

## THE ILEOCOLIC SEGMENT IN UROLOGIC SURGERY

J. M. GIL-VERNET, JR.

*From the Department of Urology, School of Medicine, University of Barcelona, Spain*

When, in 1957, we wrote on ileocystoplasty versus colocolocystoplasty<sup>1</sup> we started a controversy about which of the two intestinal segments would be the more appropriate for enterocystoplasty. The sigmoid colon seems to be the more advantageous for total or partial bladder substitution. This fact has been proven by clinical results.

The ileum, because of its urine-conveying properties, apparently is more suitable for ureteral substitution.

We have used the sigmoid colon in 158 cases of vesicoplasty and the ileum in 33 cases of ureteroplasty.

A logical eagerness to improve our results induced us to use the ileocolic segment. In 1956, together with Arandes Adan,<sup>2, 3</sup> we reported a case of contracted bladder, ureteritis and a solitary kidney. This was the first time that the ileocolic segment was utilized to enlarge a small bladder and also provided a substitute for the ureter. Since then we have amended and extended the indications for this operation in many vesical and ureteral lesions.

When techniques 1 and 2 for construction of a functioning artificial bladder were described,<sup>4</sup> we stated that ureteral reflux almost always followed the procedure. However this type of reflux tends to disappear with time, and usually does not result in upper urinary tract infection. Instead, the reflux causes dilatation of the pyelocalyceal system from which secondary infection may develop or calculi may form, although the latter possibility has not been observed.

In previously irradiated patients plastic surgery cannot be contemplated until at least 3 months have elapsed.<sup>5</sup> Even so, complications are frequent and dreadful.

In patients with small tuberculous bladders, solitary kidney, large hydronephrosis, renal in-

sufficiency and infected urine, urinary diversion must be provided, for instance by means of a nephrostomy tube, 20 or 30 days before colocolocystoplasty is done. This will permit eradication of infection, put the pyelocalyceal system at rest, improve the renal function, and permit, through the nephrostomy tube, radiographic studies of the excretory system. The drainage tube is left in place at least 12 to 15 days (enterocystoplasty) which will permit, at the same time, dry healing of the vesicolic anastomosis and its defunctionalization as well.

However, two-stage operations are not justified for total bladder substitution because cutaneous ureterostomies or transileal ones jeopardize the surgical future of the patient. If both ureters are obstructed by tumor, which is the cause of hyperazotemia, upper urinary tract dilatation, and anemia, etc., the neoplasm is beyond the limits of operability.

The first stage of the operation (total or subtotal cystectomy) is extraperitoneal. One must avoid entering the peritoneal cavity during the bladder detachment maneuver. This permits working under strict aseptic conditions, away from all the intraperitoneal structures, and prevents leakage of urine and blood into the peritoneal cavity, which is one of the causes of intestinal adhesions.

In cases of enterocystoplasty for small tuberculous bladder, a complete resection of the pathologic detrusor is a must.

Re-establishment of intestinal continuity in one layer is far superior to the usual 2 layers, thus avoiding postoperative complications.

A good confrontation of both the vesical and the intestinal mucosa is necessary but difficult to accomplish in the depth of the pelvic excavation, particularly with the posterior suture layers, so that the excess of mucosa from the intestinal segment and bladder openings must be excised about 2 or 3 cm. in order to avoid eversion, which constitutes one of the causes of urinary fistula.

Especial attention must be given the rough surfaces (where intestinal obstruction is likely to develop). After the ileocolic segment has been

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<sup>1</sup> J. d'urolog., **63**: 466, 1957.

<sup>2</sup> J. d'urolog., **62**: 491, 1956.

<sup>3</sup> J. d'urolog., **62**: 674, 1956.

<sup>4</sup> J. Urol., **83**: 39, 1960.

<sup>5</sup> Gil-Vernet, J. M.: Official Report at the VI Spanish Surgical Congress. Cir. Gin. Urol., **17**: 4, 1963.

isolated, a large surface is exposed where adhesions are likely to form. The covering of large peritoneal losses must not be attempted; instead, they must be covered by the aid of a large surface from the small intestinal loops, which will be sutured and fastened to the edges of the peritoneal opening (method of guided production of intestinal adhesions).

When the ileocolic segment is used, this must remain in such a position that neither the sharp ileocecal angle or flexure, nor the blunt ileocolic one is disturbed. The disappearance of both these

anatomo-physiologic angles may imply insufficiency of Bauhin's valve. The ileal segment interposed between the ureter and the cecum must be under no undue tension.

