their downward course and terminating by a single opening in the bladder.

From a careful review of this unique case, it would appear that owing to the formation of a warty or papilomatous small growth in the right ureter near its vesical insertion, a partial or complete occlusion of the ureter took place, in consequence of which the small tumor was pressed into the bladder, and finally through the urethra, carrying with it or dragging along the inverted lower third of the ureter, which presented in the form of a sac. The sac was supposed to be a diverticulum of the bladder, owing to the fact that at no time was it possible to insert a probe into the opening in this sac to a greater depth than when inserted at the side of the sac into the bladder proper, and at no time was a discharge of urine noticed to take place from this sac.

Ogle, in 1894, presented before the Pathological Society of London a specimen of dilated ureter and pelvis of the left kidney with prolapse of ureter into the bladder. The pelvis of the left kidney substance deficient; the left ureter is dilated to the size of a pencil, the opening into the bladder admits a fine bristle. Into the bladder projects a sac of the size of a small pea communicating with the dilated ureter from which it can be filled by pressure and the small opening of the ureter can be seen on its surface. This opening is natural in size and pervious to fluid. No cause for the dila-

tation was found. No stone can be felt in the little sac nor was there any such seen in other parts of the urinary tract.

Ann. Surg., xxxix, 1904.

URETER IN AN INGUINAL HERNIA.

Dr. Hartwell exhibited a specimen of a hydronephrosis with ureter attached, stating that the patient from whom the specimen was removed was a man, sixty-two years old.

The hernial contents were the caecum, the appendix, a foot of the colon, and ten inches of small intestine.

Lying behind and outside the hernia proper, but inside the scrotum, was a round, firm cord, in which a canal could be made out. It was a half inch in diameter, and the portion in the scrotum was about six inches long. It lay in the shape of a loop with the convexity downward, and the two ends passing behind the neck of the hernia into the pelvis. Its course could not be traced beyond this point, and its nature was uncertain, a prolapsed ureter and a dilated vein being considered possibilities.

On account of the dense adhesions, the hernial operation took a long time, and upon its completion the loop of cord mentioned was pushed up behind the peritoneum and left there. Death.

At the autopsy, the unidentified cord proved to be a ureter prolapsed in a loop into the scrotum behind the peritoneum, probably pulled there by the colon in its descent, the hernia being of the so-called "gliding" variety. The kidney from which this ureter descended was

found to be the seat of a large hydronephrosis, the position of the ureter acting as an obstruction to the outflow of urine. This obstruction was probably intermittent, because on straightening the ureter, the urine flowed freely into the bladder.

Dr. Hartwell said that the only similar case he could find on record was reported by von Bergmann in his Surgery.

Prolapse of the ureter has been reported by Caille in a child two (2) weeks old. A sac which was supposed to be a vesical diverticulum presented at the ureteral orifice. It was found to be a prolapsed ureter, dragged down by a papillomatous growth.

(White and Martin p. 763.)

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CHAPTER VIII.

OCCLUSION.

1756-1905.

Occlusion of the ureter may be due to new growth within the ureteral wall, polypus, or stone, or pressure from new growth in the adjacent tissues. The obstruction may be at any point from the entrance to the exit of the ureteral tract, and may be periodic or permanent, circular or linear, partial or complete. It may also be due to injury from without or within, such as that which may be caused by blows, surgical operations or the passage of a renal calculus. Floating kidney may cause the ureter to become obstructed at a right angle or twisted upon itself for an indefinite length of time.

Allan, in 1837, reported a case of obstructed ureter with ulceration of the kidney and abscess, male aged 39 years. Post-mortem examination showed peritoneum natural, except on the left kidney and lumbar muscles where it was of a dark color. This kidney which was enlarged to twice its natural size, adhered strongly to the surrounding parts, its tubular part was in a great degree destroyed or converted into little cells having a common communication with the pelvis of this organ and opening, besides by ulceration in the cortical substance at two points into a sac capable of containing a pint, occupying the cellular mem-

brane in the lumbar region. The mucous lining of the kidney was thickened by inflammation and the commencement of the ureter similarly changed in structure and completely closed at this point by coagulable lymph while in the remainder of its course it was contracted but pervious. Right kidney ordinary size, its ureter natural.

Haviland, in 1858, before the Pathological Society of London, presented a specimen of kidney from a lad 19 years of age with obliteration of a ureter, abscess-like dilatation of the calyces of the kidney. The left kidney was found to have lost all its original structure and to be converted into a number of sacs, containing a pus-like fluid, each cavity being lined with a distinct membrane which, when separated, preserved the form of the abscess. These cavities seemed to have had no outlet. The ureter was atrophied and impervious and with the vessels was surrounded by a great quantity of fat. The right kidney was hypertrophied and pale, having a cavity at one of its extremities which contained pus. Its ureter was considerably enlarged and imbedded in fat which also contained a great number of indurated lymphatic glands.

Ewart, in 1878, reported a case of inflammatory stricture of the left ureter which was presumably the starting-point of a chain of unusual symptoms ending in death, the patient a male aged 23 years. Operation: Incision was made into the inflamed tissue but serum only was obtained, died soon after operation. Necropsy: Both kidneys were much

enlarged and very pale from tubal nephritis and presented a few dark blotches and punctiform ecchymoses. The left ureter in its upper part was much swollen and of angry red color. A stricture sufficiently tight to render the escape of fluid impossible was found four inches from the kidney. Below this point, the ureter was normal; above the stricture its lining membrane was intensely inflamed as well as the pelvis, and irregularly ulcerated. The calibre was slightly enlarged and the channel was filled with a dark sanious fluid.

West, in 1881, reported a case of a male aged 74. Obliteration of left ureter by omentum adherent to brim of pelvis with subsequent atrophy of left kidney and complementary hypertrophy of the right. The left ureter passed across to the brim of the pelvis in the midst of the adhesion of the omentum and had been obliterated by pressure here. For four inches above this point it was dilated into a fusiform swelling about one inch in diameter. It felt doughy and on section proved to contain cheesy substance. Above this dilatation to the pelvis of the kidney, it was completely obliterated, being reduced to a fibrous cord.

Barker, in 1882, reported a pathological specimen of a male, aged 55 years, a case of persistently recurring spasm of the bladder, resulting in thickening of its walls, dilatation of the ureters and hydronephrosis. Death from uraemia—Kidneys both are enlarged, the fibrous capsule adherent to the surface of the organs. The cortical substance presents a grayish, nearly uniform appearance with little

trace of the normal markings. The pyramids are in great part encroached upon by the dilated calyces. No abscesses are present in the kidneys. The pelvis and calyces of each kidney are greatly dilated and contain turbid ammoniacal urine. The ureters, their calibre equals nearly that of the small intestine. The walls of the ureters are thickened. No obstruction to the passage of urine exists either in the pelves of the kidneys or in the ureters.

