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URETERAL INJURIES.

BY

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IN studying the literature of this important subject, I have been much impressed with the paucity of our knowledge and the futility of our resources in dealing with this condition. Many surgeons are felicitating themselves that a ureteral injury has not occurred in their practice, but I am sure they do not realize that a ureter can be tied off or clamped, and the patient need suffer no symptoms which would give rise to even a suspicion of the accident. No pain results, no appreciable hydronephrosis occurs; in fact, the kidney is simply killed, its function is at once in a great measure suspended, and gradually it atrophies until there is nothing left but a fibrous cord. These injuries may occur during the progress of an abdominal operation; perhaps in the enucleation of large and deeply imbedded fibroids, or in the removal of malignant growths; in fact, in a hysterectomy, vaginal or abdominal, for any condition. The ureter may be accidentally cut, torn, cauterized or injured anywhere in its course, high up between the kidney and bladder, or low down at its entrance into the bladder; or it may be purposely tied off, so as to exclude the function of the kidney, if for any reason, this course was deemed advisable. As, for example, where the ureter had been injured and it was found necessary to complete the operation as quickly as possible on account of the serious condition of the patient, or because so large a piece of the canal had been removed that it was impossible to approximate the ends.

Some interesting experiments have been made on animals by Kawasoye (*Zeit. f. Gyn. Urologie*, 1912, 111, 113) to determine which was the best method to occlude the ureter: (1) by simple ligation; (2) the formation of a two-limbed U-shaped kink, the two limbs being tightly tied together; (3) the formation of a three-limbed Z-shaped kink, the three parallel limbs being sewed together with catgut, and a simple ligature in addition being thrown around the ureter distal to the kink; (4) the formation of a true knot in the ureter distal to which a simple ligature

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was placed. Only the last of these methods has proved trustworthy—"Clark."

In all ligature operations in which stasis of urine and dilatation of the ureter above the point of ligature takes place an abscess or fistula is apt to result from the cutting through of the wall of the ureter by the ligature. So, in order to get perfect occlusion of the tube by fibrous organization which will completely obliterate its lumen, the ureter must be well loosened out of its bed and a knot made in it and then the open end tied by some sort of ligature material, because in this way the urine as it is secreted trickles so slowly into the tube that little or no pressure is made at the point of ligature from distention.

When the ureter has been injured high up during an abdominal operation the divided ends can often be found and may be brought together by one of the many methods in vogue for ureteral anastomosis, or perhaps the distal end can be lifted up and dissected out freely, so as to implant it into the bladder, at a point sufficiently high not to interfere with the gravitation and free flow of the urine, and, if successfully performed, the future function of the kidney will not be in any way jeopardized because the injury was repaired before any secondary changes could have taken place in the organ. If, however, the ligature slips, or the union is imperfect, or a slough results from pressure necrosis from a clamp, and a urinary fistula follows—whether abdominal or vaginal—an interesting pathology sets in; a more or less distention of the ureter and calices has taken place, and an ascending infection is added through this open end, which in time produces such destructive changes to the renal parenchyma that the future of the kidney is so imperilled that its removal is often necessary, not alone because of the annoyance due to this urinary dribbling, but because of the pain, distress and ill health consequent upon the irritating presence of the infected and useless organ.

Some interesting experiments upon dogs have been made by Beers of New York, and his conclusions may be of some value in this class of injuries, as reported in the *Medical Sciences* for June, 1912, and the April number of *American Journal of Urology*. The Mayos and many other surgeons knew clinically that when a ureter had been injured and a urinary fistula had resulted and had existed for four weeks, ureteral implantation was not advisable, and when the implantation had been successfully made, often it became necessary to take out the kidney. Beers oper-

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ated upon sixty dogs, and his observations and experiments extended over a period of four years.

"He found that after ligation of the ureter hydronephrosis developed in aseptic kidneys, with cessation of secretion, at about the third week. The kidney then began to shrink, and at the end of three months there remained only a fibrous mass not more than one-fourth the size of a normal kidney. If before the end of three weeks the ligature was removed, and the unobstructed kidney taken out by nephrectomy, the released kidney was found capable of functioning satisfactorily. If, after ligating a ureter, septic organisms were introduced, the kidney and its pelvis became distended, kidney substance disappeared, and at the end of three months there was found only a mere cystic shell of the kidney and its capsule. In the septic cases removal of the ligature and nephrectomy of the unobstructed kidney always led to a fatal result. The importance of these investigations cannot be overestimated since they taught us, first, that the occlusion of an aseptic kidney might result in no harm except atrophy of the organ; second, that if within three weeks the ureter was reimplanted in the bladder, the kidney would resume its function; and, third, that a ligated septic kidney degenerated beyond redemption. If accidentally ligated, cut, or otherwise injured, the ureter should at once be repaired, reimplanted, or released, or later the complete removal of the kidney would be an imperative necessity."—*Gallant.*

