

Surgery Illustrated – Surgical Atlas

Bladder augmentation using bowel segments (enterocystoplasty)

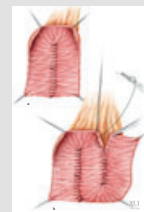
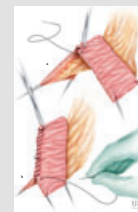
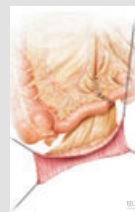
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INTRODUCTION

Gastric segments, small and large bowel segments as well as the ureter are used for bladder augmentation [1]. Since the late 19th century, ileal segments have been used for bladder augmentation (ileocystoplasty) [2,3]. Later, these segments were detubularised and reconfigured to create, together with the remnant bladder, a spherical reservoir [4]. In the middle of the past century, the use of caecum for bladder augmentation was reported [5,6,7,8]. In ileocaecocystoplasty, the presence of the appendix is advantageous for patients who are unable to perform clean intermittent self-catheterisation (CISC) through the urethra. In these cases, the submucosally embedded appendix can be used as an additional continent cutaneous stoma to evacuate the augmented bladder, as in patients with heterotopic continent cutaneous diversion [9]. If ureteric re-implantation is necessary, the ileocaecal valve can be used as anti-reflux mechanism for severely dilated ureters [10,11]. Non-dilated ureters can be implanted into the large bowel by the submucosal tunnel technique [12]. At the beginning of the 20th century, the use of sigmoid colon was reported for bladder augmentation (colocystoplasty) [13,14]. Gastrocystoplasty was reported in 1978 by Leong and Ong [15,16]. However, complications of bladder augmentation by gastric segments, e.g. hyponatraemic, hypochloaemic alkalosis, haematuria-dysuria syndrome [17,18] and secondary malignancies after the 10th postoperative year [19,20,21,22] made this type of bladder augmentation obsolete.



PLANNING AND PREPARATION

INDICATIONS

Enterocystoplasty is indicated in patients with an anatomically reduced bladder capacity and compliance (e.g. in neurogenic bladder, tuberculosis, radiation cystitis, interstitial cystitis). If a patient with neurogenic bladder is unable to perform CISC through the urethra due to anatomical or orthopaedic reasons, a 'Mitrofanoff' cutaneous stoma is of advantage for catheterisation [23]. Patient selection is critical. Patients with neurogenic bladder, who are not willing or motivated to perform CISC on a regular basis, are not candidates for enterocystoplasty. In patients with impaired manual dexterity who are not able to perform CISC, an incontinent urinary conduit diversion is preferable.

SPECIFIC INSTRUMENTS AND MATERIALS

- Optical loupes (2.5–3.5, 50 cm focal length)
- Allis clamps
- 4/0 glyconate monofilament absorbable sutures on a 1/2-circle needle (HR22) for bowel anastomosis and enterocystoplasty.
- 4/0 polyglytone monofilament rapidly absorbable sutures on a 1/2-circle needle (CV-23) for fixation of stents and cystostomy catheter.
- 4/0 polypropylene monofilament nonabsorbable sutures on a 1/2-circle needle (RB-1) for closing the caecal seromuscularis over the submucosally embedded appendix.
- 3/0 polyglactin braided absorbable sutures on a 3/8-circle needle (UR-6) for fixation of the efferent segment to the abdominal fascia.
- 4/0 polydioxanone monofilament uncoloured absorbable sutures on a cutting 3/8-circle needle (FS-2S) for anastomosis of the efferent segment with the umbilical skin.

- 6 F and 8 F polyurethane/polypropylene ureteric stents.
- 10 F 'pigtail' cystostomy catheter.

PATIENT PREPARATION

The day before surgery the bowel is cleansed by administering 3 L of polyethylene glycol solution. During surgery, antibiotics (e.g. ampicillin/clavulanic acid and metronidazole) are administered and continued for 7–10 days.

PATIENT POSITIONING

The patient is placed supine on the table with $\approx 15^\circ$ of overextension if possible. In patients with meningomyelocele, individual positioning is necessary to avoid skin ulcers. In all children, the operating theatre should be free of latex. The same applies for patients with spina bifida or bladder exstrophy.

ILEOCYSTOPLASTY

Figure 1

From a lower midline abdominal incision, the peritoneum is dissected from the posterior bladder wall for later coverage of the posterior anastomosis between the bladder and bowel.

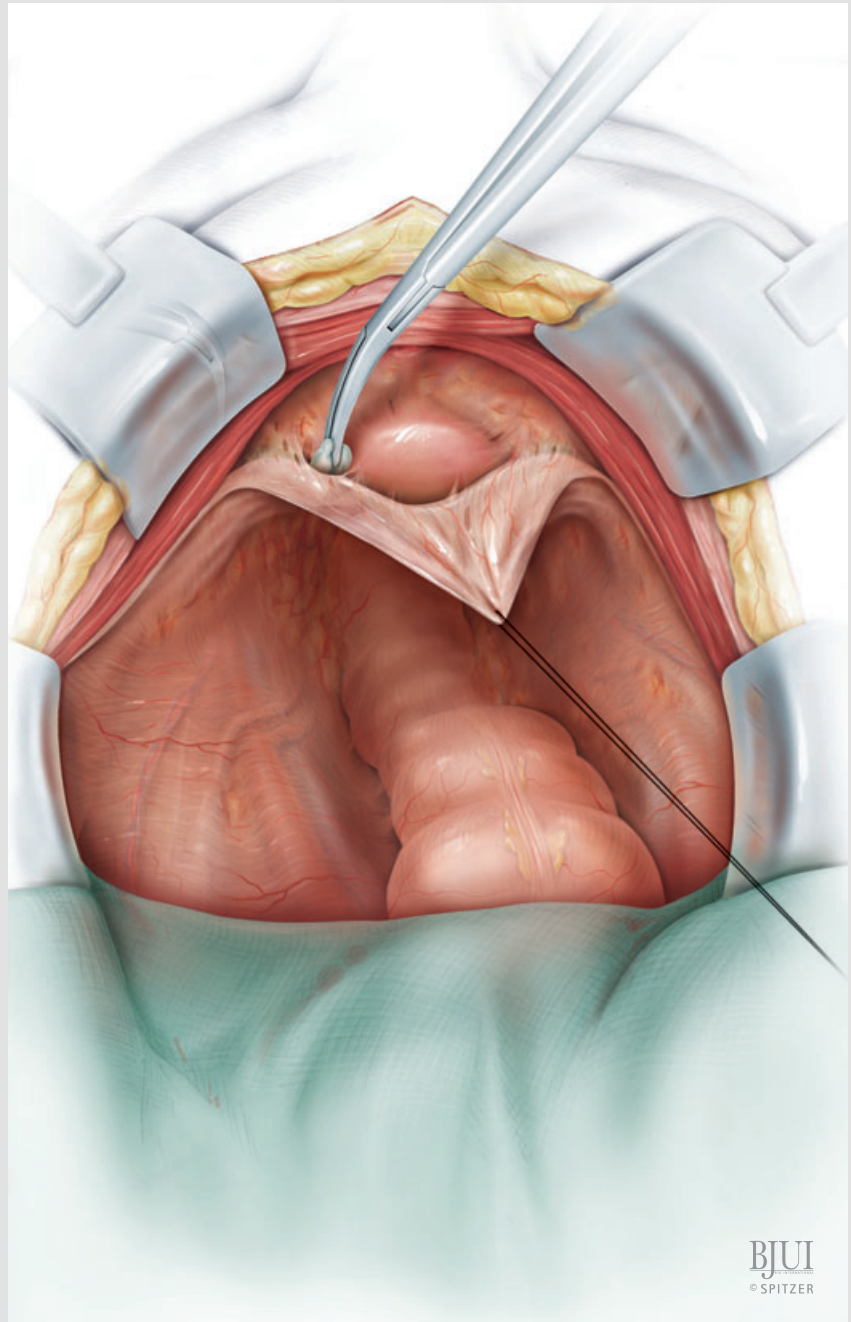


Figure 2

The bladder is opened transversally with the incision being extended close to the trigonum in order to obtain a large circumference for bowel anastomosis and avoid an 'hourglass' phenomenon.

