orifice secondary to tuberculosis; one appeared in the course of a long-standing calculus pyonephrosis; one presented the history of the passage of two stones from the kidney; and the last, the most recent case, was secondary to a healed ulcer around the orifice due to a colon cystitis. It seems convincing, therefore, that not all ureterovesical cysts are congenital, as some authors state; on the contrary, they seem more frequently to be acquired.

Two of the cysts were large, three were about the size of a cherry, and one—a pyriform cyst—was the size of an almond. Four of the cysts were round, one was elongated and finger-like, the other was pyriform. The ureteral orifice was located at the tip of the cyst in three cases, toward the midline of the bladder in one case, and at the outer and upper part of the cyst in two cases. The orifice was influenced by the motion of the cyst in every case but one. In this case it was located above and external to the cyst and held a fixed position, the cyst blowing out along the lateral margin of the trigon below the orifice. The cyst wall was studied pathologically in two cases (Cases 1 and 2). In Case 1 the cyst wall was composed of two mucous layers, ureter and bladder, with an intervening connective-tissue and muscle-fiber layer. In Case 2 there was no muscle fiber between the two mucous layers.

All these cases presented symptoms of vesical irritability, such as increased frequency of urination and pain. In none of them was there blood. In Case 2 there were symptoms of obstruction and at one time there was complete retention. This case also offers a most interesting symptom-complex, the history being similar to a paradoxical incontinence, such as is seen in the male with prostatic obstruction. I have been unable to find a similar case in the literature in which the incontinence was due to cyst situated intra-urethrally with the orifice of the ureter located just within the external urethral opening. Cases of incontinence have been reported, but these have been due to faulty insertion of the ureter into the urethra. In three of the cases there was pyonephrosis behind the obstruction; in one a hydronephrosis. The other two presented no evidences of renal involvement.

I wish to direct your attention especially to the treatment of this disease. Two of the cases have remained untreated; one is of recent date and the patient has promised to submit to an operation later. The other, the congenital case, I have not seen since my first examination. Two of the patients have undergone nephrectomy, one for tuberculosis of the kidney, the other for a calculus pyonephrosis. The ureterovesical cyst had entirely disappeared, following the nephrectomy for tuberculosis. The patient on whom the nephrectomy was done for calculus pyonephrosis, I have not seen since the operation, which was done by another surgeon.

The operation which was employed in Cases 1 and 2, the total resection of the cyst under the guidance of the cystoscope, is a method which seems to offer very satisfactory results. One of the patients remained well for a year without evidences of obstruction. The other patient has remained perfectly well for two years and has a patent orifice through which a No. 7 catheter passes easily. There has been no suggestion of recontraction or of balloon formation, nor has there been evidence of obstruction in the upper urinary tract. In the first case the operation was done as an emergency to relieve a large pyonephrosis. At the time I did not think that the result would be so lasting, as I feared that the orifice would recontract in a short time.

The endovesical operations which have been employed have consisted merely in slitting the orifice of the ureter; but all the observers who have utilized this method have reported rapid reformation of the stricture at the orifice, as occurred in Case 1 with the first operation. Several authors state that this slitting operation is a difficult procedure. I must say, however, that even the resection of the cyst under the guidance of the cystoscope was executed simply and offered no particular obstacles. In the male the removal could be done by means of rongeur cystoscope.

The suprapubic operations, whether slitting the orifice longitudinally with suture of the two mucous surfaces, or the circular amputation of the cyst with suture of the two surfaces, or the hernia operation employed by Young in his case, are more extensive and more radical procedures and possibly offer better curative results. I am of the opinion, however, that the chances of recontraction are about as great with these methods as in the procedure which was employed in my two cases of total resection with denudation of a large area around the ureteral orifice. The results in these cases seem to show, at least, that the procedure may offer relief for two years or more; and I think that since the operation is a minor one, done without general anesthesia, and is simple in technic and devoid of danger, it should be the operation of choice in many cases. The endovesical slitting operation offers no permanent benefit, and the suprapubic method seems a bit too radical as the initial operation in most cases, particularly in women.

