



P. C. Ambe · G. Möslein

Center for Hereditary Tumors, Helios University Hospital Wuppertal, University Witten-Herdecke, Wuppertal, Germany

Ileoanal pouch

Proctocolectomy with an ileoanal pouch is the procedure of choice for a variety of underlying diseases, such as ulcerative colitis (UC), classic familial adenomatous polyposis (FAP), and other polyposis syndromes or conditions with multiple synchronous cancers involving the rectum. Recently, the indications for Crohn's colitis and slow-transit constipation are being revisited. Proctocolectomy with an ileoanal pouch is mostly indicated as an elective prophylactic procedure, rarely in the event of a manifest cancer.

Since the first description of the procedure in 1978 by Parks and Nicholls with an S-pouch [1] and the J-pouch by Utsunomiya in 1983 [2], the latter has become the overall recommended standard. Functional outcome has a major influence on quality of life (QoL; [3]) and the specifics of the underlying disease play an important role regarding, for example, an indication for protective ileostomy or completion of rectal resec-

tion as a total mesorectal excision (TME) or a “close shave” rectal resection.

In the event of an underlying FAP, desmoid tumors (aggressive fibromatosis) must be prevented, since they are not only the most predominant cause of mortality, but they also have the most decisive influence on QoL. Desmoids usually occur in the intestinal mesentery and growth is triggered or enhanced by trauma—a major argument against performing a routine ileostomy owing to double surgery at the identical ileostomy site. Leaving the mesorectum in place, instead of removing it in the corresponding sheath, may dispose the tissue to functional problems, such as desmoids, and cause malfunction of the pouch reservoir, such as therapy-refractory pouchitis, pouch in- or outlet problems, and fistulae.

Last but not least, the issue of the established, preferred double-staple anastomosis, which according to the literature yields better functional results than

a hand-sewn anastomosis, must be challenged and the discussion on this subject resumed. For patients with UC, specifically “cuffitis,” and for patients with FAP, the sequelae of regrowth of neoplasia in the rectal remnant are a difficult clinical problem to resolve. This must be addressed and technically revisited, since both problems frequently necessitate a reoperation with resection of the rectal remnant and—against the aim—is often solved by fashioning a permanent ileostomy, with all the health and QoL constraints that this involves.

Diagnosis and surgical indication

The diagnosis and primary treatment of UC is conservative and lies in the hands of gastroenterologists. Surgery is an option for patients who are refractory to treatment and/or who present with dys- or neoplastic lesions. In children and adolescents, growth retardation may be an-



Fig. 1 ◀ Patient positioning: The patient is placed in a Trendelenburg low lithotomy position and special care is taken to position the legs in well-padded boots

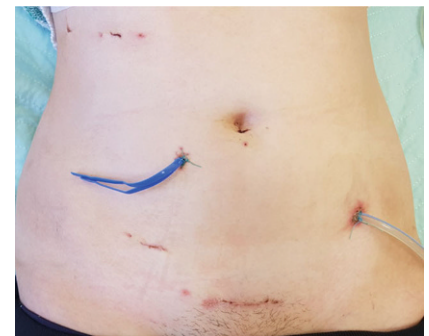


Fig. 2 ▲ Postoperative illustration (day 5) with the virtual ileostomy in place

The German version of this article can be found under <https://doi.org/10.1007/s00053-018-0232-1>

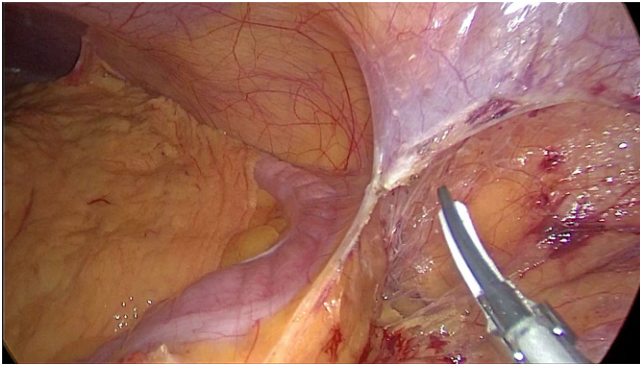


Fig. 3 ▲ Detaching the embryonic adhesions at the height of the sigmoid colon and moving proximally after long-segment visualization of the left ureter

