

After operation it is customary to leave the ureteral catheter in place for four or five days.

In several instances the ureter has seemed too short. An inch or more may be gained by loosening the pubic attachments of the bladder (Witzel, Kelly, Penrose) and suturing its fundus to the lateral pelvic wall. Boari has succeeded experimentally in bridging a greater gap. He dissected up as a flap the whole thickness of the anterior bladder wall an inch wide with its base at the fundus. This he turned back and sutured as a sleeve about a ureteral catheter and the extremity of the ureter. He then closed the wound in the bladder. Such an extensive line of suture would require protection by drainage for fear of leakage. Dislocation of the kidney to gain slack has not been performed in connection with cysto-ureterotresis. An isolated loop of intestine has been employed experimentally to bridge the gap between ureter and bladder.¹

STATISTICS

Having discussed the chief operations of ureteral surgery, a brief review of the clinical statistics will fitly impress the brilliant practical results of these procedures in marked contrast with those which we have yet to note.

Plastic Operations at the Upper End of the Ureter.—Christian Fenger,² who has himself performed 10 out of the 30 operations for renal retention which he is able to collect, clearly and succinctly sets forth the brilliant results of these operations.

One case of division of pelvic partitions and transpelvic section of spur was successful.

Nine cases of valve were operated upon transpelvically by incision of the valve and transverse closure.

Of these, 1 died of uremia, 1 of ileus.

Five were completely successful.

Two relapsed.

Eleven cases of valve and stricture were subjected to extrapelvic incision and transverse suture.

Of these, 10 were successful, 1 unsuccessful.

Six cases were subjected to resection and reimplantation of the ureter (uretero-pyelo-neostomy).

Of these, one died of sepsis or iodoform poisoning. Three proved successful, and 2 failed; 1 because of an extensive stricture

¹ J. of the Am. Med. Ass'n, 1901, xxxvii, 323.

² Ann. of Surgery, 1901, xxxiii, 369.

lower down the ureter, the other because of the friability of the tissues.

While 3 cases were subjected to pyeloplication and capitonnage, and all 3 were successful, in 2 a valve was incised as well.

We may disregard 1 case of unkinking the ureter.

In 2 cases a ureteral stricture was successfully divided and sutured transversely. These may be grouped with the 12 extrapelvic incisions:

To summarize:

Ten intrapelvic operations—

Two deaths.

Six successes.

Two relapses.

Thirteen extrapelvic operations—

No deaths.

Twelve successes.

One failure.

Six uretero-pyelo-neostomies—

One death.

Three successes.

Two failures.

One simple pyeloplication successful.

With no deaths directly attributable to the operation, and only 25% of failures among these first attempts, we may well look forward to a brilliant future for this class of work.

Ureteral Anastomosis.—Bovée¹ has collected 12 cases of transverse end-to-end anastomosis with 2 deaths not directly attributable to the operation, 1 oblique end-to-end successful, 9 end-in-end with 1 death, and 5 end-in-side with 1 death. In all 27 cases with 7.5% mortality. That no case of obstruction by contracture of the scar is reported possibly illustrates the inaccuracy of statistics. Yet even this negative evidence has some weight, and certainly the enthusiasm of surgeons over the brilliant series of successes in these cases is not unwarranted.

Cysto-ureterotresis.—Bovée records 79 operations, 42 for the cure of fistula (1 death) and 37 for operative accidents (2 deaths). While the attempts at vaginal operation have been remarkably unsuccessful, the worst complication of the abdominal procedures has been a temporary leakage of urine, and even this has been extremely rare. The theoretical objections to the operation are stenosis of the ureteral orifice and ascending pyelo-nephritis in case cystitis occurs,

¹ Ann. of Surgery, 1900, xxxii, 165.

since the ureter is not guarded by its natural muscular orifice. The former danger need not be feared if the end of the ureter is enlarged by splitting it, and the latter is probably a theoretical rather than a real objection, for no case of renal infection attributable to this cause has been recorded.

