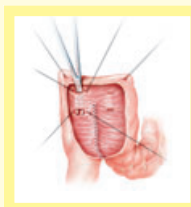
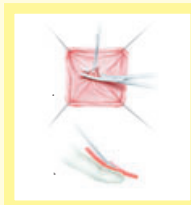
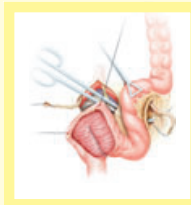
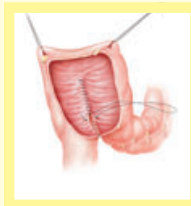
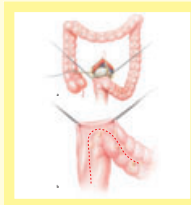


Surgery Illustrated

Sigma-rectum pouch (Mainz pouch II)

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PLANNING AND PREPARATION

INDICATIONS

The sigma-rectum pouch (Mainz pouch II) is a form of continent urinary diversion in patients with anatomical (e.g. cystectomy for bladder cancer) or functional loss of the bladder (e.g. bladder exstrophy) and competent anal sphincter. It can also be used to convert a ureterosigmoidostomy or colonic conduit.

PATIENT SELECTION

A competent anal sphincter is mandatory. The patient must be able to hold an enema of 350 mL saline for ≥ 3 h during night and day, and during walking and working. A rectodynamic investigation with an anal sphincter profile is helpful; the resting closure pressure should be >60 cmH₂O and closure pressure under stress >100 cmH₂O. Good patient compliance is mandatory.

Contraindications are: pelvic irradiation; previous bowel surgery for benign or malignant colorectal disease; diverticulosis or polyposis of the sigma; T4 bladder cancer; planned adjuvant irradiation; cerebral atherosclerosis; diabetes; serum creatinine

levels of >1.5 mg/dL, patients with high cardiopulmonary risk (American Society of Anesthesiologists grade 3–4) and obesity; severely dilated upper urinary tract ($>$ grade 3).

SPECIFIC EQUIPMENT/MATERIALS

Fine instruments and $\times 2.5$ lens system for antirefluxive ureteric implantation.

SPECIFIC PATIENT PREPARATION

- Contrast enema (water soluble) to exclude malignancy of the colon and diverticula, colonoscopy or three-dimensional CT. Estimate the length of the sigma before surgery; if it is short, extended mobilization of the left colonic flexure might be necessary.
- Bowel preparation: 4–7 L of Fordtran solution the day before surgery. Metronidazole combined with cephalosporine and aminoglycoside.
- A rectal tube is placed before surgery to facilitate extraction of the ureteric stents during surgery. It is replaced at the end of surgery.

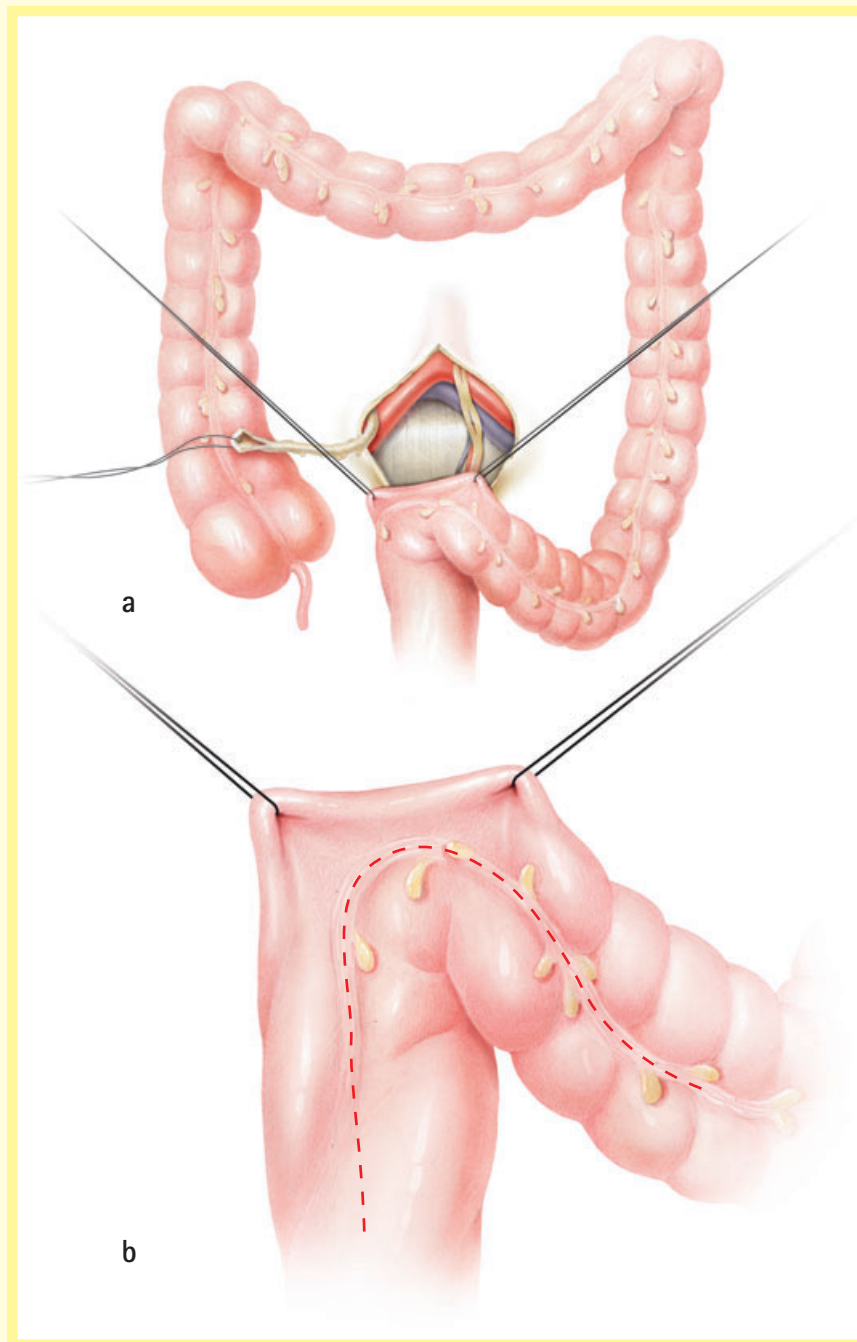
SPECIFIC PATIENT POSITIONING

The patient is placed supine with the pelvis slightly elevated.

