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INJURED URETERS IN ABDOMINAL SURGERY:
THEIR CARE, WITH REPORT OF A CASE OF ANASTOMOSIS AND RECOVERY.¹

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(With seven illustrations.)

It has recently fallen to my lot to have to deal with a ureter severed during the removal of a large abdominal tumor, and the interest awakened by that case has led me to consider, more particularly than I had hitherto, the various necessities and possibilities of such a circumstance and to review somewhat the work of others in that direction.

It is with the hope of developing a like interest in, and a thorough study of, this comparatively untrodden ground that I have ventured to string together a few notes to serve as a basis for discussion this evening.

It happens now and then, in the course of our surgical work

¹ Read before the New York Obstetrical Society, February 5th, 1895.

in the lower abdomen, that we are obliged either to open a ureter, say for the removal of a stone, that we wound a ureter, that we excise a portion of its circumference transversely or longitudinally, or, again, that we sever it; and I propose to run over these various occurrences, to present different modes of treatment which have been advocated, and to comment upon them, I trust for your pleasure and possibly for our common benefit.

The removal of a stone from the ureter can be accomplished by a longitudinal incision in the large majority of cases; the calculus may be high up near the pelvis of the kidney, when it is best worked upon by crowding it into the pelvis of the kidney, thus to have better access to it by the lumbar incision; or a stone may be so far below the brim of the bony pelvis that it can best be crowded to the bladder, to be removed by that route, or through the vagina, or through the rectum; but, found at some distance below the kidney, and distant also from the neighborhood of the above-mentioned parts, it may also safely be extracted by the extraperitoneal incision.

The following cases are of interest as illustrating this point: In the *British Medical Journal* for 1890 Mr. G. Twynam reports the case of a child of 8 which had suffered from abdominal pain and hematuria for a period of sixteen months. Failing to arrive at a satisfactory diagnosis by the usual means, he explored the kidneys and the ureters through an incision in the left linea semilunaris. He discovered a calculus in the right ureter at a distance of two inches from the bladder. He re-closed the wound and it healed well. Three weeks later he operated for the removal of the stone through an incision similar to that made for tying the common iliac artery. The ureter was isolated with difficulty, but the stone was extracted with forceps through a linear incision. He stitched the ureter with fine silk and introduced a drainage tube to the bottom of the cavity. For three days the urine drained freely from the wound, but ceased altogether on the fifth; the wound healed and the boy made a perfect recovery.

The second case is that of Mr. Arbuthnot Lane, published in the *Lancet* of 1890. In this one a calculus had been impacted in the ureter for twenty years; it was also detected by the finger passed into the abdominal cavity through an incision in the left linea semilunaris. It was found below the crest of the ilium, but was forced up and was removed by a small incision in the

side. The aperture in the ureter was stitched up with a fine continuous silk suture, and the wound healed rapidly.

The results of these cases undoubtedly prove that the method followed was wisely chosen, and even here, were the ureter not sutured at all, the chances are many that its edges would ultimately unite (Fenger, in the Transactions of the American Surgical Association, 1894, quotes three such cases from Tuffier in which no sutures were used), and the result is all the more certain to prove satisfactory if the wound is kept aseptic and if perfect drainage is maintained, as it can be in this location as long as one will.

Now, in view of our present status in aseptic surgery, I believe that we may operate for the removal of a calculus from the ureter almost as safely by the transperitoneal incision, once we have the abdomen opened; then either to unite the edges of the wound in the ureter by a continuous suture and unite the peritoneum over it as well, or that we may incise the ureter through and through and treat it by the modern surgical method. I appreciate that this is contrary to the precepts laid down by others who have written upon the subject, but I still feel confident that it will be accomplished with safety equal to that by the extraperitoneal method, and certainly with far greater facility.

This method of operating for stone is said to have been practised twice, and one of the cases is reported as "successful" as regards suturing only, the other as regards life. Cullingworth performed laparotomy and found the right ureter dilated; a calculus was found immediately above the bladder; he cut into the ureter, removed the stone, and this was followed by a free escape of pus; he stitched up the ureter with interrupted silk sutures and placed a glass drain in the abdomen. However, death resulted from peritonitis in eighty hours, but it was found that the sutures in the ureter had held well.