On the whole, then, the results already obtained in plastic ureteral surgery are excellent. They preserve the healthy kidney and permit it to remain sound, and are not attended by any notable difficulty in technic nor any considerable mortality. In direct contrast are the operative methods employed to divert the course of the urine, which, by the difficulty of their technic, their high mortality, and small percentage of actual cures, may well deter the most experienced. In the table at the beginning of this chapter they have been listed "for exstrophy of the bladder" because this unfortunate deformity is almost the only warrant for their performance.

Closure of the Ureter and Nephrectomy.—When all attempts at re-establishing the continuity of the ureter fail, nephrectomy may be contemplated as preferable to cutaneous fistulization or entero-ureterotresis. Indeed, if the opposite organ is known to be sound the removal of one kidney may be perfectly compatible with the maintenance of life. Under these circumstances the operation is quite free from danger.

In a few instances surgeons have been satisfied to tie off the ends of a divided ureter and so to leave the kidney to atrophy. As far as I know the result has always been happy; yet to leave the kidney thus as a possible focus for suppuration is no small risk, for numerous experiments have shown that with the ureter thus tied off the kidney falls a victim to bacteria which, under ordinary circumstances, it could transmit without harm to itself. Hence of the two operations nephrectomy is to be preferred.

OPERATIONS TO DIVERT THE URINARY STREAM

Cutaneous Fistulization.—Although this operation has been performed several times, and with some success, it leaves the patient in a deplorable condition of constant wetness, is followed within a few months by infection of the kidney, and has no feature other than its simplicity to recommend it. To quote Morris:¹ "Surface grafting the ureter, with its resultant fistula, is only less objectionable than nephrectomy; indeed, some patients have undergone nephrectomy to get rid of the fistula, as Poggi's patient did. It is only in

¹ Surg. Dis. of the Kidney and Ureter, 1901, ii, 596.

cases of ectopia vesicæ and in those where the ureter of a *single kidney* is blocked that such an expedient can be willingly resorted to; and in my opinion it ought not to be done at all in the case of ectopia vesicæ, since uretero-colic grafting (i. e., Maydl's operation) has become, during the last few years, a comparatively safe procedure."

Entero-ureterotresis.—The implantation of one or both ureters into the bowel (the rectum or the sigmoid flexure is usually selected) is followed, when successful, by results which, at first sight, are encouraging. The rectum becomes accustomed to retain the urine perfectly for a space of from three to six hours, and the immediate result is by that much better than cutaneous fistulization. This fact has led many surgeons to advocate the operation. But recent researches tend to prove that the conclusion was precipitate. Animal experiments from the time of Glück and Zoller (1881) down to Peterson,¹ Zeit,² and Frank³ have been extremely discouraging. The immediate mortality runs from 60% to 90%, while those dogs that survive show interesting lesions. "Dogs which had fully recovered from the operation and the resulting pyelo-nephritis,⁴ and were, to all appearances, in perfect health and vigour again, *all* had granular, contracted kidneys, due to induration and cicatrization of diseased areas. . . . Dogs which had fully recovered after unilateral implantation were living by the other kidney. The kidney of the side operated on was atrophic and granular, the result of an early pyelo-nephritis. The functionally active kidney was from 2 to 8 times the size of the atrophic one" (Zeit).

The results of the operation upon man have been but little better. According to Peterson, double implantation has been performed 18 times with 8 deaths (44%) immediately due to the operation, and 3 deaths from a subsequent pyelo-nephritis (total mortality 61%). Unilateral implantation fared somewhat better with 3 primary deaths among 15 cases and 2 secondary deaths. Of those followed for more than a month after operation Peterson has compiled the following table:⁵

1 ureter implanted, well after.....	6 months.
1 ureter implanted, well after.....	18 months.
1 ureter implanted, well after.....	2 years.
1 ureter implanted, well after.....	8 years.
2 ureters implanted, well after.....	5 weeks.