Livingston, in 1883, presented a specimen before the New York Pathological Society from a child, of double hydronephrosis due to abnormal bending of the ureters, suppurative disease of the knee-joint, abscess of the liver. Kidneys both were removed before they were examined. The right one was opened and the pelvis found to be considerably dilated with atrophy of the pyramids, only the cortex remaining. The left was in the same condition. The pelvis of both kidneys contained a small quantity of urine. No renal calculi could be found. The part of the ureters that had been left in the body was normal size and entered the bladder naturally and the bladder was normal as well as the urethra. The cause if the hydronephrosis seemed to be the bending of the ureters twice on themselves. On the left side there was also constriction at the second curve. Bell in 1883 reported a case of a male aged 49 years of Occlusion of both ureters. Death by syncope. Both kidneys were enlarged to about double their normal size, congested and friable. There was a calculus of the size of a peach stone in the in-

fundibulum of the right kidney, also two or three quite small calculi (scarcely as large as peas) in other parts of the kidneys. I suppose about $1\frac{1}{2}$ ounces of urine escaped on section of the left kidney; rather less than 1 ounce from the right; the ureters were blocked. On the right side a calculus was impacted about an inch above the bladder whilst in the left ureter a less firmly impacted calculus had less than half an inch to travel and seemed as if it might have escaped into the bladder within another day if only that fatal syncope had been avoided.

Sansbury, in 1885, reported a case of valvular obstruction of ureter; pyelonophrosis in a female aged 34 years. Necropsy: Right kidney granular and contracted with thickened adherent capsule and thinned cortex; in the cortex, advanced fatty changes. The ureter of the kidney was perfectly patent. Left kidney in a condition of complete pyonephrosis being converted into a fibrous bag divided by septa into a series of compartments. No trace of true kidney substance anywhere visible to the naked eye. Filling the compartments a soft white material like thick white paint. The ureter in its upper two-thirds still patent but its calibre much diminished. Tracing the ureter upwards to just where it entered the pelvis of the kidney, it swelled out rather suddenly, the appearance being just such as would result from an injection of the pelvis of the kidney, supposing the ureter blocked at its mouth. On slitting up the ureter, two small valve-like flaps were found

guarding the entrance. The two were on the same level. One exactly resembled a semilunar valve, the other, cut through in the opening of the ureter, could not be so clearly made out. Between them these two valves effectually closed the pelvic outlet, preventing any escape from the kidney. The fact of the complete blockade of these valves is established by comparing the condition of the mucous membrane of the ureter above and below the valves. Immediately above the valves, the mucous membrane presents the rough, crinkled surface which is found lining everywhere the renal sac. Immediately below, the mucous surface is quite smooth. In the lower third of the ureter a lumen could not be discovered nor could the opening of the left ureter into the bladder be found. Accordingly, the calibre of the ureter towards its lower end must have been either absent or very minute. But it must be observed that this latter change in the ureter was a potential, not an actual cause of obstruction. The bladder was somewhat contracted. The case presents many points of interest. In the first place, the renal inadequacy represented by the total destruction of one kidney and the disablement of the other, is sufficient explanation of the symptoms present. They were in the end undoubtedly uraemic. As to the cause of this inadequacy we may take note of the early occurrence and well advanced stage of the interstitial nephritis present in the right kidney (the patient 34 years of age). In the left kidney we may take note of a very unusual form of obstruc-

tion of the ureter. In some of the general text-books on medicine and pathology, I find valvular folds of the mucous membrane given as a cause of hydronephrosis, but in the more special treatises on this subject, I have not come across the record of such cases—certainly of cases parallel to the present one, with the exception of a case recorded by George Johnson, but there the obstruction though similar was in the urethra. Then as to the light in which one is to regard the obstruction here present, the question arises: Is it congenital or acquired? The narrowing of the calibre of the left ureter if not its actual obliteration in the lower third of its course may have been sequential to the blockade higher up or it may itself have a developmental error and then would be an argument in favor of the congenital nature of the valvular obstruction higher up; but the difficulty in the way of this interpretation exists in the precise nature of the impediment, for though indeed valvular obstruction is given as a not infrequent congenital cause of hydronephrosis the kind of valvular obstruction meant is, so far as I can discover an oblique entry of the ureter into the pelvis and not the presence of so definite a structure as that which we have here. It is precisely this definiteness of structure which to me appears to constitute the difficulty of the case; for the error of development, if it be one, is not an error either by excessive or by defective development, nor will it fall in with Forster's third subdivision of malformation by aberrant development, for as it stands, the

valve is almost as much of a new formation as a focus of new growth, but I would ask, must we regard this definite structure to be congenital or acquired as having always been as definite as it now is? It seems to me that a little redundancy of mucous membrane at the mouth of the ureter with some looseness of the subjacent connective tissue permitting of the mucosa being thrown into folds, and overlapping the mouth of the ureter, that such together with the distending force of an accumulating urine would yield the necessary data for the production of such a pocket as we have here. We are familiar throughout the body with folds of the lining membrane of the several hollow tubes. In the arteries, in the veins, in the lymphatics, in the alimentary tract, in the gall-bladder, we meet with them. All we require in all such cases is that the folds should be of sufficient size to form transverse obstructions; they will then, provided a distending force be present, take the shape of pockets. Perhaps comparative anatomy or the study of the development of valves in man would throw some light on this point.

Hadden, in 1885, reported on the specimen of obstruction of ureter by a gumma taken from a man aged 55 who died of strangulated hernia; the right ureter is dilated more than twice its normal size down to a point four and one-half inches from its entrance into the bladder. Below this point the ureter is very small and its lower end just admits the passage of an ordinary probe. The obstructing mass involves the bifurcation of the common iliac ar-

tery and both external and internal iliac arteries while the accompanying veins are tortuous and puckered from the contraction of the inflammatory tissue which surrounds them. The right kidney was entirely cystic; there were gummata in the liver and spleen.

White, in 1887, reported on the specimen of great dilatation of one ureter and pelvis of kidney secondary to urethral stricture; in a man about 40. Left ureter was dilated right down to the bladder to such a size that it would admit the middle finger. No cause for this dilatation was noticeable in the wall of the bladder. The pelvis of the left kidney was much dilated and the greater part of the pyramids had disappeared, constituting an early hydronephrosis.