This case certainly does not hold out an encouraging prospect, all the more as it is a recognized fact that in cases in which we have a partially obstructed ureter we are pretty sure of finding it markedly diseased and the kidney holding infecting material with which we are liable to poison our ureter wound and the peritoneum. In spite of these adverse elements, however, I should still advocate attacking the stone by this route, especially if it has been discovered after opening the abdomen, as we have seen in the cases quoted, that laparotomy has been a prime neces-

sity for the very purpose of diagnosis even. What with our information already acquired that we shall probably have to deal with pus; with our ability to protect our field fully; what with our means of disinfection (peroxide of hydrogen, flushing, etc.), our opportunity of covering the ureteral wound with peritoneum, and having a free channel for drainage through the cleared ureter, I cannot but think that we may fairly count upon a successful termination if we carry out this plan.

The second case which has been mentioned by Fenger as one of transperitoneal incision is, I think, erroneously quoted as such. It is, in fact, the very case, that of Arbutnot Lane, mentioned a moment since as a sample of extraperitoneal removal.

The exact reading of the original report is: "Consequently on July 5th the abdomen was opened along the left linea semilunaris, and in the portion of the ureter which had not been explored at the previous operation a small stone was felt. This was forced upward along the ureter to the crest of the ilium, and by means of a small incision in the side the ureter was exposed and the stone removed. The aperture in the ureter was sewn up by means of a fine continuous silk suture. The wounds healed very rapidly, no leakage taking place from the ureter." It is evident that Dr. Fenger has interpreted this to mean in the side of the ureter instead of in the side of the body, but, as the ureter was exposed by means of a small incision in the side, there can really be no misunderstanding. Furthermore, it is said the wounds healed rapidly; evidently there were two, and, as there is no mention of drainage, I think there can be no question about the incision being extraperitoneal.

So that we have but one case reported in which the transperitoneal method has been resorted to.

Union of such an incision within the abdominal cavity should be made sure with a continuous fine silk suture; or one may even trust a catgut suture which has been chromicized, for greater durability. The line of union is then to be covered by the neighboring peritoneum nicely stitched over it.

If the edges of such an incision are not perfectly adapted, after removal of a stone, for nice coaptation, they should be re-trimmed so that there shall be no question possible of complete and perfect closure.

Should the line be a long one, say over an inch, it is well not to make the suture all of one continuous stitch, but make it fast

here and there in its course, either by knot or by a half-turn now and then under the loops.

Should a wound which we have intended to maintain in its linear integrity become misshapen, it may chance that we shall have to choose some other mode of treatment ; still, if the ureter at such a site has enclosed a stone, its calibre will of a surety be sufficiently ample not to threaten a stenosis.

Now, should we chance to *wound* a ureter transversely—which, in view of Cabot's studies of the anatomical relations of the ureter to the peritoneum, we may see we are constantly exposed to, if we have the latter at all stripped up—the question is immediately presented : shall we seek to treat this by direct stitching of the edges as they lie, or shall we seek to make the partial transverse incision into a longitudinal one ? This is a point which, I think, has not had a very full discussion, though Van Hook has considered it, and which is very difficult of settlement on paper ; but it is one which every operator should have in mind, to keep the different possibilities clearly before him, ready to decide quickly in any given emergency. Any choice of method will clearly have to depend upon the extent of the injury : if it amounts to a prick point only, of course it will be met by one suture across the ureter and a covering of peritoneum ; if it is a wound that gapes slightly it may still be held by one or two sutures across the ureter and a covering of peritoneum. A trifle more gaping, however, will undoubtedly call for the transformation of the transverse shape into a longitudinal slit ; this latter to be stitched as we have indicated above, unless, indeed, by so doing we risk bringing one wall of the ureter—that stitched—in contact with the back wall. Anything threatening to be a stenosis should be avoided at all hazards, and such a wound would then have to be cared for either by a method devised by Fenger, of Chicago, in treating a stricture, that of doubling one half of the fistula upon the other half and then stitching about the edges ; or by the method of completely severing the ureter and adopting the anastomosis method, which, I am inclined to think, is decidedly the better of the two ; or, again, by implantation into the bladder.

The same rule will hold if we inadvertently *excise* a portion of the circumference of the ureter, transversely or longitudinally. Coaptation of the edges under such circumstances would most positively constrict the canal, which one is not to counte-

nance for a moment. One may here also resort to the expedient of doubling one half of the opening upon the other half and suturing the edges, or one may think well of dividing the ureter completely, as indicated above, to anastomose or to implant, according to the point of the injury.