¹ J. of the Am. Med. Ass'n, 1901, xxxvi, 444, 506, 569, 632, 735.

² N. Y. Med. J., 1901, lxxiii, 756, 839.

³ J. of the Am. Med. Ass'n, 1901, xxxvi, 1466. ⁴ Which seems always to occur.

⁵ I have advisedly omitted the cases of Beck and Evans, since both have died of pyelo-nephritis, though reported well at the end, respectively, of 7 and 13 months.

2 ureters implanted, well after.....	3½ months.
2 ureters implanted, well after.....	10 months.
2 ureters implanted, well after.....	1 year.
2 ureters implanted, well after.....	3½ years.

It is obvious, then, that about 1 out of every 3 cases upon whom unilateral implantation is done may be expected to live (whether with an atrophied kidney or not, we need not decide), while one in four bilateral implantations should recover. The evidence is, I agree, ample to condemn either procedure, even without the strong probability that the survivors all have damaged kidneys.¹ But fortunately, we have, in Maydl's and Frank's operations, procedures which, while not by any means bereft of danger, allow such a chance of recovery as to bring them well within the scope of practical surgery.

Maydl's Operation.—In 1894 Maydl² reported his first cases of uretero-trigonal anastomosis. This operation consists of the implantation into the colon, not of the ureter itself but of the bladder wall surrounding the mouth of the ureter. The operation has only been employed for exstrophy of the bladder and allied conditions, and is performed as follows: A probe or a ureteral catheter is introduced into each ureter after the operative field has been cleansed as well as may be, and an elliptical section surrounding the mouths of both ureters is then cut from the bladder wall, great care being taken not to injure the ureters. Next, the peritoneal cavity is opened. A convenient loop of the sigmoid flexure or the rectum is selected and brought out of the abdominal wound. The ureters, with their attached portion of trigone, are then freed, a longitudinal incision is made in the wall of the gut, with the necessary precautions, and into this the section of trigone is sutured. The remainder of the bladder is now stripped of its mucous membrane and the abdominal wound closed as tightly as possible, with splitting and transposition of the recti, if necessary. As a final precaution the sphincter ani is stretched and a tube inserted and left in for several days to establish drainage and so to minimize the danger of leakage and renal retention.

This operation avoids several of the dangers associated with simple uretero-intestinal anastomosis. For the cicatricial ureteral orifice, which has proved so liable to contracture with disastrous results to the kidney, it substitutes the normal muscular orifice of the ureter,

¹ J. of the Am. Med. Ass'n, 1901, xxxvi, 1263.

² Wien. med. Wochenschr., 1894, xlv, 1113, 1169, 1209, 1256, 1297. *Ibid.*, 1896, xlv, 1241, 1333, 1373. *Ibid.*, 1899, xlix, 249, 304, 360.

and, while this is not an absolute protection, it has proved very effectual clinically. Among 36 cases collected by Peterson there was a primary mortality of 14% (5 cases) and a secondary mortality of 5% (2 cases). Sphincteric control proved good in 27 cases, fair in 4, and poor in 1. The convalescence of 6 cases was delayed by temporary urinary fistulæ. These figures proclaim the practical advantage of Maydl's operation. Yet even this procedure cannot be considered ideal. A capital operation in the course of which a foul bladder and the peritoneal cavity are simultaneously invaded must always retain an appreciable mortality, and diverting the urine from the bladder into the rectum can never be accepted except as a makeshift to avoid greater evils. Yet as surgery stands to-day no plastic operation has had a success to compare with Maydl's operation in the treatment of exstrophy of the bladder. In resection or extirpation of that organ for malignant growths Maydl's operation is ruled out by the fact that the growth almost always involves one ureteral orifice or both; yet the other forms of uretero-intestinal anastomosis offer so uninviting a prospect that, until something better presents itself, the prudent surgeon must be inclined not to extirpate these tumours unless a cysto-ureterostomy is possible.