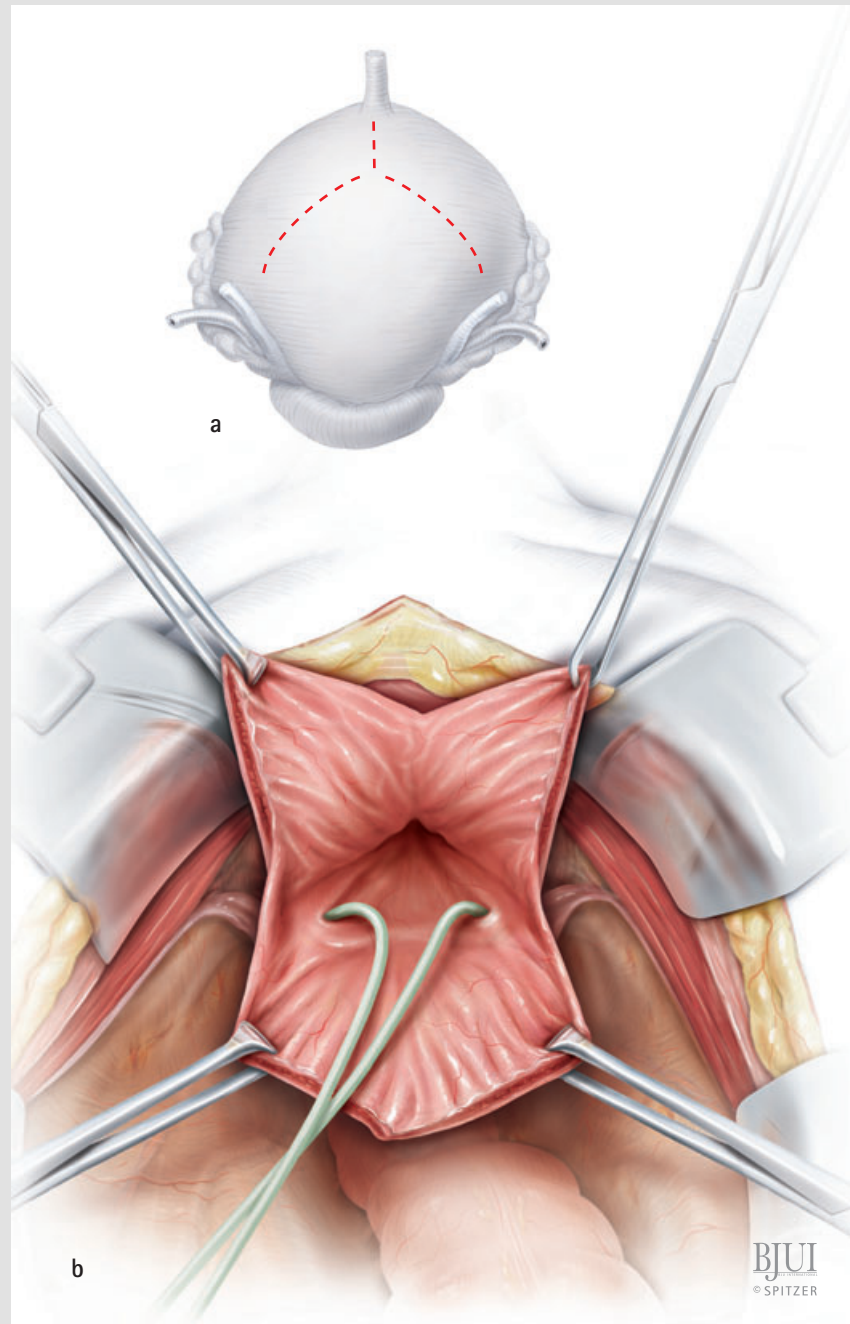


Figure 3

For ileocystoplasty, ≈ 30 cm of ileum are excluded from the bowel continuity and a spatulated seromuscular end-to-end anastomosis of ileum is made with 4/0 glyconate monofilament absorbable sutures using a 1/2-circle needle. A site of exclusion of the bowel segments for the ileocystoplasty should be chosen, where the mesentery can easily reach down to the bladder. The mesentery of the excluded ileum should contain more than one arcade to ensure adequate vascularisation.