We come now to consider the question of treatment of complete division of the ureter in its several portions. The ureter has been purposely cut in its upper portion near the pelvis of the kidney to get below a stricture, and, after full two centimetres of its length have been resected and the cut end split open, it has been stitched into the pelvis, thus establishing a good continuity. This you will doubtless recognize as the great achievement of Küster on a boy of 13 years of age.¹ This had been suggested for the same individual by Braun, of Marburg, two years before, but as the case came later under Küster's care it was his privilege to put the idea into execution. A fistula remained, but it was closed five months later, and within a year the boy was seen and presented a good condition but for a lumbar hernia.

Another instance of intentional section is mentioned by Dr. Baldy in the *American Gynecological and Obstetrical Journal*, November, 1894, who says that, witnessing Dr. Penrose operate for removal of a cancerous uterus, the ureter being involved in the cancerous mass and the dissection being difficult, furthermore the walls of the ureter being infiltrated, he counselled that the ureter be severed beyond the limit of the disease and later be implanted into the bladder.

Dr. Polk also, in the *Medical Record*, January 5th, 1895, in mentioning a case of congenital absence of one kidney, said: fortunately the anomaly was discovered before he took out a piece of the ureter of the only kidney, which he was about to do in an operation upon the uterus.

References to this occurrence as an accident are not very numerous, yet there are a number on record, as quoted in the "Cyclopedia of Obstetrics and Gynecology," vol. vi., namely, by Von Nussbaum, Hegar, and Müller, and a few others, and, in addition, those of more recent date by Schopf, Cushing, Kelly, and Krug. My own, reported herewith, completes, I believe, the list up to date.

¹ Reported in *Archiv für klinische Chirurgie*, vol. xlv., 1892, p. 850.

The question of properly meeting such a condition has only lately been brought to its best development. Some of the text books of even recent issue make no mention at all of such a possibility. Others still advocate the older methods—namely, nephrectomy and carrying the ureter to the outer world or to the rectum—or they fail to lay sufficient stress upon the best methods which may be adopted with a fair promise of success—namely, the anastomosis and bladder implantation. So also, in a recent German study, Hermann Thomson, of Odessa, in *Zeitschrift für Geburtshülfe und Gynäkologie*, Stuttgart, 1893, summarizes the possibilities up to that time :

1. Direct union of a severed ureter is generally not to be attempted.

2. The only surety for a primary union depends upon the stitching being made upon a catheter; and even this is not to be attempted, on account of the almost certain stenosis of the ureter.

3. The implantation of the ureter into the bladder or into the rectum is also not to be recommended as a means of cure.

4. We may count upon a complete cure after lesion of the ureter only by performing a nephrectomy, immediate or mediate.

The fact is, there have been as yet so few opportunities for the thorough testing and weighing the merits of these various methods of getting out of a serious difficulty that each operator has mostly been obliged to call upon his own resources on the spur of the moment. But still I think there is a sufficient amount of literature to furnish us some very clear indications for a uniform course of action, and it is on these premises that I propose to base a few arguments.

The very operation which this author commends as the most desirable in the end to obviate serious difficulty is the one which, I believe, the most of us will wish to avoid if other simpler means offer any fair promise of restoration to health.

The easiest plan of all to follow in case of such a lesion presenting, after that which has also been recommended of tying both ends of the ureter and dropping them back into the cavity (Guyon), is that which has been generally advocated—tying the distal extremity of the ureter and making the proximal end fast in the abdominal wound, in the loin, in the bladder, or, after the manner of Novaro, in the rectum or in a loop of intestine ;

but we immediately see how objectionable several of these methods are.

Attempts have also been made to establish a continuous channel between two ends of a ureter which had been implanted into the abdominal wound, but these offered no promise of success; either the distal extremity atrophied and became useless, or it was found that no tissue which could be utilized to connect the two could serve as a carrier of urine, neither the surface of the bowel, the peritoneal surface back of the abdominal wall, nor the skin on its anterior aspect.

The ill results attending the implantation into the rectum were also quickly manifest, for it was repeatedly found that the ureter and the pelvis of the kidney became greatly distended—in short, that hydronephrosis set in early. This was attributed to a partial stenosis at the site of implantation, which seems to be an almost insuperable difficulty, though there are some cases on record which, with time elapsing, seem not to have suffered any injury (Chaput). This effect seems to be due to the muscular fibres of the bowel, which apparently are constantly urged into activity by the presence of the ureter.

