URETEROILEAL AND PYELOILEAL NEOCYSTOSTOMY IN MAN*

FRANK J. RACK, M.D. AND F. A. SIMEONE, M.D.

CLEVELAND, OHIO

FROM THE DEPARTMENT OF SURGERY OF WESTERN RESERVE UNIVERSITY SCHOOL OF MEDICINE AT CITY HOSPITAL, CLEVELAND, OHIO

THE FUNCTION OF the ureter is frequently destroyed by obstructions secondary to congenital abnormalities, by benign postinflammatory fibrosis, by intrinsic or extrinsic malignant disease, and by accidental or deliberate interruption of ureteral continuity. Under these various circumstances, a number of technics have been devised for providing drainage from the kidney in order to avoid surgical or physiological nephrectomy. Ureterostomy and nephrostomy have proved to be life-saving procedures in emergencies, but as definitive operations they share with other external fistulae the many disadvantages of external fistulous drainage. Internal drainage of the interrupted ureter has been accomplished by anastomosis to the contralateral ureter,[7] to the bladder directly, or to a tube constructed from the bladder,[13] or, finally, to the colon.[2, 4] Despite the successes reported from the use of these technics, they have not been entirely satisfactory and other methods for restoring ureteral continuity have been sought.

In dogs, observations have been made on the bridging of defects in the ureter by means of vitallium tubes either alone[9] or surrounded by fascia.[10] Encrustation of the vitallium tube does take place and the technic is considered unsuitable for man. Polyethylene tubes, segments of homologous ureters, and segments of veins have also proved useless for the purpose, and have not been employed in man.

During the past two years, isolated segments of ileum have been used at City Hospital of Cleveland for cases in which both bladder and rectum had to be removed for malignant disease. Encouraged by the results of this procedure, isolated segments of ileum have been used to join the interrupted ureter (or the renal pelvis in one case) to the urinary bladder. The following case abstracts illustrate the indications and the results.

CASE REPORTS

Case 1. M. M. (C.C.H. U-72712), a 42-year-old woman, was treated for a squamous cell carcinoma of the retained cervix with external irradiation and with radium during 1950. Fibrosis of the distal portion of the right ureter developed, and within two years intravenous urography showed no excretion of contrast medium. Retrograde pyleography showed hydronephrosis and hydroureter (Fig. 1). At operation the distal 7 cm. of the right ureter was found to be completely fibrotic and obstructed. Proximal to this area the ureter was dilated to a diameter of 2 cm. and its lumen was filled with purulent fluid (Fig. 2). Right ureteroileal neocystostomy was performed in the following manner (Fig. 3): An isolated segment of ileum, with its mesentery preserved, was utilized to serve as a substitute ureter. Intestinal continuity was reestablished by end-to-end anastomosis of the divided ileum. The proximal portion of the isolated ileal segment was closed with a double layer of inverting sutures. The dilated right ureter was then divided well above its fibrotic segment and the proximal end anastomosed to the side of the proximal portion of the ileal segment. The distal end of the ileal segment was anastomosed to the dome of the bladder. The patient made an uneventful recovery. Postoperative studies of the right kidney by means of excretory urography revealed gradual restoration of function of the right kidney, with

* Presented before the American Surgical Association, Cleveland, Ohio, April 30, 1954.