Blake, in 1887, reported a case of abscess of the kidney from obstruction of a ureter in a man aged 35 years. Necropsy showed obstruction of left ureter by a calculus leading to dilatation of ureter above and pelvis of kidney and calyces with atrophy of kidney, suppurative process in pelvis of kidney, necrosis of mucosa of calyces of kidney, leading to perforation of kidney and discharge of pus into perinephritis tissue, perinephritic abscess extension upwards to diaphragm, perforation of diaphragm, gangrenous pleurisy.

Sowers, in 1888, reported a case of urethritis acute cystitis, obstruction of the ureter, hydronephrosis, ulceration through the peritoneum, diaphragm pleura and lung-tissue and discharge of fluid through bronchi; recovery.

Watson, in 1891, reports on inflammatory stricture of the ureters and reports two cases of his own: Case 1. Autopsy showed right kidney transformed into a big hole, a single sac lined with pyogenic membrane, all the cortical substance of the kidney with the pyramids having been evidently destroyed some time previous by the chronic suppurative process. In the course of that ureter, one inch below its exit from the pelvis of the kidney was found a dense deposit of connective tissue originating probably from the chronic inflammatory process. The ureter was so narrowed at this point that it barely admitted a fine probe. The left kidney measured about 14 cc. in length and was the seat of an extensive hydronephrosis, the cortex being thinned and the organ converted into a series of large compartments. The ureter was widely dilated down to within an inch and one-half of the bladder. At this point was found a smaller deposit of connective tissue than that found in the right ureter, owing to which the calibre of the ureter at that point was similarly narrowed. In this case there was a doubtful history of the passage of a renal calculus about 8 months previous to death. Case 2; the mouths of the ureters were patulous and wide and the mucous membrane around them was swollen and edematous. At a point about 2 inches above the bladder the left ureter was obliterated by the dense deposit of connective tissue which extended for about $1\frac{1}{4}$ inches in length. The mass occupied all the tissues of the ureter from the mucous membrane out-

ward and constituted a true inflammatory stricture. Above this point the ureter was widely dilated and inflamed. The right ureter was widely dilated from the bladder to within $\frac{1}{2}$ inch of the kidney; at this point it was bent upon itself and was occupied for a distance of about $\frac{3}{4}$ inches by a mass of connective tissue similar to that described as situated in left ureter; the calibre of the ureter being narrowed at this point so as to only admit of the passage of a large steel knitting needle. In addition the following cases are reported by Dr. Watson: Galliard in 1880—Left kidney seat of an extensive hydro-nephrosis due to the presence of an inflammatory stricture one and one-half cm. long in the course of the ureter just below its exit from the pelvis of the kidney. There was an extensive formation of connective tissue at the seat of the stricture "Progres Medical 1880 Vol. viii; Ayroles Societe Anatomique Vol. lix." Autopsy showed obliteration of both ureters by the formation of a mass of connective tissue resulting in stricture and occlusion. St. George Hospital Reports Vol. X 1879—Male, aged 22, autopsy—Stricture of left ureter 4 inches below its exit from the kidney; the structure was evidently not of ordinary formation, it was due to the deposition of connective tissue, the result of chronic inflammation above it; the mucous membrane of the ureter was thickened and swollen. Both kidneys were enlarged and the seat of a diffuse nephritis.

Nash, in 1892, writes on stricture of the ureters following gonorrhea, a cause of hydronephrosis, says "amongst the numerous causes which give rise to hydronephrosis, I am not aware that gonorrheal stricture of the ureters have been mentioned. In ureteral strictures in this case I believe to have been produced by gonorrheal inflammation. Against their being congenial are the facts (1) that the dilatation of the renal pelves and calyces was not so advanced as would have been expected if the obstruction had lasted 44 years. (2) Congenital strictures are usually found at one or other extremity of the ureter and as far as I know are never multiple.

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CHAPTER IX.

CALCULUS.

1820-1905.

Calculus—Concretions formed primarily in the ureter are very rare; when they do occur, they are composed of phosphatic salts deposited above a structure or upon an ulcer or a foreign body within the ureter. Renal calculi which have descended and become impacted in the ureter, because of their volume or of their shape and roughness are much more common. They are composed of uric acid or the urates of calcium oxalate, or of the phosphates. One stone may be impacted alone or the ureter may be filled with a large number of them. They may be several inches in length and large enough in diameter to completely fill the ureteral canal. They are usually ovoid in shape but may be spherical or irregular. The impaction may take place at any point, but usually occurs in the upper end of the ureter within an inch or two of the kidney at about the level of the brim of the true pelvis or at the lower end of the ureter just before it enters the vesical wall.

Wilkes, in 1855, reported a case of obstruction of urine from a calculus lodged in the ureters in a male, aged thirty-eight; necropsy showed both kidneys much enlarged, especially the left. On making sections they were found to be invested by a thick adipose capsule firm and dense in structure, but easily sep-

arated from the kidney; in some parts it was nearly an inch in thickness. The left kidney and its capsule weighed eighteen ounces. The pelvis of this kidney was distended with urine and very much enlarged. The mouth of the ureter was blocked by a conical calculus more than an inch in length, moulded to the shape of the opening of the ureter. The infundibula contained some sabulous matter and two small calculi about the size of peas. Both kidneys were pale in structure. Left ureter natural in size and free from obstruction in the rest of its course. The right kidney was natural in size, the pelvis and ureter to about the middle of its course were very much dilated and distended with urine; at this point two calculi were firmly impacted in it about an inch distance from each other, one oblong and the other round. The ureter below was pervious and admitted a common-sized probe while above the little finger would pass readily into it. There was a good deal of sand in the infundibula. Bladder, empty, but healthy in structure.

Beith, in 1851, reported a case of diseased bladder with calculi impacted in the ureter in a male aged 53 years. Necropsy:—Right kidney was converted into a large cyst four or five times the size of the healthy organ. The inner surface of both the cyst and ureter was rendered uneven and irregular by numerous bands passing around portions of the walls and constricting the cavities at these points. In the ureter this occurred to such an extent that it might be said to be divided into several com-

partments, one above the other. In the compartments three calculi were found imbedded, the largest of which occupied its superior third and was about three inches long and three-quarters of an inch in diameter.

Jones, in 1852, reported a case of renal calculi, one at the beginning and the other at the ending of the ureters in a female aet. 20 years. Necropsy:—The right pelvis contained one or two loose portions of calculus and the commencement of the ureter a calculus about the size of the last phalanx of the little finger. It had grown down the ureter so that it was turned out with difficulty. Below this, the ureter was not dilated. On the left side the ureter was dilated. The lower extremity was occupied by two calculi of the size of hazel nuts consisting of a thick deposit of oxalate of lime externally with a uric acid nucleus. The bladder was healthy.