Another objection to this mode of implantation is the uncertainty of the point of lesion. Should it be high up in the abdomen, the kidney extremity cannot be brought to the top of the rectum without subjecting it to an unwarrantable amount of stretching which would be fatal to a secure union and would also produce a diminished calibre of the duct.

With such a difficulty presenting, the end of the ureter has been implanted in the small intestine; but here we offer the objection that the small intestine is too movable to promise a firm healing, that we expose the ureter to strangulation, the intestine to the same and to colic, besides the various reflex disturbances.

Another very serious objection to this procedure is the certain infection from the bowel which is sure to take place. The bacillus coli communis is ever present and will promptly find its way into the ureter and into the pelvis of the kidney, producing a septic pyonephrosis. This is pretty well established by the various experiments with post-mortem inspections, and by a few operations of this kind on man which were followed by disintegration of the kidney.

Next came the studies trying to implant the ureter into the

bladder, notably those by Hegar, Paoli, and Busachi. These various experiments proved fairly successful, and their principles were put into practice upon the human subject by Baumm in 1892 and by Novaro in 1893, by Penrose in the early part of 1894 and by Krug in the latter part. But we see at once three difficulties in the way of making this the mode of choice or utility. In the first place, it can only be applied to those cases in which the injury is very close to the bladder. If the upper extremity is far away we cannot avail ourselves of this method; though this might be met in part by the suggestion and experiments of Van Hook, who has sought to pull upon the bladder to such an extent as to stretch it high into the abdominal cavity there to bring it in contact with a shortened ureter.

This can never prove of any great service, surely. The traction which renders union difficult or impossible, the traction for all time upon the ureter and kidney, the consequent diminished calibre of the ureter and imminent hydronephrosis, the inability of the bladder to empty itself, all entail backing up of urine and intrarenal pressure.

The second objection to this mode, implantation into the bladder, is founded on the possibility of stenosis at the site of implantation, owing to the ureter being placed directly through the walls as it has been in the bowel, instead of slantingly as it is in nature. This natural entrance is peculiarly well fitted to guard against a constriction of the canal; the opening through the viscus is oblong, the contraction of muscular fibres of the bladder is spread over an oval length of the ureter, and closure of its lumen is thus made impossible.

Undoubtedly the device to split the extremity of the ureter which is placed within the bladder will serve a good purpose in retarding stenosis at its extremity; still, I believe that there is reason to fear the effect of contraction upon it ultimately. However, the cases are all too few upon which positive rules can be based. Dr. Baldy, in giving the report of the two cases in which he saw this operation performed, argues that stricture is bound to be much more common from the end-to-end operation than in the case of bladder implantation. But the question must arise, "Is it so?" There are only two cases of the latter kind, and there are three of the ureteral anastomosis upon which to form a judgment, Dr. Kelly's, Dr. Cushing's, and my own.

The third objection which I make to the bladder implantation

is the fear of infection of the kidney from the bacillus coli communis, which is very commonly to be met with in a bladder which has been diseased or in which surgical instruments have been much used without proper antiseptic precautions. The natural opening of the ureter into the bladder is valve-like, which is only patent when the ureter contracts upon its contents to force them into the bladder. Under new conditions it is at times constricted by the muscular fibres; it is at other times gaping. How can it, then, stand as a guard to the kidney? It must allow a back pressure when the bladder is full, and more positively still when this viscus contracts to empty itself.

The effects of such back pressure, resulting in intrarenal pressure, are fully set forth by interesting experiments carried out by F. Guyon upon dogs. These are entitled "Influence de la Tension intra-rénale sur les Fonctions des Reins," in *Annales des Maladies des Organes génito-urinaires*, 1892. He there shows, even, that a partial obstruction of a ureter works more injury than does its absolute occlusion (the former induces considerable hydronephrosis, while the complete induces only very slight hydronephrosis and then destruction of function and structure ensue), and that the injury does not remain confined to one kidney, but is felt also in a most positive manner on that of the opposite side.