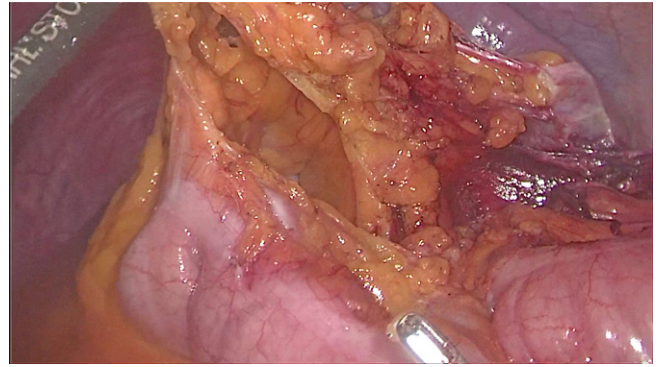


Fig. 4 ▲ Opening of the lesser sac and detachment of the entire greater omentum from the left to the right flexure

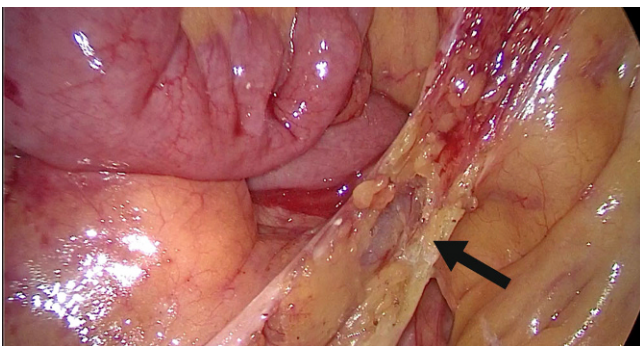


Fig. 5 ▲ Dissection of the mesenteric pedicle centrally and visualization of the mesenteric artery (*arrow*). The surrounding fatty tissue is dissected and if necessary the visceral peritoneum is incised for length gain



Fig. 6 ▲ Transanal retrieval of the entire proctocolectomy specimen

other indication to proceed with surgery. Both indeterminate colitis and Crohn's colitis without anorectal manifestation are no longer considered an absolute contraindication; however, it is mandatory to inform patients about the increased rate of pouch failure in these cases (approx. twofold compared with UC).

To determine the timing for prophylactic surgery in FAP patients, both the phenotype (clinical manifestation) and symptoms should be taken into account. Molecular genetic proof of the diagnosis of FAP and detection of a pathogenic mutation in the APC gene are preferable but not indispensable prior to surgery. The lack of proof of the underlying genetic cause does not influence the surgical indication. Symptoms that should drive toward prompt surgery include growth retardation, diarrhea, chronic anemia, or abdominal pain. A recently implemented international staging system, which classifies size, distribution, and histology of

adenomas in FAP in conjunction with a recommended therapeutic strategy, is helpful and should be applied as preoperative score [4].

Choice of procedure

In classic FAP without cancer, as a basic principle one-stage laparoscopic (also secondary to previous abdominal surgery) proctocolectomy is pursued, whereas for the attenuated phenotype, laparoscopic (sub)total colectomy is the procedure of choice. The indisputable and clear advantage of the laparoscopic approach, including the beneficial effect on female fertility, is well-documented [5, 6].

As our general strategy, we aim to avoid both larger incisions and a routine protective ileostomy, to leave the omentum, and to perform a TME, if applicable as a transanal laparoscopic TME (taTME). If the laparoscopic approach

is not feasible for technical reasons, our preference is a small Pfannenstiel incision and a hand-assisted completion of the colectomy. A deviation stoma is avoided in favor of a virtual ileostomy, as has been described by the authors [10], in conjunction with an anal tube, unless the tension of the pouch mesentery is worrisome or a primary anastomotic leak is demonstrated.

In the event of UC, indeterminate colitis, or Crohn's disease, for reasons stated earlier, the primary laparoscopic approach for elective surgery is preferred, mostly as a two-stage procedure. In the emergency setting or in comorbid and immunosuppressed patients, an initial subtotal colectomy with preservation of a sufficiently long rectal remnant and terminal ileostomy, if possible laparoscopically with a single-port approach (at the site of the future ileostomy), is recommended. Consecutively, the single-port site is used for colonic speci-

men extraction and for fashioning of the terminal ileostomy. Laparoscopic completion proctectomy is pursued once the patient has recovered and medication can be reduced or omitted. Again, the single-port incision will be employed by closing the detached terminal ileum, repositioning into the abdomen for the abdominal preparation and rendezvous approach. The ileoanal pouch will later, by detaching the embryonic adhesions at the height of the sigmoid colon and moving proximally after long-segment visualization of the left ureter, be fashioned exteriorly after mobilization of the small bowel. A consecutive deviation will generally be avoided, especially since the mesentery is spontaneously elongated after a deviating ileostomy and therefore the pouch-anal anastomosis is generally tension-free.