Goodfellow, in 1862, reported a case of left kidney extensively sacculated and containing numerous minute calculi, obstruction of ureter by three calculi, right kidney condensed in structure and studded with minute calculi, in a female aet. 6: Post-mortem showed right kidney, small, pale, condensed in structure and studded with minute calculi varying in size from that of a medium-sized pin-head downwards.

These calculi were composed of phosphate and oxalate of lime. Left kidney externally lobulated. The structure was completely atrophied and replaced by numerous sacculi varying in size from that of a small hazel-nut

to that of a large pea. In these sacculi there were numerous minute calculi resembling in form and composition those found in the right kidney. The calyces and pelvis were considerably dilated, also the ureter. At the lower end of this canal there were three oval calculi about the size and somewhat the form of a small horsebean. These consisted for the most part of the phosphate and oxalate of lime. The coats of the bladder were much thickened and the lining membrane injected.

Cutter, in 1864, reported a case of nephritic calculus lodged in the right ureter of a female aet., 28 years. Autopsy showed right kidney twice the size of the left; the right ureter was enlarged, twisted and distended; at the kidney it was nearly three quarters of an inch in diameter and tapered down to the normal size at the bladder. About an inch from the bladder a calculus was found impacted in the ureter.

Morris in 1874 reports three cases on the passage of renal calculi down the ureters. He says few writers on practical medicine allude to the passage of a calculus from the kidney down the ureters to the bladder, and those who do notice it give only a meager description of the symptoms. The calculi which pass with such formidable severity down the ureters are calcareous deposits from the urine within the pelvis of the kidney and occasionally assume a size as to be unable to leave that cavity, producing the most agonizing and disastrous results.

Lloyd, in 1875, reports a case of calculus in the ureter in a male, aet., 27 years. Post-mor-

tem showed the substance of the left kidney had almost disappeared, the pelvis being dilated into a sacculated pouch capable of holding 8 or 10 ounces and containing pus, blood and urine. The ureter was much dilated as far as the brim of the pelvis where there was a constriction, below which was lodged a large crooked calculus of irregularly fusiform shape largest at its lower end, which was rounded and curved to the shape of the pelvic wall and lay in a cul-de-sac formed of the dilated ureter pushed downwards just before its opening into the bladder; this latter orifice was of normal size, the upper end of the calculus tapered almost to a point, which was hooked as to lie over the brim of the pelvis, thus fixing against the bone the whole intra-pelvic portion of the ureter. The calculus was composed of lithic acid with a powerful superficial layer of triphosphate at its upper end.

The course of the disease appears to have been this: A renal calculus descending through the orifice into the bladder was arrested at this point. As it increased in bulk it also by a process resembling the growth of a stalagmite, pushed upwards by a tapering end towards the kidney. During this growth, by its obstruction of the duct, it dilated and eventually destroyed the kidney at its own side and as it grew in length it gradually interfered with the movements of the bladder, finally tying it down by the ureter to the walls of the pelvis, thus mechanically preventing its dilatation. Hence followed cystitis with the symptoms of

vesical calculus and in due course consequent degeneration of the right kidney.

Newman, in 1876, reported a case of suppression of urine lasting five days. Death; symmetrical blocking of both ureters with calculi in a male, aet., 73 years. Post-mortem showed the right kidney represented by a mere capsule of the size of a small hen's egg, and in this there was hardly a trace of kidney structure to be seen. At the point of emergence of the ureter was found a calculus, an aggregated mass of lithic acid coated with phosphates firmly adherent to the lining membrane. The left kidney was normal in size and healthy in appearance. The pelvis contained a drachm of urine and several small calculi were fixed in the substance of the kidney. At the same point as on the other side was a calculus similar in structure and smaller in size, firmly wedged into the ureter.

Longstreth, in 1880, reported a case of calculus of right, and double ureter of left kidney in a female aet., 49 years. Autopsy showed right kidney surrounded by an immense quantity of fatty tissue. This organ was removed in connection with the aorta, the ureter and the urinary bladder. The ureter likewise was surrounded by a collection of fat measuring over an inch in diameter. On dissecting the fat from around the kidney, marked evidence of inflammation was found and the same condition was noticed around the ureter. On section of the kidney substance, the organ was found almost completely destroyed. Its pelvis was greatly dilated and contained a large ir-

regular calculus with a very rough surface. At the upper part of the organ was an abscess containing very thick purulent matter; and one or two small fragments of calculous material at the lower part of the cavity of the pelvis reached nearly to the surface of the organ. The interior of the pelvis showed very marked alterations from inflammatory changes and was covered with thick creamy pus, shreds of tissue and small calculous masses. Walls of the ureter were greatly thickened and its mucous surface very uneven.

Pick, in 1886, reported a case of impaction of stone in one ureter, with atrophy of the kidney on the other side, in a male aged 45 years. Necropsy showed left kidney twice its natural size blocked the ureter. The ureter itself, contained six or seven small calculi studded throughout its substance. One large calculus was contained in the pelvis. The bladder contained one small stone.

Goodlee, in 1887, reported a case of obstruction of one ureter by a calculus accompanied by complete suppression of urine in a male. Post-mortem showed right ureter much distended throughout and half way down it was obstructed by a stone 1-25 inches long and 5 inches in diameter, which had evidently occupied this position for a long time, but it is remarkable that the distension, though not so great, was very palpable below the obstruction. Left ureter was normal and patent.

Mott, in 1890, reported a case of renal calculus, nephrectomy performed 9 years ago;

impaction of calculus in ureter of the other kidney followed by non-obstructive jaundice and death; in a male, aet. 26 years. Necropsy showed on dissecting out the ureter that a stone could be felt in it about an inch and a half beyond the pelvis. On slitting up the ureter a small uric-acid calculus of an irregular shape measuring 2-3 inches long by 1-3 inches transverse diameter, was found impacted in the ureter an inch and a half from the hilus.

Sutherland and Edington before the Glasgow Pathological Society in 1898 reported a case of calculus in vesical extremity of ureter invaginating wall of bladder;—absence of symptoms: Viewed from within there is a distinct slightly lobulated swelling at the seat of the orifice of the right ureter. Before incising the swelling a structure of a dark bluish color could be seen within and a probe introduced from above encountered a hard body of some size. As displayed by incision the body is of a dark flattened oval calculus measuring 8 mm. in diameter. It has been found to be composed of oxalate of lime; it has prominent, somewhat sharp, projections and is very hard. The sac in which it is contained holds it loosely. The ureter in its courses shows slight dilation and thickening. There was not hydronephrosis. The calculus is practically inside the wall of the bladder and has invaginated the mucous membrane before it in the form of a sac.