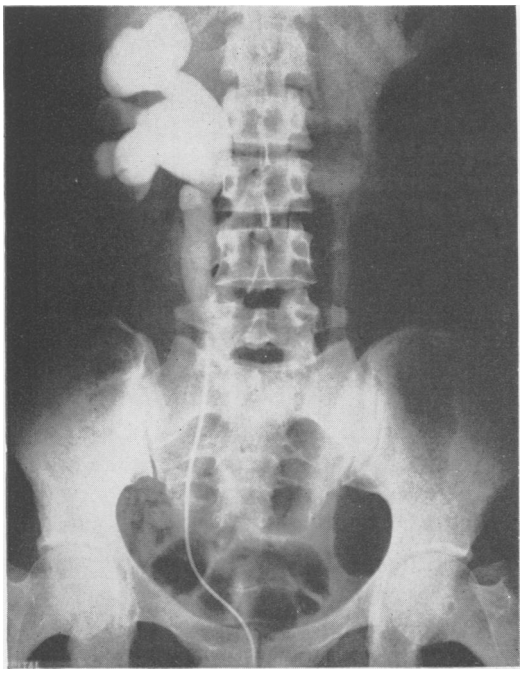

FIG. 1. Retrograde pyelogram made in Case 1 prior to ureteroileal neocystostomy showing right hydronephrosis and hydroureter.

little residual hydronephrosis (Figs. 4 and 5). Eighteen months after operation intravenous pyelograms revealed normal kidney function bilaterally. Blood and serum chemical values remained normal throughout the postoperative period and during the follow-up period.

Case 2. E. D. (C.C.H. #329285), a 47-year-old woman, was admitted to this hospital because of adenocarcinoma of the rectum. At operation widespread disease was present so that the primary lesion was inoperable. Both ureters passed through metastatic tumor in the retroperitoneal areas, and there was incomplete ureteral obstruction. To prevent the development of ureteral obstruction and to maintain urinary flow, left ureteroileal neocystostomy was done, as in Case 1. The left ureter was divided well above its point of entrance into the metastatic tumor and the proximal end anastomosed to the side of the proximal portion of the isolated ileal segment. The distal end of the ileal segment was anastomosed to the dome of the bladder. The right ureter remained intact. Five months postoperatively the left kidney showed good function and there was no hydronephrosis (Fig. 6). Cystometric readings showed a normal type of curve. The patient died ten months after operation from carcinomatosis. At no time during her terminal illness did she show any evidence of renal failure. Autopsy showed widespread mucinous adenocarcinomatosis. Both kidneys were normal histologically. There was no evidence of infection in the ileal segment, the residual ureter, or the kidneys.

Case 3. C. H. (C.C.H. U-2328), a 63-year-old woman, was operated upon for stage IV squamous cell carcinoma of the cervix. At operation the tumor was found to have extended from the cervix to the left ureterovesical area producing complete obstruction of the left ureter. A Wertheim type of hysterectomy with bilateral salpingo-oophorectomy and radical lymph node dissection were done. In addition, it was necessary to remove the left half of the bladder along with the distal portion of the left ureter. The bladder was closed by means of a double layer of sutures. An isolated ileal segment was prepared, and its proximal end closed. The proximal end of the divided left ureter was anastomosed to the side of the proximal portion of the ileal segment. The distal end of the ileal segment was anastomosed to the remaining dome of the right half of the bladder (Fig. 7). Postoperatively, the patient did well and had an adequate urinary output. On the third postoperative day she died suddenly, presumably from a cerebral embolus. Autopsy was not performed.

Case 4. J. G. (C.C.H. U-11143), a 43-year-old woman, was admitted to this hospital from another city because of a poorly functioning right nephrostomy. A crossed ectopia of the left kidney had been found at operation elsewhere. At that time (May, 1951) the left kidney was removed from the right side of the pelvis. A cyst of the lower pole of the right kidney was also found, but an attempt to remove the cyst was unsuccessful, and the right ureter was partially excised in the process. At a second operation during that same hospital admission, the renal cyst was removed and a permanent right nephrostomy was created (Fig. 8). During the subsequent two and a half years the patient suffered frequent episodes of pyelitis. Azotemia developed. At operation, at Cleveland City Hospital on August 13, 1953, what appeared to be about one-half of the right kidney with a thickened pelvis was found. No ureteral segment could be identified. The defect between the renal pelvis and the bladder was bridged by using a 25 cm. isolated segment of ileum to serve as a substitute ureter. One end of the segment was anastomosed to the pelvis of the kidney and the other to the dome of the bladder (Fig. 9). Urine was recovered from the bladder by the time the operation was concluded. A urinary fistula developed in the right flank and healed after three weeks. The pyeloileal neocystostomy functioned well and the patient returned home (Fig. 10). Six months after the ileal transplant the pa-