The dangers of ureteral injuries are much greater when operating through the vagina, and particularly if the vagina be small and the uterus placed high in the pelvic cavity, and I believe these dangers are increased by the use of the clamp forceps, because, in this class of cases, the forceps are usually removed after thirty-six hours, when the possibilities of hemorrhage from the opening of the divided vessels has ceased. If the broad ligaments have been tied off by catgut, and especially chromic gut or silk, then these late sloughs, as are occasioned by the use of forceps, are not so often seen because the ligature is a permanent method of hemostasis, and if the ureter is encircled in the knot it remains so long occluded that its lower end may become permanently sealed, but not always, as was shown by Kawasoye's experiments previously referred to, and the kidney will be forever put out of commission and with no disagreeable symptoms, providing the other organ is healthy, because it so quickly hypertrophies, and vicariously does the work of two.

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Perhaps the matter of secretion after occlusion of the ureter is simply one of hydrodynamics, and goes on until the limit of distention of the ureter and pelvis is reached. Then the extrarenal pressure becomes greater than the secretory pressure, and secretion ceases, and when the function of the renal parenchyma is at an end atrophy results.

A very important question presents itself to the practical surgeon: assuming that it is not desirable or possible to satisfactorily replant a torn ureter into the bladder, what shall we do and when shall it be done? Many of these cases of urinary fistula and its consequent urinary dribbling, if left, close of themselves. The kidney shrivels and stops secreting, and the leak ceases, and the patient is satisfied and perhaps enjoys excellent health. How long a sensitive woman can or should submit to this very annoying and distressing condition is a matter for grave and serious reflection. Murphy maintains that "if you take out a kidney that has only a little of its tissue destroyed, you hazard the life of the patient 30 per cent.; that is, thirty in one hundred die. If you take out a kidney of which little is left, only a shell—you hazard the patient about 2 per cent." It seems to me, therefore, that it is prudent to have these unfortunate women bear their burdens for a few months, until the danger time of operative intervention has been reduced to a minimum, because at a late date the good kidney has assumed the work of the disabled organ and the dangers of urinary suppression from operation are practically eliminated, and then perhaps a case, when left this length of time, may close up and give no further annoyance or trouble.

Let me briefly report an interesting experience which came to me when I least expected it:

I operated upon a Mrs. Z., æt forty-eight, on October 10, 1911. She had two children, one twenty-six and the other seventeen years of age. Diagnosis: uterine prolapse, with cystocele and rectocele; the cervix came out beyond the introitus, although the body of the uterus remained well up in the pelvic cavity and retroverted. I did a vaginal hysterectomy, with anterior and posterior colporrhaphy and perineorrhaphy. I separated the structures well off to right and left and presumed the ureters were out of the path of injury and clamped very close to the uterus, as it was perfectly healthy. I used the clamp method, as I thought it would be the easiest and safest operation, and I did a vaginal hysterectomy because I did not wish to make an incision into the abdominal wall, as the woman had a very beautiful figure, and

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also on account of the possibility of future adhesions. The technical difficulties were not great, and the operation was easily and quickly done. On the evening of the second day the temperature rose to 100°, but after that it remained normal, and the pulse was only once above 90, and then fell to 70 and remained there throughout the convalescence. There was practically no pain, and only twice she received an eighth of a gram of morphia hyperdermically. She voided in the first twenty-four hours over 1000 c.c. of urine, and thereafter over 1500 c.c. every day. She left the hospital on the fourteenth day, and was about her house, when on the seventeenth day, while in bed, she felt something give away, and then noticed that urine was coming freely through the vagina. Upon examination I found some loose sloughs in the vaginal vault, which I removed and directed her to use a douche for a few days, and to estimate the amount of urine passed in twenty-four hours, and what she voided at any one time. She never passed more than 2 1/2 to 3 ounces, and the total amount collected in twenty-four hours was a little over 1 pint. This state of affairs continued for about five weeks, when I called in Dr. Lothrop, who assisted me in cystoscoping the bladder and to whose experience I give much deference. First, we let run through a catheter into the bladder, some weak methyline blue solution, and noticed that it did not return by the vaginal opening. We then put a pint of the solution into the bladder, and withdrew it through the catheter, which showed us that the bladder was not injured and that the ureteral opening of the bladder was closed. After washing the bladder clean of the blue solution, we catherized the right ureter, but could not get into the left one. It was now evident that the left ureter had been injured and the slough had given away and there existed a left ureteral fistula. Two courses were open to me: either to remove the kidney, which I thought was a cowardly proceeding, or to reimplant the torn end into the bladder. I at once communicated with Dr. Will Mayo, whom I knew had had a large experience in ureteral surgery, and his very practical letter to me made me at once decide that perhaps it was the best surgery to remove the kidney when a ureteral fistula had existed for so long a time. The woman willingly accepted my advice, and went to the German Hospital and I removed the kidney which I found very adherent and considerably enlarged. It was delivered with a great deal of difficulty. The woman voided 38 ounces the first day after operation, and under salt infusion 60 ounces of urine