SURGICAL STEPS

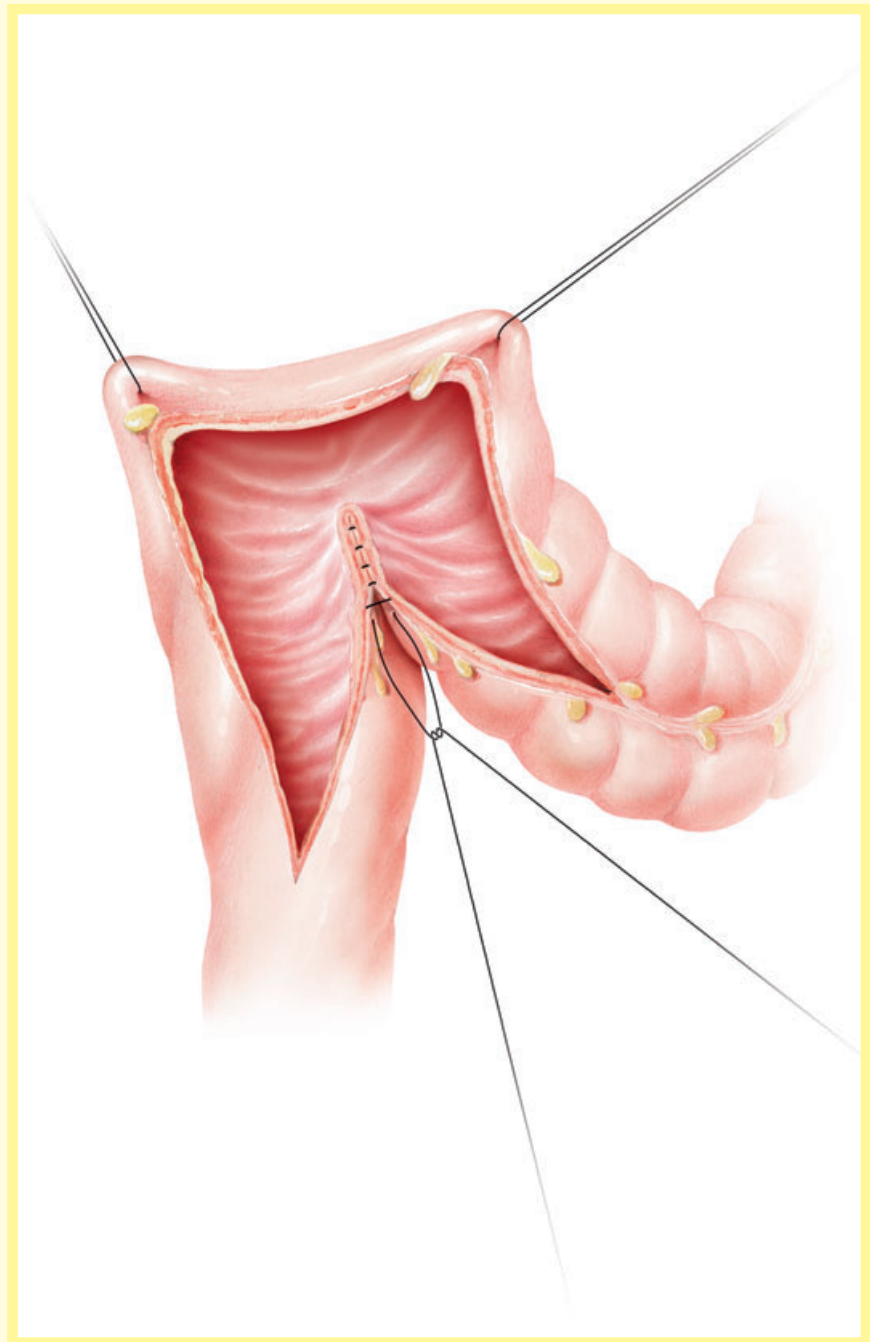
Figure 1

Median laparotomy. The length of the rectosigmoid is estimated. Two stay sutures are placed at the 3 and 9 o'clock positions at the level of the promontorium, to which the pouch will be fixed later. The dotted line represents the line of incision. The lower end represents the point where the side-to-side anastomosis will start later (Fig. 2). Check whether the anastomosis can be made tension-free! If not, mobilize the sigma and descending colon up to the left colonic flexure, ligate and divide the phrenocolic ligament.



Figures 2 and 3

The outlined bowel is opened antimesenterically and detubularized over a total length of 15–20 cm with electrocautery. The side-to-side anastomosis is made using single sutures for the seromuscular layer (monofilament absorbable suture material 4/0) and a 5/0 running suture for the mucosa.