Surgical procedure

The patient is placed in a Trendelenburg low lithotomy position and special care is taken to position the legs in well-padded boots (■ Fig. 1). The first incision is made in the umbilicus and after gas insufflation and an initial inspection of the abdomen, three to four trocars are placed under vision (positions are demonstrated in ■ Fig. 2). A 5-mm trocar is positioned at the previously marked optimal site for an ileostomy. If a projected virtual ileostomy is performed, the vessel loops will be everted and secured at this trocar site.

The preparation is initiated by detaching the embryonic adhesions at the height of the sigmoid colon and moving proximally after long-segment visualization of the left ureter (■ Fig. 3). This is followed by exposure of the inferior mesenteric vessel pedicle and rather central transection of both the vein and artery (approx. 2 cm distal to the origin) between clips. After close colonic dissection at the height of the splenic flexure, the greater omentum is preserved and the lesser sac is entered (■ Fig. 4). This preparation is continued along the transverse colon as far as easily feasible, usually until almost reaching the hepatic flexure (left-sided tilt of the patient for this procedural step).

At this point, the surgeon and camera surgeon shift to the left side of the patient.

coloproctology 2018 · 40:130–135 <https://doi.org/10.1007/s00053-018-0238-8>
© Springer Medizin Verlag GmbH, ein Teil von Springer Nature 2018

P. C. Ambe · G. Möslein

Ileoanal pouch

Abstract

Proctocolectomy with an ileoanal pouch is the procedure of choice for a variety of underlying diseases, such as ulcerative colitis, classical familial adenomatous polyposis (FAP) and other polyposis syndromes or conditions with multiple synchronous cancers involving the rectum. Recently the indications for Crohn's colitis and slow transit constipation are being revisited. Since the first description of the procedure in 1978 by Parks and Nicholls with an S-pouch and the J-pouch by Utsunomiya in 1983, the latter has become the overall recommended standard. Multiple procedural details are not described in the literature; however, these may contribute to important differences in functional outcome. The methodology varies with the recommended one, two and three-stage procedures and also in being performed conventionally or laparoscopically. Additionally, since the

introduction of taTME for rectal cancer, a retake of the discussion regarding the most recommendable ileal pouch-anal anastomosis has evolved. In this article we describe our technical approach for a one-stage procedure of laparoscopic proctocolectomy. It has become our strategy of choice to defer from routine ileostomy and to perform the rectal resection as transanal laparoscopic total mesorectal excision (taTME). Additionally, perioperative management, outcome and the current literature are discussed. The report is illustrated with pictures of a 26-year-old female patient with FAP and profuse distal polyposis reaching the supra-anal level.

Keywords

Prophylactic proctocolectomy · Virtual ileostomy · Ghost ileostomy · Ulcerative colitis · Familial adenomatous polyposis

Ileoanaler Pouch

Zusammenfassung

Die Proktokolektomie mit einer ileoanal Pouchanlage ist das Verfahren der Wahl für unterschiedliche Grunderkrankungen wie die Colitis ulcerosa (CU), klassische familiäre adenomatöse Polyposis (FAP) und auch andere Polyposis-Syndrome bzw. bei synchronen kolorektalen Karzinomen mit Rektumbeteiligung. Neu diskutiert wird heute die Indikation bei M. Crohn und selten bei der schweren Slow-transit-Konstipation. Seit der Erstbeschreibung des Verfahrens 1978 durch A. Parks und R. Nicholls mit einem S-Pouch hat sich der von J. Utsunomiya 1983 beschriebene J-Pouch als Standard durchgesetzt. Zahlreiche Details in der Durchführung des Verfahrens werden in Darstellungen nicht beschrieben – diese könnten jedoch einen wesentlichen Beitrag zu einem unterschiedlichen funktionellen Outcome leisten. Grundlegende Unterschiede bestehen in einem ein-, zwei- und dreizeitigen Vorgehen sowie dem offenen oder laparoskopischen Verfahren. Seit der Einführung der transanal laparoskopischen totalen mesorektalen Exzision (taTME) für