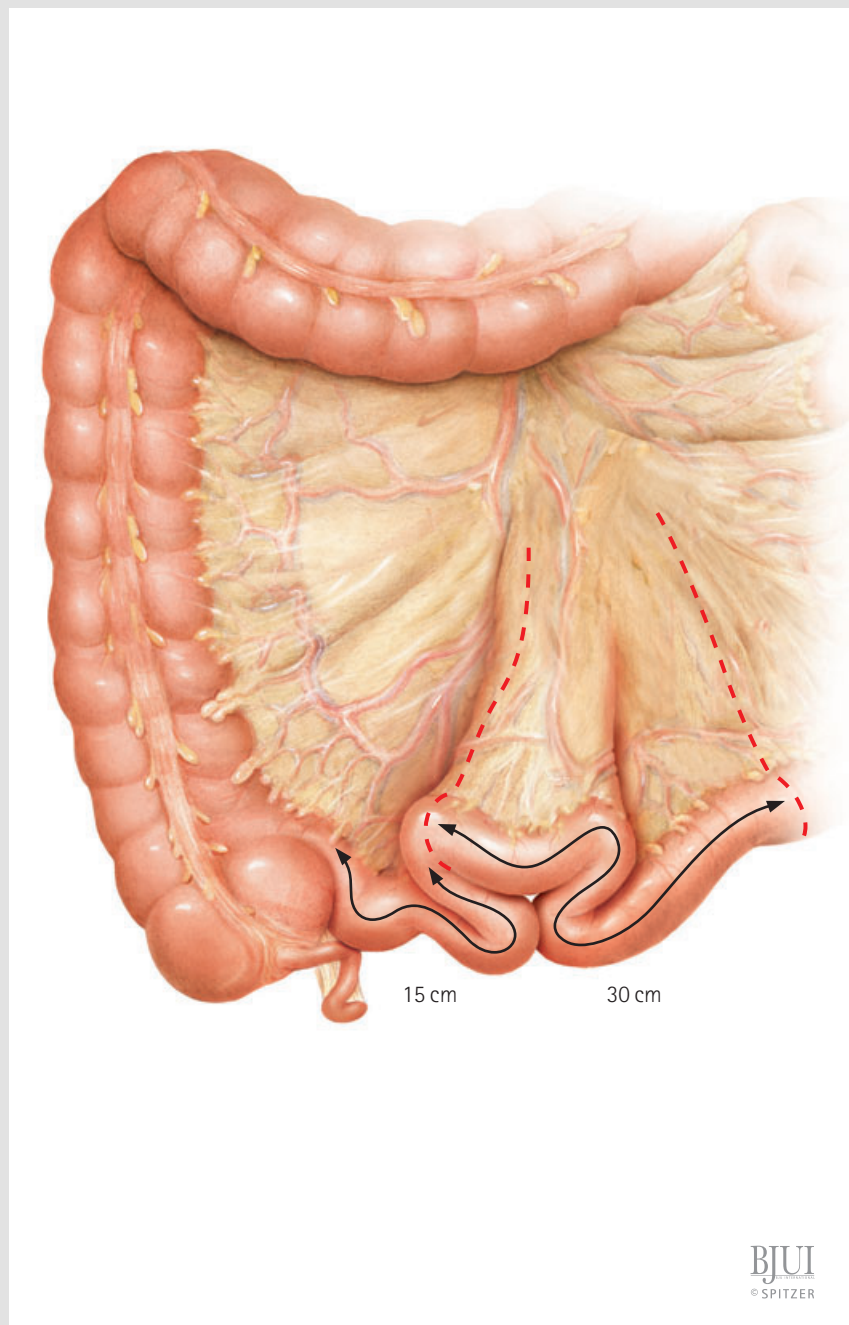
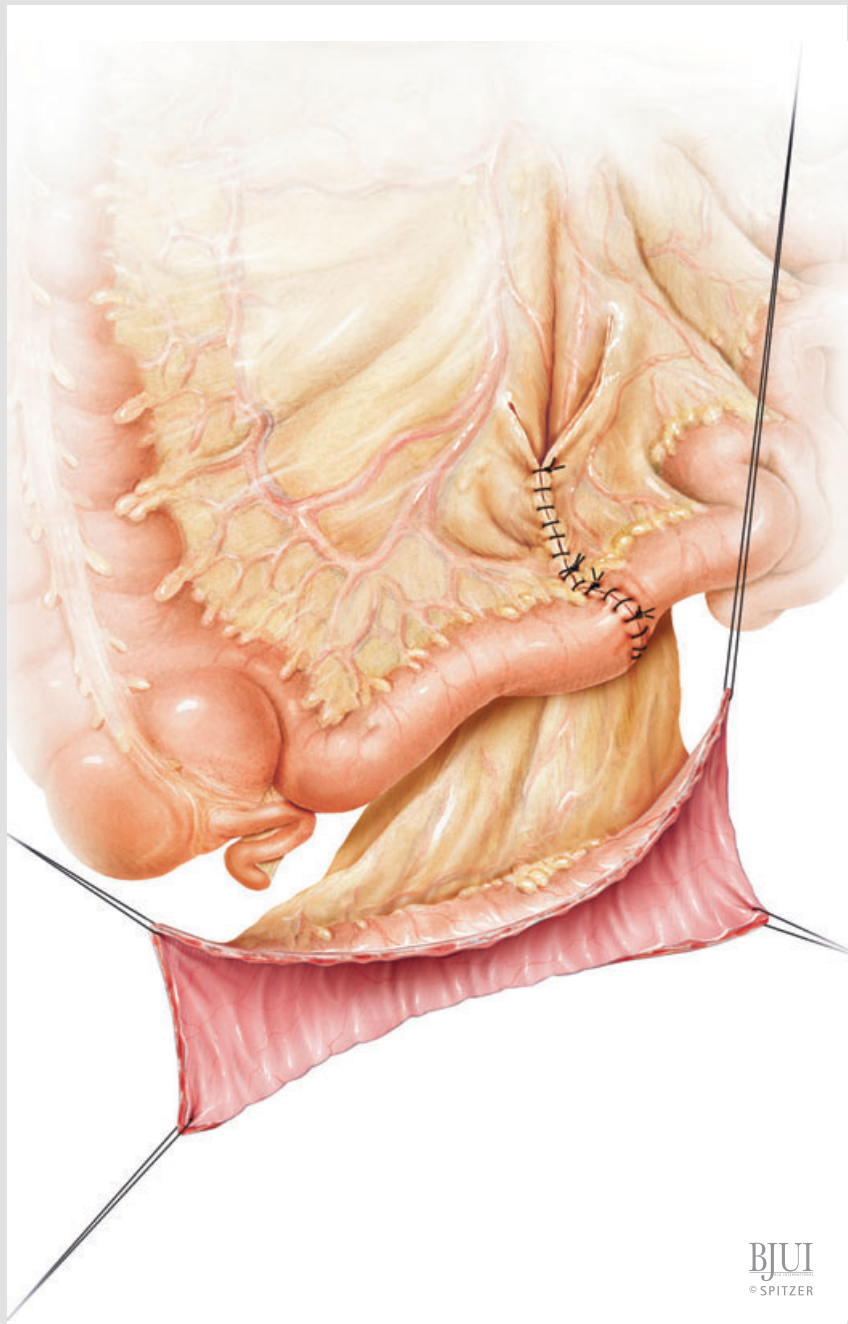


Figure 4

The ileal segment is intraoperatively flushed with saline and opened lengthwise at the opposite side of the mesentery.



Figures 5a and b

An Allis clamp is placed in the middle of the excluded ileal segment and the posterior wall of the ileal pouch is created by side-to-side anastomosis of the two opposed margins. The anastomosis is made by a single row of all-layer running sutures with 4/0 polydioxanone monofilament absorbable sutures on a straight needle, which allows faster hand suturing than a curved needle and a needle holder.

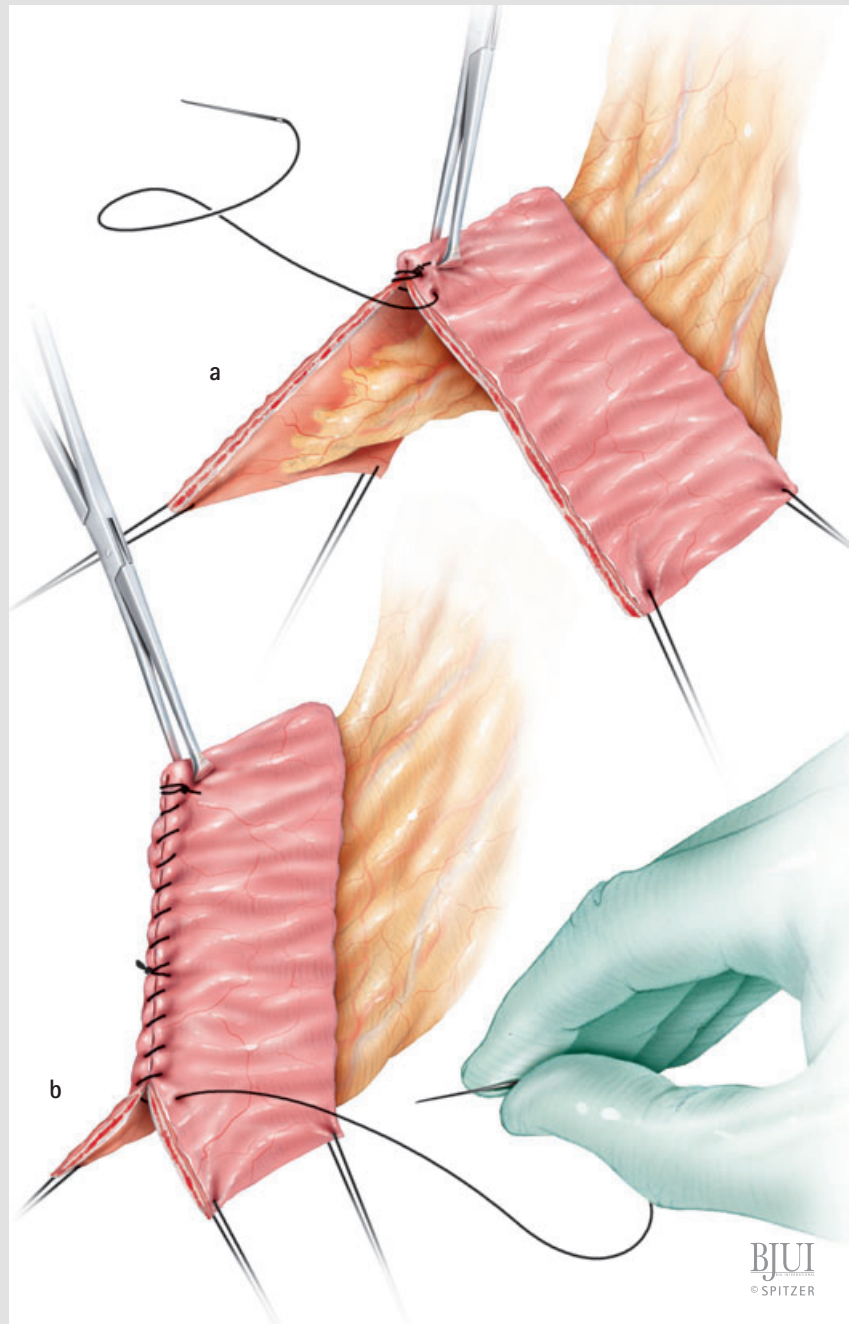


Figure 6a

Completed ileal plate.