Guyon goes so far as to hold that an aseptic obliteration of a ureter will cause an aseptic atrophy of the kidney—as he puts it, "from being less required, then suppressed, physiologically, it comes to be, under this continued tension, required less and suppressed anatomically." He thereupon repeats what he has before advised, that in cases of torn ureter, as may happen in removing abdominal tumors, it is better to make an aseptic ligation of the ureter rather than resort to nephrectomy in cases which will not bear a prolonged operation. This advice cannot hold good, however, for general practice sufficiently to recommend it absolutely, even fortified as is the opinion by similar experiments of Cohnheim, Straus, Albarran, and Germont, and in our own country by those of Byron Robinson, mentioned in *Annals of Surgery*, vol. xviii., since in another set of experiments, mentioned in *Zeitschrift für Geburtshülfe und Gynäkologie*, 1893, we are told that although Wladimiroff did find as a rule that obliteration of one ureter produced a hydronephrosis

simply, yet in two cases out of nineteen a pyonephrosis was developed.

Guyon would undoubtedly hold that the kidney was already septic, or that the ligature was so. Be it as it may, this question cannot stand solved as yet.

Not satisfied with results obtained hitherto, and with the leading thought to escape the more formidable operations, various surgeons were constantly attempting to secure the end-to-end union. These efforts were in the same line with the experiments upon the various fistulæ of the ureters, especially the uretero-vaginal following upon hysterectomies, and the operators repeatedly sought the aid of the gum-elastic catheter, over which they hoped to secure union. This was passed through the urethra, through the bladder, and so up to the point of severance.

Gusserow and Pawlik repeatedly attempted this operation, but all their efforts proved unavailing for final closure. Pawlik did secure union on one occasion, but in attempting to withdraw the catheter he found its removal very difficult, owing to the incrustation of salts upon it; when this was accomplished the wound reopened, and he tried it no more.

Yet this (strictly speaking) end-to-end method has been carried out on two occasions on the human subject. The first is that of Schopf, reported in the *Allgemeine Wiener medicinische Zeitung*, 1886, No. 31. He united the two ends of a severed ureter by means of eight silk sutures, which included only the external and middle coats. The patient recovered fully after the operation, and there were no symptoms to point to a probable failure. Still, death from tuberculosis followed after seven weeks. The autopsy, however, showed that there was probably stenosis, if not obstruction, for the ureter was completely surrounded by cicatricial tissue.

This is quite in keeping with the results obtained by Tuffier in his experiments upon dogs, reported in the *Archives générales de Médecine*, 1889. Either the animals died shortly before results could be noted, or the ureter was found much constricted, even obliterated.

The second case recorded is that of E. W. Cushing, of Boston. It is noted in *Annals of Gynecology and Pediatrics*, vol. vi., February, 1893, without any statement of the date of the operation. Cushing's work was apparently original, as he says: "The ends of the severed ureter were found and united by two fine

silk sutures and one of catgut. There was a discharge of a little urine from the wound for some two weeks, but the fistula promptly closed, forming a rare, if not unique, incident in the surgery of the ureter."

Within three days I have seen Dr. Cushing, and he tells me that he has seen this patient within a month and that she is sound in every respect.

However, as said above, the numerous experiments made before this had fully demonstrated that such a method was not to be relied upon.

Not, as has been feared by Cabot (*American Journal of the Medical Sciences*, January, 1892), that the walls of the ureter are too thin to bear sutures; nor that if one uses catgut it is too quickly absorbed, and if silk, it forms a foundation for concretions, for, in fact, the walls are amply thick to allow of sutures being passed down to the mucosa only, and catgut can be made durable by chromic acid, and no urine need touch either kind; but, rather, that perfect coaptation was difficult, that leakage was probable, and that stenosis was almost sure to follow, either from cicatrix in the line of union, from compression from without, or from folding in the mucosa.

At about the same date as this first case is reported, namely, 1887, work had been undertaken which promised well to secure good results.

To Alfonso Poggi, of Bologna, is due the credit of first instituting successful experiments in this direction, and of paving the way for good surgical work to maintain the calibre of the ureter, to save the function of the kidney, and to free the surgeon from the necessity of resorting to nephrectomy, which was so universally advocated at that time.

In the *Riforma Medica* for 1887 we may read the description of Poggi's studies upon the dog, and we find there also a couple of plates showing the appearance of the ureters after removal, one at the end of fifteen days, another after three and a half months. In his experiments he attempted the end invagination, dilating the lumen of the distal portion, inserting the proximal end, suturing about the edges, and covering the wound as best he could with peritoneum.