onkologische Rektumresektionen und den theoretischen Vorteilen dieses Verfahrens, ist eine Diskussion um die zu empfehlende ileopouchanale Anastomosentechnik erneut entfacht. In diesem Beitrag wird eine Operationsmethode vorgestellt, die Schritt für Schritt das einzeitige Vorgehen bei der laparoskopischen Proktokolektomie darstellt. Besonderheiten sind v. a. der Verzicht auf eine Protektion (Stoma) und die Durchführung der Rektumresektion als taTME. Zusätzlich werden das perioperative Management, eigene Ergebnisse und die aktuelle Literatur diskutiert. Zur Illustration des beschriebenen Verfahrens wird die Operation bei einer 26-jährigen Patientin mit einer FAP und ausgeprägtem tiefem Polypenbefall im Rektum dargestellt.

Schlüsselwörter

Prophylaktische Proktokolektomie · Virtuelle Ileostomie · Ghost-Ileostoma · Colitis ulcerosa · Familiäre adenomatöse Polyposis

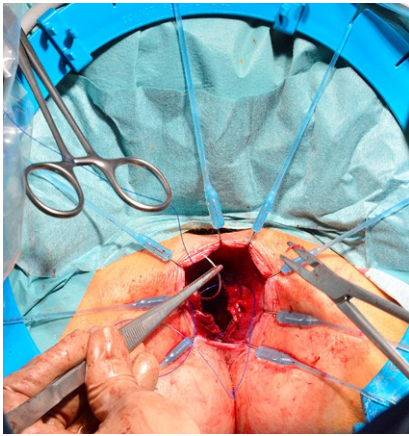


Fig. 7 ▲ Transanal fashioning of the distal purse-string suture

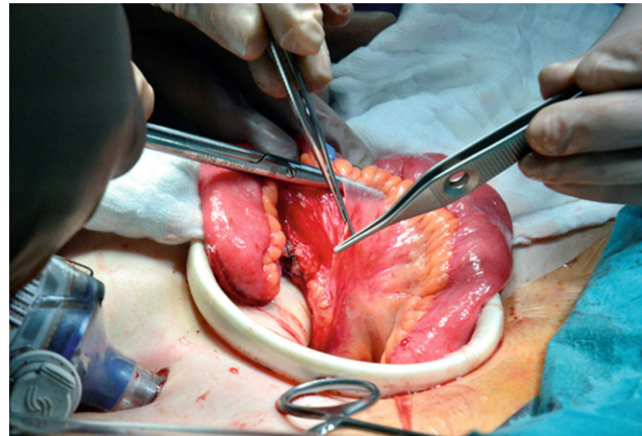


Fig. 8 ◀ Peritonectomy of the mesentery and incision of the visceral peritoneum with dissection of arcades for lengthening if required

We assume the preparation of the cecum and if necessary mobilize the appendix and the terminal ileum, lift and transect the ileo-colic pedicle centrally. Dissection of the ascending colon beyond the hepatic flexure and completion of mobilization of the entire colon are performed next, also completing the mobilization and preservation of the omentum. Transsection of the colonic vessels ensues in clockwise direction. The right colic and the right and left branches of the mid-colic vessels are divided, again quite centrally. This is followed by dissection of the mesentery at the height of the ligament of Treitz and if required incision of the visceral peritoneum and mobilization of the mesenteric pedicle in order to gain optimal lengthening for the pouch (every millimeter counts!; ■ Fig. 5). The entirely devascularized colon is positioned ventrally and the small bowel is folded in the upper left quadrant of the abdomen. The terminal ileum is divided with the linear cutter in close proximity to Bauhin's valve.