Figure 6b

For cases with a very tiny bladder, a longer ileal segment (45 cm) is excluded, opened and the bowel segments are sutured in an 'S-shaped' configuration to each other.

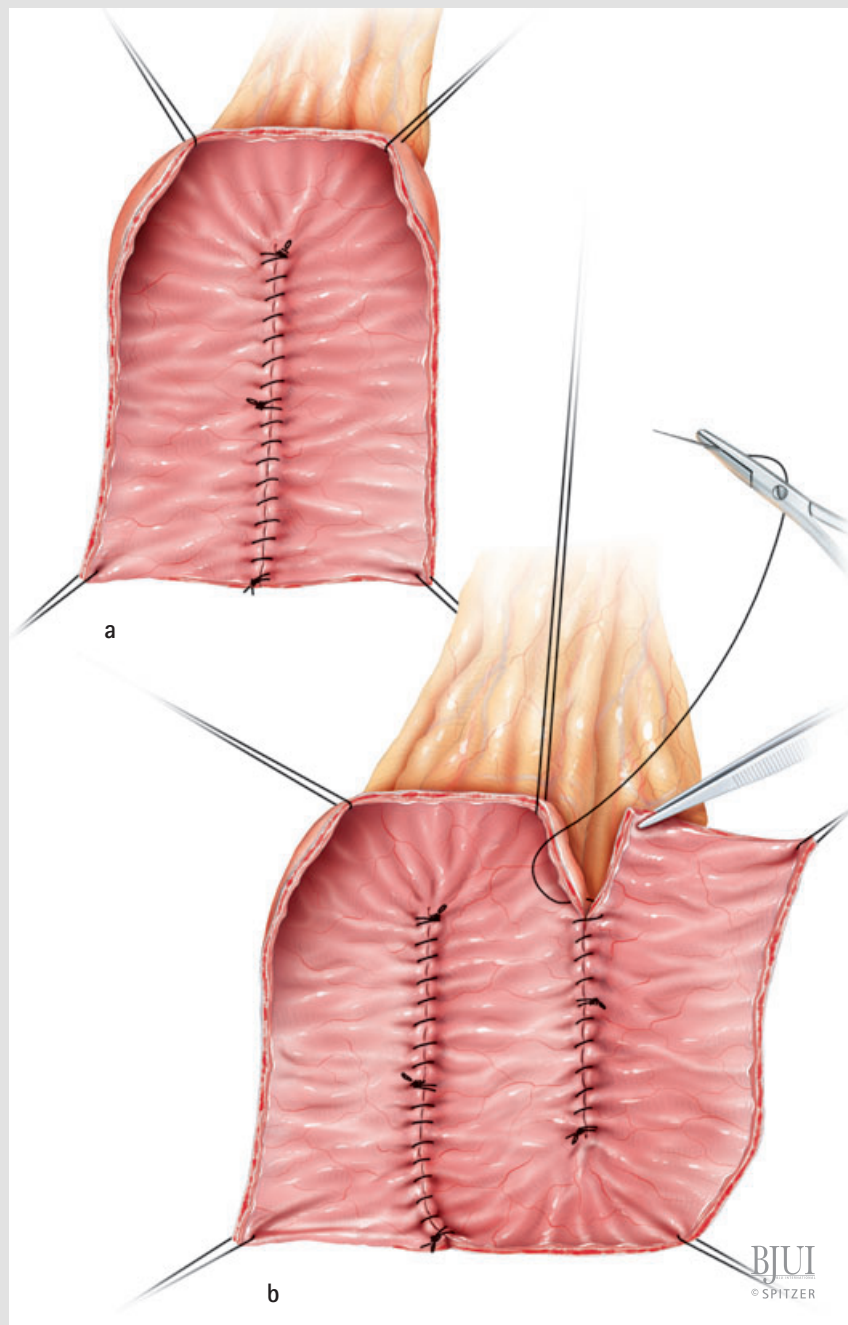
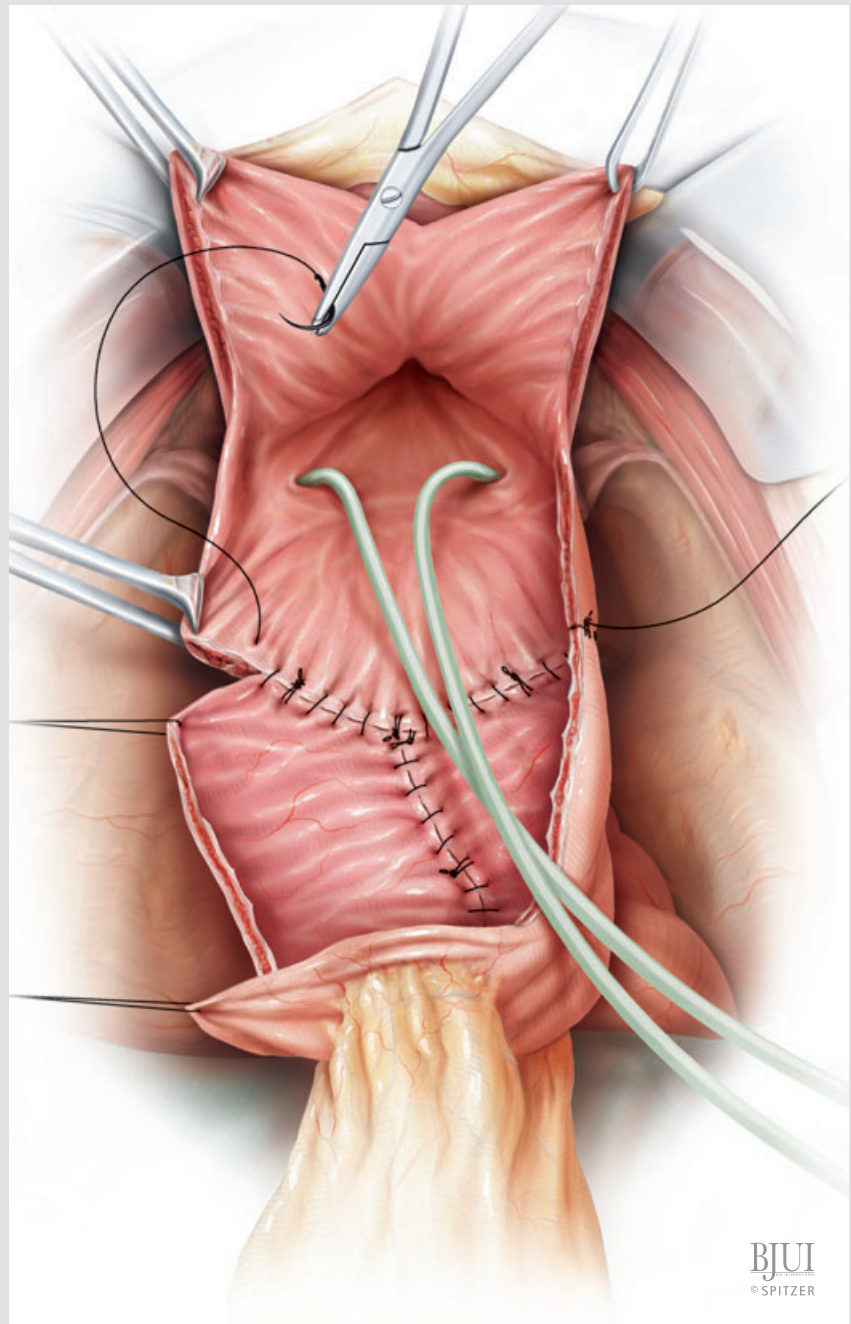


Figure 7

The ileal plate is sutured to posterior margin of the bladder remnant with all-layer 4/0 glyconate monofilament absorbable sutures on a 1/2-circle needle (HR22). Stenting of the ureters is only temporary for intraoperative identification of the ureteric orifices.

