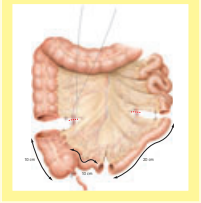
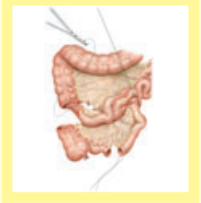
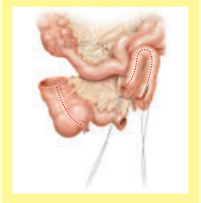
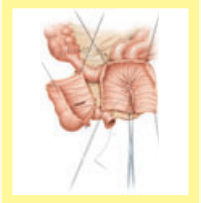
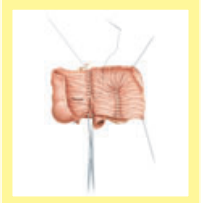
Surgery Illustrated

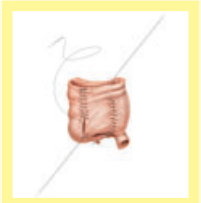












Surgical Atlas

Simplified orthotopic ileocaecal pouch (Mainz pouch) for bladder substitution

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ILLUSTRATIONS by STEPHAN SPITZER, www.spitzer-illustration.com

INTRODUCTION

Since the early 1980s ileocaecal segments have been used in the Mainz pouch technique for orthotopic bladder substitution to the bladder neck or to the urethra [1–3]. The Mainz pouch provides a low-pressure reservoir with good capacity [4]. In orthotopic bladder substitution to the urethra, functional characteristics compare favourably with other types of ileal-pouch bladder substitutes [5].

However, the surgical technique was criticised for being tedious and time-consuming, and that the technique of antirefluxive submucosal tunnel ureteric implantation was not applicable to dilated, irradiated or short ureters.

In 2001 we introduced surgical modifications to simplify the construction of an orthotopic Mainz pouch, and to use the same standardized technique of ureter implantation for normal, dilated and even very short ureters, but still providing antireflux protection [6].

PLANNING AND PREPARATION

Indications. The main indication for orthotopic bladder substitution to the urethra is bladder cancer, when cystoprostatectomy (or cystectomy in females) allows preservation of the sphincteric urethra. This is generally possible in the absence of urothelial cancer in the prostate (bladder neck in females) and at the surgical margins (frozen-section analysis) of the transected urethra. Orthotopic bladder substitution to the trigone (with no ureteric reimplantation) or to the bladder neck is indicated in benign conditions which nevertheless require subtotal cystectomy, e.g. interstitial cystitis or severe detrusor hyper-reflexia. Whether or not ureteric reimplantation into the pouch is preferable depends on the presence or absence of vesico-ureteric obstruction and/or reflux.

Patient selection is critical for the functional success of the procedure; in those aged ≥70 years the results for urinary control become less favourable. In patients with a neurogenic bladder and females, capability and willingness to perform transurethral clean intermittent self-catheterization (CISC) must be checked before surgery. In handicapped and very obese patients catheterization of a continent abdominal stoma might be preferable to transurethral CISC.

SPECIFIC INSTRUMENTS AND MATERIALS

- Optical loupes (×2.5–3.5, 50 cm focal length);
- Headlight;
- Babcock clamps;
- 4/0 glyconate monofilament sutures, double-armed with two 5/8 needles (FR 26) for urethral anastomosis;
- 4/0 poly p-dioxanone monofilament sutures on a 1/2 needle (HR22) for ileo-ascendostomy, pouch suturing;
- 4/0 polydioxanon on a straight needle;
- 4/0 polyglytone monofilament sutures on a 3/8 needle (P-13) for fixation of stents, pouchostomy;
- 7/0 polyglycolic acid braided sutures on a 3/8 needle (DR10) for ureteric anastomosis;
- 6/0 glyconate monofilament sutures on a 1/2 needle (HR13) for ureteric anastomosis;
- 6 and 8 F polyurethane/polypropylene ureteric stents;
- 10 F pigtail pouchostomy catheter;
- Poly GIA-75 staplers (lactomer absorbable copolymer staples).

The day before surgery the bowel is cleansed by administering 3 L of polyethyleneglycol solution. During surgery antibiotics (ampillicin/clavulanic acid and metronidazol) are administered and continued afterward for 7–10 days.

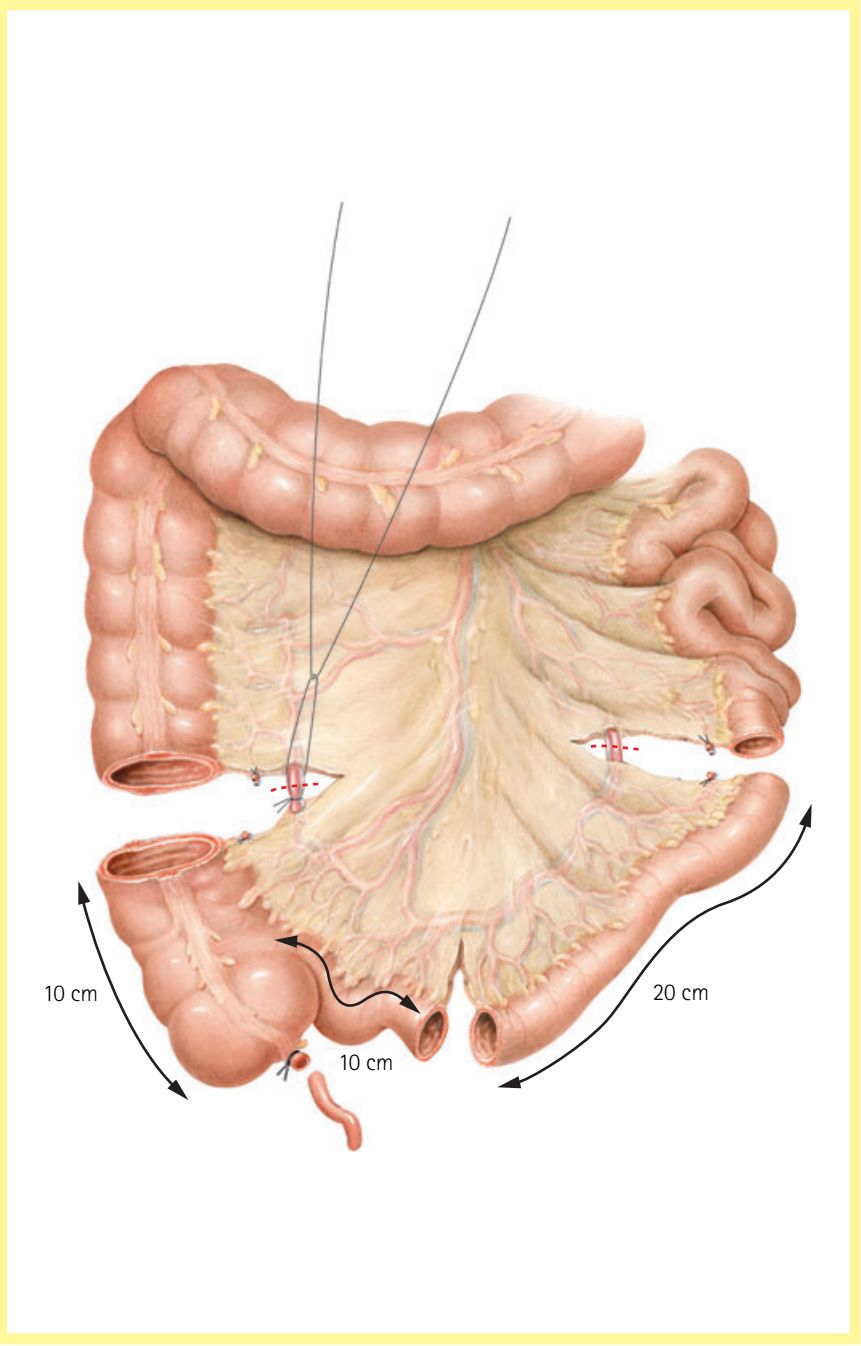
The patient is placed supine on the table, allowing access to the external meatus of the urethra to place a transurethral catheter during surgery. For urethro-intestinal anastomosis, a slight Trendelenburg position is helpful.

INTRAOPERATIVE DECISION-MAKING: SUTURING OR STAPLING THE POUCH?

Whether suturing or stapling of the pouch is used depends primarily on bowel diameter and secondly on the surgeon's preference. In children and patients with a small diameter of small bowel and/or caecum and ascending colon, the standard sutured technique is preferable. In all others, it depends on the surgeon's preference. However, as the length of bowel segments to be resected differs slightly with either technique, this decision has to be made before resecting the bowel. In the following, both the **sutured version (Figs 1–7)** and the **stapled version (Figs 8–16)** are illustrated. If ureters have to be cut short because of irradiation damage or urothelial tumours, again this has to be considered before resecting the bowel segments, to allow ileal **ureteric substitution (Figs 19 and 20)** by resecting a somewhat longer segment of the prevalvular ileum. However, for all variations of pouch formation, techniques of **ureteric implantation and urethral anastomosis (Figs 17 and 18)** are identical.

Figure 1

Sutured version, normal length ureters. The caecum and ascending colon are mobilized up to the hepatic flexure. The terminal 30 cm of ileum and 10 cm of caecum and ascending colon are isolated. A Foley balloon catheter is inserted into the ileum and the excluded bowel segments are irrigated with 1–2 L of saline. Thereafter, the proximal 20 cm of ileum is separated from the terminal 10 cm of prevalvular ileum, with transection of the superficial arcade of the mesentery only. The appendix is resected.