The procedure is now continued with two simultaneous teams, if available. The abdominal team proceeds with the rectal dissection in the TME sheath, whereas a second team performs the taTME. For this, the patient's legs are approximated to an intermediate height and the taTME monitor is positioned at the opposite cephalad side, for a comfortable monitor view. In order to insert the platform as atraumatically as possible and after placing the Lone Star retractor, intersphincteric injection of carbostesin is

administered in four quadrants. If polyp growth reaches far down distally, as shown in this patient, after submucosal injection of 1:10 suprapurin a primary mucosectomy is preferred. The proximal purse-string suture—depending on the local appearance—may be fashioned under direct visualization or placed laparoscopically after insertion of the platform. This is followed by preparation of the extramesorectal sheath up to the rendezvous with the abdominal team. The surgeon decides, depending on general appearance and preference, whether the specimen is to be extracted transanally or via a small Pfannenstiel incision (the length of which depends on the size of the specimen). In this procedure, the transanal extraction is hassle-free (■ Fig. 6). Distal purse-string suturing is performed under direct visualization (■ Fig. 7) and the knot is placed on the advanced spike of the circular stapler for the anastomosis. Alternatively, at this point a 12-mm silicone drain may be advanced transanally and the purse-string suture tied upon it, as a guiding rod connected to the anvil in the pouch, in order to advance the pouch more easily into the pelvis. The ileoanal reservoir is constructed by exteriorization of the terminal ileum via the Pfannenstiel incision in a standardized fashion. As a distinctive feature, we emphasize deperitonealization of the pouch mesentery (■ Fig. 8) so as to gain additional length. If required and with the same aim, smaller arcades of vessels may be sacrificed utilizing

diaphanoscopy to select them. In order to fashion the J-pouch, we prefer the 60-mm-long linear cutter. The carefully selected apex of the pouch is slung with a vessel-loop and incised horizontally. We refrain from setting sustaining sutures. Importantly, the two limbs of the pouch must be manually separated and lateralized, and thus ideally both stapler lines are positioned accurately antimesenterically (■ Fig. 9). The first and the second firing of the cutter are illustrated and, importantly, with the second firing a blind loop on the short limb should be avoided. The unavoidable short blind loop of approx. 1 cm is generously oversewn and as such abolished. The pouch limbs achieve a length of 10–12 cm. A hand-fashioned purse-string suture with Prolene serves to secure the anvil of the circular stapler (28/29 mm), and if so intended may be attached to the transabdominally advanced silicone drain, facilitating repositioning of the pouch intra-abdominally and advancing it into the pelvis. After connection of both stapler devices, we proceed with firing of the anastomosis under laparoscopic visualization. Caution must be taken not to pull any anal skin or sphincter muscle into the stapler when approximating the tissue. The impermeability of the anastomosis is tested via an air or dye test. This is followed by insertion and fixation of the transanal tube that is left in place for 5 days (■ Fig. 10). Abdominally, a drain is placed behind the pouch and exteriorized via the left-sided trocar. Next, usual closure of the

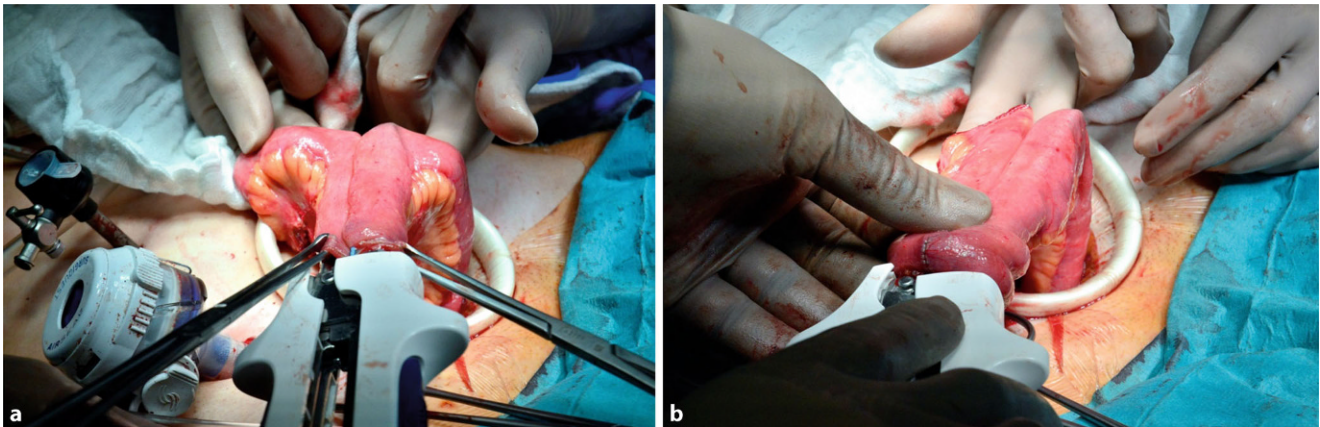


Fig. 9 ▲ The ileoanal pouch is fashioned after the horizontal antimesenteric incision of the bowel wall by placing two consecutive stapler lines with a 60-mm linear cutter. **a** First and **b** second stapler line. Importantly, note the strict antimesenteric placement of the stapler line