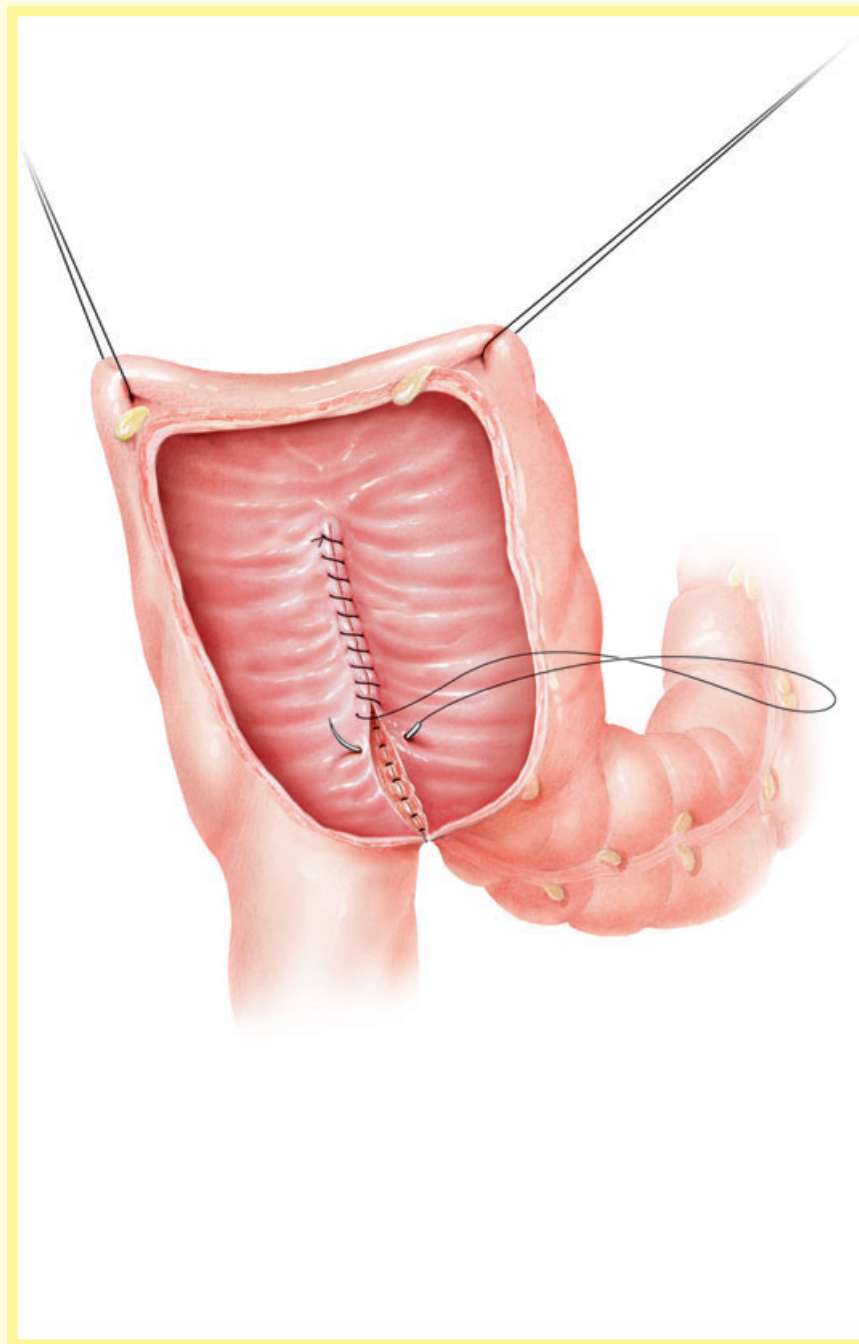
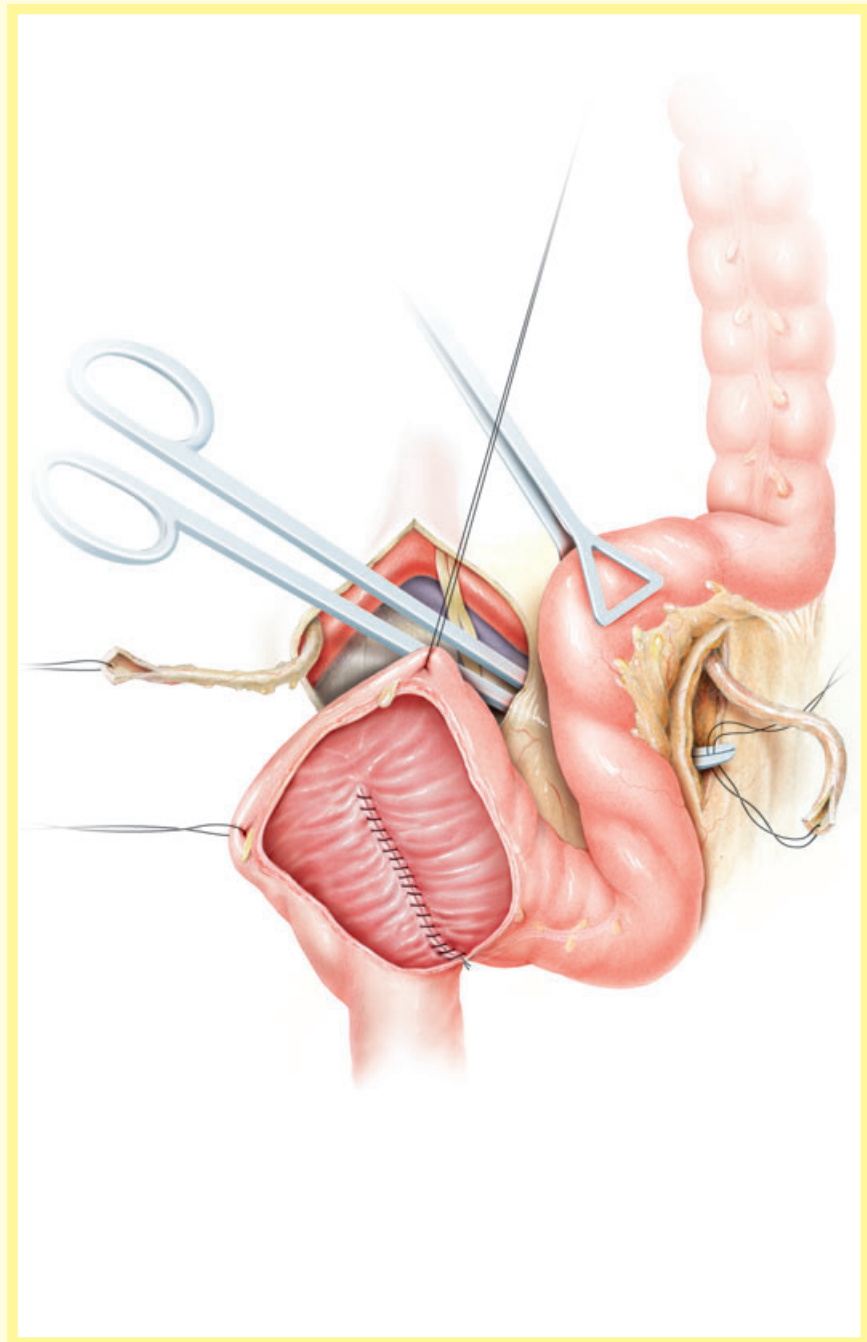
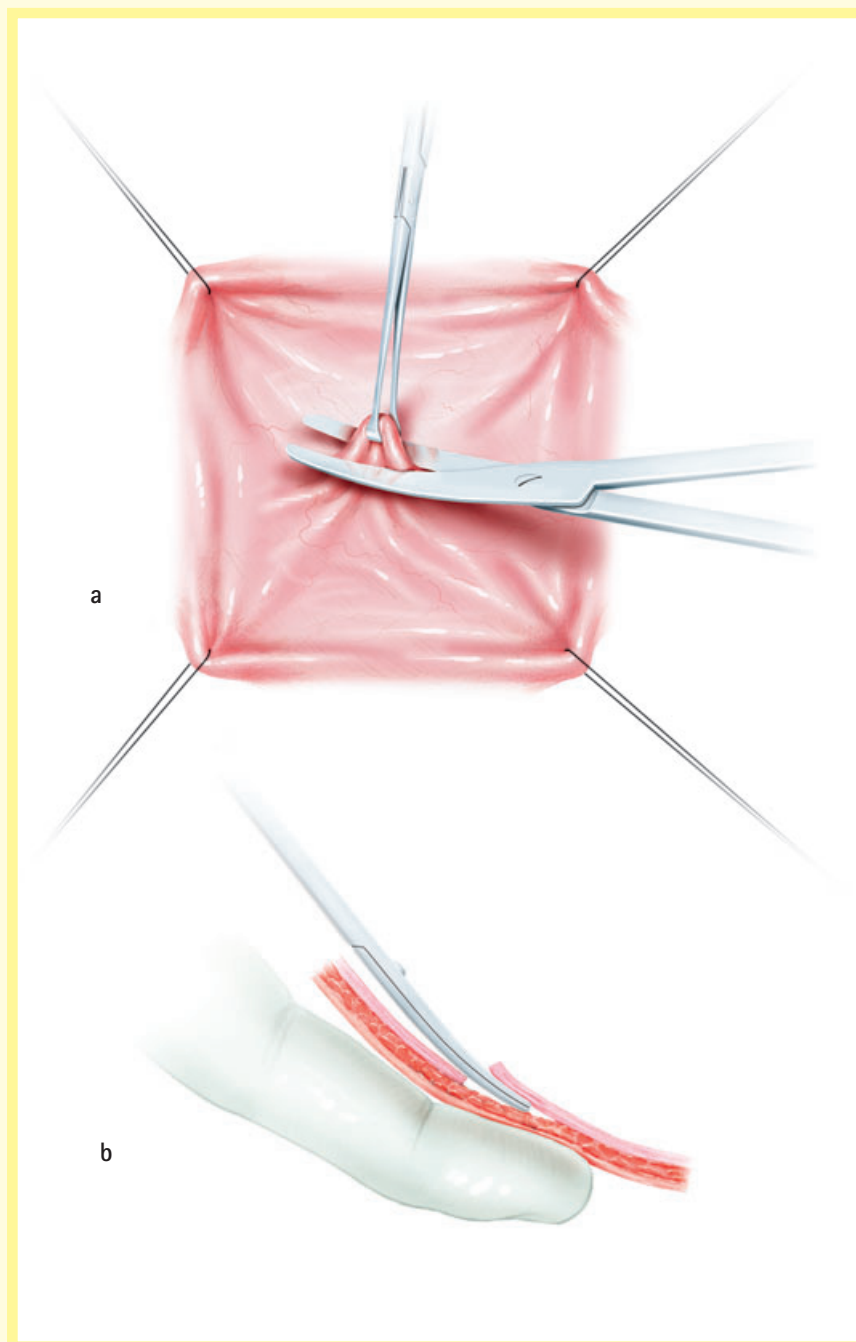