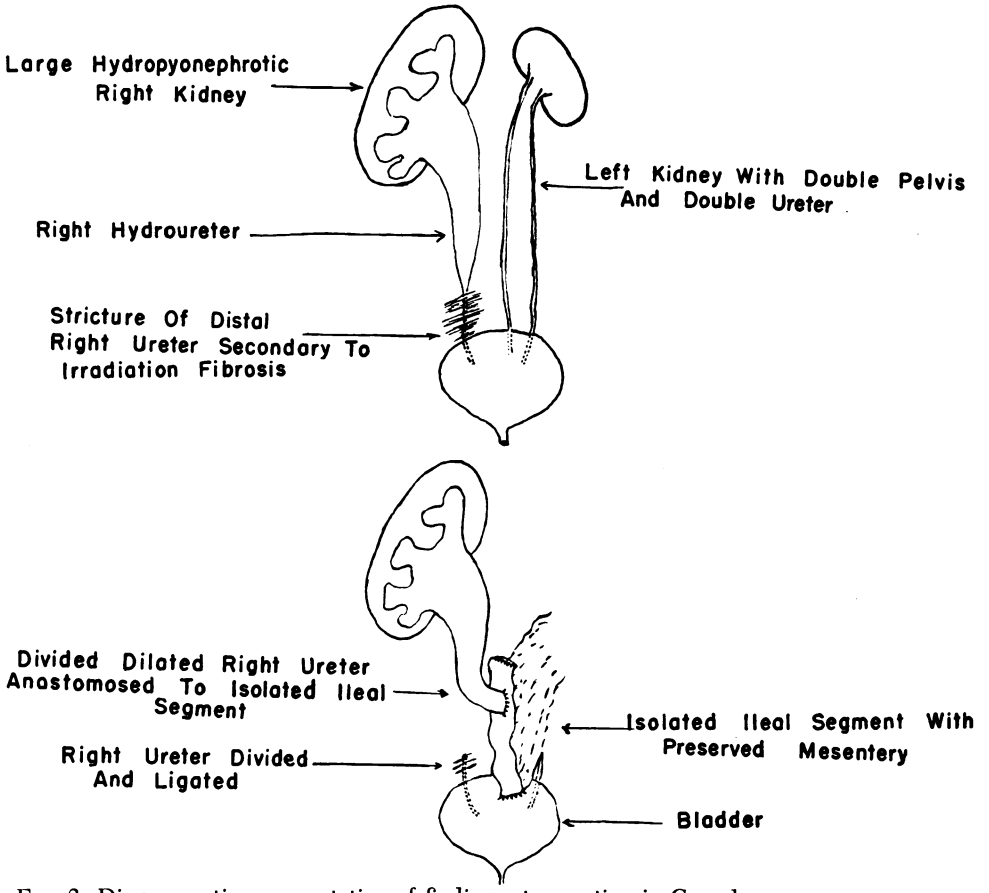

FIG. 2. Diagrammatic representation of findings at operation in Case 1.
FIG. 3. Diagrammatic representation of ureteroileal neocystectomy as carried out in Case 1.

tient developed jaundice. Surgical exploration of the biliary tract was undertaken at another hospital and hepatitis was found. The patient subsequently developed infection in the wound and died of a staphylococcus bacteremia. An autopsy was not performed.