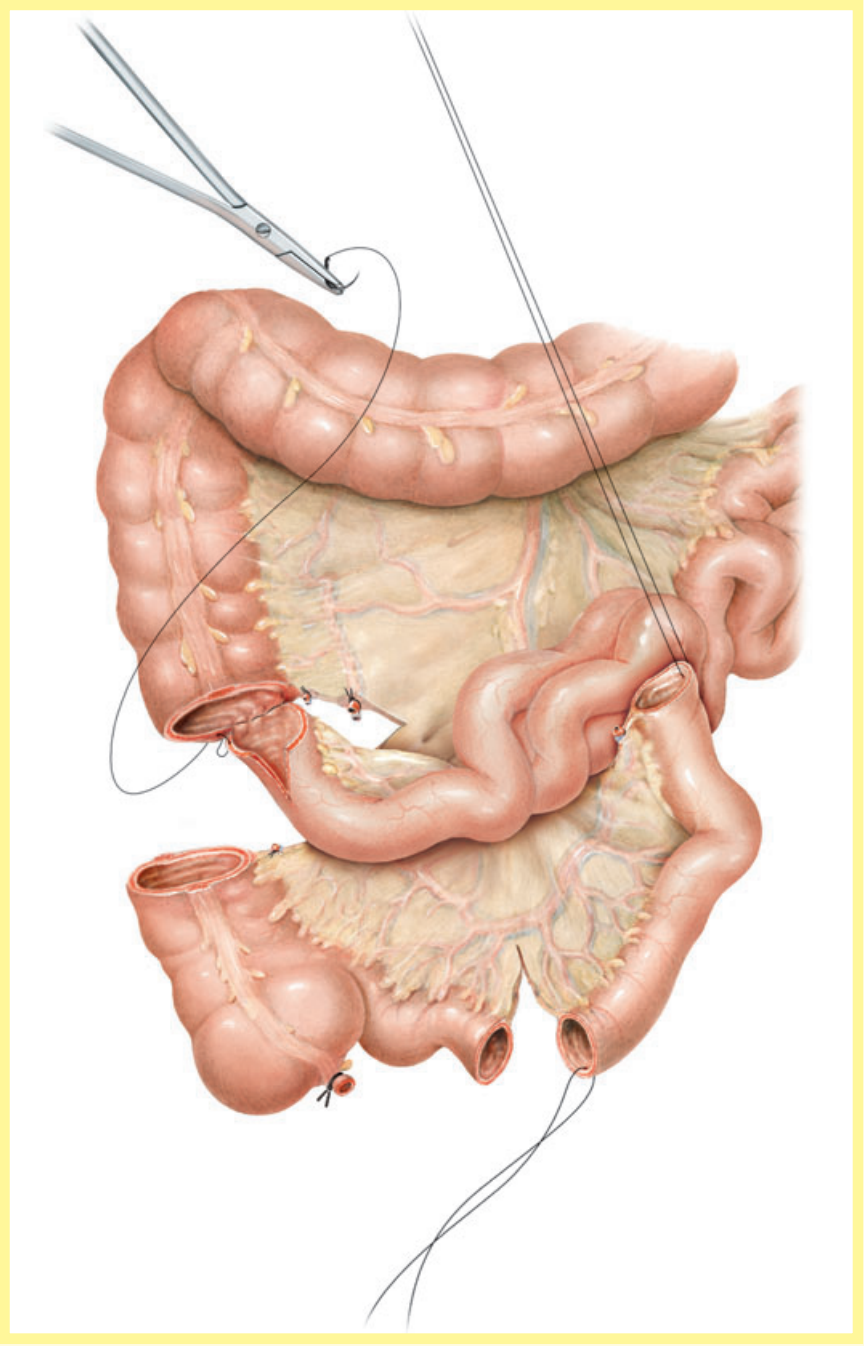
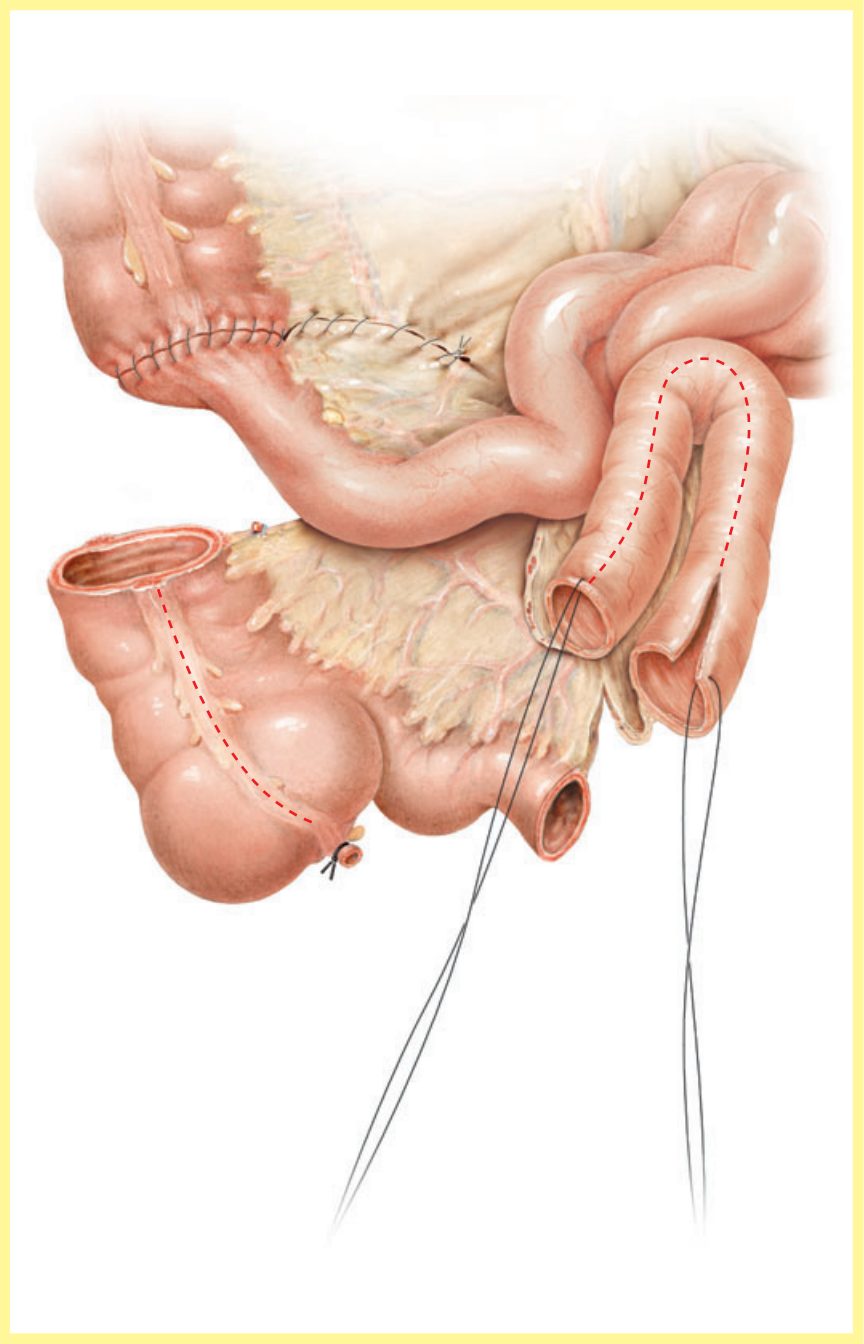


Figure 2

The intestinal continuity is restored by a spatulated end-to-end ileo-ascendostomy. The single-row seromuscular anastomosis is established with two running 4/0 glyconate sutures, here shown for the posterior wall.

Figure 3

The anterior wall of the spatulated end-to-end ileo-ascendostomy has also been closed by a running suture. The separated loop of 20 cm ileum is folded into a U-shape and opened along its antimesenteric border with cautery.



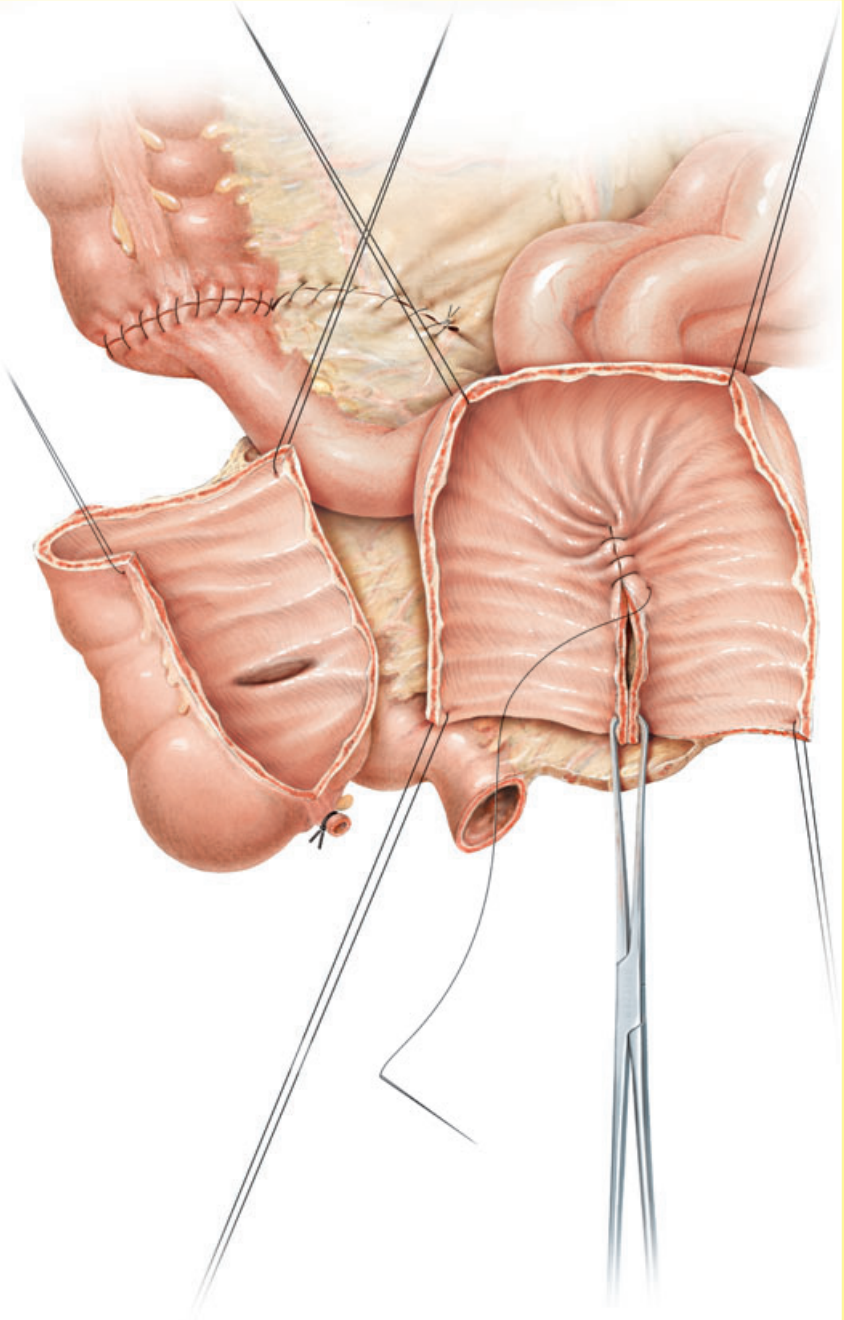


Figure 4

The posterior walls of the opened and into a U-shape arranged ileal segments are joined to each other by side-to-side anastomosis using a single row of all-layer running 4/0 polydioxanon on a straight needle. Stay sutures and Allis clamps help to align the segments. Caecum and ascending colon are opened thereafter at its antimesenteric tenia.