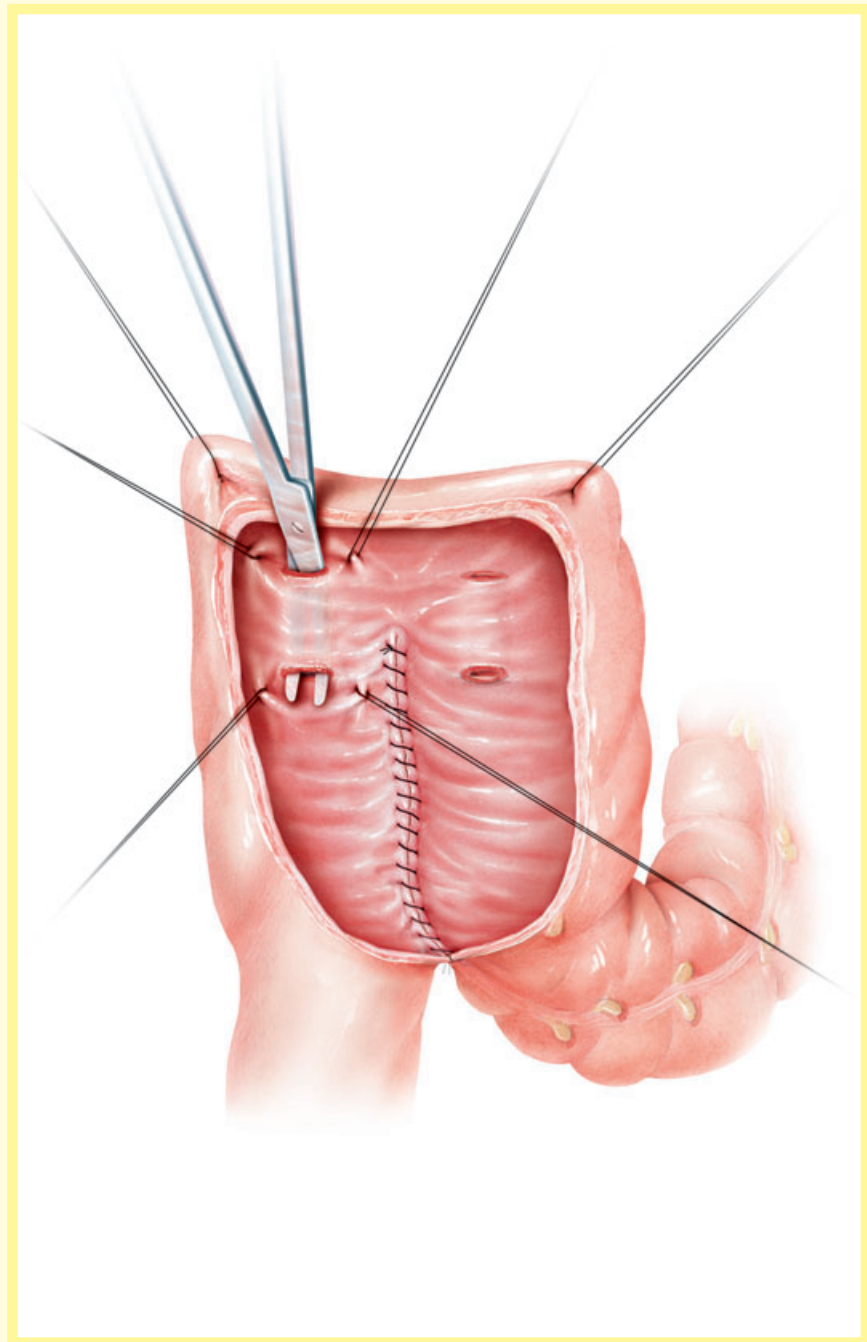
Figure 4

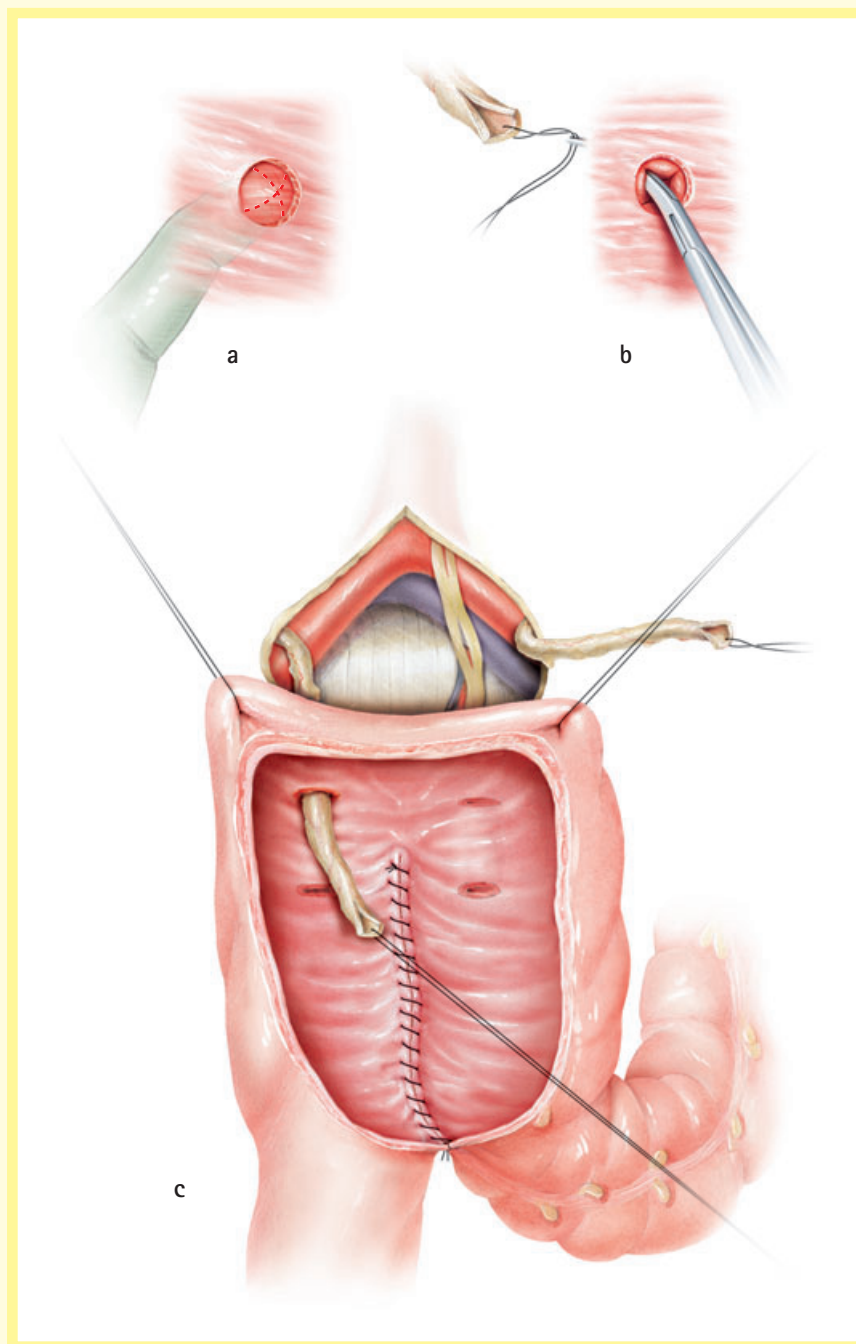
The right and left ureter are dissected through a right and left paracolic peritoneal incision, respectively. The blood supply of the left ureter is more critical. Avoid any lesion of the longitudinal vessels running underneath the adventitia. Preserve accessory branches of the gonadal vessels that run parallel and medial to the ureter. The ureter is pulled through a vessel-free window of the mesentery into an intraperitoneal position, so that it meets the 'port of entrance' into the pouch at the level of the promontory without tension or kink.



**Figures 5 and 6**

Four stay sutures that mark the length of the tunnel (3.5 cm) facilitate antirefluxive ureteric implantation. A small piece of mucosa is excised (Fig. 5a). By elevating the bowel wall using a finger, a cross-like incision is made into the seromuscular layer and a submucosal tunnel is dissected.

