BILATERAL SUBMUCOUS TRANSPLANTATION OF URETERS INTO LARGE INTESTINE BY TUBE TECHNIC

CLINICAL REPORT OF TWENTY CASES

ROBERT C. COFFEY, M.D.
PORTLAND, ORE.

Transplantation of the ureters has been one of the most perplexing problems that have ever engaged the attention of surgeons. The reason is that heretofore this operation has been considered to be nothing more than the artisan’s technic of performing a mechanical feat. Instead, it must be looked on as nothing less than the means of execution of a biologic plan for transmutation of the mammalian to the avian eliminative system. This involves the studious consideration of physics, anatomy, physiology and bacteriology, as well as mechanics, in formulating a technic.

Our concrete problem is the transmission or transfer of the relatively sterile product of a vital secreting or excreting organ, in which the pressure must be low and regular, into a muscular reservoir, infested with bacteria, in which the pressure is high and irregular. Furthermore, the patient must be alive and well after the operation.

PHYSICS

As far as I know, there is no mechanism by which fluid may be transmitted from a chamber of low pressure to one of higher pressure without the use of the valve principle.

ANATOMY

There is no place in the animal organism where the product of a secreting organ is delivered into a muscular reservoir without the use of the valve principle. In all cases the valve is made by the duct running beneath the mucous membrane of the receiving organ, for a distance, before emerging into its lumen. This plan must be duplicated surgically if the integrity of the secreting organ and its delivery duct is to be preserved.

PHYSIOLOGY

The fluid is delivered into the reservoir by intermittent muscular action or peristalsis. The peristaltic force may be in the delivery duct, in which case delivery is made by direct force. It may be in the wall of the receptacle or reservoir, in which case delivery is made by creation of a vacuum that follows in the wake of a peristaltic wave. Or it may be by the synchronous action of the two.

BACTERIOLOGY AND PATHOLOGY

The operation must be performed in such a way that infection will be avoided. In doing this, serious difficulties are encountered: First, the peritoneal cavity must be opened. It is highly susceptible to infection. To be sure, it has defensive powers in proportion; but even these defenses may prove tremendous dangers in themselves, for the gastro-intestinal tract may be impaired or actually obstructed by adhesions resulting from these defenses. Second, the retroperitoneal space must be opened. Here, nature’s defense against infection is at its poorest. The slightest infection in this space, in the absence of drainage, is liable to produce fatal results. With both the peritoneal cavity and the retroperitoneal space open and exposed, the two great sear systems, one of which may be termed a cesspool, must be opened and connected. This must be done in such a way that the greater pressure and the virulent infection of the cesspool cannot hinder or enter the other system.

At the meeting of the Clinical Congress of the American College of Surgeons at Boston in 1928, I presented the results of eighteen years’ experimental and clinical research in the form of a technic that had for its purpose the performance of this operation in such a way as to meet and cover all the problems involved. At that time, I reported nine consecutive cases in which operation was done by this technic. When I was asked to hold clinics during the meeting of the American Medical Association, it occurred to me that I could probably do no better than confine my work to this one procedure. It seemed that this would be a good opportunity to submit the evidence to the jury which must finally decide the case; namely, urologists and surgeons.

The American Urological Society met in Seattle, July 1. At this meeting, an invitation was given to the members to attend a series of clinics to be held in Portland on this subject during the annual session of the American Medical Association. More than forty of the members signified their intention to attend these clinics. In addition to urologists, a number of general surgeons and gynecologists were invited. Three clinics were held on three days. On each day, one transplantation operation was performed. The thirteen cases in which the operation had been done up to that time were reported in full. Eight of the patients on whom the operation had been done were present and were shown at two clinics, July 9 and 11. Specimens from two patients on whom the operation had been done as a palliative measure for hopeless cancer of the bladder and who had later died of cancer metastases not involving the kidneys were exhibited. The interest manifested was considerable. The questions asked and suggestions made by those present led me to believe that a brief statement compiled from the records showing what has happened following these operations in all these cases up to the present time might be of interest.

The exact operation, including preparative and postoperative care, described elsewhere,1 has been used in all cases. For brevity, the histories have been reduced to a minimum. Every page of bedside notes (more than 1,400) has been reviewed. All and only those incidents are reported which are of vital importance or which might cause apprehension on the part of a surgeon. The time of reestablishing food intake and bowel action has been recorded as an indication of the general reaction of the patient. No cathartics or other artificial means of producing bowel action have been used. The time shown for operation covers the time elapsed from the beginning of the first incision to the time of application of the dressings.