Figure 5

The posterior wall of the pouch is completed by side-to-side anastomosis of colon with the opened ileum. Again, a single row of all-layer 4/0 polydioxanon running sutures on a straight needle are used and the bowel segments are aligned with stay sutures and Allis clamps.

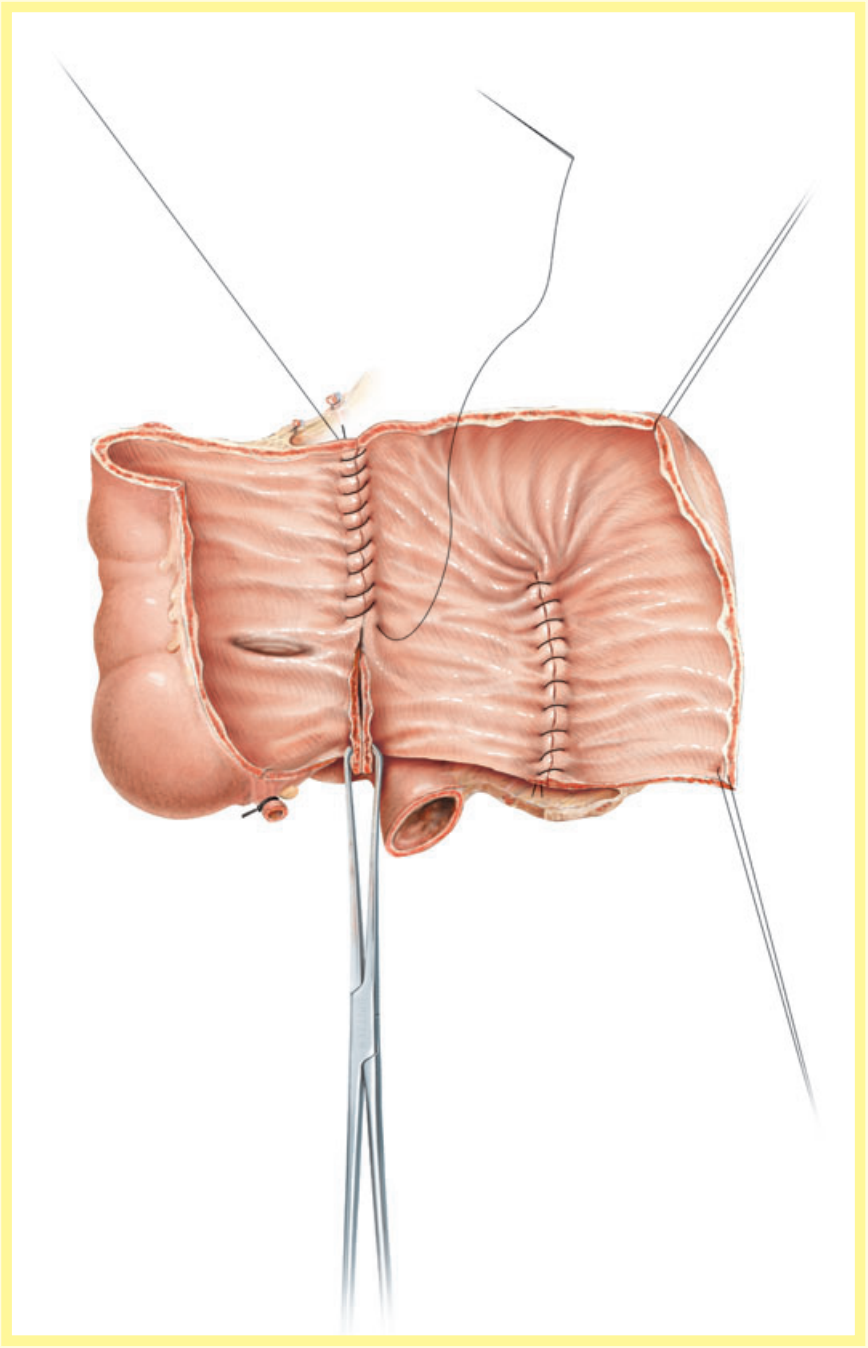
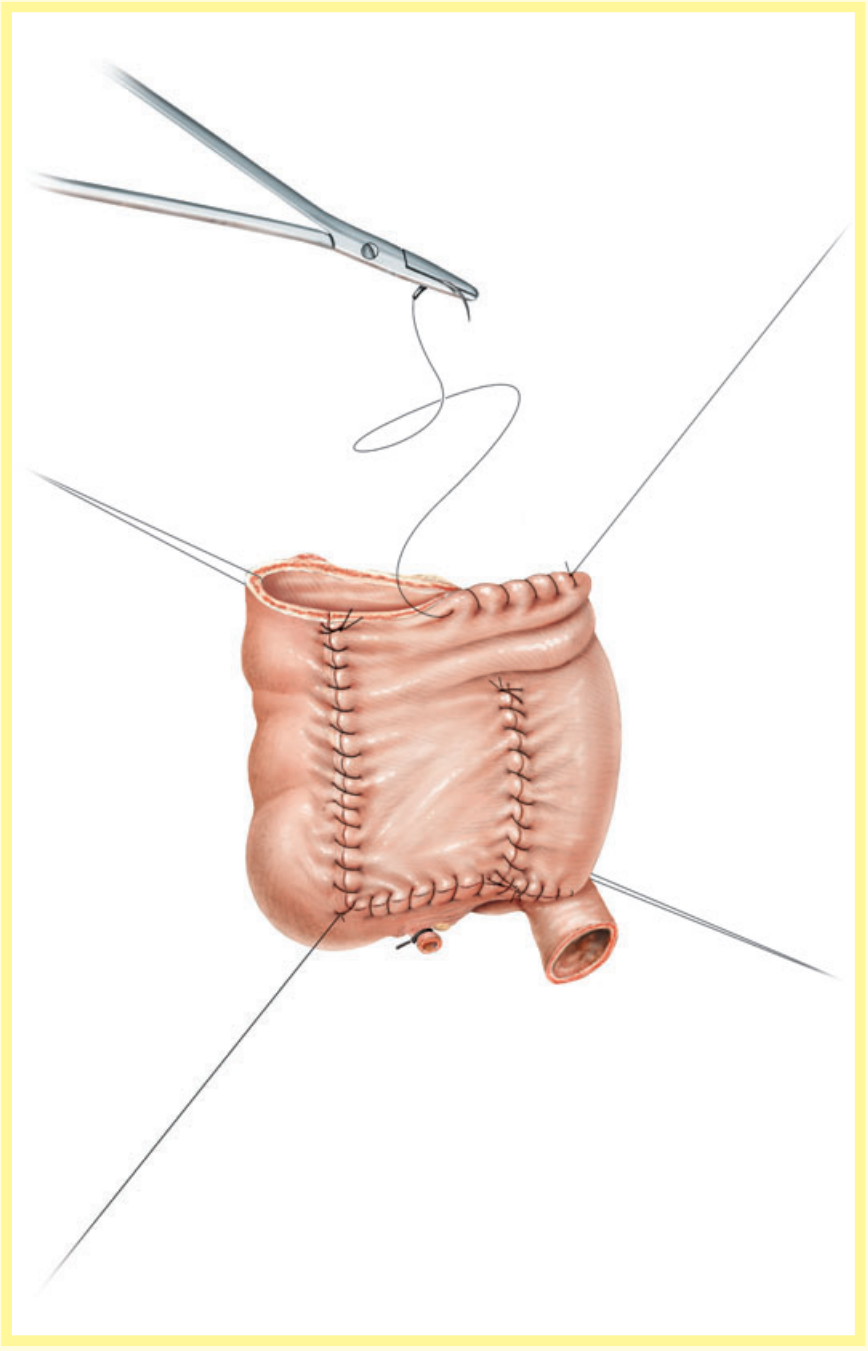


Figure 6

In a door-wing fashion, the bowel segments are opposed to each other and the anterior wall of the pouch is established by side-to-side all-layer running 4/0 polydioxanon sutures on a straight needle of ileum and colon.

Figure 7

The lower and the upper aspects of the pouch are closed, again using a single row of all-layer 4/0 running glyconate sutures.