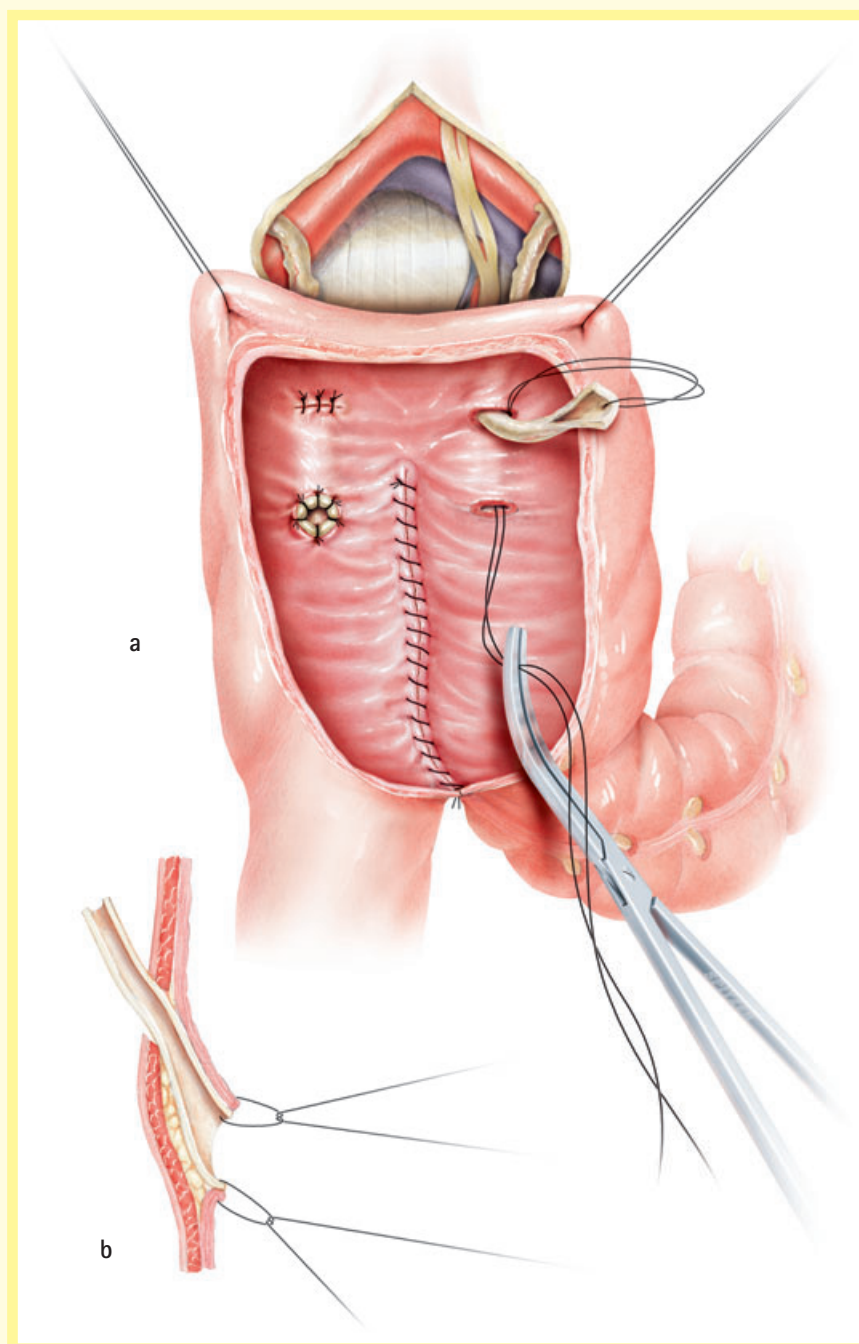


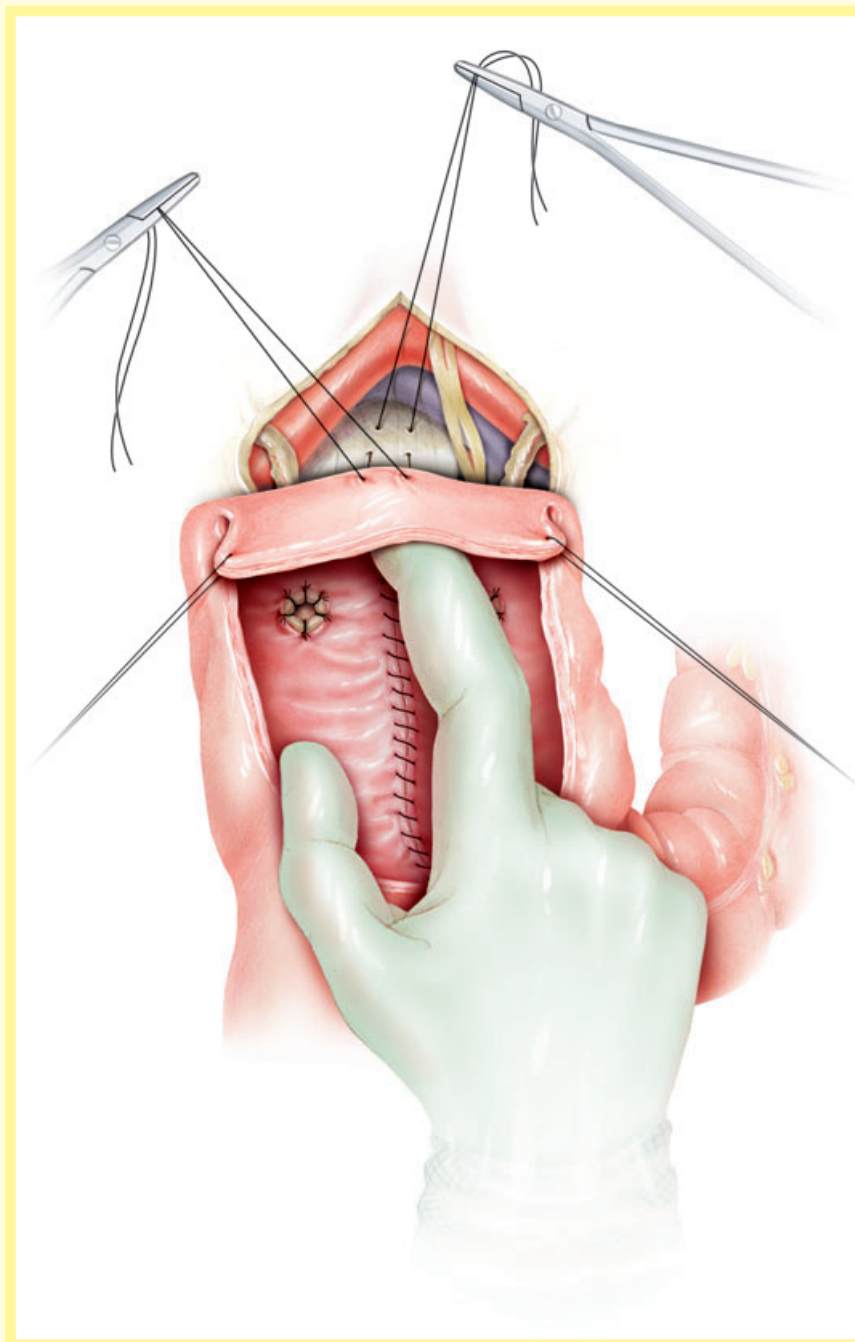
**Figure 7**

Through the cross-like incision, the ureter is pulled into the pouch using a long but small clamp. The course of the ureter should be nice and smooth, with no kinking or angulation.

Figure 8

The ureter is pulled through the submucosal tunnel and shortened. Check that capillary arterial bleeding from the ureteric stumps and spontaneous urine ejaculation are present. Exclude (a) insufficient vascularization, (b) kinking, (c) compression of the ureter inside the tunnel. The ureteric stump is split over 0.5 cm at the 12 o'clock position and fixed to the bowel seromuscularis by two 5/0 polyglactin sutures at the 5 and 7 o'clock positions. The anastomosis is completed by one suture at the 12 o'clock and two at the 3 and 9 o'clock positions, with 5/0 polyglactin (magnification lenses) grasping the ureter and the bowel mucosa. The left ureter is implanted in the same way.