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were passed in the second twenty-four hours, and a normal amount thereafter. She left the hospital on the tenth day, and I am pleased to say she is now a well woman. The plastic surgery which was done on the anterior and posterior vaginal walls and the perineum are very satisfactory, and there is no tendency whatsoever to a returning cystocele or rectocele. Her blood pressure is 127. I append herewith the report of Dr. Williams, pathologist to the University of Buffalo, and Dr. Will Mayo's very practical letter to me.

Dr. Mayo writes; "I think that taking everything into consideration, it is a question whether or not it would be wiser to remove the kidney. It undergoes such rapid changes after the ureter has been cut, and in a considerable number of cases, nephrectomy eventually becomes necessary, and at that time the kidney is usually found to have but little function. The patient, who has but one perfectly good kidney, is better off than a patient having one good kidney and one bad one. In the case of the patient having one kidney, the kidney quickly hypertrophies and is competent to do the work for both."

DR. WILLIAMS' REPORT ON THE SPECIMEN.

Case of Doctor H. E. Hayd.

Left kidney; weight, 5 ounces, pink in color. Two small areas of subcapsular hemorrhage said to be the result of operative clamps. On section average width of the cortex is 1/4 inch. Capsule strips with a little difficulty leaving a moderately finely granular surface; cortex pale, pyramids bright pink; pelvis distended, mucosa thickened and roughened; mouths of calices distended.

Microscopic.—Capsule moderately thickened with numerous areas of cellular infiltration between the tubules with a few fibrous glomeruli and sclerotic arteries. The convoluted tubules show granular débris, probably unimportant; the straight collecting tubules show desquamation of the epithelium and some hyaline casts, and some hemorrhage between the tubules. The pelvic mucosa is swollen, with a uniform infiltration with leukocytes, many eosinophiles and large numbers of lymphocytes, often in masses, beneath the epithelium; these latter may represent the lymphoid tissue of the mucosa.

The infiltration of the polynuclear leukocytes gives the most conclusive evidence of inflammation. The small veins below the epithelium are dilated and to a large extent filled with poly-

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nuclear leukocytes. The polynuclear leukocytes also infiltrate the layers of the epithelium between the epithelial cells.

Several medium-sized arteries in and below the mucosa show marked hyaline degeneration. Long slim cells in mucosa, arranged in parallel strings may represent budding capillaries. The infiltration of leukocytes extends widely into the fibrous tissue around the pelvis.

None of the changes noted in the kidney itself seem definitely referable to the surgical condition. The pyelitis in the pelvis of the kidney probably is.

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DISCUSSION ON THE PAPER OF DR. HAYD.

DR. ALBERT GOLDSPOHN, Chicago.—It is very true, as the Germans experienced first years ago, that injury of the ureter is of frequent occurrence, especially during or after vaginal hysterectomy. This was more especially the case when the old French method was employed, clamping the structures and taking the clamps off one or two days after, a thing that ought not to be necessary except very rarely. It is a brutal piece of work. I cannot call it surgery to do vaginal hysterectomy chiefly by that method. The peritoneal cavity must then be left open which should be closed as a rule, the same as when we invade the peritoneum from anywhere else, unless drainage is necessary.

I am surprised at what Dr. Hayd said, that Dr. William Mayo advises extirpation of the kidney so soon after that accident, because we know that the kidney gradually and slowly undergoes atrophy when the urine runs astray. That is correct, but the atrophy of the kidney under these condition is a slow process. If the ureter is ligated, tie a knot in it and ligate it beyond the knot. That is the best thing for us to do when we meet such an injury high up, too high to reimplant into the bladder. It is either that or implant it into the ureter of the opposite side. If the case is a desperate one, and in order to get through safely, it is best to tie it, then there will be atrophy of the kidney in a rather short time for the reason the doctor has mentioned. But when the urine is at liberty to escape, the atrophy is a slow process; and I can say from an experience of two cases, that it is not necessary to extirpate the kidney so soon. Some years ago I did reimplant the ureter after it had been injured in a vaginal hysterectomy, in one instance by myself, and in another by another surgeon, reimplanting the ureter into the bladder in cases that were both more than six months old and with the best effect. The injury had been noticed and these patients were cautioned against permitting any septic condition in the vagina, so that the ascending infection might not occur before they were ready to have this operation done. I can say from experience

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and from the opinion of the Germans at least, that it is not right to extirpate the kidney so soon if at all. If the patient will not consent to this second operation and extirpation is contemplated, then wait about half a year before you extirpate, for the reason that at that time, the other kidney will have assumed the function of this kidney whose urine has been running astray and the latter will be no longer needed.