REPORT OF CASES

Case 1.—A boy, aged 20 months, with exstrophy of the bladder, entered the hospital Feb. 11, 1927. The rectal temperature was 99.2. The operation was performed February 12, in two hours and fifteen minutes. The ureters were found dilated and thickened, easily admitting number 8 catheters (the largest available at that time). The patient returned from the operating room in good condition. At 5 p.m. the catheters were draining. The first postoperative day the patient vomited frequently; on the second there was occasional vomiting; on the third the bowels moved well and the patient took hot water and milk. On the fourth postoperative day the

catheters were not draining and were therefore removed by cutting the ureters in the rectum under anesthesia. The patient took liquid nourishment on the sixth day; the temperature was 104°. On the nineteenth postoperative day the patient was taken home in spite of the high temperature. She returned home the following day, though still with a high temperature; she developed a mild fever. A letter dated Jan. 23, 1929, received from the patient at North Hollywood, Calif., answered the question of whether she was well before this. It was approximately two years after operation. Recently, word has come from Dr. E. L. Bueerman, the surgeon who removed the operation of cancer, that the patient had not had any difficulty in holding the urine and there was no distress. As evidence of his enthusiasm and good health, he wrote, July 24, 1929, fifteen months after operation: "I am getting along just fine. Went to W. F. Salmon, Wash., all last week and picked up cherries. Had a good time." 

CASE 4.—A woman, aged 39, married, had an intractable vesicovaginal fistula. April 3, 1928, a cystoscopic examination revealed that the bladder was overfilled with cloudy, necrotic tissue. One of the ureters opened directly into the fistula. Five more attempts at repair had been made, and the patient exhibited occasional areas of old hemorrhage in this kidney. Here again there was a rather large amount of definite functional efficiency to a large extent.

CASE 8.—A woman, aged 34, unmarried, had carcinomas of the cervix, vagina and bladder with extensive involvement of all pelvic organs, and had been given a hopeless prognosis. The time for the operation was two hours and thirty minutes. Both ureters were dilated; the right ureter above it. The time required for the operation was two hours and fifty-five minutes. The patient returned home in good condition. On the first postoperative day there was a slight tinge of blood in the urine. The next four days were uneventful except for pain in the epi-}

specific areas of old hemorrhage in this kidney. Again there was a rather large amount of definite functional efficiency to a large extent.

CASE 9.—A man, aged 49, had very advanced carcinomas of the cervix, vagina and bladder. The bladder was nearly all

on the thirty-seventh postoperative day, the question of the patient returning to her home in Seattle was discussed. It was decided that she should remain. The patient moved to a, sanatorium. A palliative operation was performed Aug. 4, 1928, to relieve the bladder distress. The time required for the operation was two hours and thirty minutes. The growth was fulgurated several times. In March, 1928, the patient returned to Canada and did not return. She was discharged. He returned later for radium treatments, 2,400 mg. hours of radium was applied. As the weeks passed, the tumors shrank. The patient took water by mouth. On the fifth day she took water by mouth; on the sixth day she took water by mouth. On the tenth day she took water by mouth.

...At night, the patient had a chill and a high temperature. A letter dated Jan. 23, 1929, received from the patient at North Hollywood, Calif., answered the question of whether she was well before this. It was approximately two years after operation. Recently, word has come from Dr. E. L. Bueerman, the surgeon who removed the operation of cancer, that the patient had not had any difficulty in holding the urine and there was no distress. As evidence of his enthusiasm and good health, he wrote, July 24, 1929, fifteen months after operation: "I am getting along just fine. Went to W. F. Salmon, Wash., all last week and picked up cherries. Had a good time." 

CASE 4.—A woman, aged 39, married, had an intractable vesicovaginal fistula. April 3, 1928, a cystoscopic examination revealed that the bladder was overfilled with cloudy, necrotic tissue. One of the ureters opened directly into the fistula. Five more attempts at repair had been made, and the patient exhibited occasional areas of old hemorrhage in this kidney. Here again there was a rather large amount of definite functional efficiency to a large extent.

CASE 8.—A woman, aged 34, unmarried, had carcinomas of the cervix, vagina and bladder with extensive involvement of all pelvic organs, and had been given a hopeless prognosis. The time for the operation was two hours and thirty minutes. Both ureters were dilated; the right ureter above it. The time required for the operation was two hours and fifty-five minutes. The patient returned home in good condition. On the first postoperative day there was a slight tinge of blood in the urine. The next four days were uneventful except for pain in the epi-
I, and was exhibited to the physicians at each of the three clinics.