Defunctionalization of the colon by cecostomy or cutaneous appendicostomy is a must in cases of extremely obese patients and those in poor general condition.

Of primary importance is drainage of the cavity and extracavitary spaces.

Some of these operations require from 5 to 6 hours for completion.

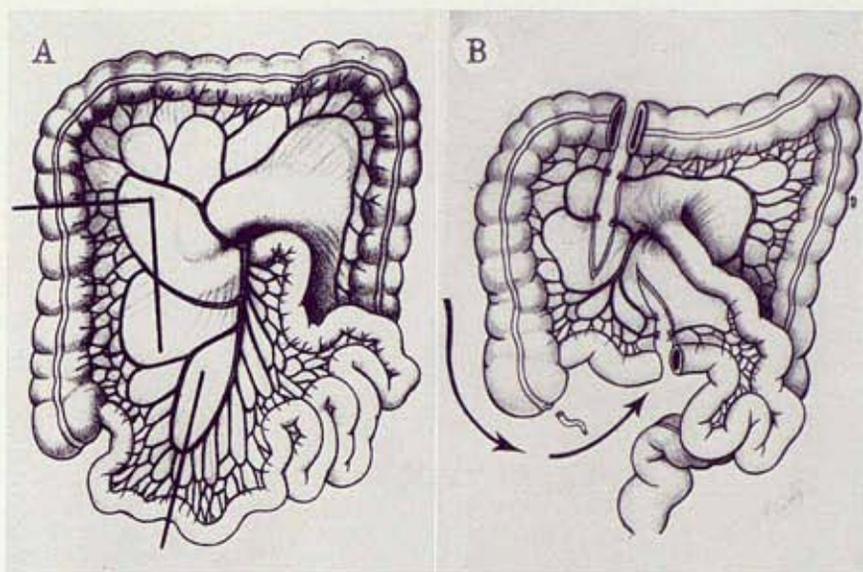


FIG. 1. *A*, exclusion of ileocolic segment and debridement of its mesentery. *B*, in some cases exclusion of ascending colon and part of transverse may be necessary. Entire segment being irrigated by ileocolic artery.

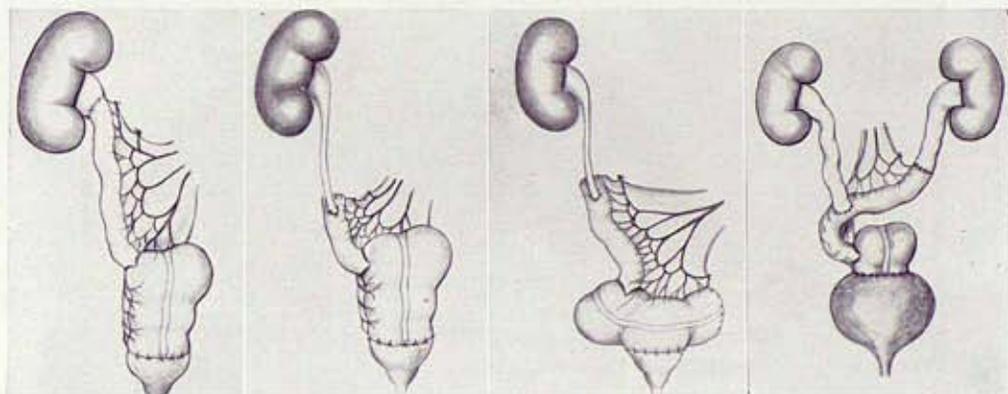


FIG. 2. Different mounts of ileocolic segment

## TECHNIQUE

Once the peritoneal cavity has been opened and the structure of the right colon verified, one proceeds with right parietocolic detachment, usually up to the hepatic flexure.

Surgical interruption of the ileum usually takes place 20 to 30 cm. from the ileocecal valve, which permits observation of the vascular sup-

ply. Usually, the right mid-colic artery is clamped and ligated from below its anastomosis with the inferior and superior or right colic artery. The paracolic arcade is ligated at the level of the hepatic flexure and divided by previous suturing of the colon with Petz's apparatus or by any of the usual means.