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UNTOWARD RESULTS OF NEPHROLITHOTOMY *

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HISTORY

The first references as regards the practicability of nephrotomy were traced by Henry Morris¹ to the early French medical literature (Camerarius and Roussett in 1581). During the next two centuries the feasibility of renal incision in nephrolithiasis was repeatedly discussed on theoretical grounds by various writers, particularly of the French school (Ducledat and Consinot in 1622, De Lafitte in 1753), but was not put into practical use, probably on account of Hévin's indictment of surgical interference in stone-kidney (1753). The influence of this famous monograph was of such weight as to retard for more than a century any further practical progress, in spite of the strong plea made by several writers of that period in favor of early incision (Gerdy 1829, Rayer 1849).

The feasibility of nephrotomy for the extraction of renal concretions was, toward the end of the nineteenth century, almost simultaneously discussed by several prominent British surgeons (Sir Thomas Smith, Annandale, Spencer Wells in 1870) and actually carried out for that purpose by Bryant, Lente, Barbour, and also by William Ingalls in this country.² Thus, according to Dickinson's tables,³ nephrotomy was done during the

* Read in the Section on Genito-Urinary Diseases of the American Medical Association, at the Sixty-Fourth Annual Session, held at Minneapolis, June, 1913.

1. For more detailed historical references see Henry Morris's *Hunterian Lectures for 1898, on renal surgery*.

2. Ingalls: *Boston Med. and Surg. Jour.*, Oct. 8, 1882.

3. Dickinson: 1885, III.

next ten years in about half a dozen cases of advanced pyonephrosis of calculous or tuberculous origin, in four of which concretions were extracted.

The merit, though, of first having incised the apparently healthy parenchyma of a kidney for the purpose of extracting a concretion, belongs to Henry Morris, who on Feb. 11, 1880, successfully removed a mulberry calculus weighing 31 grains from the undistended, and, to the naked eye, quite normal kidney of a young woman.⁴ This operation, which its author termed nephrolithotomy,⁵ quickly gained in popularity, especially since le Dentu in 1888 devised effectual control of hemorrhage by exact approximation and suture of the cut surfaces of the renal parenchyma, and particularly since Tuffier in 1889 showed that the usual incision, used for post-mortem examinations, was connected with the least lesion of vessels and the least destruction of renal parenchyma.

Noteworthy is, furthermore, Zondek's⁶ modification of renal incision, commencing about 1 cm. posteriorly from the convex border and thence continued in a forward direction, as giving ready access to the renal pelvis and calices, without destroying more than a narrow strip of renal parenchyma and thus facilitating the extraction of concretions.

OPERATIVE RESULTS AND MORTALITY

The operative results obtained with nephrolithotomy have been very satisfactory at the hands of the great majority of renal surgeons. This operation has been, for the last twenty or twenty-five years, the method of choice for the removal of calculi in nephrolithiasis. Israel⁷ considers nephrolithotomy by far superior to any other procedure as regards obtaining ideal operative results and according to Kümmell⁸ nephrotomy is the most appropriate and, at present, most popular method for the removal of concretions from the dilated pelvis and calices.

Mortality.—The mortality of nephrolithotomy is, according to collected statistics from the clinical centers of the world, less than 4 per cent. for aseptic and moderately infected stone-kidneys; the operative mortality, though, of infected or pyonephrotic stone-kidney is high, and is estimated by some authors to be 20 per cent. and over. The mortality of 222 cases, 135 of which were aseptic and eighty-seven infected, collected by Watson and Cunningham,⁹ was 2.2 and 18.3 per cent., respectively.