The specimen, after four days on ice, was then preserved in Kaiserling's solution and later in solution of formaldehyde, to be around again. Very well at present.

The growth was firm, and was fixed in the connective tissue of 500 cc. was made. The hemoglobin was brought up to 80 as second postoperative day. The growth was diminishing. He was taking less amidopyrine. "He holds the urine well. There was marked reddening of the growth and the patient is gaining weight."

The growth was positive over the left kidney on the twenty-seventh day, and on the sixteenth there was pain in the back over the kidney region. On the twenty-fourth day the patient had two chills, followed by a temperature of 104. After this the progress was uneventful. On the thirtieth day he was up on a back. He took amidosulfonpyrine for a few days, then went away, and later returned for a check up. Cystoscopic examination was made, and on the forty-first he was discharged on the fifty-third postoperative day. The growth was eliminated. 

The growth was intact, the bladder had worked its way back into the chest and also in the back and the left kidney region; at four, the patient was discharged in good condition. Both catheters were draining. She vomited frequently. On the third day the bowels moved well, and the patient took albumin water. The stylet was used.

The patient was discharged on the thirty-third day. He was operated on, Aug. 22, his mother wrote: "My little son Thomas is progress. He is not in pain. Mother stated that she had to get the boy up once at night."

The patient entered the hospital July 4, 1929. The hemoglobin was 55. There was a marked amount of distress in the bladder. July 5, a direct blood transfusion of 200 cc. was made. The hemoglobin was brought up to 80 as a result of the transfusion. Operation was performed, July 9, during the clinic. The time required was two hours and twenty minutes. Advanced carcinoma was found infiltrating the bladder wall, the trigon, and connective tissue on the fourth postoperative day. The growth was diminishing. He was taking less amidopyrine. "He holds the urine well. There was marked reddening of the growth and the patient is gaining weight."

The patient was discharged, September 22.

CASE 16.—A girl, aged 4, had exstrophy of the bladder, an imperforate anus and a rectovaginal fistula. An attempt by another surgeon to establish an anus resulted in a second sphincterless opening. The operation was performed, during the clinics. The time required was two hours and five minutes. Number 8 catheters being used. A large one could not be introduced. A large local improvement was found in the sigmoid. This was gradually worked downward and out through the rectovaginal fistula. The bowel was then closed in the usual way. At this time the patient was able to transplant the ureters high and at a later operation to cut the rectum below the implanted ureters, turn in the ends of the sigmoid below and close a colon and transverse colon in the bag. The transplantation operation, after the bowel had been cleaned, proved to be easy. The patient vomited considerably for the first two days, but she recovered by the third day. The bowels were moving well. On the sixth day she was taking liquid nourishment, and on the eleventh, the catheters were removed. The patient made an uneventful recovery and was discharged on the thirty-first postoperative day. She returned, August 27, much improved in health and appearance.
but the mother complained that the child screamed loudly and strained when the bowels moved. Examination under anesthesia revealed a urinary calculus in the rectum the size of a black walnut which could not be extruded through either fistula. It acted as a ball valve. It was crushed and removed. The eccectic bladder was much less inflamed than before the operation.

Case 17.—A woman, aged 25, unmarried, had an ulcerating tuberculosis of the left kidney. Cystoscopic examination revealed small ulcers in the bladder; the bladder wall was principally made up of scar tissue; the bladder was thin and the urine secretion was frequent and painless. The kidney function was normal. The urine contained a few hyaline casts. The diagnosis of probable tuberculosis of the bladder was made. The operation was performed, July 22, 1929, in two hours and fifteen minutes. The left kidney was found to be about one-third larger than normal. It was smooth. The enlarged kidney was removed on the tenth postoperative day. The patient was up and discharged on the twentieth day and discharged on the twenty-fifth day.

As is ordinarily done, it was transplanted into the sigmoid, a stitch being made at the point where the bladder wall was thin after the cystoscopic examination. The stitches were removed. The second postoperative day, the bladder tissue was removed and the wound was left to heal by granulation. There was no more vomiting, and no marked distention. The urine held, with an oliguria catheter and was run through this ureter. The loin catheter and gauze packing were removed. The patient complained of pain in the right kidney region. At 3 p.m., a stylet was passed but no urine was returned. After this, a small amount of fluid was injected but it did not return. During the night the patient complained of general unrest in the back, being most marked in the right kidney region. Twenty-three hours after operation the patient was taken to the operating room, and through a loin incision the fleshy capsule of the kidney was opened, the finger being passed along the ureter until the ureter was felt, when it was brought backward with a small flat curved retractor. The ureter was somewhat dilated and seemed constricted; it was sly with a sharp knife, and a few drops of turbid urine escaped. A small lathy soft rubber catheter was introduced about 2 inches into the pelvis of the kidney. Four small soft rubber catheters were placed around the ureter to hold it in place and two sheets of rubber tubing around this to provide drainage. The operation required only a few minutes, and there was no shock. The catheter began to drain immediately and freely.