Transverse division of the mesocolon is done

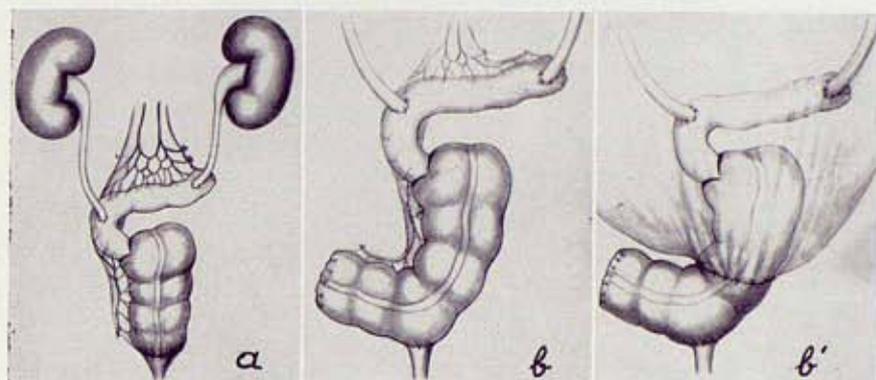


FIG. 3. Total substitution of bladder by ileocolic segment. *a*, End-to-end with prostatic apex. *b* and *b'*, Side-to-end.

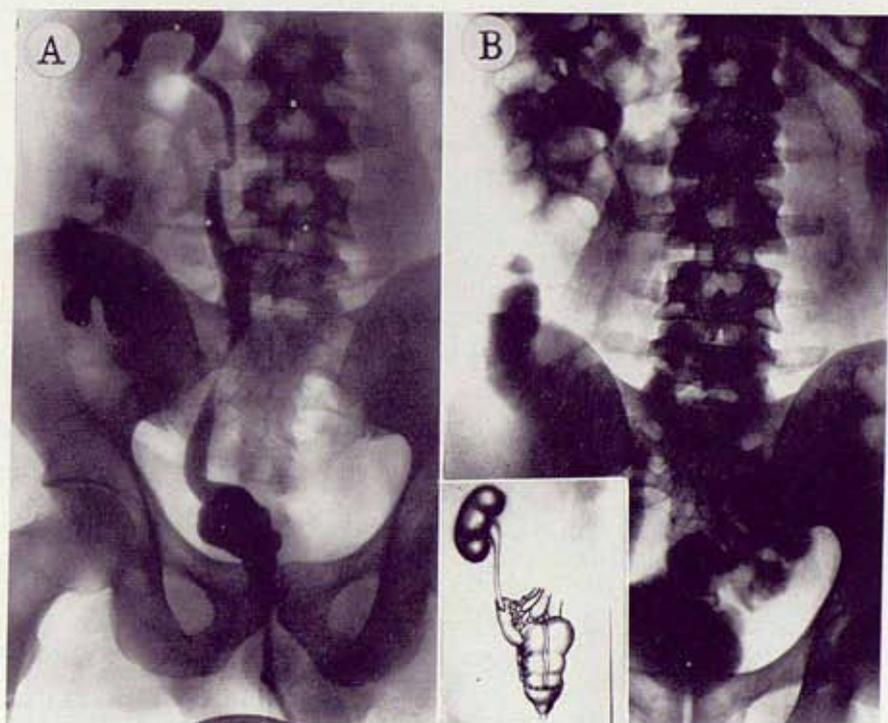


FIG. 4. Observation 1. *A*, urinary tuberculous. Solitary kidney. Retrograde cystography. Contracted bladder and ureteral reflux. Micturition every 10 minutes. *B*, excretory urogram after ureteroileocolocystoplasty. Micturition every 3½ hours.

from below the arterial arcade, and close to the ileocolic vascular pedicle, the only artery which will supply the whole segment.

A rectal tube is inserted through the ileal end. An antibiotic solution (200 cc) is instilled for cecocolic irrigation. The solution will be left in place until intestinal continuity is re-established by ileotransversostomy.

A counter-clockwise rotation of the intestinal loop is done in order to place it in isoperistaltism, passing it through a peritoneal opening over Douglas' pouch in such a way that half of the isolated intestinal segment is extraperitoneal and

the other half, intraperitoneal. Slight rotation of this ileocecolic segment does not interfere in any way with its blood supply. Anastomosis with the small bladder can be either end-to-side or side-to-side.

In a functioning artificial bladder, the anastomosis with the urethra takes place in a side-to-end manner, the haustra from the cecum being useful for that purpose. This type of anastomosis is preferable to end-to-end due to the different caliber of both anastomotic openings.