HEMORRHAGE AFTER NEPHROLITHOTOMY

The most important objection to and the greatest danger of nephrolithotomy is hemorrhage, which may occur either during or after the operation. Hemorrhage during the operation is a very serious occurrence which has, not infrequently, forced on the operator the removal of an otherwise intact kidney. Though hemorrhage occurring at the operating-table rarely, if ever, will prove fatal at the hands of the resourceful surgeon, it is particularly postoperative hemorrhage which lends to nephrolithotomy an almost ominous aspect. Such an accident may occur within a few hours after the operation, as in the following case:

CASE 1.—A young man of 21, with bilateral moderate renal pyuria, showed radiographically in both kidney-regions characteristic stone-shadows of almost identical size and shape.

4. Morris, Henry: *Hunterian Lectures*, 1898, p. 6.
5. Unknown to Morris, this term had been used over 100 years ago by Hévin in his monograph.
6. Zondek: *Arch. f. Klin. Chir.*, 1899, lix.
7. Israel: *Chirurg. Klin. d. Nierenkr.*, 1901.
8. Kümmell: *Ztschr. f. Urol.*, 1908, li, 351.
9. Watson and Cunningham: *Diseases and Surgery of the Genito-Urinary System*, 1908.

On account of the slight functional inferiority of the right kidney, this organ was at first incised and a coral-shaped urate calculus removed. Careful suture was made of the cut surfaces of the parenchyma in the usual manner. The patient left the operating-room in good condition. About eight hours later, shortly after an attack of vomiting, uncontrollable hemorrhage from the lumbar incision set in, to which the patient succumbed before medical aid could be applied.

The post-mortem examination, which had to be confined to the kidneys, did not reveal any palpable cause for the sudden hemorrhage. A calculus of identically the same size and shape as that of the right side was, at the post-mortem table, easily extracted without any lesion of renal parenchyma, through a posterior pyelotomy incision of the left kidney.

Hemorrhage from the nephrotomized kidney does not, as a rule, assume such a sudden and rapidly fatal character immediately after the operation. I can find only one case reported by Neuhäuser¹⁰ from Israel's clinic in which acute hemorrhage set in within twenty-four hours and in which, in spite of quickly applied appropriate treatment (tamponage of kidney), death occurred twenty-eight hours after nephrolithotomy. Much more frequent, on the contrary, is late hemorrhage, which occurs several days or even weeks after the operation, occasionally preceded by moderate or insignificant bleeding into the bladder or the wound, which may stop for a while, only to return with unexpected force, and may then prove fatal, as in the following observation:

CASE 2.—Man of 41, luetic infection and chronic alcoholism admitted; moderate arteriosclerosis; left-sided renal pyuria; many larger and smaller characteristic calculi shadows in left lumbar region. Marked functional deterioration on left side. Nephrolithotomy was followed by very satisfactory convalescence during the first week. Slight hemorrhage from the wound on the eighth day, which soon stopped without treatment. Three days later, without warning, abundant hemorrhage set in. The patient was rushed to the operating-room where nephrectomy was performed. Death occurred within three hours from onset of hemorrhage.

The examination of the removed kidney showed a chronic pyelonephritis with interstitial changes. Necropsy was refused.

Similar occurrences are reported from Israel's clinic,⁷ who, beside the case already mentioned, lost three other patients from late postoperative hemorrhage. Pleschner¹¹ reports from Casper's clinic three cases of postoperative hemorrhage after nephrotomy. In one case fatal hemorrhage occurred four days after the operation; both other patients could be saved by secondary nephrectomy, which in one instance had to be done thirty-three days after the operation. Bevan¹² has had four or five cases of hemorrhage, among them one fatal case. In two cases hemorrhage into the bladder, after the kidney wound had healed, was so severe as to necessitate secondary nephrectomy.