Deaver, in 1902, reported a case of congenital absence of left kidney, obstruction of right ureter by stone in a male aet. 65 years.

Post-mortem showed that left kidney was missing, the left ureter being represented only by a fibrous cord extending down through the inguinal ring to the scrotum. A small stone was found blocking the right ureter near the bladder.

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CHAPTER X.

CYSTS.

1834-1905.

Cysts of the ureters are infrequent and may contain urine, pus, mucous blood or serum, one or all combined. They may be single or multiple within the lumen or in the ureteral wall and vary in size from a few drops to several ounces. They may be primary or secondary; primary when they originate as a result of defective structure of the ureter not due to outside causes such as diseases of the kidney, bladder or other abdominal viscera; secondary when due to these causes or to obstruction.

Eve, in 1889, before the Pathological Society of London reported on the case of psorosperial cyst of both ureters in a female, aet. 51 years. The specimen was described as follows: Section of a kidney with the ureter which is the seat of psorosperial cysts. Its inner surface is thickly studded with closely grouped rounded cysts the size of millet-seeds and of a yellowish color. They project prominently from the mucous membrane and cease at a point an inch and a half below the pelvis. With the exception of changes, the result of decomposition, the kidney appears healthy. The opposite kidney has two ureters both of which are affected in the same manner as in preceding specimen, but in these some of the cysts appear to have ruptured and have left minute rounded apertures in the mucous membrane.

Clarke, in 1892, reported on a specimen of a case of psorospermial cysts of the left kidney and ureter and of the bladder with hydronephrosis of the left kidney. Left kidney hydronephrotic and the ureter was felt to contain small elastic-feeling bodies which collapsed on pressure. Left kidney was found to contain a group of small cysts at its upper end. In the dilated pelvis of the kidney and in the upper half of the ureter there were numerous cysts of a greenish brown color and being on an average the size of hemp-seed. There was a moderate amount of hydronephrosis. There were numerous small cysts at the neck of the bladder and at the vesical orifices of the ureters there was one subcapsular cyst in the right kidney which in other respects appeared to the naked eye to be normal.

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CHAPTER XI.

RUPTURE.

1837-1905.

Rupture of the ureter may be due to trauma, disease or the presence of one or more concretions and there does not seem to be any point in the ureter more susceptible to rupture than another. Concretions are the most common cause, especially so when associated with infection or stricture. The rupture may be linear or circular in character, seldom involving the entire circumference of the ureter.

Stanley, in 1485, reported a case of a female who was knocked down and pushed before the wheel of a cart injuring right hypochondrium, followed by circumscribed swelling right hypochondrium; death. On examination there was a large cyst extending from the diaphragm to the pelvis. There was a passage from the upper part of this cyst to the pelvis of the kidney where a large irregular aperture existed.

Fuller, in 1863, reported a case of great rarity and interest; pyonephrosis from obstruction of the ureter by renal calculi, rupture into the peritoneum and consequent fatal peritonitis. Female aged 21 years: Autopsy—when bowels were moved aside a large ragged hole was seen just beneath the liver from which pus was issuing in abundance. This proved to be in the anterior surface of the right kidney. The opening was about the circumference of a half crown, the edges were thin and vascular, the

kidney itself was enormously enlarged and distended by thick pus into a mere bag. The calyces were all distended and lined with a thin layer of false membrane. The part of the cavity which had burst was a sort of diverticulum, which communicated by a narrow neck with the pelvis. Intermixed with the pus were many small fragments of calculi of a very friable consistence; some of these were lodged in the ureter so that a probe could only be passed through the tube with much difficulty.

Poland, in 1869, reports a case of a female, aet. 33, severe contusion of the abdomen during pregnancy, ruptured ureter, abdominal lesions, abortion, death. Post-mortem showed the right ureter was torn quite across just below the pelvis of the kidney so that it ended by a broken end in the middle of the above half-sloughy tissue which middle part was softened down and destroyed.

In remarks on rupture of the ureter Dr. Poland says: The ureter in its anatomical disposition is a long canal leading from the kidney to the bladder, and is so placed as almost to secure it from all external injury. It lies behind the peritoneum along the posterior wall of the abdomen and is protected on all sides, the only parts which are at all vulnerable are its commencement from the kidney called the pelvis and the first part of its course for a few inches. Here it is situated in the loin, and may undergo stretching from inordinate torsion of the body or may be exposed to external violence from severe contusion in this region. Hence in all cases recorded, injury to the

ureter has been found close to the kidney. The ureter may be subject to lesions of several kinds; thus it may be ruptured from severe contusion without lesion of any other important structure, the urine escaping into the cellular tissue behind the peritoneum; the rupture may involve the peritoneum inducing peritonitis: or it may be complicated with lesion of the kidneys and other important structures. The ureter has also been injured by penetrating wounds and again it may become obliterated and induce disease of the kidney.

Holmes, in 1877, reported a case of a male, aet. 13, who was stabbed by accident, wounding the kidney and ureter through the posterior parieties of the abdomen, with prompt recovery of patient.

Bennet, in 1883, reported a case of injury of the kidney and obstruction to the ureter, retention of urine in the loin; says, in recording this case: "I wish to invite attention to the following questions: 1—The possibility of early and rapid dilatation of the pelvis of the kidney: 2—The effects of a rent or laceration of either of these structures. The case was a male, aet. 24 years, having been brutally assaulted, was in a state of collapse, with colicky pains in lower part of abdomen and hypogastrium and of great tenderness best marked in the left flank; there was no external bruising."

1—Injury to the kidney as the evident cause of hematuria (2) the sudden and complete disappearance of the blood from the urine on the fourth day of the injury and this supervening

very quickly on (3) an attack of severe paroxysmal pain in this flank with (4) the dulness and fulness in that region. I concluded that probably the ureter was blocked in some part of its course by a clot and that blood and urine, unable to escape down it, were accumulating in the loin, but whether in the pelvis of the kidney or outside in the perinephritic tissue, I could not determine. I thought, however, that it was probably within the former and determined on the aspirator for its relief, which was done under chloroform." Patient recovered.