Both ureters are reimplanted into the ileum, the anastomosis being done in accordance with

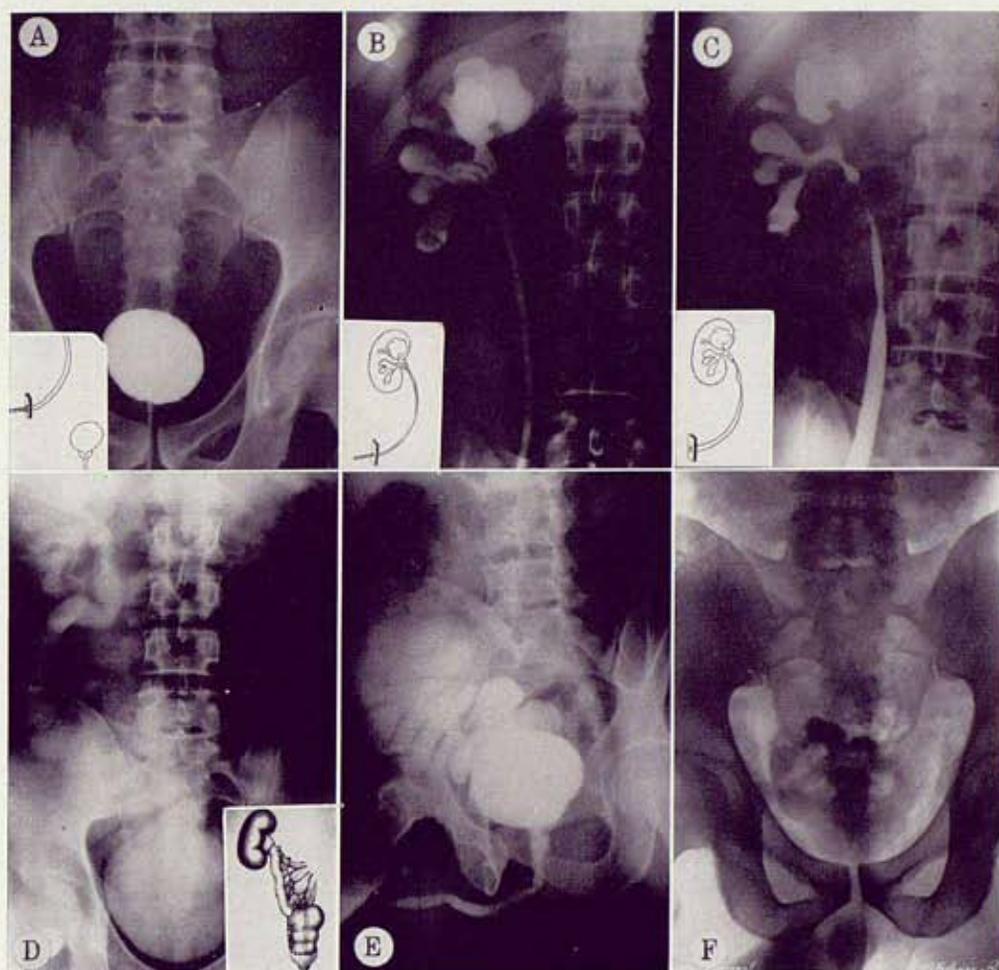


FIG. 5. Observation 2. *A*, retrograde cystography. Contracted tuberculous bladder. *B*, definitive cutaneous ureterostomy on solitary kidney for renal insufficiency and contracted tuberculous bladder. Retrograde ureteropyelography. *C*, retrograde ureteropyelography. Pyelonephritis, retraction of renal pelvis and ureteritis originated by catheter. *D*, excretory urogram 4 years after total substitution of ureter and partial bladder by ileocolic segment. *E*, micturition cystourethrography. Bauhin valve is competent. No ureteral reflux. *F*, post-micturition. Residue unappreciable.