The etiology of postoperative or late-hemorrhage after nephrolithotomy is not clear. It is certainly not dependent on the size of the incision; most abundant hemorrhage, on the contrary, was observed in instances in which a small incision had been made. P. A. Müller¹³ considers arteriosclerosis one of the main etiologic factors. Syphilis and a general tendency to bleed (hemophilia) are of etiologic importance. For a number of cases Neuhäuser's¹⁰ explanation appears plausible, according to which separation of cut surfaces of the kidney with consecutive hemorrhage may follow distention of the renal pelvis due to blocking of the ureter through a

10. Neuhäuser: *Fol. Urol.* V, No. 5, p. 360.

11. Pleschner: *Ztschr. f. Urol.*, 1910, p. 371.

12. Bevan, G. D.: *THE JOURNAL A. M. A.*, Feb. 26, 1910, p. 666.

13. Müller, P. A.: *Ztschr. f. Urol.*, 1910, p. 371.

blood coagulum. This explanation seems to fit my second case. Noteworthy is the fact that all fatal cases of hemorrhage recorded in the literature, including my own, were observed in men, demonstrating again the greater resistance of women to loss of blood.

Therapeutically, internal remedies (stypticin, gelatin, epinephrin) are of little or no value. Tamponage of the kidney is practiced at Israel's clinic and has yielded there better definite results than secondary nephrectomy. Albarran¹⁴ has abandoned intrarenal in favor of extrarenal tamponage, which he claims to be effective without possessing the disadvantages of the former method (sepsis, secondary hemorrhage in removing gauze pads). Removal of the bleeding organ is, according to the majority of authors, the safest method; it is the *ultimum refugium*, which, when permissible by the condition of the other organ, should be carried out without delay.

PERIRENAL INFECTION AND SEPTIC NEPHRITIS

Perinephritis of more or less gravity and extension may follow nephrolithotomy done on an infected stone-kidney. Perirenal infection, as a rule, starts in the wound, which, in spite of all precautions, will become contaminated with septic material from the incised kidney; rapidly the loose tissue around the kidney becomes involved and especially the indurated and poorly nourished fatty capsule offers a fertile soil for the infection, which in patients with low resistance may spread to the peritoneum. The most prominent symptoms of this septic peritonitis are marked meteorism and paralysis of the bowels. Albarran describes such a case¹⁵ and I have recently made a similar observation.

CASE 3.—Man of 33 with very severe right-sided and moderate left-sided pyuria; marked deterioration of function of right kidney. Characteristic calculi shadows in both kidney regions. Operation revealed horse-shoe kidney, with advanced pyonephrosis of its right half. No line of cleavage between both renal halves. Calculi of the size of olive-pits can be palpated in both halves of kidney just above the renal pelvis. Nephrolithotomy with drainage by rubber tube on right side; removal of calculus of left side by small pyelotomy incision.

The patient rallied well from the operation. During the first few days his temperature was about 99 F., his pulse between 90 and 100 and of fair volume, his general condition satisfactory; bandages were always very wet and several ounces of urine were removed from his bladder by catheter. On the fourth day meteorism set in, which increased rapidly. No bowel movement could be obtained in spite of laxatives and high enemas. Death occurred on the seventh day under symptoms of general sepsis (high temperature, rapid and small pulse, singultus, nausea, bronchitis).

Important items of the necropsy report are: Peritoneum hyperemic and covered with thin shreds of fibrin in a few places; transverse folds of small intestines in some places covered with grayish pseudo-membrane; hyperemic spots in cecum; both lungs contain many greyish-red bronchopneumonic spots in posterior part of lower lobes. Tissue around kidney shows hemorrhagic infiltration. Marked parenchymatous degeneration of liver.

A different result could have possibly been obtained in this case by primary removal of the pyonephrotic half of the horse-shoe kidney.

Graver than perirenal infection is that of the operated organ itself, which results in a septic nephritis. Albarran¹⁶ gives a good description of the symptomatology of this condition (irregular temperatures, severe pyuria,

general malaise, etc.), which almost always ends fatally under the symptoms of a systemic urosepsis. It is not advisable to lose valuable time with expectant or palliative measures (laxatives, diuretics, antiseptic irrigations, vaccine therapy). Removal of the diseased organ constitutes the only effective, and, in some instances, life saving treatment.