Barker, in 1885, reported a case of excision of the kidney for ruptured ureter and urinary abscess in a child aged 3 years and 8 months, who was run over by a hansom cab. Recovery. There was extreme bruising of the left side and the mark of a wheel having passed across as far as the anterior iliac spine. It was concluded to remove the kidney. It consisted in an incision about three inches long immediately below and in the direction of the last rib and commencing below and in the direction of the erector spinae muscle, then division of the layers of muscle and aponeurosis, then clearing the whole surface of the kidney from its surrounding fat with the finger, next transfixion of the pedicle with an aneurysm needle armed with carbolised twisted silk and tying the pedicle in two portions, then in drawing the kidney out of the wound, and a further ligation of the vessels en masse on the proximal side of the first. After this the pedicle was divided with a snip or two of the scissors and slipped back into its place, then suture with

silver stitches and dressing with salicylic wool, as a drain-tube being left in the original drainage opening. There was no marked shock. Child went home seven weeks after the removal of the kidney, well.

The kidney removed proved to be perfectly healthy macroscopically and microscopically, and the pelvis was not dilated. The ureter appeared to be divided just below the seat of rupture.

Page, in 1894, reports a case of ruptured ureter followed by nephrectomy in a child aged 5 years who was knocked down and run over by a light vehicle, the wheel of which was said to have passed over his abdomen: Operation done; no rent or other abnormality of ureter was visible. Child bore operation well. Kidney removed. I ventured to speak of this case as one of ruptured ureter, but inasmuch as the rupture was never seen it is natural that some doubt may be felt as to the correctness of the diagnosis.

Paton, in 1900, reported a case of ruptured ureter or renal pelvis in a male aet. 36 years: Operation, recovery. Dr. Paton says there can be no doubt I think that the injury in this case was either rupture of the ureter or of the renal pelvis. The diagnosis between these two injuries is, except by a discovery of the vertical tear by operation, impossible, but for purpose of treatment this is of slight consequence.

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CHAPTER XII.

FISTULA.

1856-1905.

Fistula may be congenital, or result from stone, disease or trauma, by surgical operation, or otherwise.

It may be single or multiple, and terminate within the alimentary, biliary or urinary tract, peritoneal cavity, Fallopian tube, uterus, vagina or upon the external surface of the body.

Spontaneous closure may occur, but such a termination is rare. The most frequent cause is injury inflicted during a surgical operation, for the removal of uterine neoplasms per vaginum.

Nephrectomy is sometimes necessary for their relief when due to any cause.

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CHAPTER XIII.

TUBERCULOSIS.

1844-1905.

Tuberculosis of the ureters is common as a secondary deposit resulting from tuberculosis of the kidney. This is the most frequent source. Primary tuberculosis is evidently rare. Bang, in 1874, and Gemmell, in 1886, each report such a case. There does not seem to be any portion of the ureter more frequently the seat of primary tuberculosis than another. While in the secondary form it is near the bladder, when that organ is involved, or near the kidney when it is diseased.

Tirard in 1891 reported a specimen of tubercular growth in the ureter of a boy aged 5 years. There was a family history of tubercle, the mother having died of consumption and one brother from inflammation of the brain. Necropsy: in the left ureter a hard nodule existed at about the junction of the upper and middle third of the tube which was dilated above this point and constricted below. A probe could not be passed through this nodule without force. On slitting it open the ureter was found to be studded with small tubercles and at the nodular swelling to be completely surrounded by a rugged mass, the surface of which was hard and rough, apparently from the deposition of salts (urates) upon a caseous surface. Right ureter appeared normal. Upon microscopical examination of the left kidney

the usual appearance of consecutive cirrhosis were found, the epithelium in the tubes near the glomeruli was swollen and granular, that in the straight tubules somewhat atrophied, while the tubules were dilated irregularly. A relatively large number of nuclei was found over the Malpighian tufts. With regard to the tubercular growth in the ureter it is interesting to note that no tubercles were to be seen on the mucous surface of the bladder or on the surface or in the substance of the kidney.

Hamilton, in 1898, reported a case of tuberculosis of the right kidney and ureter in an unmarried woman aged 23 years. There was no history of tuberculosis in her family. Operation, kidney removed. On examination of the kidney removed it was found that the typical appearances of tuberculous pyelitis were present. The pelvis of the ureter was dilated and coated here and there with miliary tubercles. The ureteral obstruction was evidently caused by dilation of the pelvis and the resulting atrophy of the renal cortex.

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CHAPTER XIV.

BENIGN NEOPLASMS.

1827-1905.

Benign neoplasms of the ureter are common, many of them are referred to in the chapter on pathology and a few have been selected for consideration in a special chapter.

Nicod, in 1827, reported a case of polypus of the ureter and vessels; also the same author in 1835 polypus in the canal of the ureter.

Sanderson, in 1863, reported on a specimen on fibro-cellular tumor surrounding and constricting the right ureter. The ureter is surrounded by a pear-shaped mass compressed from behind forwards and measuring about 3 inches from base to apex and $2\frac{1}{2}$ inches across. Its base is incorporated with the capsule of the kidney while at its upper margin it is in relation with the renal vessels. In its passage through the tumor the ureter is constricted at its origin to the diameter of a very small crow-quill. The pelvis of the kidney is much dilated and contains three or four rough mulberry calculi of a reddish-brown color; in other respects the organ is healthy. On section three kinds of substance may be distinguished. Immediately around the ureter the naked eye aspect of the tissue is colloid; microscopically it is found to consist of a reticulum of very delicate fibres infiltrated with gelatinous-structureless juice. Outside of this it is of firmer consistence and exhibits either masses

of roundish nuclei, fusiform nuclei in process of transformation into nuclear fibres or in the firmest parts of the mass, wavy bands of whitish fibrous tissue.

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CHAPTER XV.

MALIGNANT NEOPLASMS.

1830-1905.

Malignant neoplasms of the ureter include both sarcoma and carcinoma, primary and secondary. The various types of each are found. Carcinoma is the most frequent, and is usually of a secondary variety.

Targett, in 1891, presented a specimen of sarcoma of the ureter taken from the body of a man aged 46 years. Autopsy showed pelvis of right kidney partially embedded in growth, and its cavity, together with the calices of the kidney was widely dilated in consequence of the obstruction of the ureter. From its upper extremity to the bifurcation of the right common iliac artery the right ureter was surrounded and invaded by the new formation; below that level it passed to the back of the bladder as a large solid cord in size, and appearance on section closely resembled the spinal cord; within the bladder the growth projected at the orifice of the right ureter as a polypoid tumor the size of a cherry, the pedicle of which was covered with a healthy mucous membrane, but its summit around the opening of the ureter was superficially ulcerated. Histologically the tumor was a round-celled sarcoma. The invaded ureter was examined near its vesical end and the microscopic sections showed that the lumen of the duct was entirely filled with small round cells

and granular debris. The mucous membrane had disappeared and groups of round cells were to be seen between the planes of the muscular coat. The preparation is of interest inasmuch as the whole length of the ureter was invaded by a new growth from without, which having reached the interior of the duct, filled and even distended its channel and thus spread downwards to the bladder.