Case 5. F. M. (C.C.H. U-16747), a 44-year-old woman, was operated upon because of a stage I carcinoma of the cervix. Radical hysterectomy was done. During the procedure the left ureter was inadvertently severed. Immediate end-to-end anastomosis was done. Nineteen days after operation excretory urograms revealed dilated and blunted caliceal cups and the left ureter was not visualized distal to the level of the true pelvis (Fig. 11). Subsequently, the patient developed repeated attacks of pyelonephritis, with severe chills and fever. Retrograde passage of a ureteral catheter past the point of anastomosis was found to be impossible. Exploration was carried out two months after the hysterectomy. The site of anastomosis was found encased in inflammatory tissue, with the proximal segment of ureter dilated to twice normal size. The ureter was divided proximal to its point of obstruction and a left ureteroileal neocystostomy was completed. The patient made an uneventful recovery, and excretory urograms made one week after operation revealed normal kidneys bilaterally (Fig. 12). Chemical data from examination of the blood are reported in Table I. The patient, when seen three months postoperatively, was well, and intravenous pyelograms showed the left kidney to be normal.

DISCUSSION

The usefulness of isolated ileal segments for providing external urinary drainage has received ample support.[1] With the exception of the operation reported by Nissen in 1940,[12] for which the outcome is not known, only Foret and Hensglein[6] and Rack[14] have reported the use of ileal segments in single cases to join the ureter to the bladder, there-

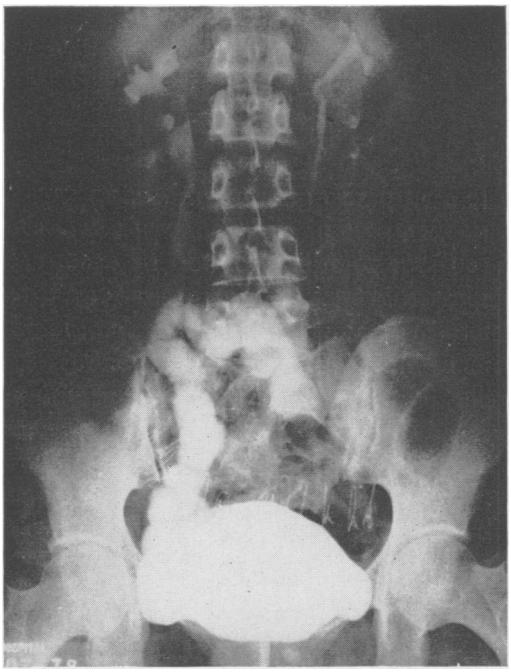

FIG. 4. Cystogram made during course of intravenous pyelography two months after right ureteroileal neocystostomy in Case 1, showing ileal segment serving as substitute right ureter and some resolution of right hydropyonephrosis present before operation.

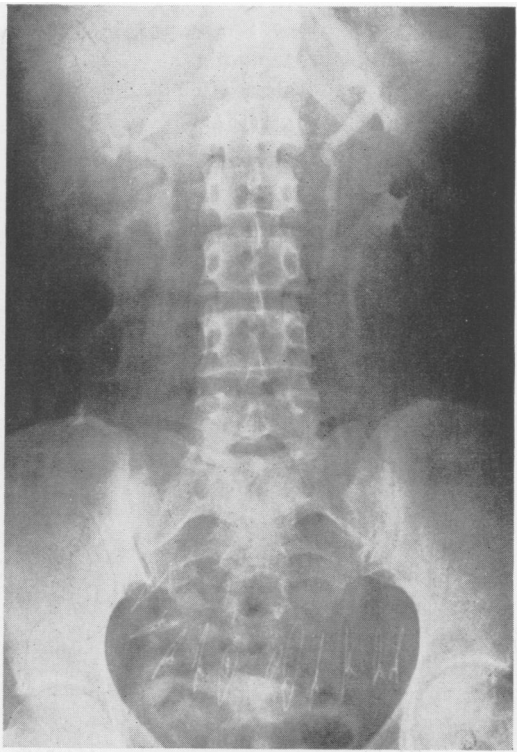

FIG. 5. Intravenous pyelogram made twelve months after right ureteroileal neocystostomy in Case 1, showing an essentially normal right kidney.

by providing internal drainage for the kidney. The results presented in this report indicate that, in selected cases, ureteroileal or pyeloileal neocystostomy is a suitable procedure.