FISTULA

Nephrolithotomy for infected stone-kidney is, as a rule, followed by urinary fistula of shorter or longer duration. Such fistulas may, as every surgeon with experience in renal work will admit, occur in spite of faultless operative technic and persist many months, or even years. They are due to retention of septic material in the kidney or its pelvis, and to imperfect drainage. After the removal of one or more concretions from a pyonephrotic kidney, the patient is left with a constantly secreting, suppurating sinus which leaves him an invalid, makes existence miserable and may even be a serious menace to life. The healing of such a fistula that the patient has carried about for many years, is not infrequently coincident with total loss of the anatomic and functional value of the organ operated on, as in the following observation:

CASE 4.—A man of 42 with bilateral pyonephrotic stone-kidney underwent left-sided nephrolithotomy over seven years ago, resulting in a suppurating fistula, which persisted more than three years, but finally healed spontaneously. At the first cystoscopic sitting after closure of the sinus, only a very small amount of urine could be collected from the left kidney, which, on examination, demonstrated the almost complete loss of function of that organ. On several cystoscopic examinations during the last three years no characteristic spurt was visible, nor could any fluid be obtained from the left ureter. The patient, though, is able to continue in his arduous business with his only functioning right-sided pyonephrotic stone-kidney.

While closure of postoperative fistula may follow expectant or conservative local treatment, secondary nephrectomy is, nevertheless, in many instances, the only effective means of relieving the patient from his distressing condition; it should be performed without too long delay, especially in cases in which the function of the remaining kidney is known to be satisfactory.

PYELOTOMY AND PRIMARY NEPHRECTOMY VERSUS NEPHROLITHOTOMY

It is thus apparent that there exist extended limitations to the general application of nephrolithotomy. The operation possesses obvious advantages (preservation of the kidney operated on, good view of renal calices and pelvis, comparatively small functional impairment). Its various immediate and remote untoward results, however, have gradually turned the tide toward other and less dangerous surgical procedures, for which the development and perfection of radiography and the various functional kidney-tests permit, at present, strict pre-operative indications. Thus posterior pyelotomy has been advocated, of late, by many European surgeons as the operation of choice for the extraction of stones situated in or near the pelvis of aseptic or moderately infected stone-kidneys. In this country the attitude of most surgeons toward pyelotomy is more conservative. I recommended¹⁷ the operation for suitable cases several years ago, and Eisendrath,¹⁸ in a recent noteworthy publication, considers it destined to become an active competitor with nephrectomy in the majority of cases.

14. Albarran: *Médecine opératoire des voies urinaires*, p. 164.

15. Albarran: *Ibid.*, p. 167.

16. Albarran: *Ibid.*, p. 166.

17. Krotoszyner, M.: *Trans. Am. Urol. Assn.*, 1908.

18. Eisendrath, D. N.: *THE JOURNAL A. M. A.*, April 12, 1913, p. 1145.

While pyelotomy is applicable only for the comparatively small group of aseptic and moderately infected cases, primary nephrectomy ought to gain more and more ground as the simplest, safest and quickest curative method for advanced pyonephrotic stone-kidneys in which the other organ is found to be functionally and anatomically intact. By being able to formulate pre-operative indications for nephrectomy, the possibility arises of removing a pyonephrotic sac without opening it during the operation for inspection; thus quick closure of the wound is obtained and rapid convalescence and complete cure ensues. Bevan¹² reports improved results in his work on infected stone-kidney because he has recognized more than formerly the necessity of doing a primary nephrectomy. Kümmell¹⁹ reports twenty primary nephrectomies for pyonephrotic stone-kidney without death, and among twenty-four nephrotomies for the same condition three fatalities and eight secondary nephrectomies. At Israel's clinic²⁰ the operative mortality for nephrotomy in infected cases was doubly as large as that of primary nephrectomy, 11 against 22 per cent. The indications for primary nephrectomy can, moreover, under certain conditions be extended to bilateral stone-kidney, especially in cases in which the burden of renal function is known to be carried by one organ only and in which the patient through a quicker and simpler operative procedure is at once relieved of an anatomically and functionally useless organ.

