SURGICAL INJURIES TO THE URETERS.

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Injuries to the ureters are by no means uncommon accidents, even though few of them ever find their way into print. The question of the repair of a severed ureter within certain accepted limits was a few years ago unsolved, while to-day we stand upon substantial surgical grounds in saying that the subject, in certain respects, is settled beyond peradventure. It is true there yet remain some few details in the technique to clear up, but the main proposition is accomplished. The adoption of such makeshifts as ligation of the severed ends, formation of a urinary fistula, or nephrectomy is ancient history. To-day we have but two propositions to consider — uretero-ureteral anastomosis and uretero-cystostomy (bladder implantation[1]). Both these procedures have been demonstrated as feasible, first by experimentation (Van Hook,[2] Paoli,[3] and Busachi) upon dogs, and subsequently by various surgeons upon the human subject. There are now upon record seven successful operations of this character, and it is not too early, I think, to make a comparison between the two methods for the purpose of determining which is the better or in what class of cases each is applicable. It has been contended by some surgeons that these two procedures are not rivals in the same field, but are applicable to distinctly different classes of cases. In this matter, however, within

[1] Baldy: American Gynecological and Obstetrical Journal, November, 1894.
[2] Journal of the American Medical Association, December 16, 1893.
[3] Annales des Maladies des Organes Gén.-Urin, 1888.

certain limits, I am compelled to dissent, and the facts as well as theories seem to uphold my position. Experience seems to demonstrate more and more that bladder implantation is applicable to a much larger group of cases than is uretero-ureteral anastomosis, and, if any choice must be made between the two methods, this is the method of election. In this connection several points present themselves for consideration, a careful study of which will materially aid us in arriving at an intelligent conclusion.

It is necessary for the purpose of performing uretero-ureteral anastomosis:

That the two ends of the ureter be perfectly free and easily brought together.

That the bladder-end be more patulous (or capable of being made so) than the kidney-end.

That the injury to the ureter be sufficiently high in the pelvis to enable the surgeon to readily carry out the necessary manipulations.

In the case of uretero-cystostomy but one point is necessary:

That the injury be not too high in the pelvis to enable the kidney-end of the ureter to be approximated with the bladder.

Theory is a very good method by which to arrive at a conclusion if facts be wanting, but where facts are at hand theory is no longer of consequence. Applying this axiom to the matter under consideration, it will be recalled that seven operations are on record for the repair of severed ureters. Of this number two (Kelly and Bache Emmet) were by the method of uretero-ureteral anastomosis; five (Novaro, Kelly, Krug, Penrose, and Baldy) were by the method of uretero-cystostomy. A careful study of this group of operations discloses several important facts: Five of the seven procedures were bladder-implantations, and in no one of the five could the end-to-end anastomosis have been accomplished. Of the two cases of end-to-end anastomosis one

at least (Kelly[1]) could have been corrected with equal success by bladder implantation. In the second case (Bache Emmet[2]) the tear was at an unusually high level, the case being, in fact, almost unique in this respect. Even in this case it is not stated in the report that the bladder and ureter could not be approximated. It is therefore evident, as far as practical experience demonstrates anything, that uretero-cystostomy *can be* performed in almost all these accidents.

Analyzing the five cases of uretero-cystostomies, it at once becomes evident, as has been pointed out, that in not a single one of them was uretero-ureteral anastomosis possible. The operations in the case of Novaro[3] and Kelly[4] were performed some weeks after the original injury, and at a time when the bladder-end of the ureter was irretrievably lost. In the Penrose[5] case the bladder-end was cancerous, and in both Krug's[6] and my own case[7] the lower end was lost in masses of inflammatory deposits; in addition, the kidney end in Krug's case showed such thickening and friability from inflammatory changes that a uretero-ureteral anastomosis would have been impossible, as dilatation of the bladder-end could not have been made even if the end could have been found. Emmet's statement, then, that "it (uretero-ureteral anastomosis) 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," is clearly theoretical, and has no basis in fact.