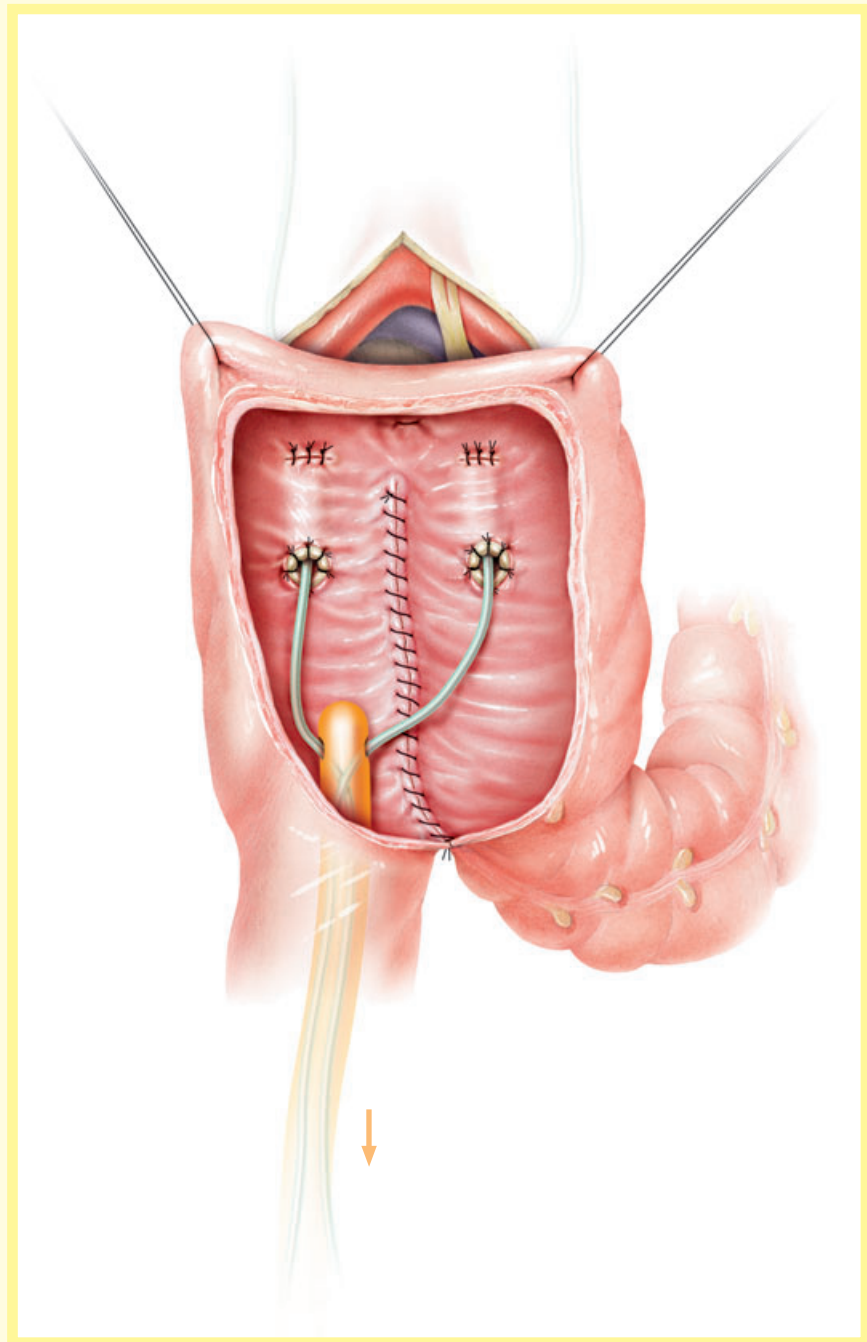


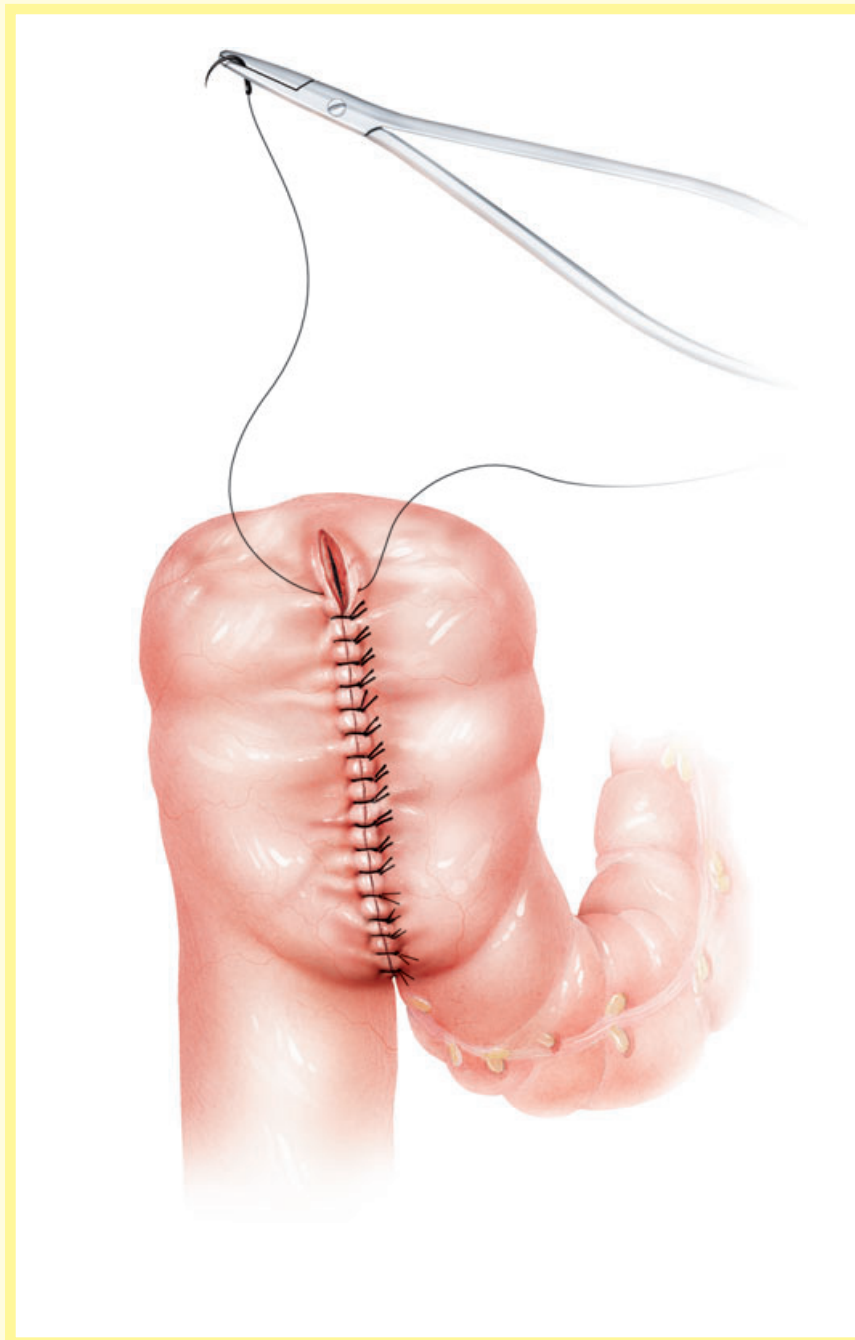
**Figure 9**

One or two nonabsorbable sutures are placed through the periostium of the promontory and the seromuscularis of the pouch from the dorsal site. Subsequently the pouch-promontory fixation suture is approximated and it is checked that both ureters enter the pouch with no obstruction or angulation.

Figure 10

Two 6 F stents are inserted into the ureters until the first resistance is felt, pulled back again for 1 cm and fixed at this level to the pouch plate with a 5/0 suture with a short absorption time. The ends of both stents are inserted through a side hole into the rectal tube and pulled out transanally. The rectal tube is reinserted.