DR. THOMAS B. NOBLE, Indianapolis.—I am exceedingly grateful to Dr. Hayd for bringing this matter before the Association. As he says, it is years since such a subject was presented before this Association, and yet it is a matter of rather frequent occurrence and occurs in the practice of every man who does much of our type of work. It is a matter that will come up in medicolegal ways. A more uniform opinion should exist as to when a nephrectomy should be done following a wound of the ureter. I believe that the ureter can be avoided more frequently than it has been. I dare to make that statement. I do not make it in a spirit of criticism. It does occur as an accident I believe, and I believe that, at the same time, the accident can be avoided if we exercise care in the performance of the different types of operations. My observation has been that this injury occurs, as has been said, very frequently in vaginal hysterectomy and in the removal of peculiarly situated fibroids; and furthermore, it will occur in cases of retroverted, prolapsed adherent uteri with old infected tubes and ovaries that involve the pelvic wall posterior to the broad ligaments, in which infiltration has occurred into the broad ligament—through the peritoneum—out into the pelvic wall outside of the peritoneum, the periureteral areolar tissue, if you please. In these cases, where a panhysterectomy is usually and properly performed, unless great care be exercised in putting the finger on this pathology, we are very prone to make it include the lower end of the ureter which will be torn.

DR. LOUIS FRANK, Louisville.—This is a subject in which I have been much interested, and though so far as I know the accident has not happened to me, I am sure that we have all tied off the ureter without a knowledge of the fact. I am absolutely sure of this. Probably all have done it once or twice, some of us oftener. I am not going to discuss what the last speaker said, namely, the type of case where this accident is liable to happen, where it is impossible to avoid it by any procedure whatsoever.

The statement was made by Dr. Morris some six or seven years ago, as you will find in the Transactions, that the ligation of the ureter in the human being was followed by absolutely no evil consequences and that atrophy of the kidney always took place. As a result of some recent experimental work undertaken last year, and remembering Dr. Morris' statement regarding the results of ligation of one ureter, I wish to say that it is quite a different proposition from the ligation of both ureters. Our experiments in tying one ureter showed some interesting facts. In the first place, I am convinced that the ligation

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of a single ureter with healthy kidneys is not a safe procedure for the exclusion of the kidney. We find in a certain percentage of cases in these experiments that the animals developed marked pathology in the excluded kidney. We have some of the dogs living for more than a year with one ureter ligated, one dog with a fistula that has lived more than a year. It has been demonstrated that in some cases infection takes place through the blood channels; that the dammed up kidney becomes a *locus minoris resistentiæ.* This was pointed out by Brewer in his address before the Section on Surgery of the American Medical Association. Some of the kidneys became converted into a large abscess sac. We have found it difficult to produce ascending infection as long as the urine is flowing out. In uretero-vaginal fistulæ or in any ureteral fistulæ, where the parts can be kept clean, ascending infection will not take place. We have infected the ureters in dogs with fistulæ, kept the external orifice of the ureter clean and no evidence of pus in the kidney could be found. So much for the question of destruction and infection of the kidney after ligation and ureteral fistulæ. The kidney is never absolutely destroyed after ureteral ligation. I believe that the doctor misunderstood when he said the kidney undergoes complete atrophy. It becomes the seat of fibrous infiltration. Nature replaces the normal structures with fibrous tissue, and a certain amount of contraction takes place.

As to the duration of function after ligation of the ureter, it has been supposed to exist for two weeks. In some cases of ours it has existed for two weeks and in some of the experiments it would last longer than that.

As to the method of exclusion, we have found that by tying the ureter with an absorbable ligature you can produce absolute exclusion that will last as long as one year. What happens after infection has taken place? We have abscesses formed in the kidney and the kidney becomes destroyed.

As to implantation of the ureter after fistula formation, how long should we wait? Practically, it makes no difference at all how long we wait if we have enough ureter to implant. If implantation of the ureter cannot be carried out, the kidney should be removed. After the ligation, if obstruction has existed for several days, and the other kidney has proved its functional ability to do all the work, we can remove the kidney. There is a mortality of 30 per cent. following the removal of the ordinary normal kidney, according to Murphy, but in this I disagree. I do not believe that the removal of a normal kidney, in the presence of another normal kidney, is followed by 30 per cent. mortality. I know it is not so. We do know that the removal of a kidney which has ceased functionating is not as disastrous as the removal of a supposedly normal kidney, for the reason the other kidney is carrying on the function, and we can rule the necessity of increased work out of consideration. It is largely a question of the function of the remaining kidney.