CONCLUSIONS

1. Nephrolithotomy is connected with serious immediate and remote untoward results.
2. It should be, wherever feasible, replaced by posterior pyelotomy.
3. Nephrectomy is the simplest, quickest and safest curative method for pyonephrotic stone-kidney, provided the function of the other organ is satisfactory.

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THE IMPLANTATION OF THE URETERS INTO THE LARGE BOWEL *

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During recent years the problem of implanting one or both ureters into bladder, ureter or bowel has repeatedly been the subject of theoretical discussion and practical experiments, and conclusions have been drawn from the success obtained as to the possibility and expediency of this method.

The first one to undertake an implantation of the ureters into the intestinal tract was Simon, who in 1851 operated for an ectopy of the bladder by uniting the ureter with the rectal wall through a tight knot, which cut through and produced a communication between ureter and rectum. For two months the patient passed urine through the rectum, but then the anastomosis became very narrow, the urine escaped through the fistula, and the patient died.

In 1879 Theodore Smith of St. Bartholomew Hospital published in the hospital reports an account of a case in which he implanted both ureters into the colon; the patient, however, died. In 1891 Kuester of Marburg

resected the whole bladder for a cancer and implanted the ureters into the rectum, also with fatal result. The first successful operation of this kind was performed by Chaput, whose patient lived for thirteen years. Gluck, Zeller, Bardenheuer and Novarro made experiments on animals. Morestin, Harvey Reed, Boari, Peterson, Martin and Zeit have all devoted a great deal of study to these questions in experimenting on lower animals as well as in operating on human beings.

There is, however, a great difference in operating on the lower animal and on man, since in the dog, for instance, the ureter is very small and thin and the bowel quite coarse, so that a union is not so easy as a similar union in a human being. Nevertheless a comparatively large number of good results have been obtained in animals and, though not a large number, several cases have been recorded in which the results of such transplantation in human beings have been successful. Chaput in 1910 records besides his own case, in which the patient lived for thirteen years, the case of Chalot's patient who lived for one year, of Guinard's who lived for five years, Michaud's who lived for two years, Auvray's for fifteen months, Boari's for six months, Fowler for three and one-half years, Peterson's for ten months, Beck's for seven months (which is, however, a mistake, since he lived eighteen months) and Martin's for eighteen months.

The indications for performing such an operation are rather rare. The principal indications are (1) injury of the ureter, in which it cannot be sutured again or implanted into the bladder, (2) fistula of the ureter, (3) painful cystitis (cystitis dolorosa, Trendelenburg), (4) total cystectomy (Kuester) and (5) ectopy of the bladder (Simon).

After Simon, Maydl has done more than anybody else to popularize the operation for the last indication, since he has had a number of successful results. But, on the whole, these operations have not gained an enthusiastic following on account of a great many drawbacks, principally the infection of the kidneys secondary to the operation and the difficult control of urination. Guyon and Albarran have shown, however, that an infection of the kidney does not necessarily follow an ascending infection of the ureters.

The methods of implantation of the ureters which have been used are mainly four:

1. After the first discovery of the bad consequences of the ordinary implantation and after Maydl's experiments a part of the bladder was taken along with the ureter for implantation, and good results have thus been obtained. This method, however, is not possible except in case of exstrophy and perhaps cystitis dolorosa.

2. The method of Chaput is the direct union of the wall of the ureter to the wall of the bowel. This method has been successful, but it is the one which endangers the union most of all. Peritonitis may follow this method very easily, since it is difficult to prevent a pulling out of the sutures by the action of the bowel or by infection.

3. Boari's method makes use of a small button, which is very similar to the Murphy button in its principle. A case in Giordano's clinic has shown, however, that concretions can form in that button.

4. The last method consists of the oblique implantation of the ureter into the bowel by a procedure such as Witzel has described for the oblique gastrostomy, sewing a catheter into the stomach-wall. Krinsky has described a method of oblique implantation of both ureters into the rectum with a flap-operation which is done by sewing

19. Kümmell: *Ztschr. f. Urol.*, 1908, II, 340.

20. Israel: *Chirurg. klin. d. Nierenkr.*, 1901, p. 308.

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