We next find an account of similar experiments made by Weller Van Hook, reported in *Journal of the American Medical Association*, Chicago, 1893, six years later. His experi-

ments were directed to the insertion of the proximal end of the ureter into a slit made upon the face of the distal extremity after ligating its tip. "A suture was passed through the wall of the upper fragment of the ureter, the opening of which had been enlarged slightly with the scissors." The suture was then carried through the slit and through the wall of the lower fragment, the upper portion was drawn into the slit, and the suture was tied. The edges were sutured to the invaginated portion, and peritoneum was gathered about the wound and stitched.

"The dog recovered with no ill effects whatever and was killed twenty-six days afterward." "There was complete permeability of both ureters, as shown by the probe passing through the ureters into the bladder." The mucous membrane was seen to be continuous, perfectly healed at the point of junction, and presenting no diminution of calibre. This lack of stricture formation was to be expected from the fact that the line of primary union was necessarily an oval, not a circle, corresponding to the shape of the slit as distended by the invaginating end of the ureters.

Both of these experimenters established, therefore, the correctness of their leading idea, and the post-mortem inspection of the ureters operated upon fully justified them in proclaiming their achievement as a warrant for similar work to be undertaken on man.

Dr. H. A. Kelly had the gratification of first performing this operation on the human subject. The operation was performed in May, 1892, and the case is reported in the *Bulletin of Johns Hopkins Hospital* for October, 1893.

He followed Van Hook's lines closely (except that he used two stitches) and he secured a perfect result. In this case the ureter was enlarged to four times its natural size, therefore the work upon the two bits became comparatively simple, once the method was determined upon.

The one which I now place on record is, then, the second case of this operation performed on the human subject.

On November 22d, 1894, while removing from a woman of 25 a large, solid mass attached over the fifth lumbar vertebra (edematous fibroid, ten by twelve inches, pronounced by the pathologist of the hospital to have been at one time attached to the uterus), I chanced to sever the left ureter at that level.

The cut ureter was quickly recognized by the appearance of

urine, though for a moment the question arose whether we had an enlarged blood vessel to deal with, the tumor having already been ligated off. I proceeded at once to attach the proximal to the distal extremity, after the manner suggested by Van Hook, but was met by a difficulty which, I think, has not been mentioned in the writings on this subject—namely, that, through compression exercised by the tumor upon the ureter, the upper portion, just where it was severed (evidently where it was engaged under the tumor), had attained to a size of eight millimetres, while the distal portion had no more than six, the calibre of which was probably only four millimetres. Had the situation been reversed, how simple to slip the smaller into the larger and

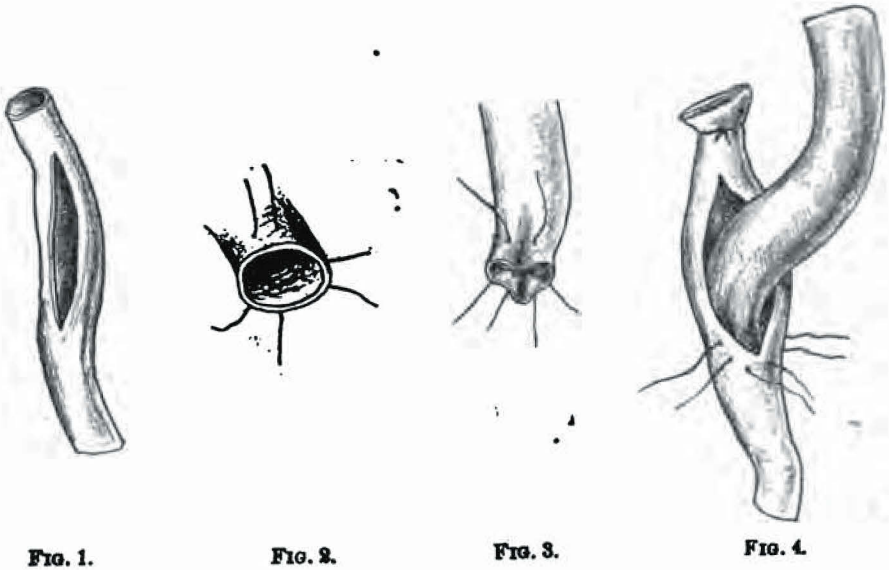


FIG. 1.