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With reference to the question of fistula, it is stated that they sometimes disappear spontaneously. Not all of these apparent cures are the result of reestablishment of continuity of the ureter. In our experimental work we attempted to produce the same thing as we do in our operative work. We tied up the ureters with catgut; we tied them up with nonabsorbable sutures, when we found the catgut would be absorbed. When we implanted it in the abdominal wall there was absorption of the catgut and the establishment of a fistula. In one dog in which the urine ceased to come out of the fistula we believed we had a restoration of function. We allowed him to go on for two or three months, then opened him up, and found complete occlusion with a tremendous suppurating kidney on that side. The point I want to make is that occasionally the ureter may become occluded secondarily by cicatricial contraction as the ureter retracts and then the kidney is put out of commission completely.

When shall we do a nephrectomy in these cases? Where restoration of continuity cannot be carried out or the ureter transplanted into the bladder, nephrectomy should be done. If the fistula is where it cannot be kept clean, nephrectomy should be done as soon as the patient will stand the operation, and in such a case as Dr. Hayd has reported it could have been done earlier without any more danger than from any secondary operation of the same magnitude.

Dr. George Van Amber Brown, Detroit.—I wish to mention a case reported in literature in which, while doing a hysterectomy, the ureters had been tied with catgut, the accident not being detected until the abdomen had been closed. A stab wound was made into each kidney establishing drainage for urine until the catgut was absorbed, after which time the ureters were again functionating, when the kidney wound closed and the patient recovered. I cite this case as a hint to us, useful in handling these cases.

Dr. Rufus B. Hall, Cincinnati.—The ureter will be injured occasionally by the most careful operator, and I rise to speak in reference to the medico-legal aspect of this subject which was referred to by one of the previous speakers. I wish to amplify the statement made by him. In the very cases in which you injure the ureter you least expect to do so as a rule, yet there are cases where you do fear that you will injure the ureter, where you know that you may injure the ureter, and that is the one which you say one ought to catheterize so that you can locate it, but that is the case in which it is impossible to catheterize the ureter.

I refer to the *postperitoneal tumors*. You have, for instance, a tumor filling the pelvis, extending well into the abdomen, that is postperitoneal. You may catheterize the ureter on the right side, but when you come to catheterize the ureter on the left side you cannot do it because the tumor blocks it up. Not infrequently you expect a fibroid, and find maybe a fibroid or maybe a postperitoneal sarcoma. You go ahead and remove the tumor, and

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in so doing you remove a section of the ureter. If it should go out from this Association that we should avoid the ureter in these cases by knowing where it is by catheterization, the lawyer has a good job and you are up against a very tough proposition in your self-defense. A patient demands relief, the surgeon removes the tumor, and in so doing he removes a section of the ureter on one side. He may not have known it at the time of the operation, but he knows it soon afterward. It has occurred to the speaker on three or four occasions to have injured the ureter accidentally in operating. This is a question to which we have to give due weight and consideration, because our transactions are used by the lawyer in his prosecution of men for malpractice, and at any time a lawyer in court is apt to take up one of these volumes and say that Dr. so-and-so said so and so, and how are you going to meet it? You must exercise due caution. If we can put a catheter in the ureter, of course we can avoid the ureter. That is perfectly self-evident, but I contend there are cases in which no man can catheterize both ureters with a tumor blocking up the pelvis.

In reference to another case, in the early history of this work, about fifteen or sixteen years ago, I removed a postperitoneal tumor. I though it was a broad ligament fibroid. It was situated low down and behind the uterus. In removing it I cut out a section of the ureter. I did not know that I cut off a piece of the ureter until some urine later came through the drainage tube. I left the tube in longer than usual and all the urine from one kidney came through the wound and persisted in doing so. She refused to have any further operation done, and has now a ureteral fistula. It is fifteen years since the operation was done. There is no disease of the kidney that can be determined by bimanual palpation or other examination.