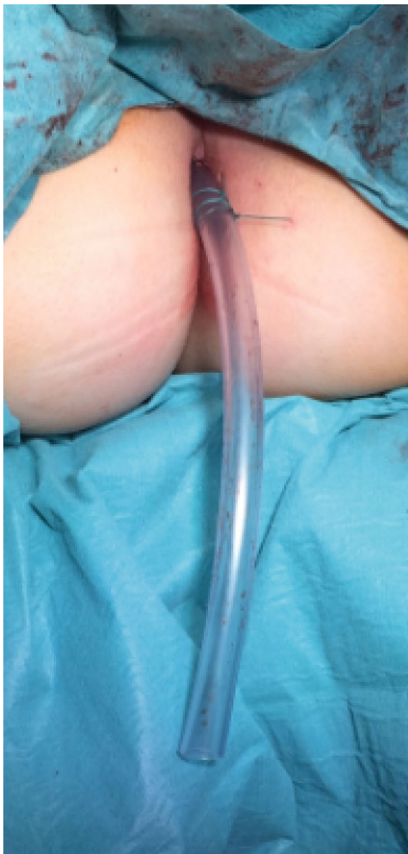


Fig. 10 ▲ Insertion of the anal tube that is fixed with a suture

abdominal incisions is performed and intracutaneous skin closure with a resorbable monofilic suture. A limited postoperative fluid intake is allowed. Nutrition uptake follows removal of the anal tube. As a general approach, bowel movement is regulated with loperamide.

Results

Since the introduction of taTME (in 2015) at our institution, we have operated on 12 patients following the approach described herein. We diagnosed one abscess posterior to the pouch in one patient on the ninth postoperative day, which was successfully drained with an interventional tube. One case of reduced vascularization of the short limb of the J-pouch has already been described elsewhere [14]. In all cases, the virtual ileostomy was removed between days 3 and 9. In the early postoperative course, one patient had a singular nocturnal experience of incontinence after removal of the anal drain. Patients were dismissed between postoperative days 10 and 16 with complete oral intake, complete continence, and medication of a maximum of six tablets of loperamide per 24 h.

Discussion

The most controversial aspects of the surgical approach described here are:

1. The primary transection of the ileocolic vessels
2. Abandoning of routine ileostomy and usage of an anal drain
3. The taTME approach for the rectal resection

1: In order to achieve tension-free length of the mesentery for construction of the pouch, complete mobilization of the ter-

iminal ileum and the mesenteric pedicle is mandatory. The Heidelberg school of Prof. Herfarth insisted on preservation of both the ileocolic *and* the mesenteric vascular arcades, with the aim of maintaining a double-fold vascular supply. In principle, however, only one of the two is required and either may be sacrificed for achievement of greater lengthening. In the Anglo-American literature, the general recommendation is to routinely transect the ileocolic pedicle [7].

2: The crucial argument for avoiding a routine ileostomy in FAP patients is the increased posttraumatic induction of desmoid growth observed at this site [8]. In addition, fashioning and taking down of an ileostomy are associated with substantial morbidity. By performing a virtual ileostomy, additional safety may be achieved in the event a secondary deviation is required, since the prepared loop of small bowel may easily be exteriorized without the requirement of a relaparotomy [9]. The combination with an anal tube contributes to the overall concept, although this lacks documented evidence. A benefit for the approach of an anal tube has been described for rectal surgery [11]. In the event of an ileoanal pouch, the postulated beneficial effect has yet to be prospectively validated.

3: taTME with a “bottom-up” approach in the hands of the experienced offers the advantage of a potentially improved preservation of continence and of urogenital function [12]. Neuromapping may offer additional safety

for nerve preservation. The feasibility of an ileoanal pouch construction with taTME and ileal pouch–anal anastomosis (IPAA) for UC was first described in 2015 [13]. Our experience with our first series of FAP patients was recently published [14]. As a rendezvous procedure with excellent visualization of the TME sheath, this procedure must be prospectively documented and evaluated regarding outcome—specifically QoL—for benign indications.