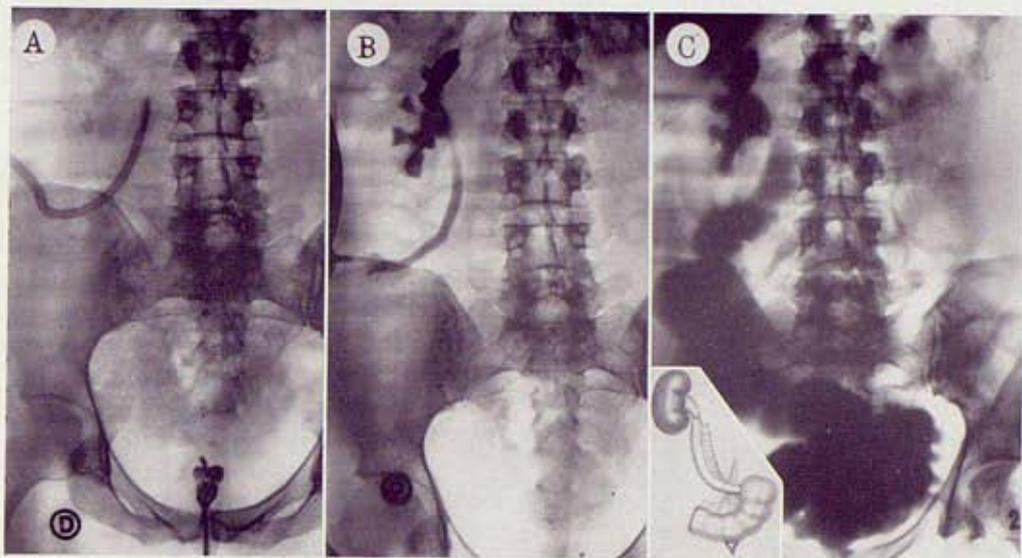


FIG. 6. Observation 3. *A*, urinary tuberculosis. Solitary kidney. Cutaneous ureterostomy with renal calculi and pyelonephritis. Cystography; contracted bladder. *B*, retrograde ureteropyelography through cutaneous stoma. *C*, result after total substitution of ureter and bladder by ileocolic segment. Micturition every 5 hours.

usual methods. If both are dilated they are reimplanted by the aid of metallic rings, thereby avoiding stenosis.

The right ureter is reimplanted at a distance not less than 10 cm. from the ileocecal valve and the left one, 2 cm. from the closed ileal end, ureteral catheters being always utilized at this stage. The right ureteroileal anastomosis must be done in such a way as to avoid undue kinking of the ileal loop which would result in poor drainage of the distal segment. In one of our cases kinking was the cause of a severe paralytic ileus, which necessitated another operation.

Both the ileal segment and the ureteral anastomosis are intraperitoneal.

When a side-to-end anastomosis between the colon and the urethra has been made, an 18F T tube is left in place to drain the newly formed bladder.

In the end-to-side anastomosis between the colon and the remainder of the bladder, a drainage system will be established by a 22F urethral catheter, preferably the Malecot 4-wing type.

Intestinal continuity is re-established by a side-to-side ileotransversostomy in 2 layers and close to the colonic stump to avoid the blind loop syndrome.

In total substitution of the right ureter as well as in partial substitution of the bladder (tuber-

culosis of the bladder and ureter with a solitary kidney) the ileal segment with its mesocolon will cover the rough surface bed resulting from isolation of the ascending colon. The anastomosis between the proximal end of the ileum and the renal pelvis can be done through a regular kidney incision at the same time, or in a second stage. In the latter case the ileum is left in the renal fossa fixing it in place with a few sutures of black silk long enough to be easily identified.

In a substitution of the left ureter, the proximal end of the ileum must be passed through the descending mesocolon for anastomosis with the renal pelvis.

Anastomosis between the colon and the bladder as well as with the urethra is done according to the aforementioned techniques.

In vesicoureteral substitutions, the technical modalities and potentialities of the ileocolic segment are multiple. See figures 1 to 9.

The indications for this method are numerous. The procedure is used not only for partial or total bladder enlargement but for total or partial substitution of both ureters and their valve-like mechanism as well.

In such cases, the measurements of the ileocolic segment will vary according to the clinical indications.