While demonstrating the feasibility of the operation in animal experiments, Davids and Lesnick[5] and McLean and Fais[11] encountered difficulties with the ureteroileal anastomosis. In the patients reported here, mucosa-to-mucosa anastomosis was done in the technic described by Cordonnier[3] for ureterosigmoidostomy. No difficulties were encountered referable to the ureteroileal suture.

Examination of the blood chemical data suggests that if absorption of urinary excretory products does occur through the

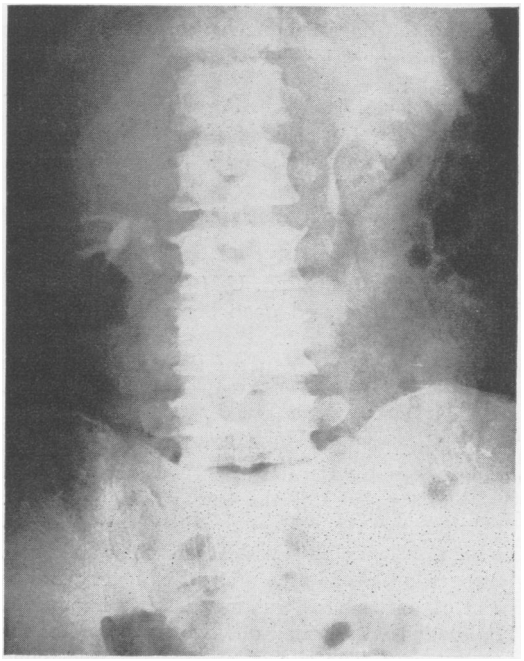

FIG. 6

FIG. 6. Intravenous pyelogram (radiograph made five minutes after injection of contrast media) made five months after left ureteroileal neocystostomy in Case 2, revealing an essentially normal left kidney pelvis.

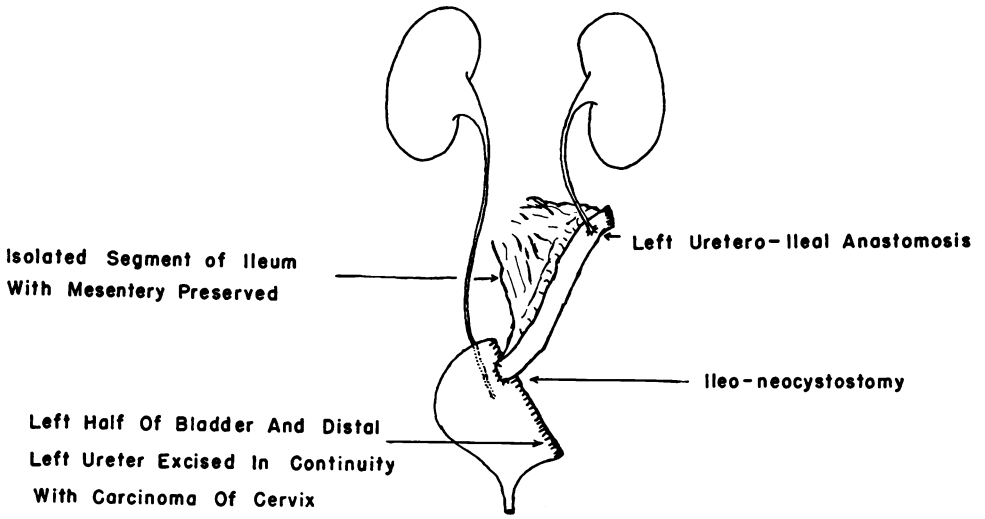

FIG. 7. Diagrammatic representation of left ureteroileal neocystectomy as carried out in Case 3, following radical hysterectomy, distal left ureterectomy and hemicystectomy.