On the first postoperative day the patient was associated and646

obtained back, being more marked in the right kidney region. Twenty-three hours after operation the patient was taken to the operating room, and through a loin incision the fleshy capsule of the kidney was opened, the finger being passed along the ureter until the ureter was felt, when it was brought backward with a small flat curved retractor. The ureter was somewhat dilated and seemed constricted; it was sly with a sharp knife, and a few drops of turbid urine escaped. A small lathy soft rubber catheter was introduced about 2 inches into the pelvis of the kidney. Four small soft rubber catheters were placed around the ureter to hold it in place and two sheets of rubber tubing around this to provide drainage. The operation required only a few minutes, and there was no shock. The catheter began to drain immediately and freely.

On the first postoperative day the patient was associated and646

obtained back, being more marked in the right kidney region. Twenty-three hours after operation the patient was taken to the operating room, and through a loin incision the fleshy capsule of the kidney was opened, the finger being passed along the ureter until the ureter was felt, when it was brought backward with a small flat curved retractor. The ureter was somewhat dilated and seemed constricted; it was sly with a sharp knife, and a few drops of turbid urine escaped. A small lathy soft rubber catheter was introduced about 2 inches into the pelvis of the kidney. Four small soft rubber catheters were placed around the ureter to hold it in place and two sheets of rubber tubing around this to provide drainage. The operation required only a few minutes, and there was no shock. The catheter began to drain immediately and freely.

On the first postoperative day the patient was associated and646

obtained back, being more marked in the right kidney region. Twenty-three hours after operation the patient was taken to the operating room, and through a loin incision the fleshy capsule of the kidney was opened, the finger being passed along the ureter until the ureter was felt, when it was brought backward with a small flat curved retractor. The ureter was somewhat dilated and seemed constricted; it was sly with a sharp knife, and a few drops of turbid urine escaped. A small lathy soft rubber catheter was introduced about 2 inches into the pelvis of the kidney. Four small soft rubber catheters were placed around the ureter to hold it in place and two sheets of rubber tubing around this to provide drainage. The operation required only a few minutes, and there was no shock. The catheter began to drain immediately and freely.

On the first postoperative day the patient was associated and646

obtained back, being more marked in the right kidney region. Twenty-three hours after operation the patient was taken to the operating room, and through a loin incision the fleshy capsule of the kidney was opened, the finger being passed along the ureter until the ureter was felt, when it was brought backward with a small flat curved retractor. The ureter was somewhat dilated and seemed constricted; it was sly with a sharp knife, and a few drops of turbid urine escaped. A small lathy soft rubber catheter was introduced about 2 inches into the pelvis of the kidney. Four small soft rubber catheters were placed around the ureter to hold it in place and two sheets of rubber tubing around this to provide drainage. The operation required only a few minutes, and there was no shock. The catheter began to drain immediately and freely.

On the first postoperative day the patient was associated and646

obtained back, being more marked in the right kidney region. Twenty-three hours after operation the patient was taken to the operating room, and through a loin incision the fleshy capsule of the kidney was opened, the finger being passed along the ureter until the ureter was felt, when it was brought backward with a small flat curved retractor. The ureter was somewhat dilated and seemed constricted; it was sly with a sharp knife, and a few drops of turbid urine escaped. A small lathy soft rubber catheter was introduced about 2 inches into the pelvis of the kidney. Four small soft rubber catheters were placed around the ureter to hold it in place and two sheets of rubber tubing around this to provide drainage. The operation required only a few minutes, and there was no shock. The catheter began to drain immediately and freely.

On the first postoperative day the patient was associated and646

obtained back, being more marked in the right kidney region. Twenty-three hours after operation the patient was taken to the operating room, and through a loin incision the fleshy capsule of the kidney was opened, the finger being passed along the ureter until the ureter was felt, when it was brought backward with a small flat curved retractor. The ureter was somewhat dilated and seemed constricted; it was sly with a sharp knife, and a few drops of turbid urine escaped. A small lathy soft rubber catheter was introduced about 2 inches into the pelvis of the kidney. Four small soft rubber catheters were placed around the ureter to hold it in place and two sheets of rubber tubing around this to provide drainage. The operation required only a few minutes, and there was no shock. The catheter began to drain immediately and freely.