The ileal portion will have an increased length

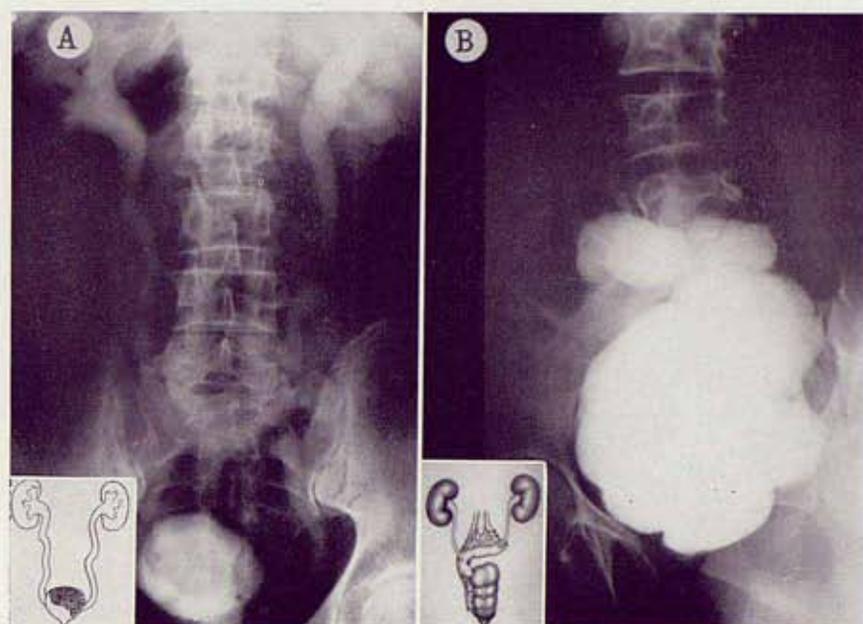


FIG. 7. Observation 4. *A*, preoperative excretory urogram. Infiltrating tumor of bladder with notable ureteral repercussion on both sides. *B*, retrograde cystography by pressure, after total prostaticectomy and ileocolic segment substitution. The Bauhin valve has been forced but there is no ureteral reflux. Capacity, 600 cc. Micturition every 5 hours.

in proportion to the extension of the ureters. The colic segment will be limited to the cul de sac of the cecum in order to preserve the function of Bauhin's valve, in this instance the intestinal continuity being re-established by ascending ileocolostomy.

The ileocecal loop is placed in isoperistaltism and in an S-shaped fashion. The proximal end of the ileum will be anastomosed to the renal pelvis or to the upper ureter through the descending mesocolon. The left ureter is reimplanted in the mid-portion between the ileum and cecum to the bladder dome in 2 layers. The bladder incision is made transversely. Thus the anatomic opening will look like a fissure which will be closed during the act of micturition from the detrusor contraction. Therefore reflux of urine to the cecum will be avoided. By this means the atonic megaloureters are replaced by a peristaltic segment together with an efficient valve-like mechanism.

#### DISCUSSION

Use of the ileocolic segment is indicated in cases of retractile cystitis, small bladder with reflux, small bladder and stenosing ureteritis, bladder tumors, and also for the conditions about to be described.

The ureters of patients who have had urinary diversion provided by cutaneous ureterostomy usually have some irreversible lesions due to the presence of catheters and associated infection. Even reimplanting the ureters into an isolated intestinal segment will not establish normal physiology. The ureters are rigid tubes with no possibility for contraction or relaxation. In these cases, generally patients with a solitary kidney and a small bladder, use of the ileocolic segment permits total or partial substitution of ureters.

The ileocolonic segment can be used as a corrective operation in patients who have undergone ileocystoplasty or colocystoplasty and still have pollakiuria due to a poor volumetric capacity from their old isolated intestinal segment or from vesicoureteral reflux.

The ileocolic segment can also be used in a case of small bladder and stenosing ureteritis, usually with a solitary kidney and severe renal insufficiency plus infected hydronephrosis. The operation must be done in three stages to restore a urinary passage and improve the bladder capacity: 1) nephrostomy or pyelostomy, 2) vesicocolic anastomosis and 3) pyelo- or ureteroileal anastomosis.