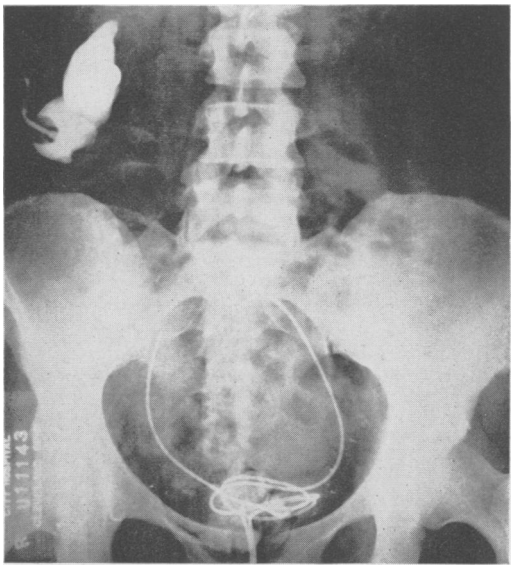

FIG. 8. Radiograph of the abdomen in Case 4, made before pyeloileal neocystostomy. Two and one-half years before, an ectopic left kidney had been removed from the right pelvis, the left ureter ligated, the right ureter partially excised, and a permanent right nephrostomy created after removal of a right renal cyst. The ureteral catheters demonstrate the level of ureteral obstruction bilaterally. Contrast media injected through the nephrostomy tube in the right flank outline the right kidney pelvis.

ileal segment, it is of no consequence if the kidneys are normal (Case 1). McLean and Fais[11] found no proof for absorption of nitrogenous products from the isolated segment of ileum in their experimental animals. Chemical imbalance was observed in three of the five patients, but all of these had urinary tract infection and impaired renal function. The important factor is the abnormal renal function and not any possible reabsorption of urinary products. This is confirmatory of the observations of Lapides[8] on the nature of the chemical imbalance in the blood after ureterosigmoidostomy. The usual abnormality observed after ureterointestinal anastomosis is hyperchloremic acidosis. The three patients with chemical imbalance reported above showed hypochloremia, with a tendency toward alkalosis. They had no abnormal loss of chloride from the gastro-intestinal tract. The hypochloremia may have resulted from a disturbance of the renal threshold for chloride, but data are not available for settling this question.

Every effort was made to introduce the isolated segment of ileum in an isoperistaltic manner. This was possible in four of the five patients. In one patient (Case 4) the ileal segment could not have been intro-

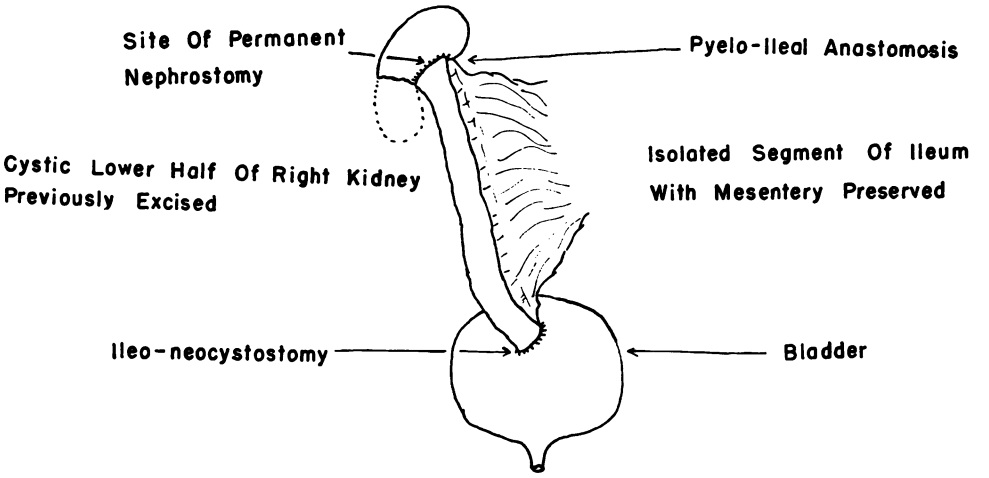

FIG. 9. Diagrammatic representation of right pyeloileal neocystectomy as carried out in Case 4. Area below right kidney indicated by broken line represents renal cyst previously excised.