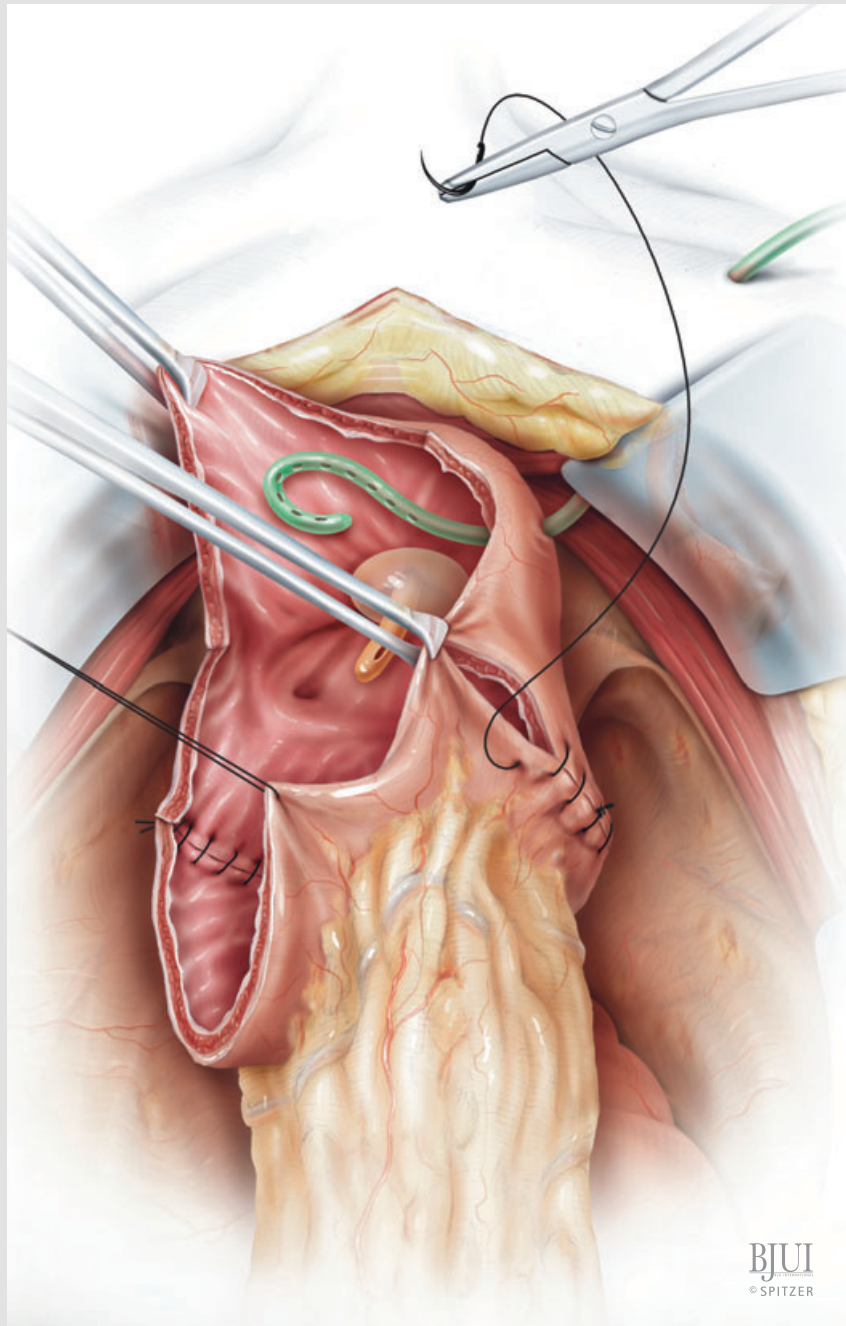


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Figure 8

The ileal plate is folded over to form Goodwin's 'cup patch'-pouch shape [4] and is sutured to the bladder remnant with all-layer 4/0 glyconate monofilament absorbable sutures on a 1/2-circle needle (HR22). Suturing starts on each side posterolaterally, where the previous posterior bladder–bowel anastomosis ended. Stenting of the ureters is not necessary in enterocystoplasty without ureteric re-implantation. A cystostomy catheter (10 F 'pigtail' catheter) is placed through the anterior bladder wall and fixed to it with a 4/0 polyglytone monofilament rapidly absorbable suture.

Gravity drains are placed at the anastomosis. In patients with a ventriculoperitoneal shunt, no drains are placed into the abdominal cavity.



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COLOCYSTOPLASTY (SIGMOID COLON)**Figure 9**

In some patients the mesentery of the ileum is too short to reach the bladder without tension. Moreover, in most patients with neurogenic bladder, the sigmoid colon is elongated and lies directly adjacent to the bladder dome. In these circumstances, colocystoplasty with sigmoid colon is an option. A 30-cm long segment is excluded from the bowel continuity.