When the case is one of bilateral megaloureter,

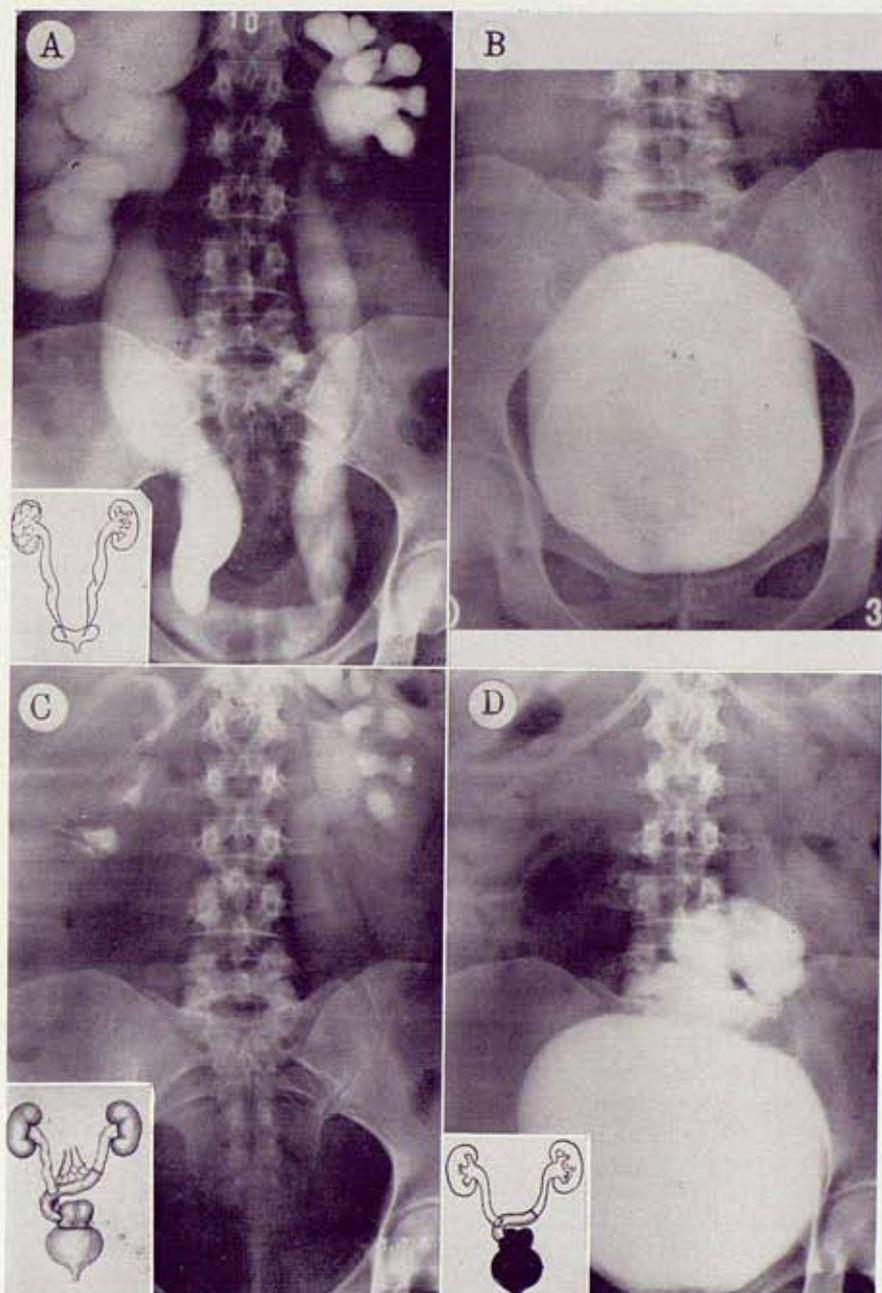


FIG. 8. Observation 5. *A*, retrograde ureteropyelography. Bilateral megaureter. Pronounced hydronephrosis especially on right side. *B*, retrograde cystography. Mega-bladder with no ureteral reflux. Micturition normal, no residue. *C*, excretory urogram after interposition of ileocecal segment. Notable improvement of renal function and excretory tracts on both sides. *D*, postoperative retrograde cystography. Cecal reservoir is filled. Bauhin valve is opposed to ureteral reflux. No vesical residue.

and hydronephrosis and hydroureter have developed, partial or total substitution of these damaged ureters is a must.

According to Cibert, in cases of megaloureters

without reflux, the techniques for bladder reimplantation change the stenosis to reflux, which is just as inconvenient.