**Figure 11**

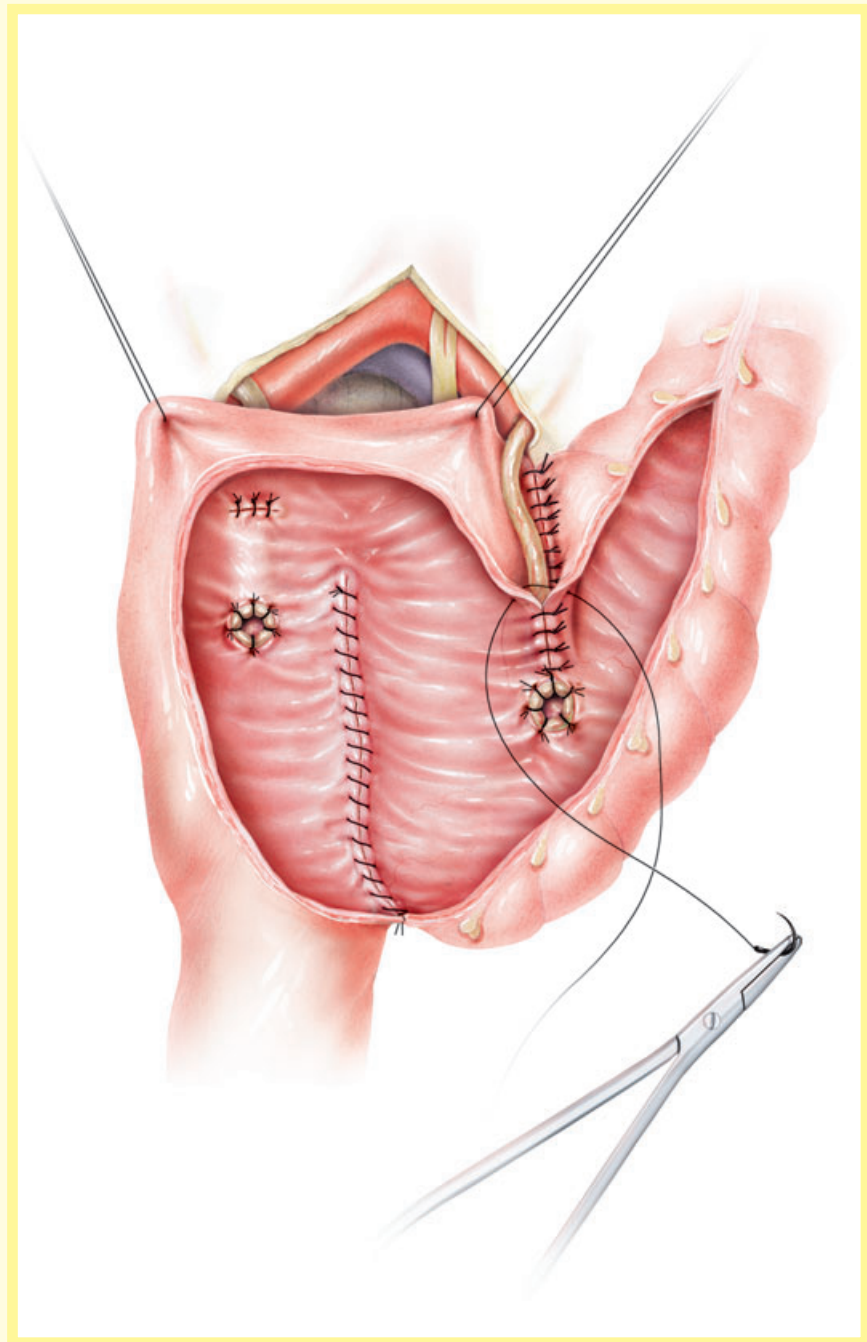
Pouch closure starts with interrupted polyglactin 4/0 sutures from the caudal to cranial direction. For any suturing of large bowel, a multilayer (seromuscularis, submucosa) interrupted suture using 4/0 polyglactin is safe in our experience.

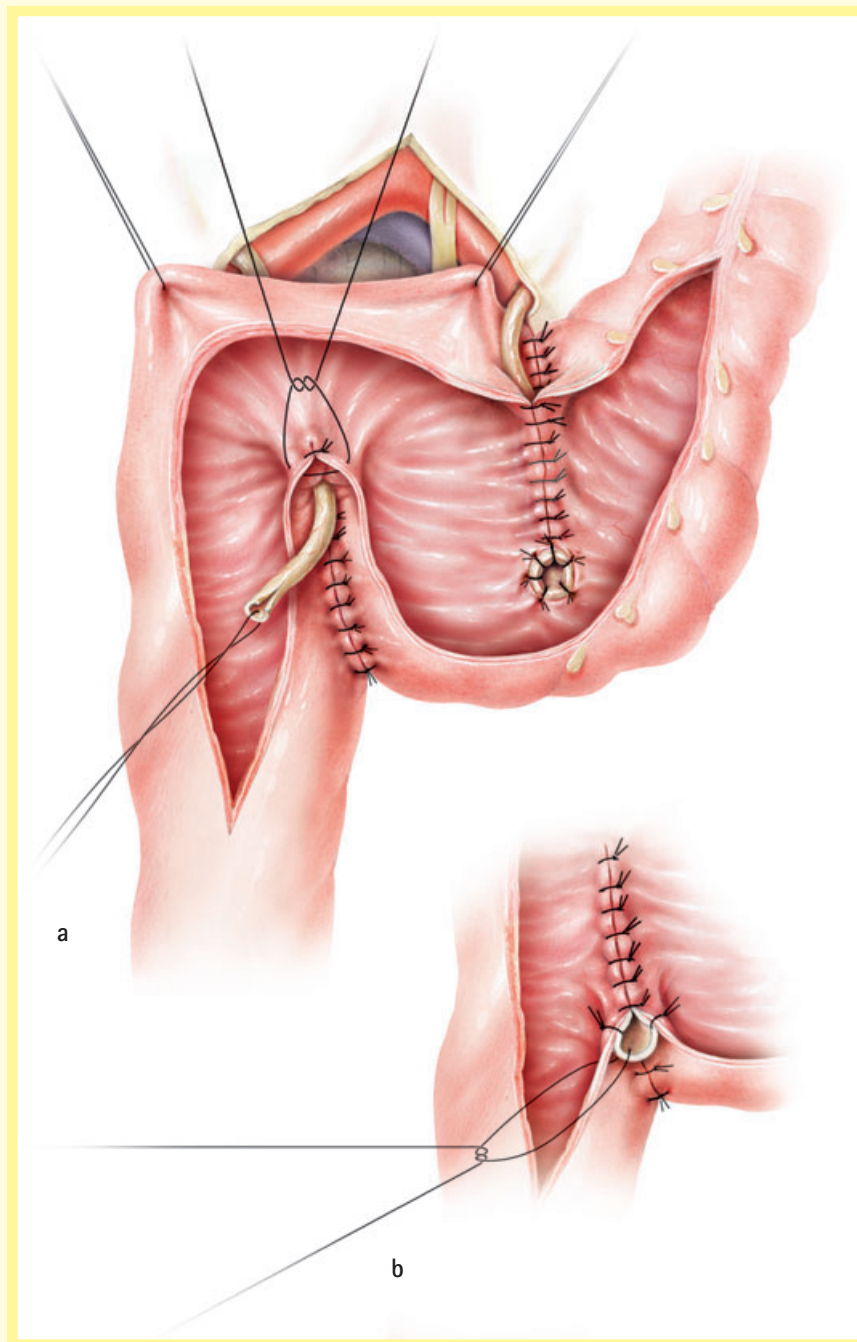
The mesenteric windows are closed and the pouch is covered with the greater omentum mobilized from left to right (our preference) and freed from the stomach. The ureteric stents and the rectal tube are carefully fixed to the skin with separate nonabsorbable sutures.

Figure 12

For dilated ureters, use ureteric implantation via a serous-lined extramural tunnel.