The facts established are, therefore, that in the great majority of cases uretero-cystostomy is possible. In but a small portion of the cases can uretero-ureteral anastomosis be successfully performed; even where this operation is

[1] Annals of Surgery, January, 1894.
[2] American Journal of Obstetrics, April, 1895.
[3] Centralblatt für Chirurgie, 1893, No. 27.
[4] Johns Hopkins Hospital Reports, February, 1895.
[5] Medical News, April 28, 1894.
[6] Americal Gynecological and Obstetrical Journal, November, 1894.
[7] Baldy: American Journal of Obstetrics, 1896, vol. xxxiii. No. 3.

feasible, in the great majority of cases uretero-cystostomy is equally practicable. If this be true, and as far as the facts are to be relied upon it is unquestionable, uretero-cystostomy is generally the operation of *necessity*. As to the operation of *election*, where the possibility of both methods present, the facts are not so decisive. However, the indications as far as they go seem to favor uretero-cystostomy. The points which have been considered in this connection are:

The ease with which each operation may be performed in any given case.

The danger of immediate obstruction.

The danger of future obstruction.

The danger of kidney infection.

As to the first point. Any injury to the ureter at the base of the broad ligament or thereabout forces the surgeon, in case he desires to perform a uretero-ureteral anastomosis, to work so low in the depths of the pelvis as to render the necessary manipulations very difficult, if not impossible; on the other hand, if the injury be at or above the level of the ileo-pectineal line it is exceedingly difficult if not impossible to closely approximate the end of the ureter and the bladder. Therefore, within these limitations it is manifest that there can be no manner of rivalry between these two methods; it matters not what objection may obtain in either case, we are forced to adopt that which is feasible. As a matter of fact, however, in the vast majority of cases the injury occurs between these two points and at a position which allows of the approximation of the desired points with more or less ease. In the case of most neoplasms (intra-ligamentous cysts and uterine fibroids), where the ureter is severed at a very considerable distance from the bladder, it will be found that the ureter is greatly elongated, sufficiently so to compensate for the high level of the injury and to render it easily brought in contact with the bladder. This is oftener true within these limits than that the bladder end is found, or, if found, is in

a condition to be used. Of the seven cases reported, uretero-cystostomy was performed or was feasible in six, and it is not recorded that it was not so in the seventh. Therefore, even if the statement that "it (uretero-cystostomy) can only be applied to those cases in which the injury is very close to the bladder" were true, practical facts demonstrate that as a rule these injuries occur at a point at which this operation is readily performed. Even though there be some little difficulty in easily approximating the ureter and bladder, such difficulty may be readily overcome, as was done in Kelly's case, by dissecting the bladder to a greater or less extent free from its attachments to the pubis, or by fastening the bladder to some fixed point on the pelvic wall by several stout sutures, as was resorted to in my own case. In neither of these cases was there any subsequent trouble either in the bladder, ureter, or kidney, and any criticism from that point of view is based purely on theory. The danger of immediate obstruction in the two operations does not seem to be great. In no one of the seven cases reported has this effect been noted, and it would seem that this complication does not form a very great element of danger.

Secondary obstruction would, however, appear as a possible defect, although as far as noted no such condition has occurred. In view of this possibility the criticism has been offered in the case of uretero-cystostomy that "the ureter is placed directly through the walls of the bladder 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 the muscular fibres of the bladder is spread over an oval length of the ureter, and closure of its lumen is thus made impossible." The objection is again altogether theoretical. The arrangement and action of the muscular fibres is quite different than as stated, and I think none of the gentlemen who have performed uretero-cystostomy will for a moment concede that the ureter passes naturally more obliquely

through the bladder-wall than it is made to do by the operation. The practical test again settles the matter finally. I have personally had opportunity to examine two of these cases repeatedly with the cystoscope since the operations, one of which was performed about two years ago, and there are as yet no signs of stenosis, nor is the flow of urine from the ureteral opening in any way different from that of the non-injured side. In fact, it would be well-nigh impossible to tell which side had been injured, except for the abnormal position of the opening on the side on which the operation had been performed. The simple precaution of splitting one side of the end of the ureter which is implanted into the bladder, as originally proposed by me,[1] adds greatly to the certainty of non-stenosis. On the other hand, it stands to reason that there is no little danger of obstruction in an organ of such small calibre where the opening in one end is necessarily narrowed by its forcible introduction into the other. Should by any possibility stenosis follow either operation, is there any one who doubts the greater ease with which it could be detected and treated in the case of uretero-cystostomy?