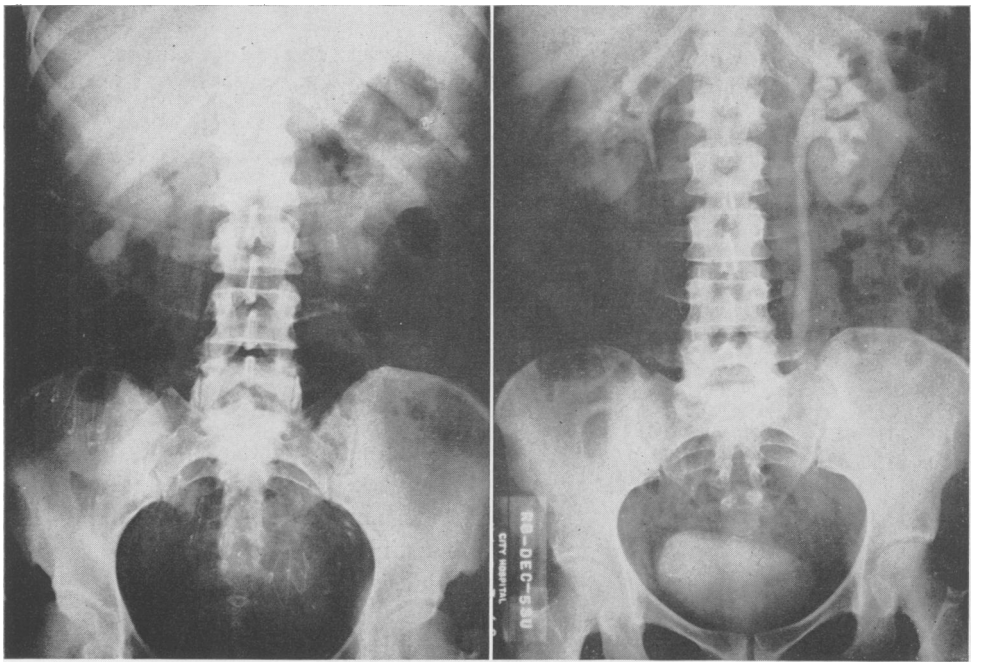

FIG. 10. Intravenous pyelogram made in Case 4 four months postoperatively after pyeloileal-neocystostomy, showing visualization of the right kidney despite chronic azotemia of two years' duration.

FIG. 11. Intravenous pyelogram made 19 days after radical hysterectomy in Case 5, showing dilated caliceal cups of the left kidney, dilatation of the proximal left ureter, and non-visualization of the distal left ureter.

duced isoperistaltically because of its length. It was sutured between the renal pelvis and the urinary bladder in an anti-peristaltic relationship because any other position compromised the blood supply to the segment. There was no conclusive evidence that this position interfered with drainage from the kidney.