On the first postoperative day the patient was associated and646

obtained back, being more marked in the right kidney region. Twenty-three hours after operation the patient was taken to the operating room, and through a loin incision the fleshy capsule of the kidney was opened, the finger being passed along the ureter until the ureter was felt, when it was brought backward with a small flat curved retractor. The ureter was somewhat dilated and seemed constricted; it was sly with a sharp knife, and a few drops of turbid urine escaped. A small lathy soft rubber catheter was introduced about 2 inches into the pelvis of the kidney. Four small soft rubber catheters were placed around the ureter to hold it in place and two sheets of rubber tubing around this to provide drainage. The operation required only a few minutes, and there was no shock. The catheter began to drain immediately and freely.

On the first postoperative day the patient was associated and646

obtained back, being more marked in the right kidney region. Twenty-three hours after operation the patient was taken to the operating room, and through a loin incision the fleshy capsule of the kidney was opened, the finger being passed along the ureter until the ureter was felt, when it was brought backward with a small flat curved retractor. The ureter was somewhat dilated and seemed constricted; it was sly with a sharp knife, and a few drops of turbid urine escaped. A small lathy soft rubber catheter was introduced about 2 inches into the pelvis of the kidney. Four small soft rubber catheters were placed around the ureter to hold it in place and two sheets of rubber tubing around this to provide drainage. The operation required only a few minutes, and there was no shock. The catheter began to drain immediately and freely.

On the first postoperative day the patient was associated and646

obtained back, being more marked in the right kidney region. Twenty-three hours after operation the patient was taken to the operating room, and through a loin incision the fleshy capsule of the kidney was opened, the finger being passed along the ureter until the ureter was felt, when it was brought backward with a small flat curved retractor. The ureter was somewhat dilated and seemed constricted; it was sly with a sharp knife, and a few drops of turbid urine escaped. A small lathy soft rubber catheter was introduced about 2 inches into the pelvis of the kidney. Four small soft rubber catheters were placed around the ureter to hold it in place and two sheets of rubber tubing around this to provide drainage. The operation required only a few minutes, and there was no shock. The catheter began to drain immediately and freely.
injured; the left kidney was almost normal. The valve action was good.

Patient 8 died 290 days after operation of general peritonitis. The right ureter, which was dilated at the time of the operation, had diminished since the operation. The left kidney was normal in size at postmortem. The valve picture is better than when he was operated on a year ago. In two cases (7 and 8), there was sloughing of the right breast following subpectoral wall carrying infection into the field. In case 5 there was an intestinal obstruction caused by an unrepaired break in the peritoneum over the left upper quadrant of the abdomen. After the obstruction had been removed, the pressure of the bladder and the urine tube made an opening which resulted in local peritonitis and death.

Fig. 5 (case 8).—Typical microscopic section from left kidney.

Fig. 6 (case 8).—Typical microscopic section from right kidney.

There has been no demonstrable evidence of serious postoperative kidney infection or pyelitis, as not infrequently occurred with the former two stage submucous transplantation without tubes. With a ligature firmly tying the ureter to the catheter above the rubber cuff and the ends of the catheters draining into 1:1,000 solution of mercuric chloride. To avoid carrying infection upward, the discharging ends of the catheters are kept in bottles containing 1:1,000 solution of mercuric chloride.

MORBIDITY

There have been five major accidents or misfortunes worthy of note, which may be attributed to the

1. Exstrophy of the bladder.
2. Fracture and dislocation of the bladder; with a life expectancy of more than six months in which morphine or a narcotic drug should be given.
3. Incurable vesicovaginal fistula.
4. Traumatic injuries which make the use of the bladder impossible.
5. Exstrophy of the bladder.
6. Tuberculosis of the prostate and seminal vesicles.
7. Incurable vesicovaginal fistula.
8. Tuberculosis of the prostate and seminal vesicles.
9. Certain cases of painful, contracted bladder resulting from the manipulations are delicate and shockless and require a minimum of anesthetic. There should be no attempt to shock connected with this operation. Therefore, the manipulations should be precise and skillful. There is no inherent danger incomparably less than that of such major abdominal operations as subtotal gastrectomy for cancer of the stomach or the main operation in radical removal of the rectum for cancer.

The total elapsed time is about the same in the three operations.

CONCLUSION

1. I believe that this operation is now complete in principle and that it is applicable for all conditions in which it is advisable to dispense with the use of the bladder as a reservoir for urine.
2. I believe that this operation is now complete in principle and that it is applicable for all conditions in which it is advisable to dispense with the use of the bladder as a reservoir for urine.