The dangers of kidney infection have been urged against uretero-cystostomy, but the arguments are too fallacious to stand for one moment the test of the facts. The statement is made that "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." There are three propositions advanced in this statement, and all three are incorrect. In the first place, is the natural opening of

[1] American Gynecological and Obstetrical Journal, November, 1894.

the ureter valve-like? I conceive not, unless we are to consider that the ureter, being more or less collapsed throughout its whole length, acts in this way as a valve. In this case the same thing holds true on the injured side. Again, I have never heard anyone who has had the privilege of seeing, through a cystoscope, the seat of the operation say that the opening was gaping. I have myself seen three of these cases, and in none of them did this occur. Finally, the position of the new opening, high up on the fundus of the bladder, eminently protects it from the chances of septic invasion, and particularly from the back pressure caused by the contraction of the bladder on its contents. Finally, in not a single one of the five operations has kidney infection resulted.

To sum up, then, it is clearly evident that in the large majority of cases of torn ureter during the course of an operation the injury will occur below the level of the ileopectineal line, in which case it is amenable to treatment by uretero-cystostomy.

The danger of stenosis in uretero-cystostomy does not obtain.

The dangers of kidney infection are mythical.

All things considered, where the question of choice between the two operations arises, if there be any difference, it lies in favor of uretero-cystostomy.

DISCUSSION.

DR. BACHE MCE. EMMET, of New York.—I simply put myself forward to start the discussion. I have had no experience whatever with this operation of fastening the ureter into the bladder, and my single experience with making anastomosis of one end of the divided ureter into the other is scarcely enough to justify remarks which will be of value. When that experience occurred to me, and I made the anastomosis and had excellent success—and, so far as I know, no subsequent trouble—it gave me occasion to look up the literature a bit and to see

what had been done in that line, and to study the experiments. There had been but few cases in which the ureter had been artificially connected with the bladder, and in them there was no subsequent history to found a judgment upon. In view of the cases which I read about, I feared that an opening made into the bladder might be followed by infection of the kidney, especially if any cystitis should follow the operation, which is possible when the functions of the bladder have in any way been interfered with. Especially is this likely where it has been necessary to make any traction upon the bladder on account of shortening of the ureter. Contraction of the bladder being thus interfered with, cystitis is likely to develop, which means frequent urination, entrance of air and bacteria into the bladder, extension up the ureter to the kidney, there to produce pyonephrosis. I would fear, in most instances where anastomosis was made directly at the bladder, that there would be backward pressure and subsequently hydronephrosis. The valvular opening into the bladder, which all have seen who have had experience with vesical fistulæ in females, is absent after insertion of the ureter into the bladder, permitting backward pressure on the kidneys. The muscular fibres are so abundant around the mouths of the ureters in the normal condition that it is not to be conceived that they are open constantly. And in view of that, I think that the caution which Dr. Baldy gave, to have the passage of the ureter into the bladder a slanting one, is very important.

Dr. Baldy has referred to some circumstances under which these injuries to the ureter may occur. It seems to me that in doing abdominal surgery we can never know when it may occur. We need to bear in mind the natural course of the ureter and its possible displacement. The precaution may be taken, recommended by Kelly, on arriving at that region, namely, to introduce a catheter into the ureter, perhaps into both of them, and so to keep them clearly before us during the time when we are most liable to wound them. It is more common to injure them when they are raised up by growths pushing from behind, as in the case with which I had to deal.

Dr. Henry T. Byford, of Chicago.—I can hardly agree with the view that in all cases we should attach the ureter to

the bladder. Drawing the bladder to a considerable distance from its original site is liable to interfere to a certain extent with its functions. If it can be shown that anastomosis of the ureter is safe, and will accomplish the purpose, it is certainly more surgical to repair the injury in this manner than to run the risk of subsequent trouble from drawing the bladder out of place. I should think that the first-named operation would be particularly liable to interfere with proper contraction of the bladder and tend to retain air.

The method of lateral anastomosis devised by Van Hook has been adopted by Kelly, I believe. The distal end is sewed into a lateral opening. There seems to be little danger, and, if it is found that this method will succeed as well as the other, it will be the preferable one for some cases.