Frank's Operation.—Frank¹ has applied the methods of modern surgery to vesico-rectal fistulization in dogs with such good results as to suggest that his procedure is as satisfactory as Maydl's. It is certainly far simpler. He opens the abdominal cavity and unites the bladder to the rectum by a bone coupler of his own devising—a Murphy button would doubtless do as well. The obvious objections to the operation are: first, the necessity of closing the (exstrophied) bladder—no simple matter; and, second, the possibility of continuous severe cystitis. Halstead performed this operation on one patient who died of shock. Among the advantages of his operation Frank claims that there is no danger that the trigone will slough, yet statistics do not show that this has been an important element in the prognosis of Maydl's operation.

URETERECTOMY

Ureterectomy has been repeatedly performed for tuberculosis, less often for neoplasm, stone, and stricture. In these last conditions ureterectomy is only indicated when it is deemed inadvisable or impossible to preserve the kidney. Indeed, the operation commonly passes by the name of nephro-ureterectomy, for, excluding the cases

¹ Med. Record, 1896, 1, 469. J. of the Am. Med. Ass'n, 1900, xxxiv, 1174, 1237.

of resection already alluded to, excision of the ureter implies a previous or a simultaneous nephrectomy.

"As to whether primary or secondary ureterectomy is better, the following considerations will guide us. If, during the course of nephrectomy, the ureter for some inches from the renal pelvis is seen to be in a dilated and suppurating condition, or affected with tuberculous disease, the rule ought to be to excise the affected portion of the ureter together with the kidney; but if there is no evidence from the history and symptoms and from the conditions found at the time of the operation that the greater part or the whole of the ureter is in a similar state, the surgeon must be guided by the condition of the patient. If this is not good, it will be best to remove the kidney and wait until the patient has recovered from the nephrectomy before excising the ureter. If the condition of the patient warrants it, the ureter should be at once removed—i. e., primary ureterectomy should be performed" (Morris).

As a matter of fact, a tubercular ureter left fixed at the lower angle of the wound may cease to be fistulous after a few weeks, just as tubercular lesions of the bladder are known to heal after the primary renal focus has been removed. At any rate, the patient's condition usually improves greatly after nephrectomy, and so ureterectomy—total ureterectomy certainly—may be always safely and often preferably deferred.

The Operation.—The ureter has been extirpated transperitoneally by Howard Kelly through an incision to the outer side of and parallel with the semilunar line. But as all other operators have found the extraperitoneal route adequate, that only need be described.

With the patient lying upon his side the oblique lumbo-ilio-inguinal incision is made (p. 637) and carried down as far as need be, even to the external abdominal ring. When the peritoneum is reached it is carefully elevated and the ureter sought for. If the operation is being performed with nephrectomy the ureter is usually readily traced down; but if the ureterectomy is secondary it is preferable to disregard the fistula and to search for the duct where it crosses the brim of the pelvis. The peritoneum is carefully elevated until the finger feels and recognises by their pulsations the internal and external iliac arteries. Opposite the junction of these, closely confined to the peritoneum by its fibrous sheath, the ureter will be found. The sheath is nicked, an aneurysm needle passed under the ureter, and after that the dissection is easy unless there are adhesions, in which case great care must be exercised not to tear the peritoneum. The ureter may be followed down into the pelvis to its

vesical orifice, where it is to be divided between ligatures. The external wound is then sutured in layers after such irrigation and with such drainage as the surgeon deems advisable.

Several surgeons have employed the combined abdominal (extraperitoneal) and vaginal method devised by Kelly, but it has not proved as satisfactory as the method described above.

The excision of that part of the bladder wall adjoining the mouth of the ureter is difficult and unnecessary except in those rare cases of ureteral neoplasm which extend into the bladder. The operation is best performed by extraperitoneal abdominal section combined with suprapubic cystotomy, the wound in the bladder being sutured according to the usual method (p. 462).