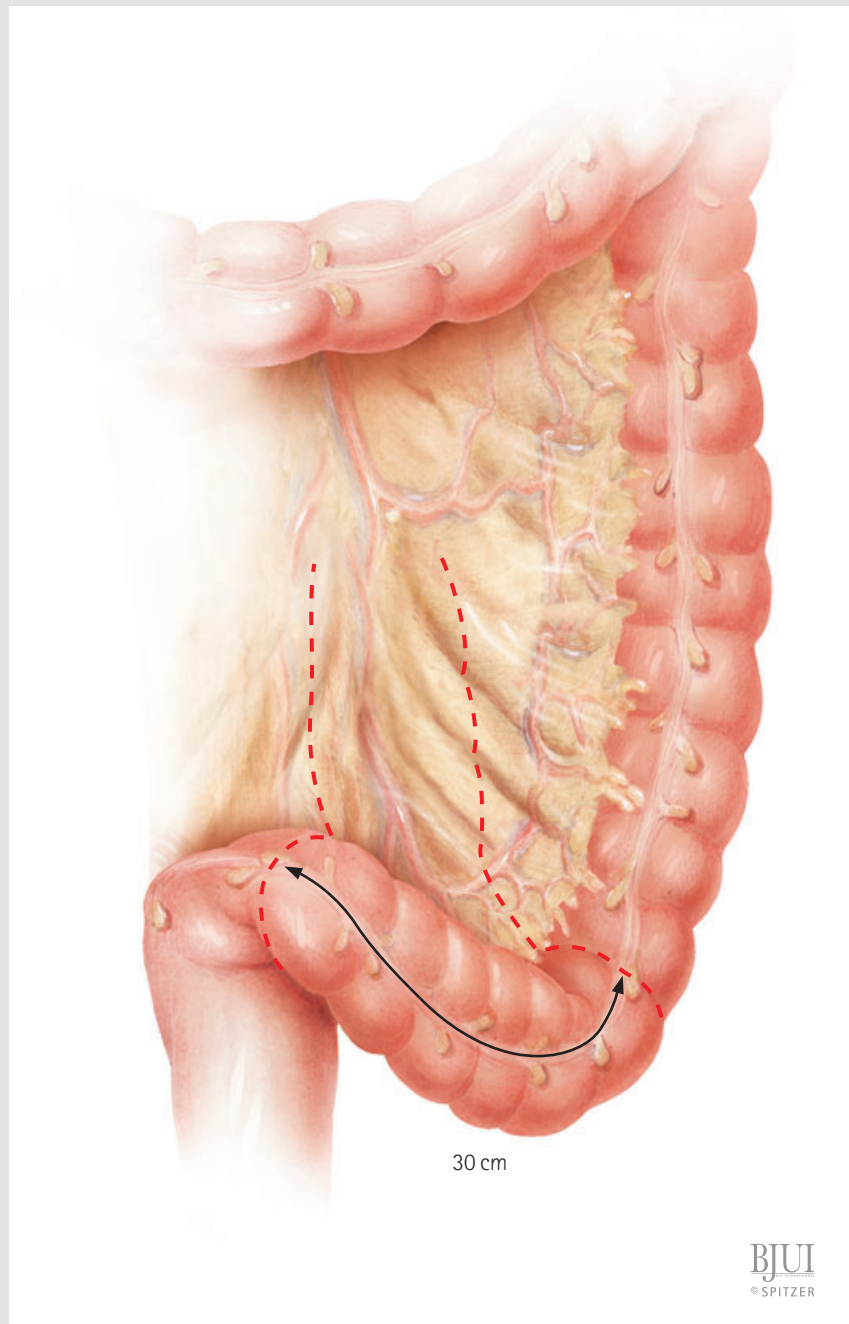


Figure 10

A seromuscular end-to-end anastomosis is made with 4/0 glyconate monofilament absorbable sutures on a 1/2-circle needle. The colon segment is intraoperatively flushed with saline, cleaned with gauze and opened at the anterior taenia.

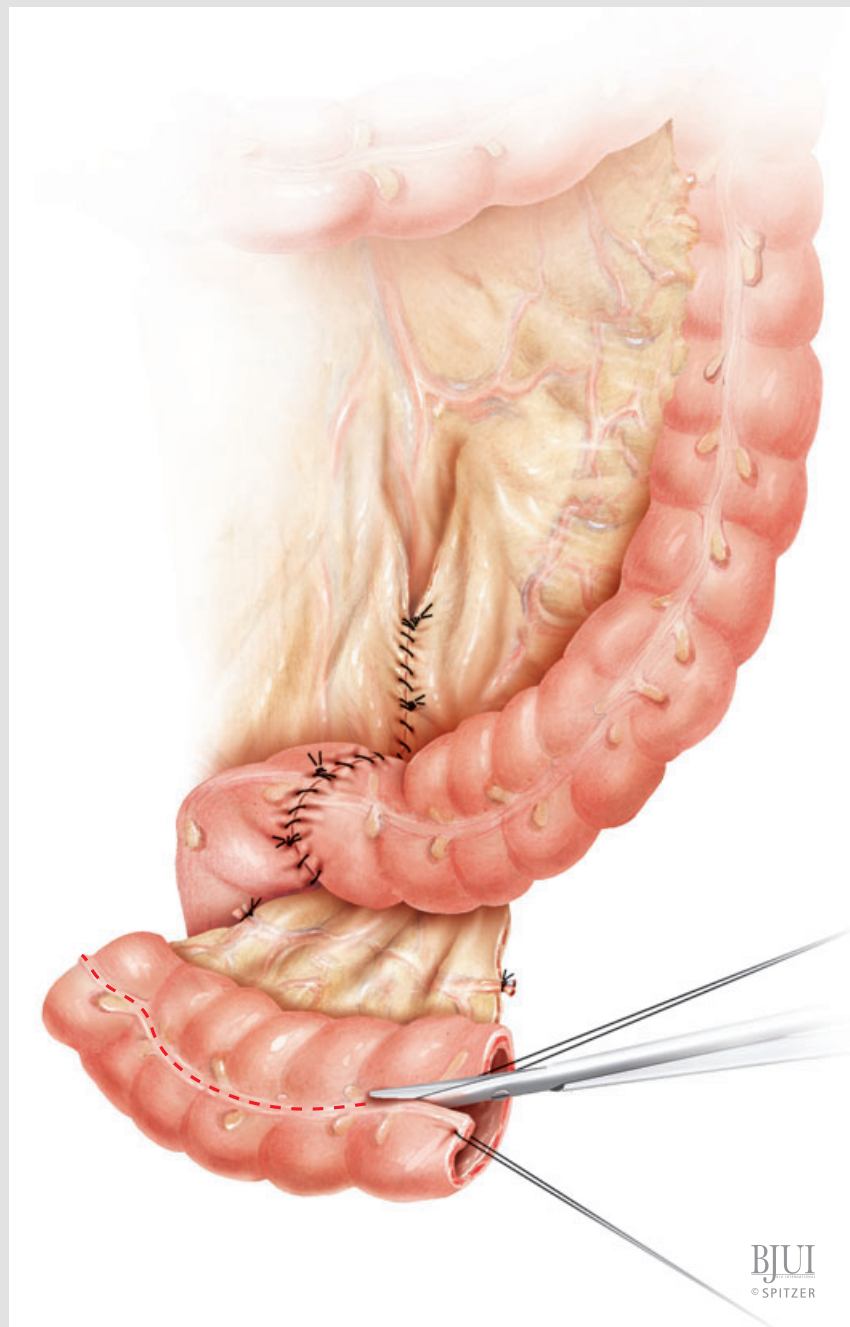
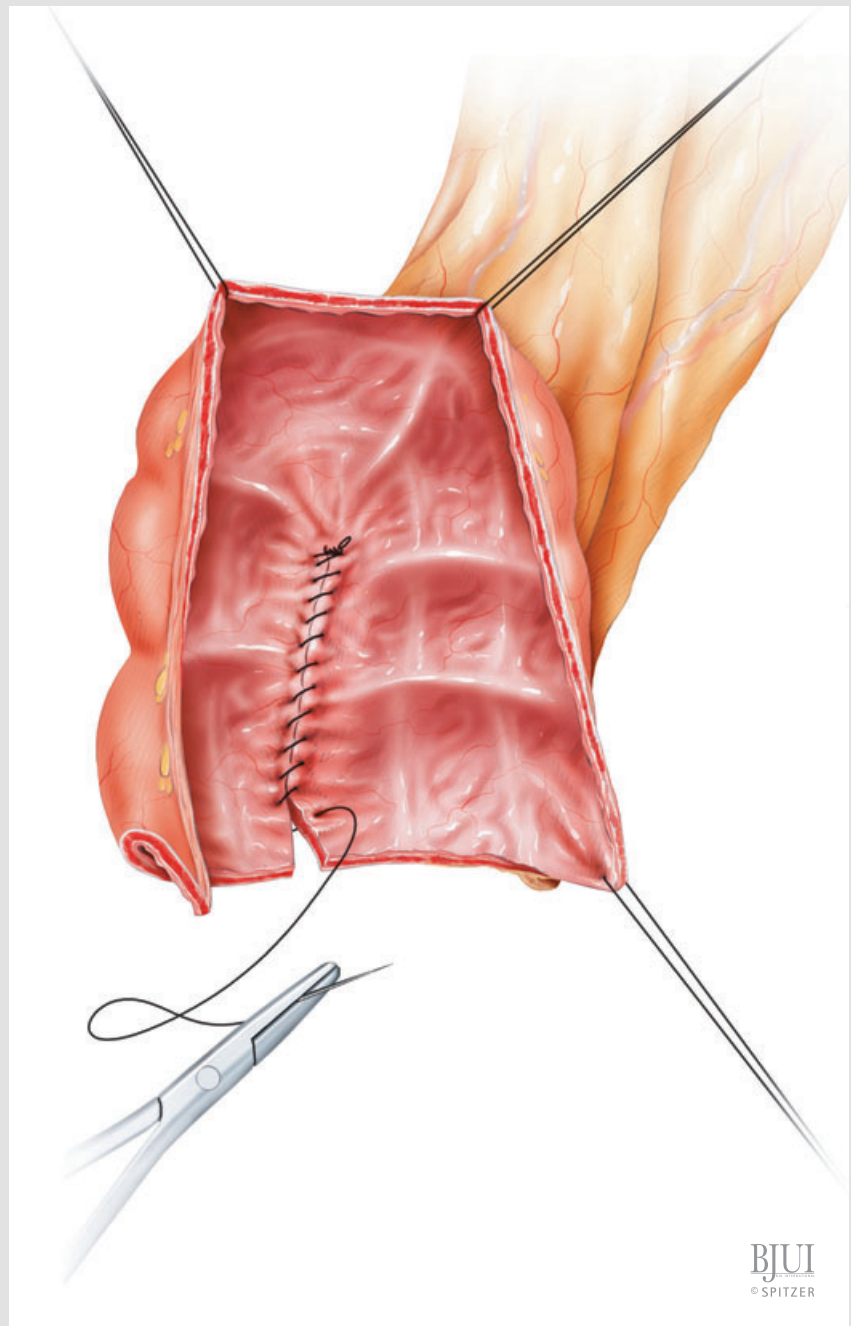