Hektoen, in 1896, reported a case of primary carcinoma of the ureter in a woman aged 50 years. Says, while it is not unusual for the ureter to become invaded by carcinoma extending from the uterus, the rectum or the urinary bladder, primary carcinoma of the ureter is very uncommon. Recent systematic works on surgery and on tumors contain no mention of carcinoma of the ureter. Indeed the entire list of primary tumors of the ureter described in the literature is very short. Lebert describes a polypoid fibroma; Thornton a papillary fibroma upon which a calculus was situated; Neelsen a typical papilloma of the upper part of one branch of a partially reduplicated ureter causing a large hydronephrosis of the corresponding half of the kidney. Chian records a so-called cholesteatoma of the ureter and Ribbert a myosarcoma. Orth credits Litten and Hartman with having observed carcinoma of the ureter. Wising and Blix describe a case of primary carcinoma of the right ureter with secondary tumors in the mesenteric glands, the rectum and the liver, with hydronephrosis, in a woman whose urine did not contain anything abnormal. There

was a hydronephrosis containing 1,000 grams of fluid. The upper 12 cm. of the ureter was spirally twisted, hard and thick, converted into a solid string the size of the little finger. On the cut surface there was no lumen, but in place of it a loose, yellowish, gray disintegrating neoplasm. The wall of the rectum was the seat of multiple submucous nodules due to extension from the metastasis in the retroperitoneal glands. Hedenius describes hazel and walnut-sized carcinomatous nodules in the mucous membrane of the pelvis and the ureter, which were situated in the mucous membrane and pronounced by Hedenius to be primary carcinoma.

The following case fatal after 8 months after the first painful symptoms appeared. The clinical diagnosis was osteosarcoma of the pelvis. Anatomic diagnosis: Tumor of the pelvis involving the right ureter, hydronephrosis and atrophy of the right kidney, atrophy of the heart, pulmonary emphysema, chronic adhesive peritonitis, fibromyomata of the uterus. Left kidney weighs 140 grams, the capsule is free, the surface smooth, the consistence firm, the corticle markings not distinct. The right kidney is not present as such. In its place is a cystic cavity containing about 800 c.cm. of a slightly turbid grayish thick fluid. The walls of this cavity whose inner surface is smooth are quite thin and directly continuous with the post-peritoneal tumor mass about to be described. The tumor appears to spring from the inner surface of the right ilium. It forms an irregular mass

about the size of a child's head. On the cut surface it is whitish-gray in color, its consistence is soft and it contains numerous small irregularly shaped cavities filled with creamy, semi-solid material. The ureter cannot be identified at the upper limit of the tumor. A probe passed upward from the opening in the bladder becomes arrested about 2.5 cm. above. Careful dissection shows the ureter to be entirely lost in the tumor tissue. Upon removal of the tumor it is found that the inner surface of the ilium is eroded. The retro-peritoneal glands are not enlarged. Microscopic examination shows the structure of the tumor to be that of a typical medullary carcinoma.

The reasons for regarding this carcinoma as originating in the ureter are the following:

1. The location—there being no other archiblastic structure in the vicinity that the ureteral lining, and the direct involvement of the ureter in the tumor, the larger part of the canal being entirely lost in the tumor mass, the hydronephrosis and complete atrophy of the kidney being due to complete destruction and closure of the lumen of the ureter.

2. The marked similarity of the epithelial cells of the tumor to the cells lining the ureter, the transitional character of the latter being well preserved in the tumor.

3. The absence of carcinoma elsewhere and the voluminous size of the primary retro-peritoneal growth.

It is important to note that in carcinoma as well as other tumors of the ureter occlusion of the lumen of the latter and consecutive hy-

hydronephrosis with atrophy of the kidney seemed to occur quite regularly as far as can be concluded from the few cases now at hand. The thorough and systematic study of early carcinoma of the ureter—the earlier the better—would throw needed light upon the more exact origin and development of this rare but interesting form of malignant epithelial tumor.

Drew, in 1897, reported on a case of villous carcinoma of pelvis, of kidney, ureter and bladder causing hydronephrosis in a male, aet. 56 years. Nephrotomy was performed, the kidney was drained by a large tube—death.

Autopsy—The ureter in the greater part of its extent is much dilated and filled with pus, along its whole length, the mucous membrane is beset with tufts of delicate villous growth attached by narrow base. There is no evidence of thickening of the wall of the ureter beyond what is due to inflammatory adhesions of the surrounding cellular tissues. The upper end of the ureter before it joins the pelvis is contracted apparently by the condensed fatty tissue around it and not by the new growth. The lower end is dilated as far as the orifice in the bladder, the intra-muscular portion being unusually wide.

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CHAPTER XVI.

PATHOLOGY.

1616-1905.

Jones, in 1848, on the minute anatomy of scrofulous deposits in the ureter says: It is, I believe, not yet completely ascertained what is the primary situation of the scrofulous matter which in the disease termed "strumous pyelitis" is found, forming a layer on the internal surface of the ureters or pelves of the kidneys. It has been considered by some to be deposited on the mucous surface; by others, beneath that surface in the submucous areolar tissue. In the greater number of cases it is scarcely possible to determine which of these two opinions is correct, inasmuch as the deposited matter has accumulated to such an extent that the mucous membrane in the situation occupied has wholly disappeared. I have recently had an opportunity of examining an instance of this scrofulous deposit in the ureter in an early stage of its formation, and will now mention the evidence I obtained in favor of the opinion which assigns the submucous tissue as the seat of the deposit.

Male, aged 11, died with scrofulous disease of the hip-joint. In the left ureter a small patch of scrofulous deposit was found. None, however, existed in the bladder nor I believe in any other part of the urinary passages. Kidneys were healthy.

Hilton, in 1863, reported a case of enlarged middle lobe of prostate with disease of the kidneys, the right ureter dilated to the size of the small intestine in a male aged 60 years. Autopsy showed ureters and pelves of kidneys greatly dilated. On the right side the pelvis was as large as the kidney and the ureter as capacious as the small intestine. When opened, milky fluid poured out but the mucous membrane was not much altered in character. Both kidneys were wasted and dissection showed numerous white lines as if an inflammatory product had been thrown out in their tissue, capsules firmly adherent, irregular on surface and cortex wasted.