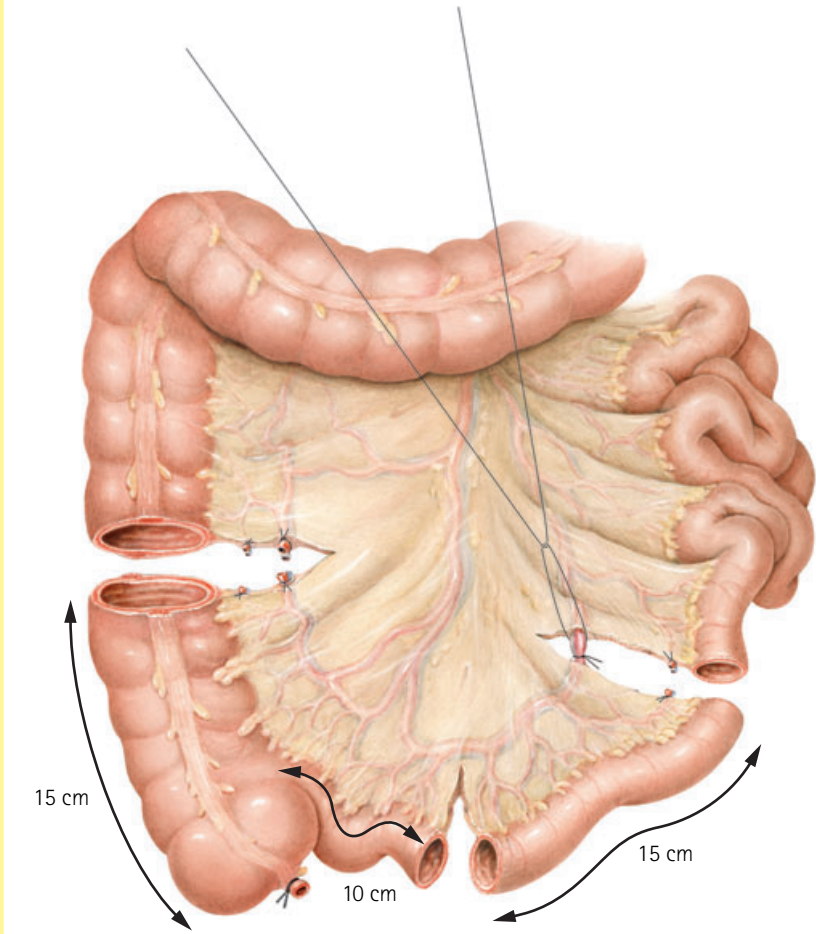
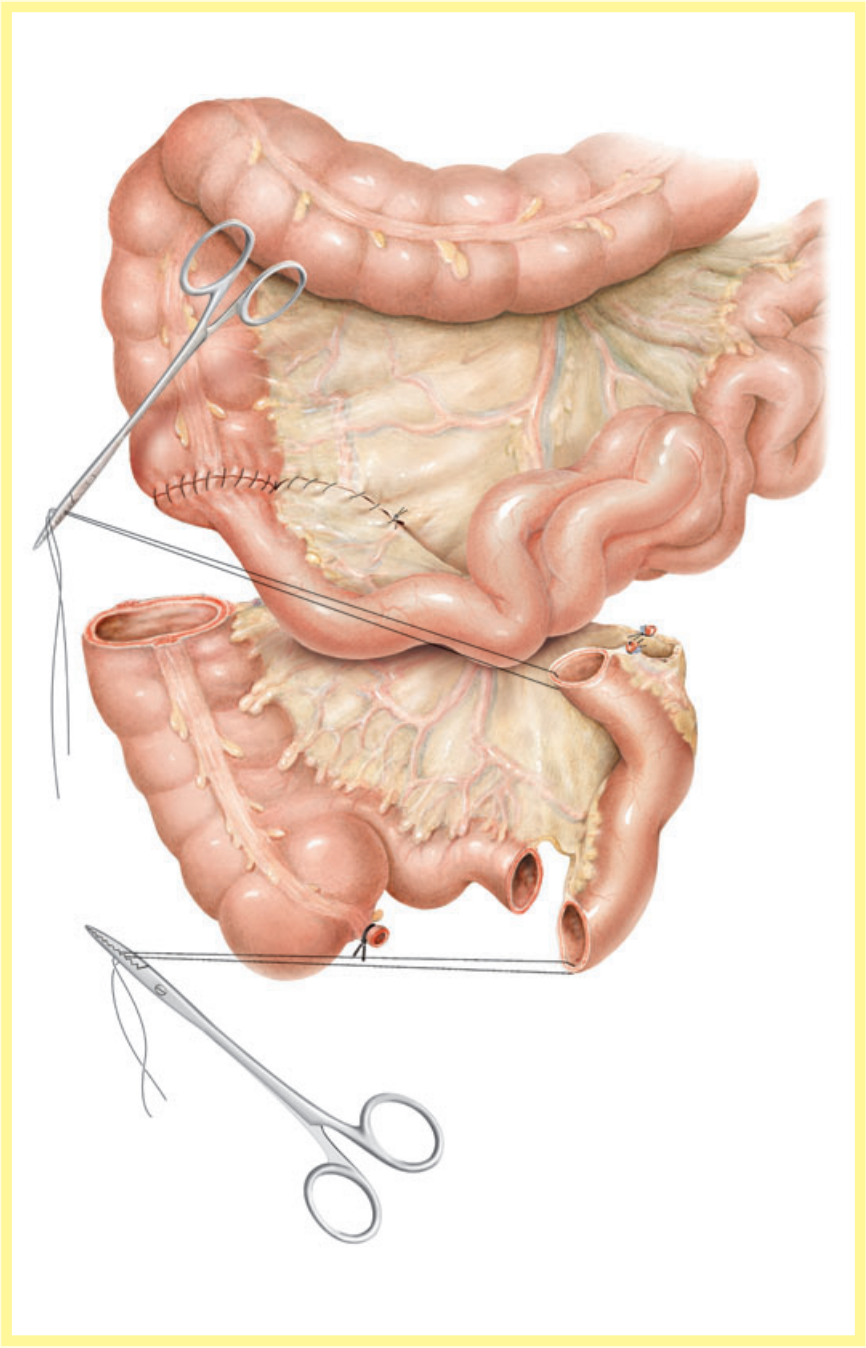


Figure 8

Stapled version, normal length ureters. The caecum and ascending colon are mobilized up to the hepatic flexure. The terminal 25 cm of ileum and 15 cm of caecum and ascending colon are isolated. A Foley balloon catheter is inserted into the ileum and the excluded bowel segments are irrigated with 1–2 L of saline. Thereafter, the proximal 15 cm of ileum are separated from the terminal 10 cm of prevalvular ileum with transection of the superficial arcade of the mesentery only. The appendix is resected.

Figure 9

After the intestinal continuity is restored (see Figs 2 and 3), the proximal ileal segments are translocated towards the cecum and ascending colon with stay sutures.



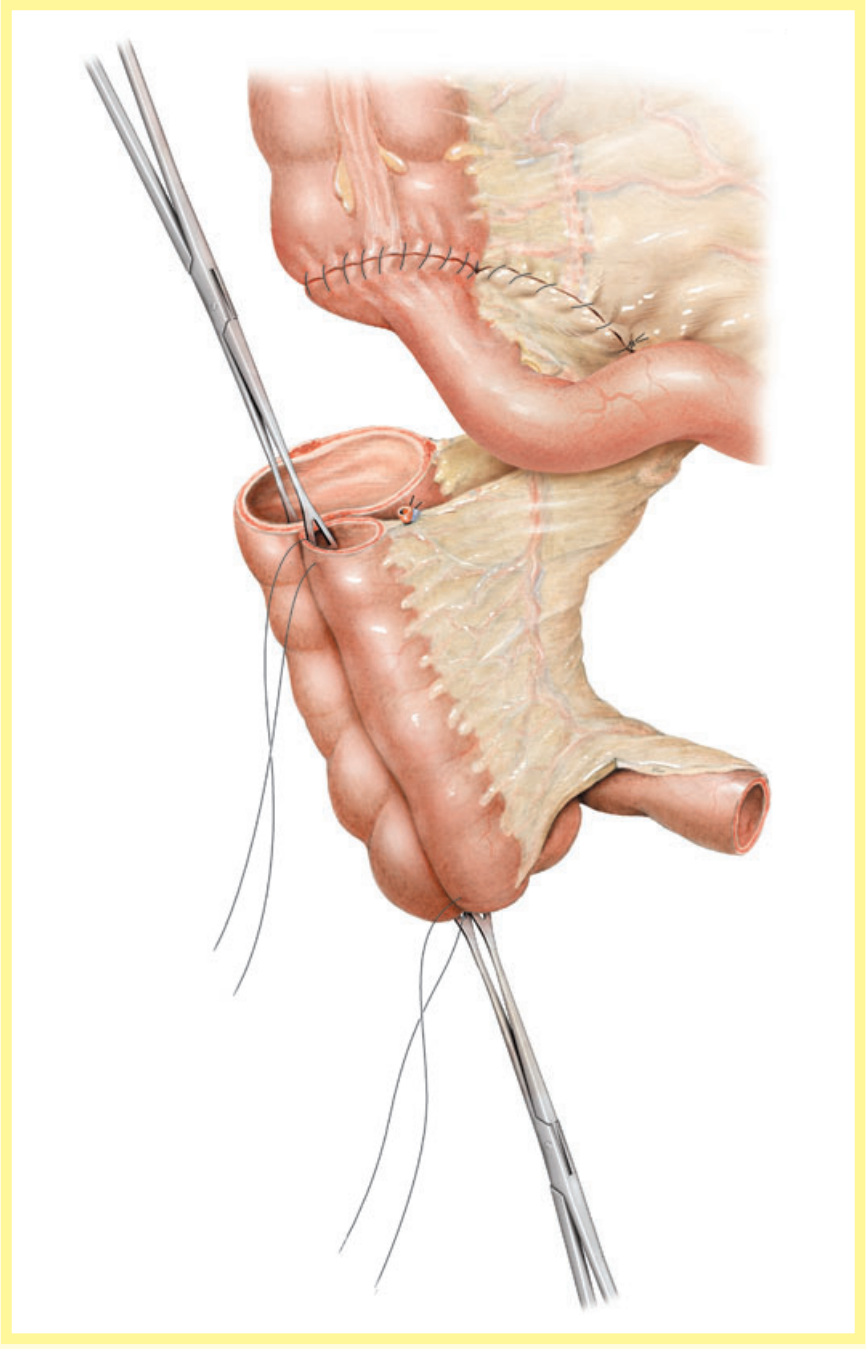
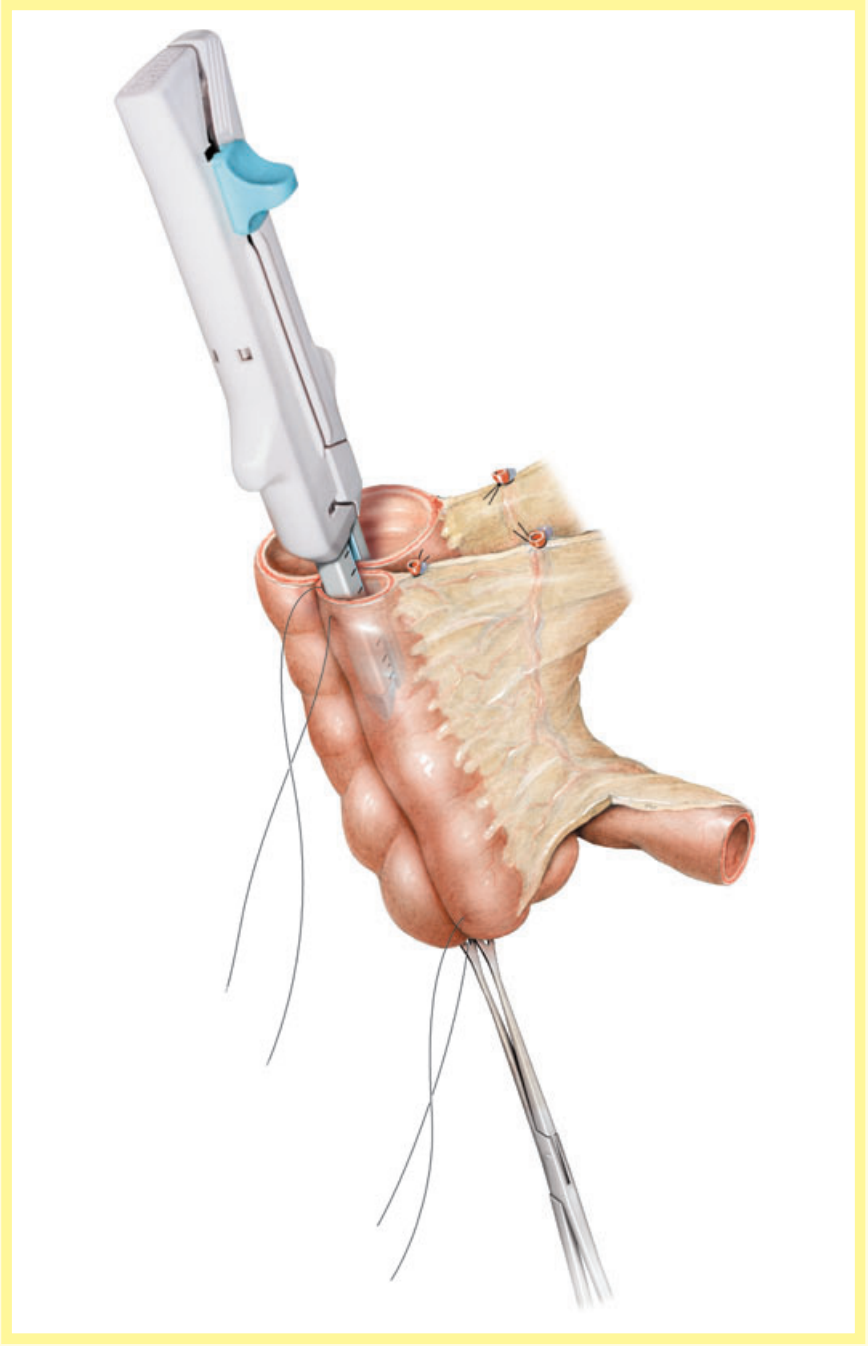