Figure 11

The posterior wall of the colon pouch is created by side-to-side anastomosis of the opposed margins. The anastomosis is made by a single row of all-layer running sutures with 4/0 polydioxanone monofilament absorbable sutures on a straight needle, which allows faster hand suturing than a curved needle and a needle holder. The colocolostomy is completed by folding over the bowel plate to form Goodwin's 'cup patch' (see Figure 8).

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ILEOCAECAECAL CYSTOPLASTY

Figure 12

In children, the ileocaecal segment can be used for bladder augmentation, if an additional Mitrofanoff stoma is required and the patient has no history of recurrent diarrhoea.

The appendix is opened at its distal end and calibrated with metal sounds up to 14–18 F in order to judge its size and thus if it is suitable for a catheterizable conduit.

If a continent cutaneous appendix stoma is feasible, windows of Deaver are created in the mesenterium of the appendix between the arcades and the seromuscularis of the anterior taenia of the caecum, which is split down to the mucosa from the base of the appendix over a length of ≈ 5 cm.

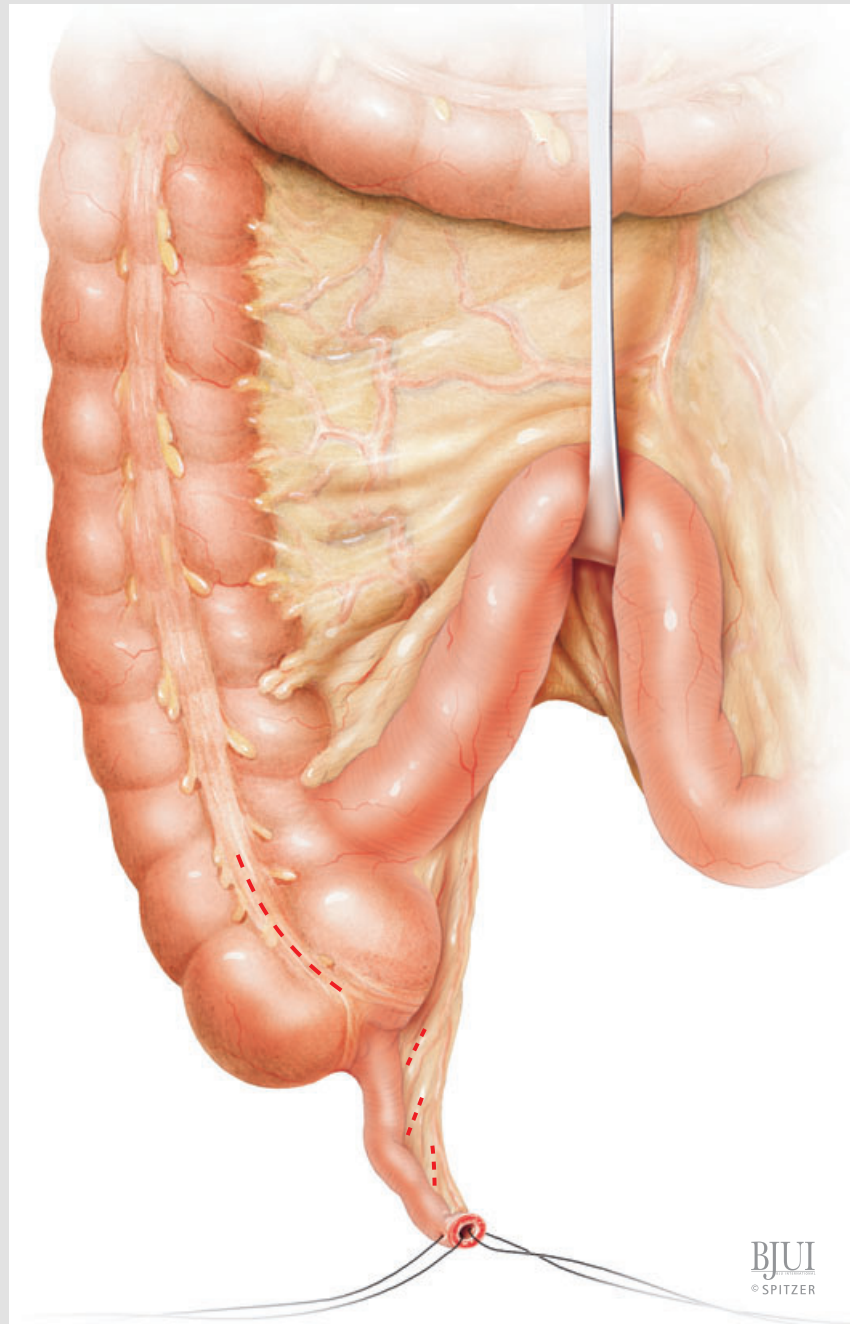
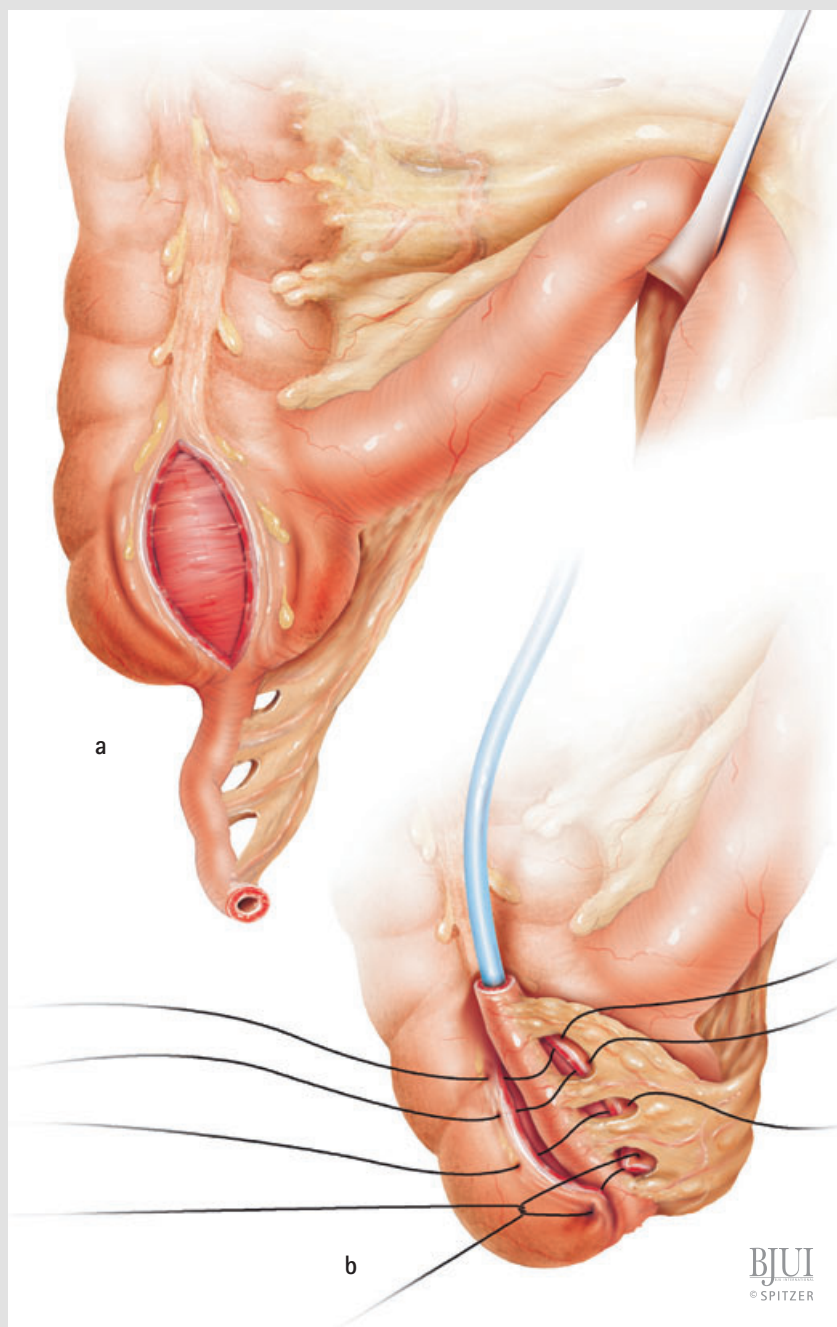