DR. H. W. LONGYEAR, Detroit.—There are cases in which the rule suggested of producing atrophy of the kidney or leaving it for several months before its removal, cannot be followed. Such a case fell to my lot in which I knew I injured the ureter. The case was one of abdominal hysterectomy, with supravaginal amputation, for a large multinodular fibroid, part of which was intraligamentous. The woman made an ideal recovery. Before the end of the second week she complained of some fullness on the right side, and on examination I found a fluctuating tumor near the crest of the ilium. On incision quite a quantity of urine escaped. I kept up drainage for several days, then resorted to ureteral catheterization and found there was no urine passing to the bladder from that side. While the catheter was in place I made the incision larger, going under the peritoneum, and found the lower end of the ureter by the catheter, but could not in any way find the portion of the ureter coming down from the kidney, although I had given methylene blue, hoping I could detect it by the color. There was a cicatricial mass obscuring it, and I was obliged to give it up. I either had to go above and

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go into the pelvis of the kidney, and come down through the ureter and try to unite it, or remove the kidney, or leave a fistula. I extended the incision upward, took out the kidney, and a perfect recovery ensued. It would have been impossible to have tied off the ureter, because I could not find it without going in from above. It would have been impossible to leave the case with a fistula of that kind without infection, which usually results in ultimate destruction of the kidney in such cases.

DR. J. HENRY CARSTENS, Detroit.—I had a number of cases of fistula in former years when I used the clamp. I do not use the clamp now except in rare instances. I have found in some cases that perhaps we do not clamp the ureter, but with the clamp we sometimes have more or less sloughing as a result, an ulcerative process goes on and perforates into the ureter two weeks or more after the operation. Fifteen years ago I had a patient with a fistula. There was excessive granulation, and I applied a little nitric acid three or four times, when the fistula closed and has remained closed.

I had another case in a strong healthy woman, who had a very narrow vagina. I used clamps. She had a fistula. After three or four months I took out the kidney. She had no further trouble. I had one other case where I did the same thing. The statement has been made that when the ureter is pervious and the urine runs out, the kidney continues to functionate. In my experience the kidney never ceases to functionate. If you take out a kidney which is carrying on one-half of the function of elimination, the other kidney has to do the whole work on short notice, and does not that kidney come up to the mark? It always does. You have no trouble at all. I want to make the point that, having two healthy kidneys in a perfectly healthy person, if you remove one kidney, the other kidney will do the work, and need not necessarily *gradually* develop hypertrophy.

DR. HENRY D. FURNISS, New York City.—In these cases of injury to the ureter it depends whether you detect the injury at the time or whether you discover it afterward. In injuries of the ureter, you should implant the ureter into the bladder, if possible. If you cannot do that, I would not hesitate to take a chance of implanting it into the large intestine, even though there is a possibility of pyelitis occurring. Pyelitis, even though it does occur, is not apt to be fatal; it may exist for a long time. and if it should occur, the kidney can be taken out afterward. If I could not implant the ureter into the bladder or colon, I would put it out under the skin in the lumbar region, allowing it to project over the skin and not suturing the ureter to the skin, because if you do, you are apt to get a fistula. Recently I put two ureters out on the back preparatory to the removal of the whole bladder. In these cases you do not realize that you have injured the ureter until a week or twelve days afterward, or unless uremia sets in. In the Wertheim operation there is

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1 per cent. of urinary fistula following it, due to necrosis, and the cases in which this occurs show up about ten days afterward.

I have seen some five cases of injury of the ureter. One where the ureter had been previously catheterized was cut, repaired at the time of injury, and the patient has had no subsequent trouble. One woman in whom both ureters were ligated died of uremia. Another had both ureters ligated during a vaginal hysterectomy, and the urine after three days escaped through the vagina. In this case both ureters were subsequently implanted into the vagina; cystoscopy three months later showed both kidneys discharging urine that upon examination was normal.

I had another case in which abdominal hysterectomy was performed, where the woman developed ureteral leakage through the vagina. It was difficult in that case to make a diagnosis of ureterovaginal fistula. It was thought at one time she had incontinence of urine from cystitis, and possibly she had a fistula.

One of the great points in the early diagnosis of these cases is that where the vaginal leakage approximates in amount that of the urine voided by the bladder ureterovaginal fistula should be suspected. At times the only way to detect an injury is by putting a pledget of cotton in the vagina and giving the women methylene blue; then we are able to locate the fistula by the stain.

We can determine the function of the kidney in these ureteral injuries by the administration of indigo-carmine, and compare the elimination from the bladder with that from the vagina. But there is one point to be remembered; when indigo-carmine and methylene blue are given to a patient who passes alkaline urine, it is excreted as a colorless urine. If we use the phenolsulphophthalein test, it makes no difference whether the urine is acid or alkaline, we can determine just the percentage that is eliminated.

DR. JAMES F. BALDWIN, Columbus.—I wish to report one more case to those given by Dr. Goldspohn, in which I implanted the ureter into the bladder after the lapse of considerably more than four weeks after the original operation, which had been a vaginal hysterectomy for cancer. It is possible that the kidney atrophied after this operation was done, but there was no evidence of that. The patient died of recurrence some two or three years later.