Figure 10

Both the separate ileum and the caecum and ascending colon must be opposed to each other at their antimesenteric borders and fixed in this position with stay sutures or Allis clamps, to allow the Poly GIA stapler to divide both bowel segments longitudinally along their antimesenteric borders.

Figure 11

Both branches of a Poly GIA 75 stapler are inserted separately into each bowel lumen and thereafter closed in exactly that position, which clamps the antimesenteric borders of the bowel segments to each other. Before the stapler is released by advancing the (blue) slide with the thumb, care must be taken that no other tissue, such as mesentery, is interposed between the bowel segments. With advancing the slide of the stapler, in a one-step procedure both bowel segments are stapled side-to-side to each other in an inverting manner by placing two double staggered rows of lactomer absorbable staples and simultaneously divided along their antimesenteric borders between the two double rows of staples.



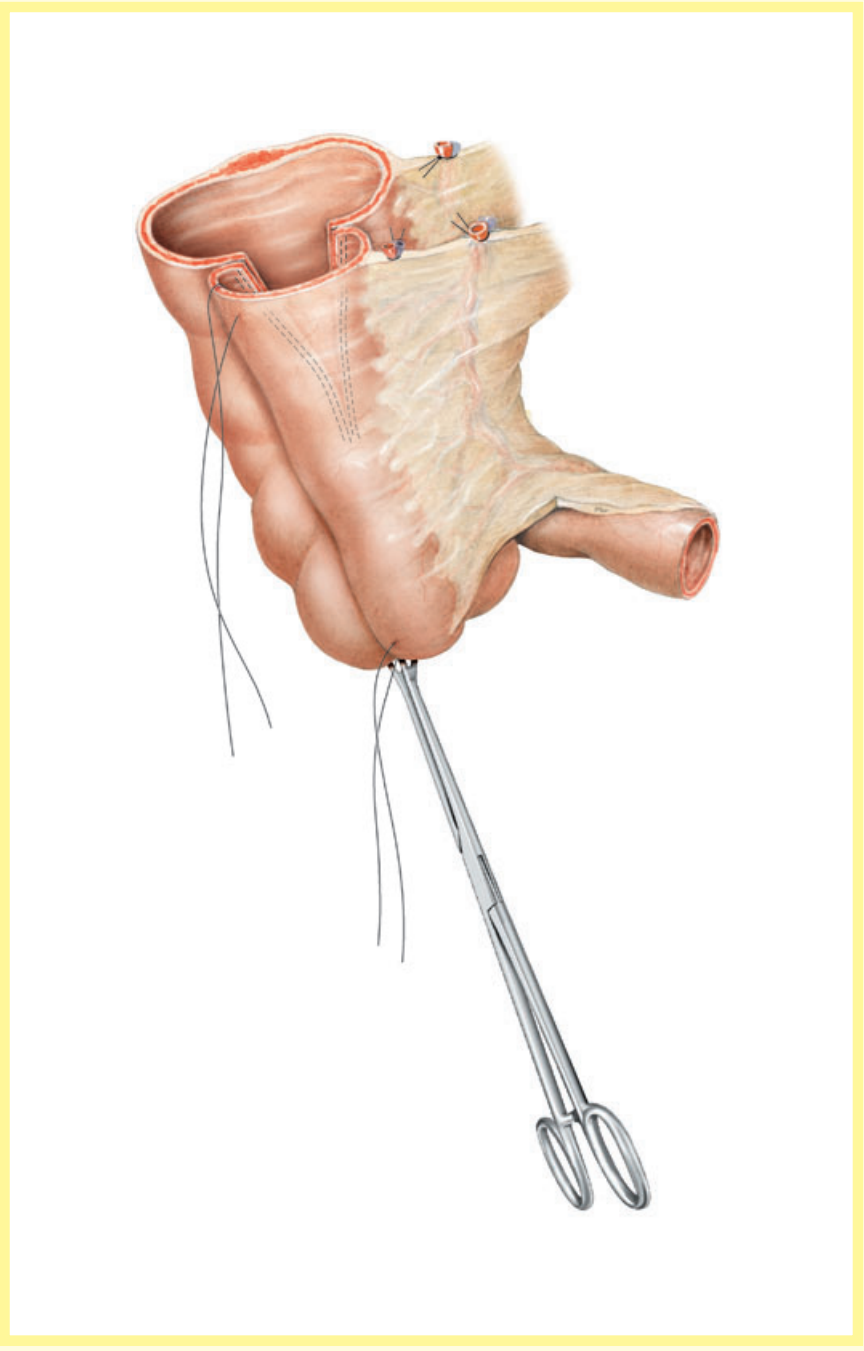
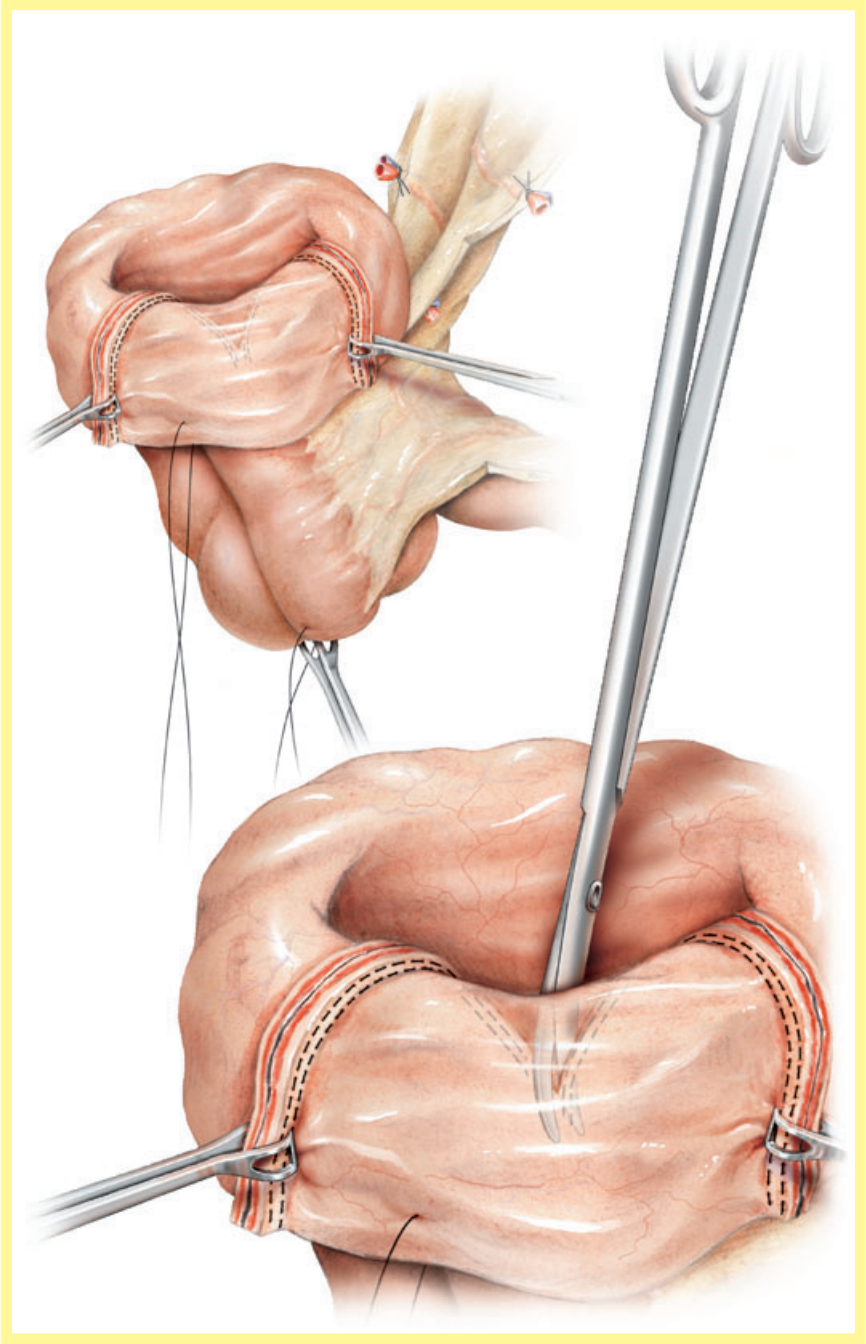


Figure 12

As the maximum length of the active stapling device is 75 mm, only part of the anastomosis has been established by the first application of a stapler. At the end of the incision, both rows of staples from either side of the anastomosis are unified, so that the anastomosis remains closed at its end.

Figure 13

Before the second stapler can be applied, the pouch has to be everted using Babcock clamps along the rows of staples. The blind end of the incision is cut open exactly in between the staple rows with Metzenbaum scissors over a distance of ≈0.5 cm.