Twenty-six patients have been operated on for

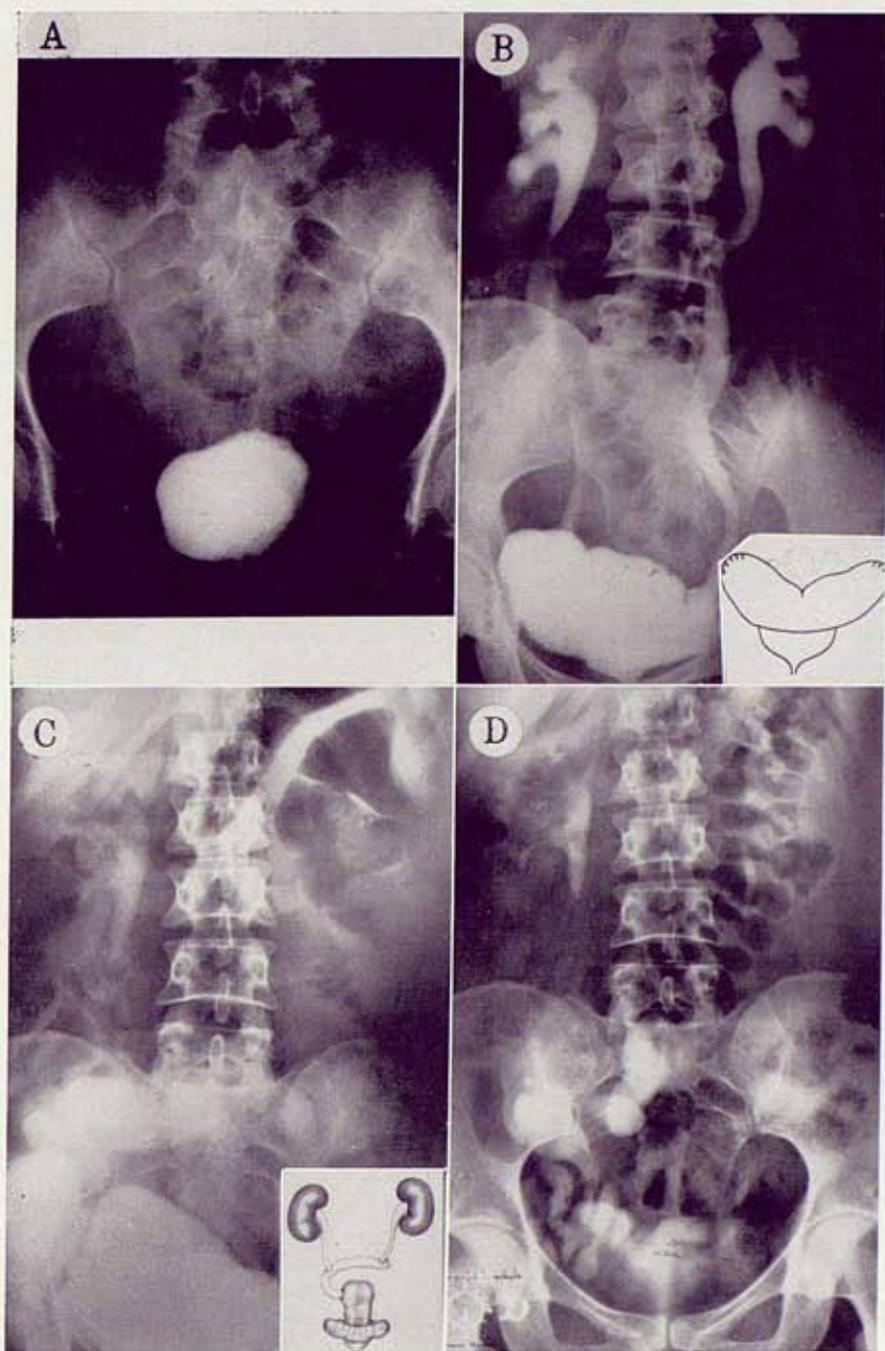


FIG. 9. Observation 6. *A*, contracted bladder by Hunner ulcer. Intense pain on micturition; pollakiuria every 10 minutes. *B*, cystography after 4 years of colocolostomy. Micturition every 2 hours with no disturbance. Notable ureteral reflux. *C*, micturition cystography after double transplant operation. Bivalve implantation on right ureter, left with ring. No reflux on left. Micturition every 4 hours. *D*, excretory urogram after double segment operation. Recuperation of renal function and regression of excretory tracts.

several reasons. Nine of these had a solitary kidney and marked renal insufficiency. In 6 cases the operation was done in 2 stages.

One patient who had carcinoma of the bladder died following operation of peritonitis of unknown cause.

One patient had dysuria and a fibrotic contracture of the vesical neck. One had severe paralytic ileus due to retention of urine in the ileal segment that was initiated by kinking at the level of the right ureteroileal anastomosis. Recovery followed a second operation.

Functional results have been excellent, particularly in those cases with a permanent cutaneous ureterostomy. The patients have been able to resume a normal life without the annoyance from collecting appliances and the threat of

pyelonephritis. The good capacity of the ascending colon has made possible voiding intervals from 4 to 5 hours, satisfactory bladder emptying and a normal forceful urinary stream.

Protection afforded by the ileocecal valve has prevented or at least diminished to a large extent reflux to the kidney. In no case was there any typical symptom from such reflux.

Long-term results obtained by using the ileocolic segment prove that it is far better than ileocystoplasty and colcystoplasty, providing the advantages of both and none of the disadvantages.

The ileocolic segment is a surgical unit, anatomical and functional, the ideal substitute for both the ureter and the bladder.