Nearly all of the cases of urinary fistula which have been reported to-day have followed vaginal hysterectomy. In 1896 I made a special visit to Paris for the purpose of seeing the masters there do vaginal hysterectomy. I saw Pean, Pozzi, Richelot, and others doing this work with the most beautiful technic. I became enthusiastic over vaginal hysterectomy, and performed it a good many times after my return; but gradually I got over my enthusiasm, did more and more of the work through the abdomen, and at the present time I probably do not perform a vaginal hysterectomy oftener than once in two years, while abdominal hysterectomies are a matter of daily occurrence. I can do an

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abdominal hysterectomy almost as quickly as the vaginal; I do not injure the ureter; I can examine the patient for gall stones, chronic appendicitis and Lane kinks, and my patients recover as thoroughly and as rapidly as after the vaginal operation. I do the latter operation only in some extreme cases in which seems safer than the abdominal.

I am surprised to hear of ureteral fistulas following the Wertheim operation. I like that operation very much, and do not see how the ureter can be injured. Occasionally in removing broad ligament cysts, fibroids, bad pus tubes, etc., as mentioned by Dr. Noble, the ureter is brought up, but I am watching for it, push it out of the way, and have never had a fistula. In those cases if much of the ureter has been exposed, I open the vagina and pass in a wisp of gauze, so that if there is any slough the urine will have a direct exit.

Dr. X. O. Werder, Pittsburgh.—I asked Dr. Hayd the question whether he had put in gauze drainage, because I have had two cases of ureterovaginal fistulæ as a result of the use of gauze drain, a number of years ago before I knew better. One case was a large tuboovarian abscess in which, after its enucleation, I found a large part of the ureter attached to the abscess wall, which I had considerable difficulty in separating without injury. Before closing the abdomen I put in a gauze drain right along the course of the ureter into the vagina, and ten days afterward a ureterovaginal fistula developed which, I am sure, was caused by the contact with the gauze with subsequent erosion of the ureter. In that case there was a spontaneous cure about six or eight months afterward. The leakage stopped, probably due to atrophy of the kidney.

Another case was one in which I had done a hysterectomy for a large intraligamentous fibroid. The operation was done in the afternoon. The next morning I found that not a drop of urine had been passed. I at once reopened the abdomen and found one ureter cut and the other tied. I implanted the cut ureter into the bladder and loosened the ligature on the other and put in along the ureter a gauze drain, and about ten or twelve days afterward I had a double ureterovaginal fistula, resulting, I feel confident from the gauze drain. This case was cured by turning a diverticulum of the bladder into the vagina, the patient has perfect control of her urine to-day though this operation was done about twelve years ago. It is a serious mistake to bring a gauze drain in direct contact with the ureters. It is always best wherever possible to cover the ureters with peritoneum; if this is not possible and drainage is considered necessary, then the gauze should be kept at a safe distance from the ureters. If you use drainage alongside the ureter, you are almost certain to have a certain amount of necrosis with a resulting fistula.

I have not been so fortunate as most of you. I have had five or six cases of fistula, three of which were in cases of carcinoma of the cervix where a radical operation was done. In one case the

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kidney was removed subsequently by another surgeon, in the second case I resorted to implantation of the ureter into the bladder with a cure, but the patient died a year or so afterward from recurrence. At the time I opened the abdomen and dissected out the ureter I found the iliac glands considerably enlarged and enucleated them; microscopical examination proved them malignant. That patient died from a recurrence a year or fourteen months later.

In another case I had a double ureterovaginal fistula follow about ten days after operation. In this case I had done a vaginal igniextirpation for carcinoma of the cervix. The woman was sixty years of age, very fat, and for that reason I choose the vaginal route in preference to the abdominal. I put in gauze drainage and feel pretty sure this was responsible for the fistula in this case also. At any rate, ten days afterward we had leakage from the vagina and a day or two later all the urine passed away in this manner, and none at all reached the bladder. The patient went home in fairly good condition with the exception of this constant leakage. Six weeks later her family physician informed me that the vaginal urinary discharge had completely ceased and that the bladder was functionating normally. A spontaneous closure of these fistulæ had evidently taken place.

Dr. Albert Vander Veer, Albany.—I want to speak of a case that occurred in my practice in 1869, where a patient was tapped and tapped, as we used to get these patients, and it was my second case of ovariotomy. I recall very vividly the tremendous hard work I had in getting the tumor out. We were then following up Dr. Peaslee's favorable commendation of draining through the vagina. I introduced a T-drainage tube through the vagina, and was never quite satisfied as to what happened, whether I injured the ureter at the time of the removal of the tumor, or whether the introduction of the instrument, the scissors, used for making the incision may have done some injury to the ureter. At any rate, a few days afterward the patient had a profuse discharge of urine. She lived some little time, but I doubt whether we could have cured her even at the present time, owing to the extensive adhesions and the great size of the tumor. Naturally I thought over that case and what I was going to do, as she was discharging urine from the vagina, and about that time Simon published his first case of removal of the kidney for the closure of a ureteral sinus, and which brought me considerable comfort in this way. I said later we would remove this woman's kidney as I believed it was the proper thing to do. That case has always made a profound impression upon me.