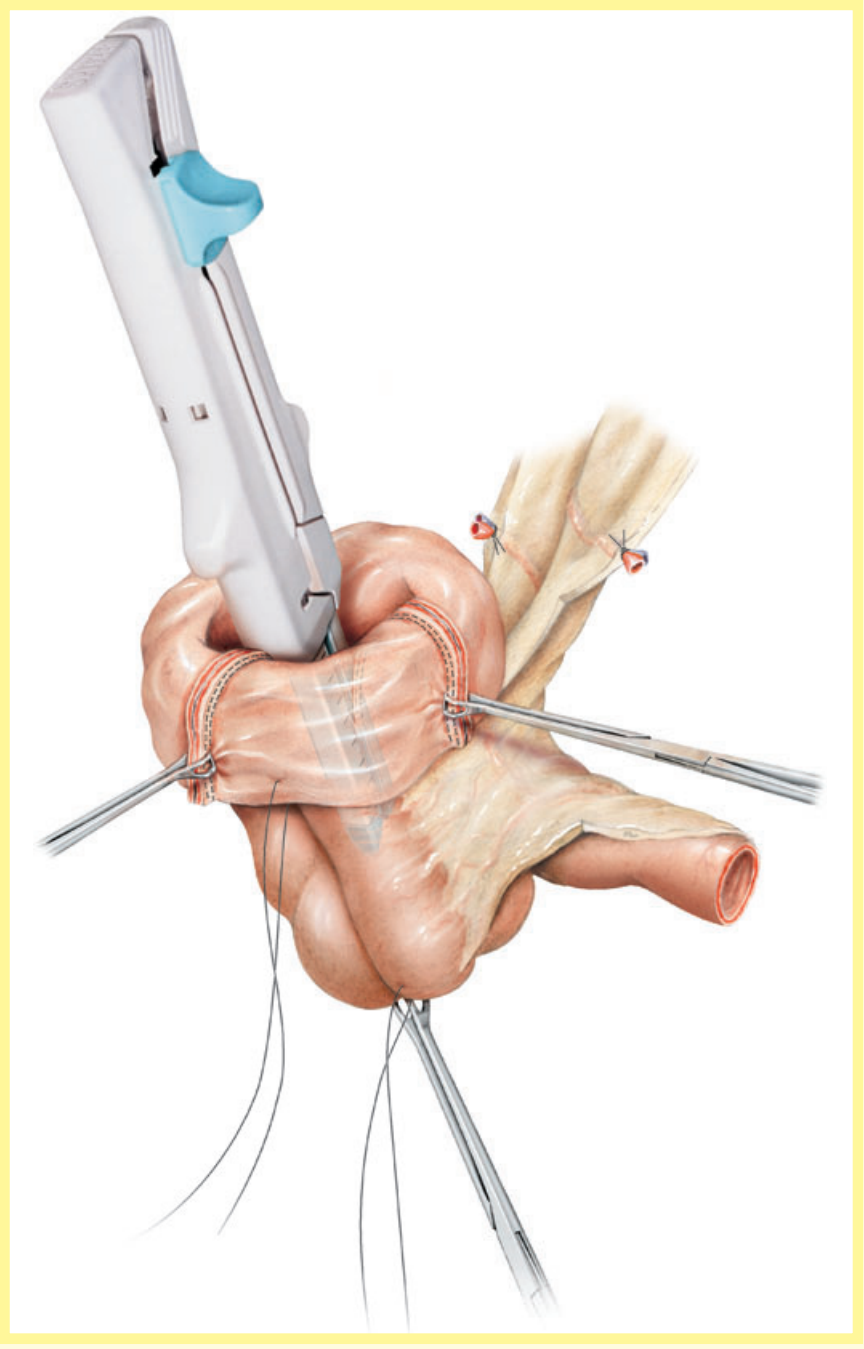
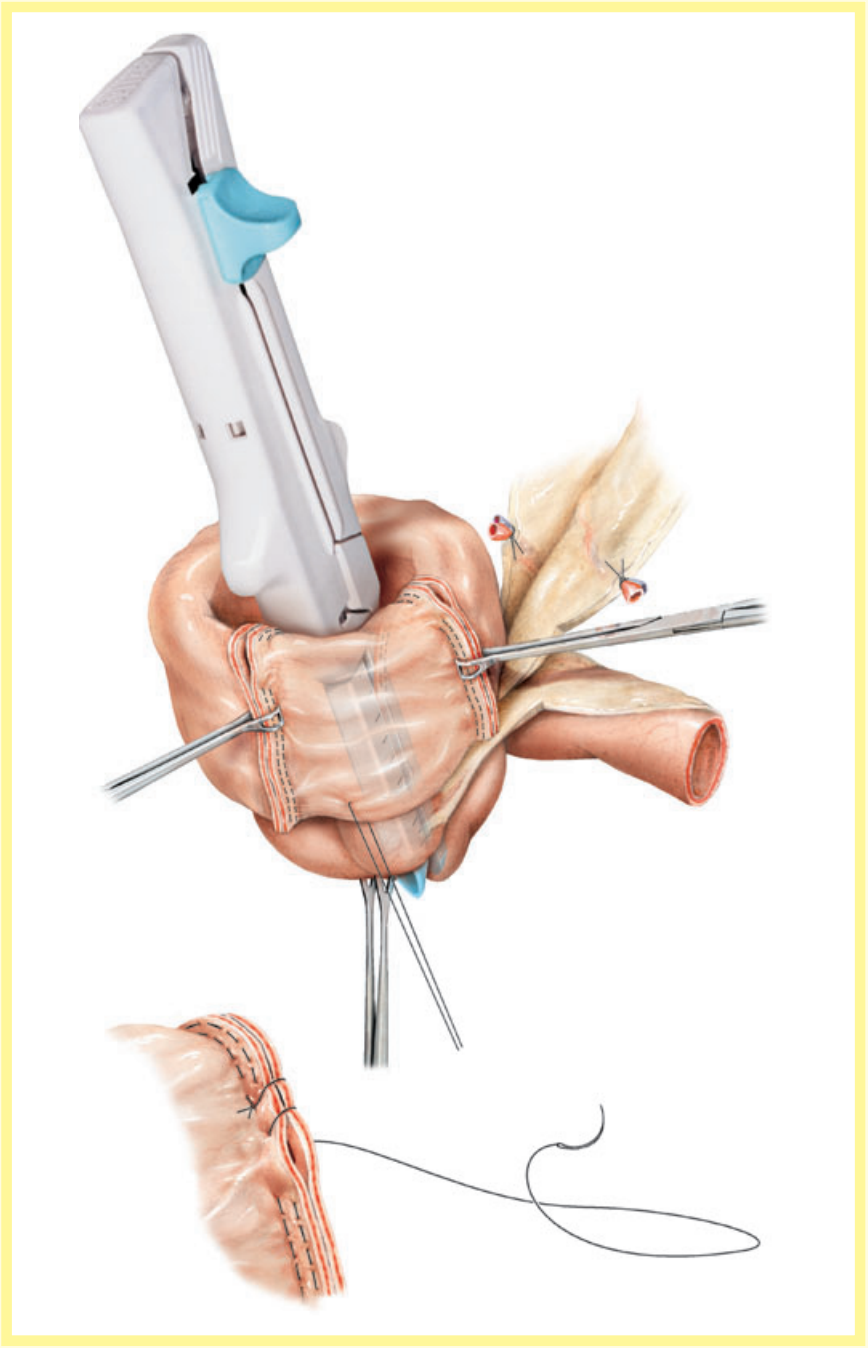


Figure 14

The branches of the second stapler are inserted in the same manner into each bowel lumen exactly between the first staple rows at their cut-open blind end, closed and released in the same manner as described above.

Figure 15

Again, with the help of Babcock clamps along the staple rows, the pouch is further stepwise everted for the third identical stapler application. The gaps between the staple rows of the first and second stapler application from cutting open the dead end are shown here. They are closed by running 4/0 glyconate sutures (see insert).