Figure 13a

The windows in the mesentery of the appendix are completed. At the lower caecal pole, a 5-cm long groove has been established from the base of the appendix by splitting the seromuscular layer of the anterior taenia. This allows submucosal embedding of the appendix.

Figure 13b

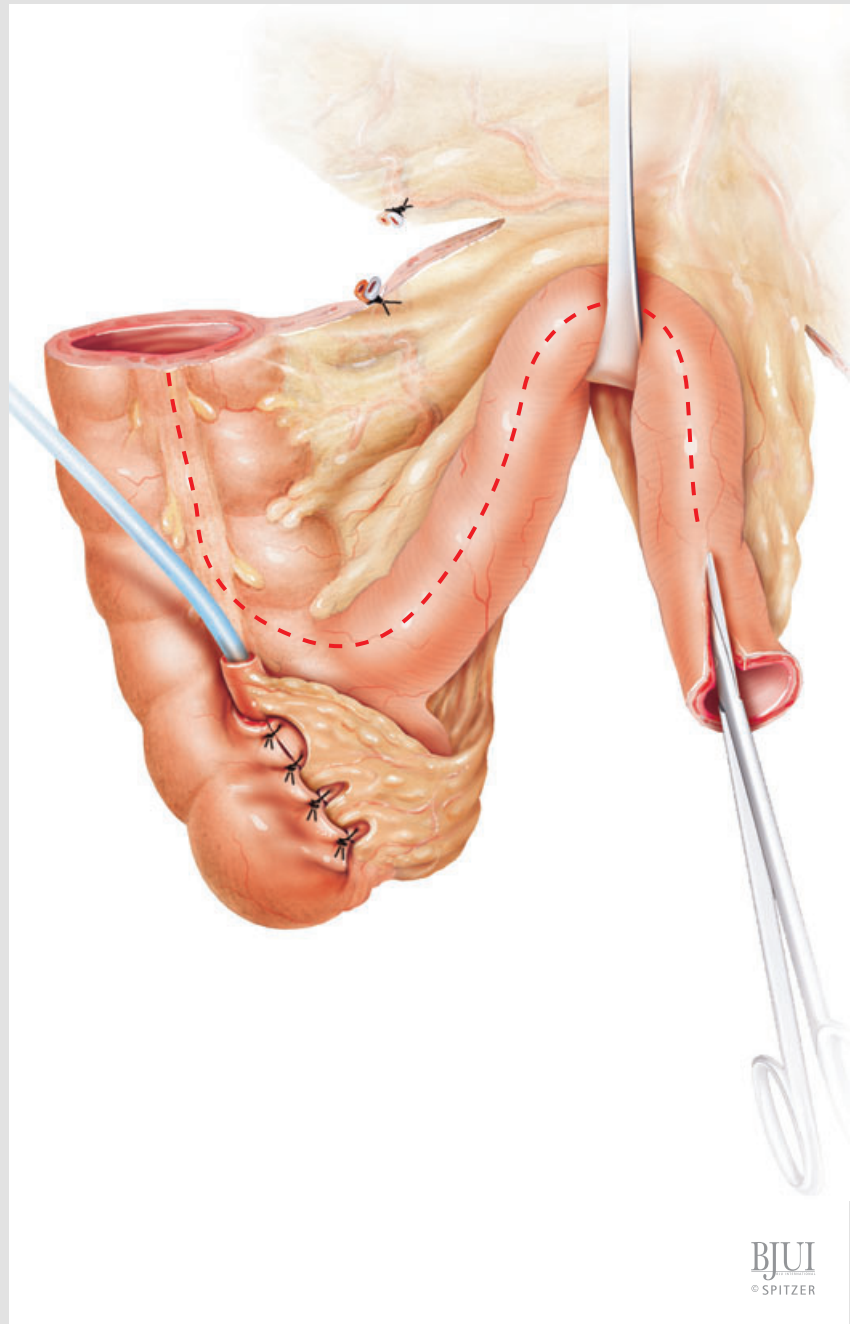
Before even opening the bowel, the appendix is intubated with a 14–16 F balloon catheter and is embedded into the groove between mucosa and the split seromuscular layers of the anterior taenia. The groove is closed over the appendix by several 4/0 polypropylene sutures between the margins of the split taenia, which are placed through the windows in the appendiceal mesentery as in the Mainz Pouch I technique [9].



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Figure 14

After the appendix has been embedded into the caecum, the bowel segments for the bladder augmentation are excluded from the bowel continuity. If ureteric re-implantation is not required, 10–12 cm ileum and 10–12 cm caecum are used. The segments are opened at their antimesenteric borders. A side-to-side anastomosis of the ileum and caecum is made to create the posterior plate of the pouch for bladder augmentation as in Figures 7 and 11. The ileocaecocystoplasty is completed as described in Figure 8.



POSTOPERATIVE CARE

MEDICATION

Antibiotics (ampicillin/clavulanic acid and metronidazole) are started at surgery and continued for 5–7 days afterwards.

Patients are mobilised as early as the first day after surgery. At discharge from the hospital, the 'pigtail' cystostomy catheter and the Foley catheter are left indwelling on continuous drainage for 3 weeks, and patients are instructed to irrigate their augmented bladder. After 3 weeks, a cystogram is taken to exclude extravasation and the Foley catheter is removed. The cystostomy catheter is used to check for residual urine after spontaneous voiding and is removed when efficacy of voiding is confirmed.

FROM SURGEON TO SURGEON

If there is extravasation from the pouch and associated symptoms after removal of the catheters at 3 weeks, the leakage might be from the site of the cystostomy catheter. Usually the problem is solved by reinserting the transurethral Foley catheter for about another 10 days.

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Abbreviation: CISC, clean intermittent self-catheterisation.