As to vaginal hysterectomy, I agree with what has been said by the two previous speakers, that we have not been favorably impressed with that operation. It is seldom that I do this operation now. I have gone through the experience Dr. Baldwin referred to, and I must say that I do not like to do vaginal hys-

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terectomy because I can do better work above. In one case I had an injury to the ureter, and for some twelve days afterward the patient passed a great amount of urine through the vagina. I could see a fistulous opening on the right side in the ureter. I did not attempt to do any operation nor an anastomosis, but I brought over connective tissue, in connection with the ureter freshened it, and put in a suture in that way. I was much pleased a few days afterward to know there was much less discharge and by simply keeping in the vagina packing for a little while the woman made a good recovery and lived for some eight years thereafter, not having any further return.

A very peculiar case came to the hospital with pelvic trouble soon after that, and I said to my assistant, "I am about through with vaginal hysterectomy." But he said it was the only thing to do. I said to him, "if you want to take this case and remove this uterus which, I believe is bound down with adhesions in every direction, and not do any harm to the ureter, you can operate on this woman." Well, he was full of vim. He took hold of the case and operated, and whatever happened in doing the operation, he said ten days afterward she was discharging a large amount of urine through her vagina. I examined the case with him, and it was apparent that injury had been done to the ureter. We watched the case for some time, for nearly a year, the woman suffered so much distress that she came into the hospital, and I did a nephrectomy from which she made a good recovery. But it was a kidney full of abscesses, and one that had become infected. Therefore I cannot quite agree with Dr. Carstens that these patients are going to escape infection. The experiments made upon dogs only recently, where the ureter was implanted into the rectum, show that the kidneys became infected in the majority of cases. In many of these cases of suppurating kidney I like to do the operation of nephrotomy, in the first place, and then, if necessary, remove the kidney afterward. If the other kidney is free from disease and is doing its work well, the mortality following nephrectomy of the other organ has been exceedingly low.

I have done a fair amount of abdominal surgery in my time, but I have never yet injured the ureter in operating above to my knowledge. I believe there is a mistake in the statistics, because I do not think we have so many of these cases of injuries to the ureters.

Dr. Hayd (closing the discussion).—I am extremely obliged to the Fellows for their splendid discussion of my paper. Their remarks have illuminated the subject considerably. To the younger men I wish to say, they must not think we do not invite criticism, because we get it here in this Association with ungloved hands, and I am surprised I did not get it harder than I did. It is a mighty serious question to operate on a rather prominent woman and find that you have cut or injured the ureter.

In regard to the remarks made by Dr. Frank, I will say that

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I read the experiments of Beers very carefully. I read everyone of the cases. I epitomized the article and I think I understood it, but whether Dr. Frank got the same results in his experiments with dogs as did Beers in his experiments on the same animals I do not know. He and Beers will have to work that out. I have worked out Beers' results and they agree with the experience of Mayo and other surgeons who say that a kidney that has been leaking through an injured ureter for many weeks had better be removed. My patient was passing a half pint of urine through her vagina, therefore, I knew her kidney was functionating, but I did not know that if we reimplanted the ureter of such a kidney degenerative changes which had been started would continue in that kidney, that it would atrophy and make a lot of trouble, and that at some future time it might have to be removed. That is the point.

I could go on and answer all of the points made by the different speakers, but it is hardly necessary for me to do so. Dr. Ill's criticism is well taken, namely, why did I take the kidney out, as it was not in a very bad condition? To look at it, it did not seem to be in a bad condition, but think of the possibilities in connection with the case. She had a competent kidney. It was doing the work nature called for. I did not want to expose her to a big operation and perhaps fail and if she lived then later be compelled to take the kidney out.

Dr. Noble was particularly kind in helping me out. We worked out where the injury was by the cystoscopic examination. It was a big job to cut open a woman from the sternum to the pubes and find her ureter and reimplant it into her bladder. It is a mighty big undertaking, and fortunate for me I had the support of the Mayos in taking out the kidney, because I can do that as well as any of you. I am not a tyro in this type of surgery. I have done ninety-four vaginal hysterectomies. Why I prefer clamps in some cases and tie off in others is not a subject for discussion now. This accident to the ureter occurred when I least expected it. It can occur to some of you when you least expect it.

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