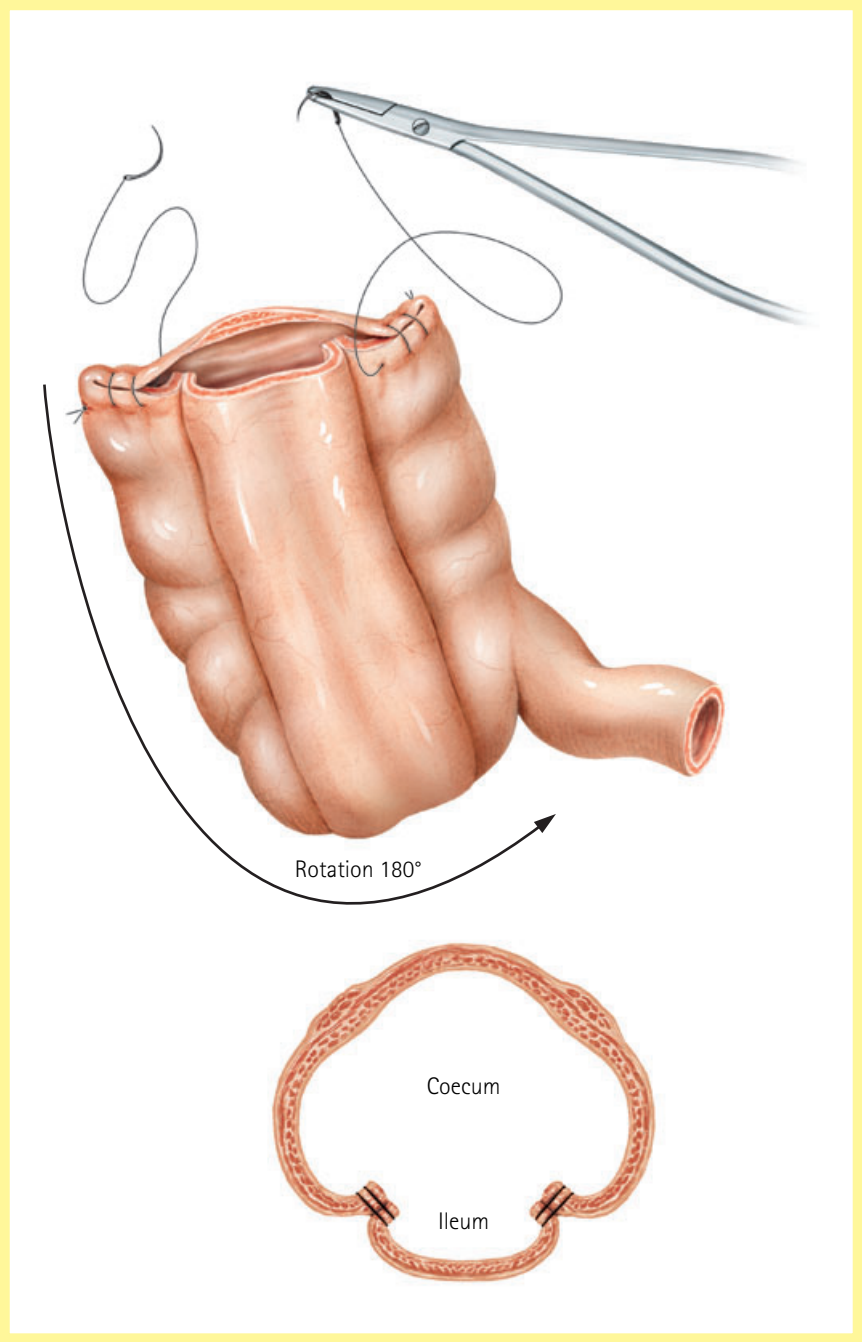
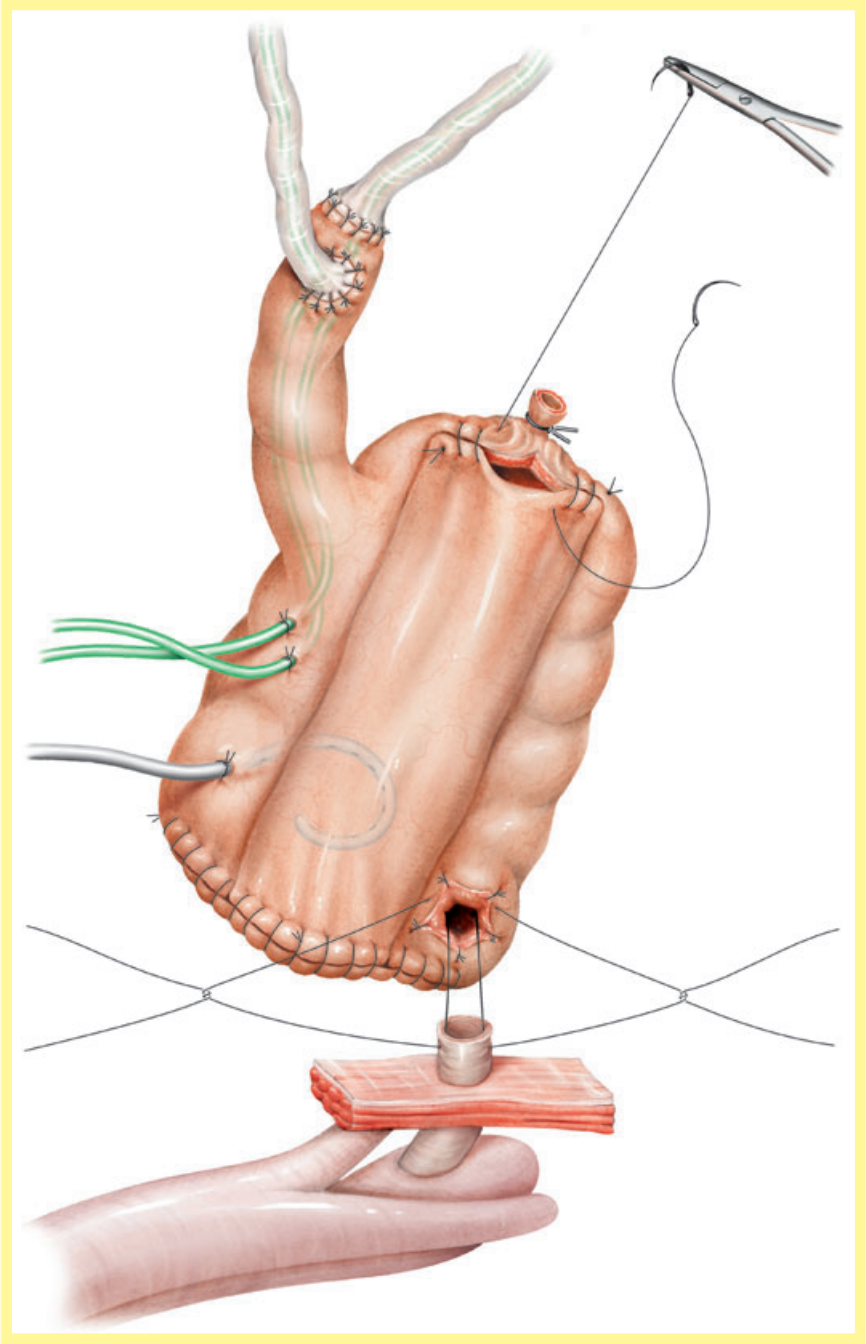


Figure 16

The upper and lower aspects of the pouch are sutured by all-layer running 4/0 glyconate sutures. The insert shows that in the stapled version the pouch is constructed from caecum and one loop of ileum only, compared with the two ileal segments of the sutured version. A counter-clockwise 180° rotation around the insertion of the ileocolic artery brings the ileocaecal valve into a cranial position and the ascending colon deep into the true pelvis. A tension-free urethro-intestinal anastomosis has been possible in every case, even in very obese patients.

Figure 17

At the deepest aspect of the pouch, a 20 F excision of the seromuscularis is made for urethro-intestinal anastomosis. The incised mucosa is everted and fixed by 4/0 polyglytone sutures. The anastomosis is established with the eight pre-placed double-armed 4/0 glyconate sutures. The ureter is implanted into the prevalvular ileum using a Nesbit technique for the right ureter and a Wallace technique for the left ureter. Before that, the left ureter must be pulled through the mesentery below the duodenum and above the inferior mesenteric artery into the right retroperitoneum. Ureteric stents must be inserted before ureteric implantation through the pouch wall and pulled through the ileocaecal valve. Optical magnification is used for the ureteric anastomosis. For either ureter, three 7/0 polyglycolic sutures are used for the spatulation, and the remainder of the anastomosis is completed by using 6/0 glyconate sutures. The ureteric stents are secured with 4/0 polyglytone sutures. In addition, a 10 F pigtail pouchostomy catheter is inserted through the anterior pouch wall and secured with a 4/0 polyglytone suture.



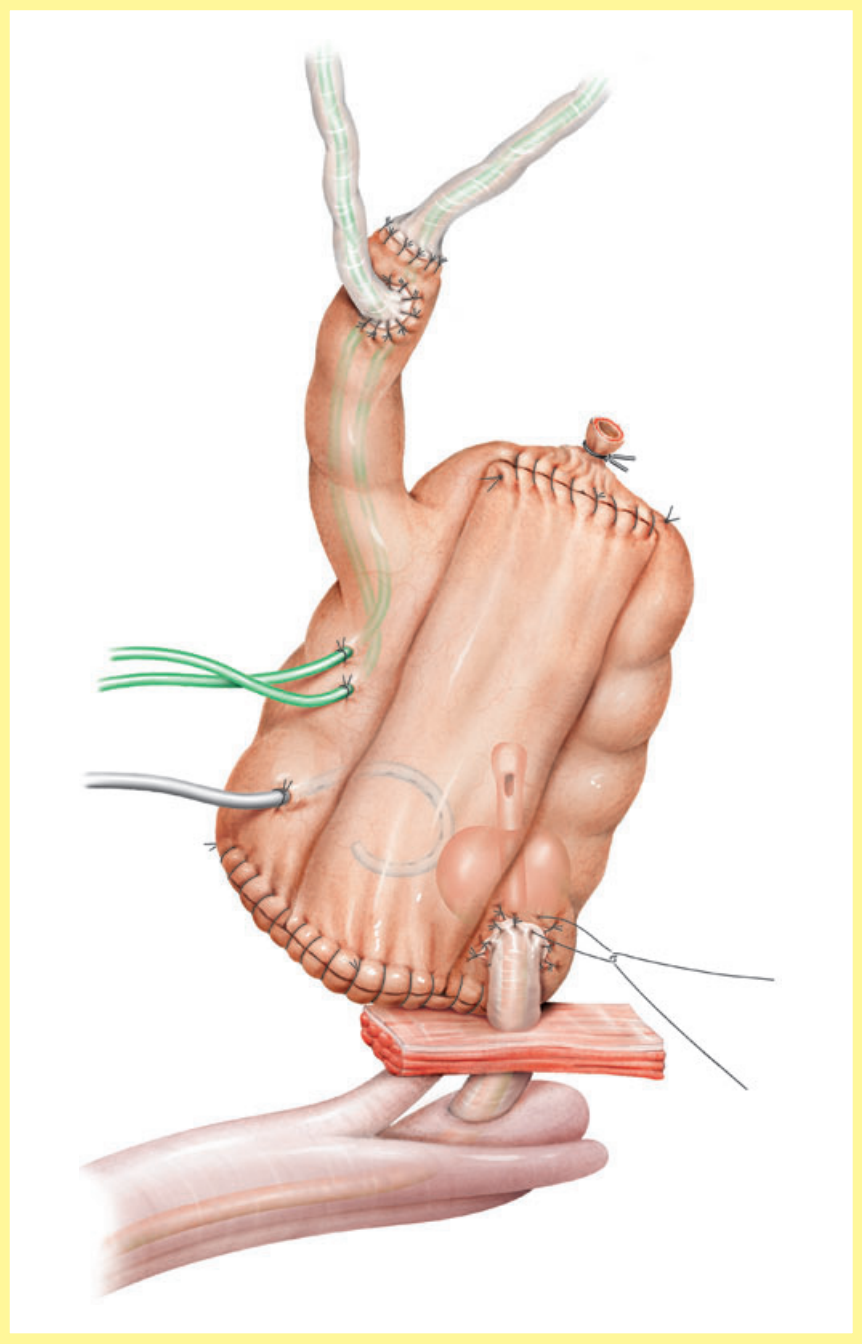
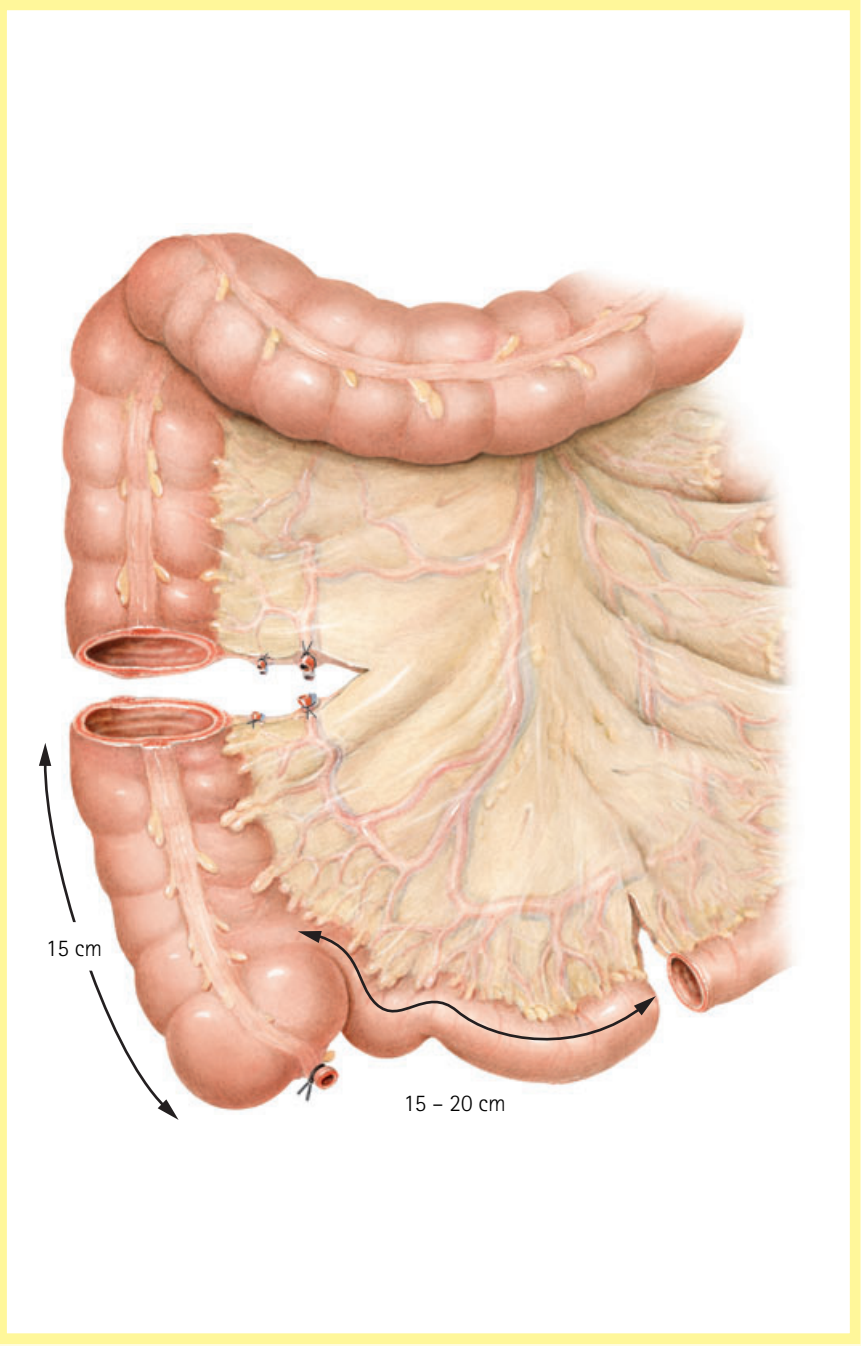