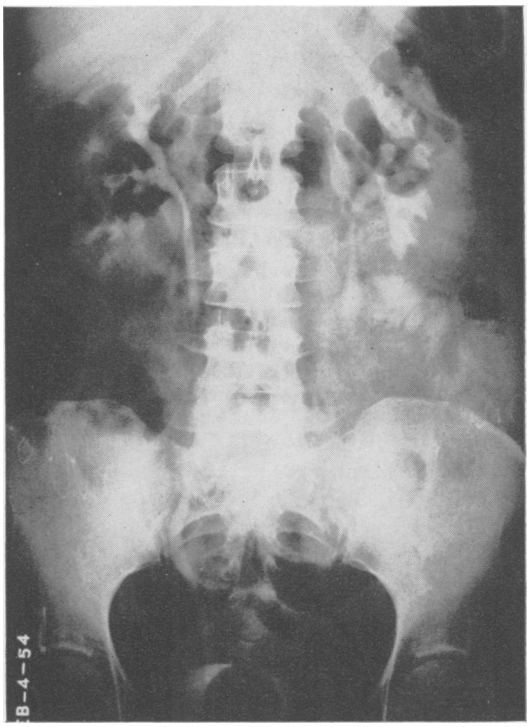

FIG. 12. Normal intravenous pyelogram made one week postoperatively in Case 5 after left ureteroileal neocystostomy. The ileal segment is partially filled with contrast media.

TABLE I. *Blood and Serum Chemical Values (Case 5).*

Ureteroileal Neocystostomy Performed on January 28, 1954	Feb. 1 1954	Feb. 3 1954	Feb. 17 1954	Feb. 22 1954
Blood urea nitrogen, mg./100 cc.....	11.2	8.4	8.4	14
CO_2 combining power, mEq.....	36.9	37.8	33.7	20.7
Chlorides, milliequivalents.....	76.5	75	87	102.6
Sodium, milliequivalents.....	128	128	128	125
Potassium, milliequivalents.....	2.4	—	3.1	3.4

Of particular interest is the demonstration that the kidney and its excretory passages can return to an essentially normal state even after prolonged obstruction and hydronephrosis. Case 1 had had ureteral obstruction for nine months before the ureteroileal neocystostomy, and Case 5 had been obstructed for two and a half months.

CONCLUSION

Isolated segments of ileum can successfully be used in man to anastomose the ureter or the renal pelvis to the urinary bladder when long segments of ureter are sacrificed because of injury or disease.

BIBLIOGRAPHY

1 Bricker, E. M.: Bladder Substitution After Pelvic Evisceration. S. Clin. N. Amer., **30:** 1511, 1950.

2 Coffey, R. C.: The Relative Merits of Three Types of Technique for Submucous Implantation of the Ureters into the Large Intestine. The West. J. Surg., **41:** 311, 1933.

3 Cordonnier, J. J.: Ureterosigmoid Anastomosis. Surg., Gyn. and Obst., **88:** 441, 1949.

4 Creevy, C. D.: Facts about Ureterosigmoidostomy. J. A. M. A., **151:** 120, 1953.

5 Davids, A. M., and G. J. Lesnick: Experimental Reconstruction of Ureters by Substitution of Small Bowel Segments Ann. Surg., **137:** 389, 1953.

6 Foret, J., and Hensglein: Replacement of both Ureters by an Ileal Graft. Lancet, **264:** 1181, 1953.

7 Higgins, C. C.: Transuretero-Ureteral Anastomosis. Tr. Am. Assoc. Genito-Urinary Surgeons, **27:** 279, 1934.

8 Lapides, J.: Mechanism of Electrolyte Imbalance Following Ureterosigmoid Transplantation. Surg., Gyn. and Obst., **93:** 691, 1951.

9 Lord, J. W., Jr., and J. H. Echel: The Use of Vitallium Tubes in the Urinary Tract of the Dog. J. Urol., **48:** 412, 1942.

10 Lord, J. W., Jr., P. L. Stefka and A. R. Stevens: On Bridging a Gap in the Ureter by Means of a Free Fascial Transplant over a Straight Vitallium Tube: an Experimental Study. J. Urol., **49:** 249, 1943.

11 McLean, D. W., and O. G. Fais: The Use of Segments of Small Intestine as Ureters. J. Urol., **68:** 190, 1952.

12 Nissen, R.: Reconstruction of the Ureter. J. Internat. Coll. Surgeons, **3:** 99, 1940.

13 Ocherblad, N. F.: Reimplantation of the Ureter into the Bladder by a Flap Method. J. Urol., **57:** 845, 1947.

14 Rack, F. J.: Ureteroileal Neocystostomy. J. A. M. A., **152:** 516, 1953.