FIG. 2.

FIG. 3.

FIG. 4.

run it down for quite a distance to make leakage impossible! But to insert a tube eight millimetres in diameter into one with a lumen of only four millimetres seemed at first sight well-nigh impossible; and, indeed, it was not easy. But, as mentioned by Van Hook, "the lumen of the tube can be enormously increased by stretching, without prejudice to the integrity of its walls," so I found, and I overcame the difficulty by making quite a long slit upon the face of the smaller tube (see Fig. 1), then tying the cut end, just as was done by the above-mentioned writer in his experiments. Next, by inserting three double sutures at three equidistant points in the circumference of the upper extremity of the tube, at about one-half centimetre from its end (see Fig. 2), so arranged that by pulling upon them this tube would collapse at three points (see Fig. 3), I passed the three double

sutures into the slot of the lower tube, and through its walls at three equidistant points also; and, by this means drawing upon the sutures, I gathered the larger extremity into the calibre of the smaller one, which did stretch to admit it (see Fig. 4); and ligating these sutures, I fixed the one tube within the other (see Fig. 5).

My next point was to stitch the edge of the slot to the upper portion of the ureter, as well as I could, by a running suture (see Fig. 6); then to gather bits of parietal peritoneum about my work and to stitch them here and there, trusting to rapid plastic exudation to seal up the joint (Fig. 7). Van Hook, in his ex-

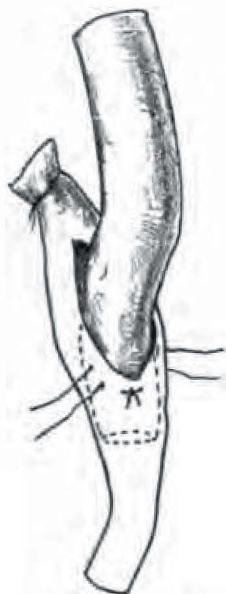


FIG. 5.



FIG. 6.



FIG. 7.

periments, utilized omentum, but I had peritoneum of the tumor stump all ready at hand.

This method proved effectual, and the patient recovered without showing any untoward symptom.

The catheter was left in the bladder for six days; after that time the patient was allowed to pass the water. The amount of urine excreted was not measured with great accuracy, but it seemed to be about normal, according to the patient's statement.

As recovery was progressing (third and fourth day) I feared that there was evidence of urinary distention of the proximal portion of the ureter, which would either cause rupture of the union or lead to hydronephrosis. This apprehension was dispelled by percussion of the tumefaction directly over the site of the repair, and the further information gained that it did not

increase in size. Evidently we had here merely the agglutination of a mass of intestines to the newly vitalized surfaces; there was nothing like obstruction of the tube.

In giving this opinion we should not overlook the possibility of error on our part, in view of the experiments upon dogs made by Robinson, of Chicago, reported in *Annals of Surgery*, vol. xvii., 1893, from which the induction seems plausible that a ureter may be occluded for weeks without producing any special harm, and that the kidney may resume its natural function once the constriction or pressure has been removed. In support of this view he quotes the case of a lady in whom the ureter of one side was ligatured for six weeks; the ligature was removed at the end of that time, and the kidney resumed its function as before.

My patient returned to her home, Middletown, Conn., in the fourth week after operation.

This mode of operating under like circumstances is, I think, the one to be commended. It is certainly feasible in every case in which there is no loss in continuity, and probably in those even in which quite a portion of ureter might be lost, as we could obtain an adjustment by freeing the ureter from its peritoneal covering within the pelvis.

It will be noted that instead of using one stitch as did Van Hook upon the dog, or two as did Kelly in his case, I used three, the better to bind the inner tube to the outer one; that I inserted them all from within out, and that I traversed all the coats of the ureter; also, that I closed the abdominal cavity without using a drain.

It seems to me immaterial whether one use here silk or catgut. The latter is theoretically the better one to use, and, were I sure of its durability, I would do so in another similar case. With the silk, one may fear capillary attraction, leading to urinary infiltration beneath the peritoneum; but, as a matter of fact, if we cover the field of operation with peritoneum, I take it that plastic exudation, quickly established, puts a barrier to that.

One may also dread the ultimate passage of the knots of silk into the bladder, and their retention there to form nuclei for stone. A bare possibility there is. I fancy rather that they work their way out of the ureter and remain encysted beneath the peritoneum.



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