Figure 18

The urethral anastomosis is completed over a 20 F silicon Foley catheter.

Figure 19

Short ureters. If ureters had to be cut short because of irradiation damage or urothelial cancer involvement, the terminal prevalvular ileum can be used as an ileal ureter substitute for both ureters. The length of the terminal prevalvular ileum, which is used as ureteric substitute, must be chosen according to the length of the ureter defects.



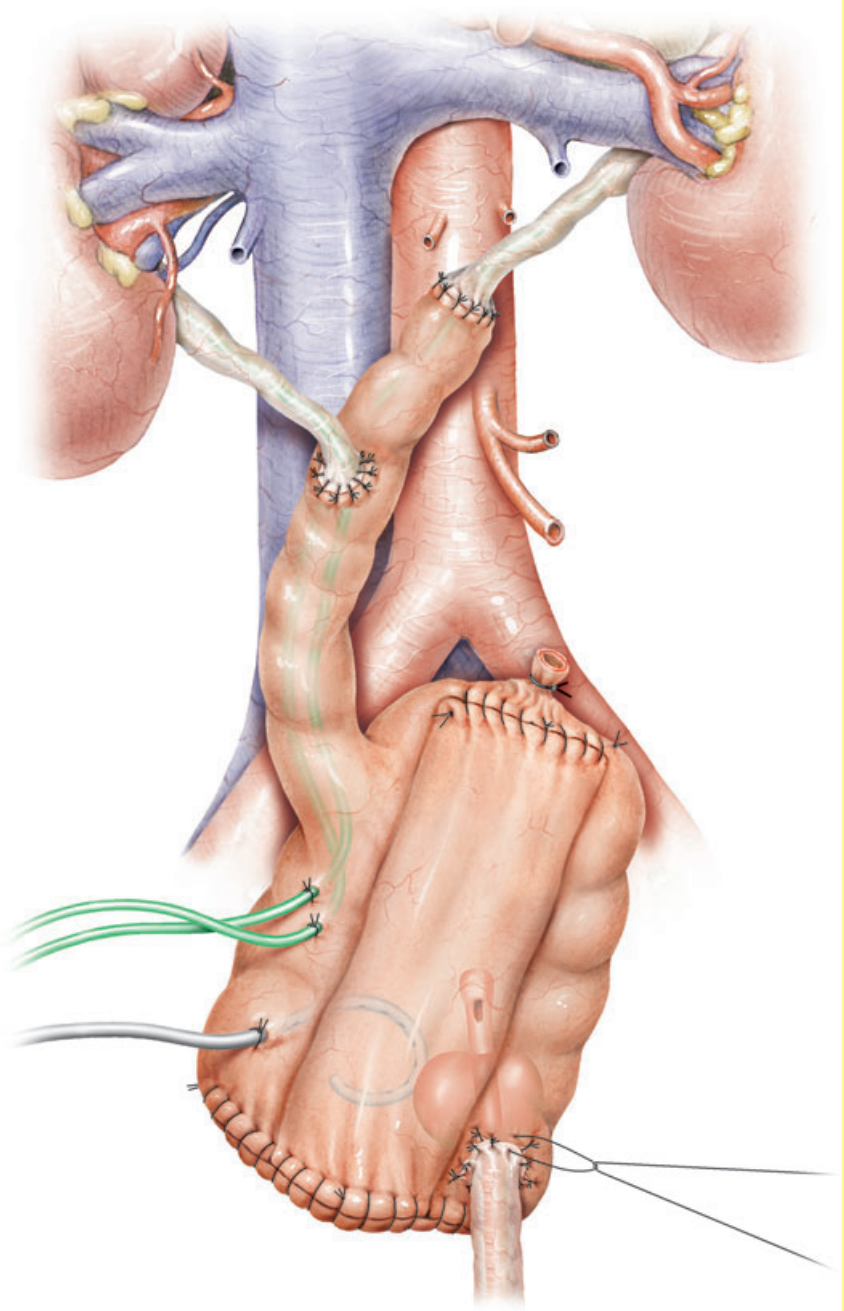


Figure 20

For ureteric substitution, prevalvular ileum can be used up to the renal pelvis. Again, the right ureter is implanted in a Nesbit technique and, for Wallace anastomosis of the left ureter, the proximal segment of the prevalvular ileum is pulled through the mesentery below the duodenum and above the inferior mesenteric artery into the left retroperitoneum.

POSTOPERATIVE CARE

Medication. Antibiotics (ampillicin/clavulanic acid and metronidazol) are started before surgery and continued until 7–10 days afterward. For postoperative drainage of the stomach, we prefer intraoperative insertion of a 12 F balloon gastrostomy catheter as compared to a nasogastric tube. Patients are mobilized as early as 1–2 days. Gravity drains in the small pelvis and at the ureteric implantation site are removed as soon as the amount of drainage is <50 mL/24 h. Ureteric stents are removed at 10 and 11 days after surgery. When a pouchogram at 12 days shows no extravasation the transurethral catheter is removed and voiding initiated. At the time of pouchogram and catheter removal, in ≈85% of patients, the ileocaecal valve is able to prevent poucho-ureteric reflux. When the pouch capacity increases with time and pressures become lower, the ileocaecal valve gains in competence and prevents reflux in >90% of patients. However, the pouchostomy catheter remains in place and is used to check for residual urine. When the postvoid residual is <50 mL the pouchostomy catheter is removed. Pelvic floor exercises are started as soon as the transurethral catheter is removed, and continued until complete continence is achieved.

SURGEON TO SURGEON

In determining the appropriate indication for orthotopic substitution, the most difficult part is to predict whether and how fast urinary continence will be achieved in the elderly. Patients with cerebrovascular sclerosis are better with a continent cutaneous diversion or even an incontinent conduit diversion. Furthermore, females who are very obese or have difficulties in using CISC are better using intermittent catheterization of an abdominal stoma.

In very obese patients with a fat mesentery, colonic mobilization up to the right flexure is the key to success, allowing a tension-free anastomosis with the urethra after 180° counter-clockwise rotation of the pouch. However, care must be taken not to harm the right colonic vein when deep incision of the colonic mesentery is necessary. If this happens and the right colonic flexure turns dark blue, resection is advised and an ileo-transversostomy must be performed rather than the ileo-ascendostomy.

If previously undetected polyps are found when opening the caecum/ascending colon, usually they are benign and should be excised and submitted to frozen section analysis. This is not an indication to abandon the planned procedure.

If there is leakage from the pouch and associated symptoms after catheter removal, this might be from the opening of the pouchostomy tube. Usually the problem is solved by reinserting a transurethral Foley catheter for ≈10 days. The problem may be prevented by reinserting the transurethral Foley catheter *before* planned removal of the pouchostomy tube. Leakage from the site of the ureteric anastomosis usually requires percutaneous nephrostomy drainage. If antegrade stenting is not possible this will most likely result in stricture at the implantation site, requiring later surgical revision. Early loss of ureteric stents usually has no sequelae. When this occurs, the upper tract should be checked by ultrasonography and attempts to reinsert a stent and/or nephrostomy catheter should be used only if there is a clinical need.

However, early loss of the transurethral catheter mostly results in extravasation and anastomotic stricture. Thus reinserting a transurethral catheter is advisable. In the male, this can be difficult. Transrectal guidance of the catheter tip and radiographic control of the catheter position are advised.

Alternatively, urethroscopy may be used for transurethral placement of a 8 F ureteric catheter over which, as a guide, coaxial placement of an open-end 20 F balloon catheter (Integral® nephrostomy silicone catheter, Uromed) can be done safely. Early loss of the pouchostomy catheter usually has no sequelae and no attempts should be made to reinsert or replace it.

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