The left ureter is more often found to be dilated. An S-shaped sigmoid segment (third sigmoid loop) is outlined by stay sutures and opened antimesenterically. If the right ureter shows a normal calibre it is implanted using the submucosal tunnelling technique described above. For implantation of the left ureter, an anastomosis of the second and third loop of the sigmoid is made close to the mesentery (interrupted 4/0 polyglyconate sutures), thus creating a groove. The ureter is placed into that groove and the bowel borders anastomosed over the ureter, thus incorporating the ureter into the pouch wall (two running sutures, 4/0 for the seromuscular layer and 5/0 for the mucosa). The ureter is cut and spatulated and definitive ureteric implantation into the suture line is done using several single sutures of 5/0.

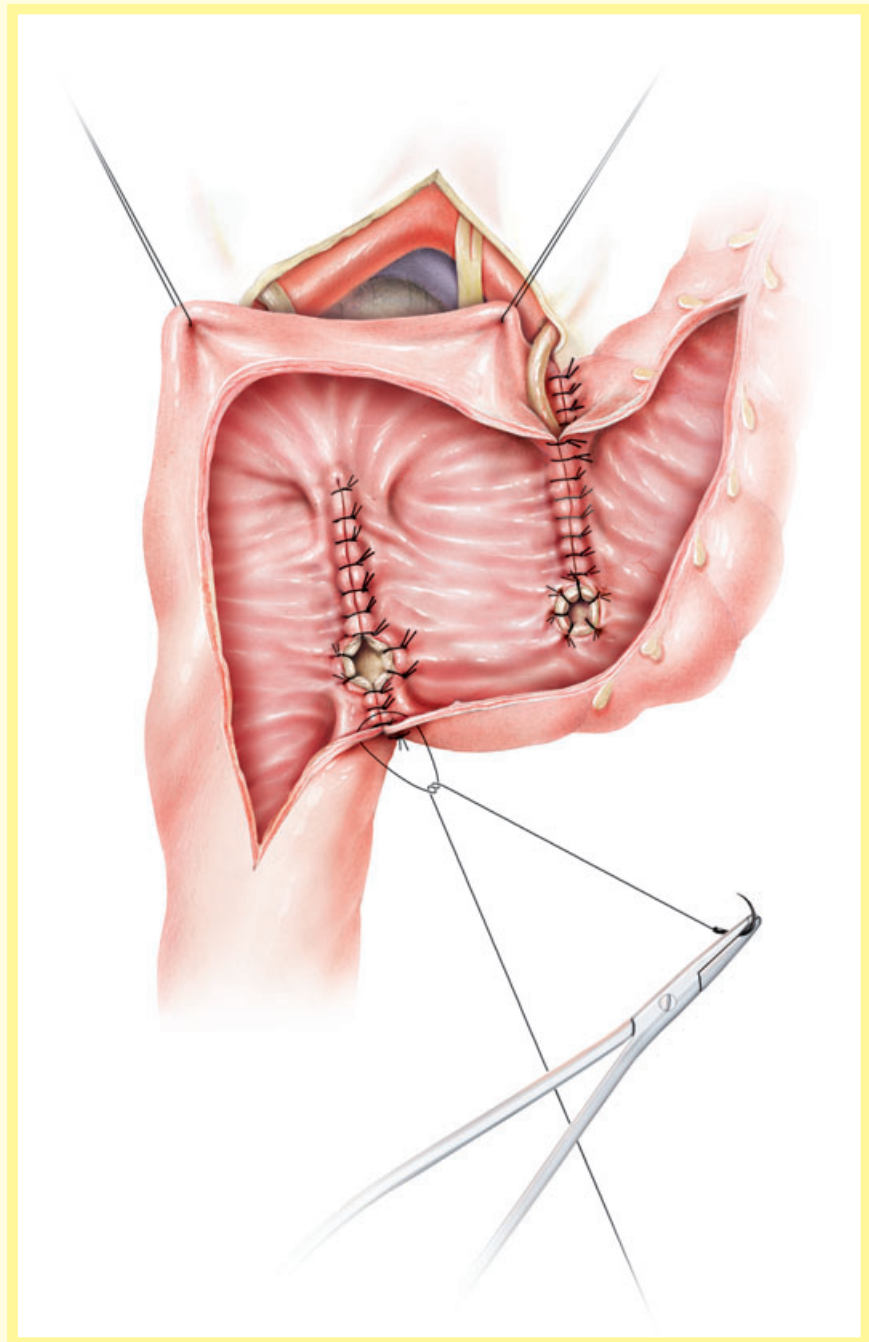


**Figure 13**

In cases of bilaterally dilated ureters, the right ureter can be implanted in the same manner.

Figure 14

The final result after bilateral ureteric implantation via a serous lined extramural tunnel. Because of the third sigmoid loop, the pouch is ideally located within the small pelvis, so that additional fixation to the promontory is not required.



POSTOPERATIVE CARE

The patient is allowed to drink the same evening. Bowel movements start mostly on the fifth day, then the rectal tube is removed. Otherwise a laxative (e.g. sodium amidotrizoate and meglumine, Gastrografin®) is given.

If the ureteric stents are not draining (blocked by blood clots or inserted too high, with lesion of the renal papilla) then use ultrasonography. If the patient is asymptomatic with no dilatation of the upper tract, then wait. If the patient is symptomatic and the kidney dilated, insert a percutaneous nephrostomy.

The fixation sutures of the stents are removed after 8–10 days; the stents will then displace spontaneously. Subsequent ultrasonography of the kidneys normally shows a mild dilatation.

Antibiotic treatment is continued for 3 weeks, followed by prophylaxis with nitrofurantoin for another 4 weeks.

If peritonitis develops then early revision is the method of choice, with a right transversocutaneostomy in case of pouch leakage and insertion of a drainage into the small pelvis.

Bicarbonate or Uralyt U® is used to correct a negative base excess early, that should not exceed –2.5. Blood gas analysis is mandatory

during the first weeks! Ultrasonography is repeated within 6 weeks, and colonoscopy should be done yearly starting in the fifth year after surgery. This investigation should be done by an experienced endoscopist, as accidental removal of the ureteric implantation site has been reported.

FROM SURGEON TO SURGEON

If the patient is obese and the mesentery of the sigma or the ureters are too short, change the approach and use another type of continent or incontinent diversion.

For the ureteric dissection, remember that mobilizing the left ureter is more critical; on the right side branches from the gonadal artery crossing the vena cava form a capillary network as an accessory ureteric blood supply; on the left, the gonadal vessels run parallel and medial with radial branches that can easily be injured during a more extended ureteric dissection.

A wide window of the mesosigmoid helps to bring the left ureter to the right side, so that it enters the pouch smoothly.

Remove any inserted stent before definitive ureteric implantation. Check capillary bleeding from the ureteric stump (× 2.5 loupe system) and spontaneous urine ejaculation before the splint is reinserted and fixed.

Use stay sutures that help to mark the length of the submucosal tunnel.

For serous-lined tunnelling, the first row of the side-to-side anastomosis close to the mesentery should be placed carefully, so as not to injure the blood supply of the bowel. Remember that the blood supply of the large bowel is different from the small bowel. The vasa recta arising from the arcade of Riolo are short radial vessels that reach the taenia libera from both sides. Sutures should be placed between the vasa recta. A larger diameter of the tunnel for ureteric implantation can be obtained by a more lateral opening of the bowel.

If the pouch plate is already constructed and ureters already implanted but the pouch cannot be closed without tension (mesentery turns too short), use an ileal patch for augmentation.

Dissection of the greater omentum is time-consuming, but it protects the pouch from urinary leakage and fills the small pelvis and, in cases of lymphadenectomy, the fossa obturatoria, thus lowering the risk of small bowel adhesions and bowel obstruction.

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