Gervis, in 1864, reported on specimen of the bladder, kidneys and ureters in a case of distension of ureters, pelvis of kidney, etc., in an infant aged 5 weeks: There were two points of much interest in connection with this specimen. First, as to what could have constituted the obstruction, for after birth the child had had no apparent difficulty in micturition, so that whatever has proved the obstruction before birth must have ceased to do so after birth; and secondly, it appeared remarkable that sufficient urine should be secreted during the last few weeks of intra-uterine life to produce pressure effects which simulated those resulting from a stricture of many years standing in an adult. At the time of making the inspection, the bladder was found nearly empty, but both ureters, and especially the left, were greatly distended although the com-

munication between them and the bladder was unimpeded.

Sherard, in 1870, reported a case of cystic disease of the kidney with dilatation of the ureter and atrophy of the bladder in a male aged 31 years; death 17th day. Post-mortem showed left kidney seemed to be in a healthy condition. Right kidney, whole of it, presented the appearance of a multiple cyst, one large sac divided first into two smaller sacs and each of these two smaller sacs divided into four others still smaller, all communicating through the pelvis with the ureter. The right ureter was also greatly enlarged, being one inch in diameter at its junction with the kidney and one inch in diameter where it emptied into the bladder. The bladder was so much contracted as to hold only about two drachms of fluid. Its walls were very thick, at least half an inch, and it was closely attached to the pelvic bones. In this case the sacculated kidney and the dilated ureter evidently performed vicariously the functions of the bladder as a reservoir of the urine, their joint capacity being about three ounces. The entire tubular structure of the right kidney being destroyed, the whole labor of the urinary secretion fell upon the left kidney. The urine thus separated from the blood by the left kidney passed through the left ureter into the atrophied bladder and then welled up filling completely the dilated right ureter and kidney. The hydraulic pressure thus exerted must have extended also to the left kidney, and doubtless to this hydraulic pressure, added to the ex-

citement from overwork, is to be attributed the intense pain exhibited by that organ. The pathology of this disease is not very evident but it may help to a probable solution to know that cancer was hereditary in the patient's family.

James, in 1877, on dilatation of the ureters and renal pelves, hydronephrosis, says: "Obstruction to the escape of the contents of a hollow viscus or of the secretion of a gland causes dilatation, and this pathological process in the case of a kidney gives rise to the conditions of cystic kidney and hydronephrosis, pyonephrosis or surgical kidney. In these affections the position of the obstruction is different. In the former, the small tubules are obstructed causing a formation of cysts varying in size and number in the substance of the organ causing a dilatation, varying in degree, of the ureter and pelvis of the kidney. He reports one case and concludes as follows:

1. That increase in the frequency of micturition is capable of causing a greater or less damming up of the urine in the ureters, renal pelves and tubules and consequent pale color, and diminution in the sp. gr. of the urine.

2. That this damming up if continued will in time cause dilatation of the ureters and renal pelves and a more or less hydronephrotic condition of the kidneys.

Gouley, in 1880, reported on Mercier's operation for valvule at the neck of the bladder with a male aet. 70 years and reported on hypertrophy of the muscles of the ureters—a new fact in pathology. He says in connection with

this case: I wish to direct your attention to another important fact, an observation of which I have not seen recorded. It is that in at least a large proportion of cases of valvule at the urethro-vesical orifice, there is a second obstruction of the ureters which divides the bas fond into two nearly equal portions. I have in my possession at least a dozen specimens illustrating this point. The significance of this is that the stagnant urine may be drawn from either of these halves without completely emptying the other. I have repeatedly made the observation upon the living subject, first emptying the posterior half without emptying the anterior, then withdrawing the catheter slightly. From one to two or even three ounces of urine have been drawn from the anterior half of the bas fond. In some cases I have drawn the urine from the posterior half of the bas fond after emptying the anterior. What is the practical deduction from this observation? It is simply that we should divide or excise the portion of the bas fond in the median line so that the posterior half of the bas fond would be emptied in the act of urination in the event of a successful incision or excision of the valvule to the anterior half.

Dakin, in 1887, in a specimen of atrophied kidney and dilated ureter from a female child aged two years who died of anaemia connected with rickets and had no symptoms of disease of the genito-urinary organs; left ureter is elongated tortuous and dilated to about the size of the little finger and has very thick

walls; it opens into the bladder by a large orifice admitting, when fresh, an ordinary sized pencil.

Mann, in 1894, reports on inflammation of the ureters in the female and speaks of the pathological anatomy as follows: "I have had no opportunities of studying this disease post-mortem, and have not had access to any work treating fully the pathological anatomy of the ureters. Judging from what I have observed clinically and from the reports of cases of other observers, I think we may distinguish several forms or stages of ureteritis.

First, the catarrhal form in which there is a little swelling of these tubes with desquamation of the epithelial lining. It is my belief that in slight cases, judging from the evidence gained by examination as well as from the symptoms, the force of the disease is first spent on the lower end of the ureter, especially the part in front of the broad ligament. In other cases, the surface of the tube seems to give forth a plentiful purulent secretion which indicates an ulcerated or granulating condition of their lining membranes. Tournier says that when these ulcerations occur, a thickening in the surrounding connective tissue takes place with perhaps adhesions of the peritoneum giving an irregular outline to the course of the ureters. Sometimes the tube is greatly thickened by inflammatory deposits in the walls. This may reach a point where the ureters are as large as a lead pencil or even larger. In the case of obstruction, dilatation even to an extreme degree may take place accompanied

by a certain amount of thickening. Tournier likens these dilated and thickened ureters to the arteries in a cadaver. I have now under observation a case in which the ureters are greatly thickened and in which the right one seems to be dilated or sacculated just behind the broad ligament. The pelvis of the kidney is doubtless generally more or less involved with the ureters, but that it is always so is not proved. A physical examination in several cases of so-called "pyelitis" has shown that the ureters were the parts chiefly involved.

That these conditions may end in involvement of the pelvis and of the kidney itself I have had clinical evidence. In several cases perinephritic abscesses have developed and in two abscess of the kidney has developed as proved by operation. Usually both ureters are involved in the pathological processes but often one side, usually the left, is much more seriously affected than the other.

Robinson states that the chief functional relation of the tunica mucosa ureteris is atrophic degeneration of the epithelium in the segments of the ureter supplied by the arteria ureterica proximal and distal. All functional ureteral irritations to which are due to periodic hyperaemia ending in hypertrophy will finally indicate decrease in number and atrophy of muscle, nerve and epithelial cells (parenchymatous cells) with an increase of connective tissue stroma cells (frame work cells).

In age relations of the ureter arterio-sclerosis plays the chief role. Its main effect is (a) on the tunica muscularis, (b) tunica fi-

brosa, (c) tunica mucosa.

The author has three dissection illustrations.

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