According to Bartels et al. [15], most surgeons perform TME as part of proctocolectomy and only a few opt for close rectal dissection (CRD). Both methods have advantages and disadvantages. In a small prospective randomized study, no difference between the procedures was found after 12 months, neither in terms of functional results nor in QoL. However, the CRD group had a lower incidence of complications. The extent to which taTME contributes to fewer complications and thus shifts the argument in favor of TME must be critically evaluated. In our experience, transanal manipulation did not have any negative effects in the small group of patients. The advantage of the double purse-string suture is that it allows for exact height determination of the anastomosis and a better circulation of the bilateral circular anastomosis with more effective removal of the rectal margin. Whether this leads to a lower rate of insufficiency, better function, and avoidance of cuffitis and rectal neoplasia must be evaluated prospectively.

Practical conclusion

Data from the literature and the short-term results of the surgical approach described here allow us to draw the careful conclusion that a protective ileostomy is not required as a general rule. A virtual ileostomy in combination with anal drainage may offer a similarly good protection without the morbidity of an ileostomy. taTME is clearly an option for benign disease. A differentiated evaluation of the postulated benefit for IPAA patients must be performed by analyzing UC and FAP patients separately. The results—in addition to functional outcome—must also take desmoids,

pouchitis, pouch failure, cuffitis, and rectal neoplasia (FAP) as well as QoL into account.

Corresponding address



Prof. Dr. G. Möslein
Center for Hereditary Tumors,
Helios University Hospital
Wuppertal, University Witten-
Herdecke
Heusnerstr. 40, 42283 Wup-
pertal, Germany
gabriela.moeslein@helios-
gesundheit.de

Compliance with ethical guidelines

Conflict of interest. P.C. Ambe and G. Möslein declare that they have no competing interests.

This article does not contain any studies with human participants or animals performed by any of the authors.

References

1. Parks AG, Nicholls RJ (1978) Proctocolectomy without ileostomy for ulcerative colitis. *Br Med J* 2:85–88
2. Utsunomiya J (1983) Studies on total colectomy, mucosal proctectomy and ileoanal anastomosis (ileoanostomy). *Nihon Geka Gakkai Zasshi* 84:749–752
3. Leowardi C, Hinz U, Tariverdian M et al (2010) Long-term outcome 10 years or more after restorative proctocolectomy and ileal pouch–anal anastomosis in patients with ulcerative colitis. *Langenbecks Arch Surg* 395:49–56
4. Lynch P, Morris J, Wen S, Advani S, Ross W, Chang G, Rodriguez-Bigas M, Raju G, Ricciardello L, Iwama T, Rossi B, Pellise M, Stoffel E, Wise P, Bertario L, Suanders B, Burt R, Belluzzi A, Ahnen D, Matsubara N, Bülow S, Jespersen N, Clark S, Erdmann S, Markowitz A, Bernstein I, De Haas N, Syngal S, Moeslein G (2016) A proposed staging system and stage-specific interventions for familial adenomatous polyposis. *Gastrointest Endosc* 84(1):115–125.e4. <https://doi.org/10.1016/j.gie.2015.12.029>
5. Marcelllo PW, Milsom JW, Wong SK, Hammerhofer KA, Goormastic M, Church JM, Fazio VW (2000) Laparoscopic restorative proctocolectomy: case-matched comparative study with open restorative proctocolectomy. *Dis Colon Rectum* 43(5):604–608
6. Bartels SA, D'Hoore A, Cuesta MA, Bendsdorp AJ, Lucas C, Bemelman WA (2012) Significantly increased pregnancy rates after laparoscopic restorative proctocolectomy: a cross-sectional study. *Ann Surg* 256(6):1045–1048
7. Lovegrove RE, Heriot AG, Constantinides V (2007) Meta-analysis of short-term and long-term outcomes of J, W and S ileal reservoirs for restorative proctocolectomy. *Colorectal Dis* 9:310–320
8. Galandiuk S, Wolff BG, Dozois RR, Beart RW Jr. (1991) Ileal pouch–anal anastomosis without ileostomy. *Dis Colon Rectum* 34:870–873
9. Quast DR, Schneider R, Burdzik E, Hoppe S, Möslein G (2015) Long-term outcome of sporadic and FAP-associated desmoid tumors treated with high-dose selective estrogen receptor modulators and sulindac: a single-center long-term observational study in 134 patients. *Fam Cancer* 15(1):31–40. <https://doi.org/10.1007/s10689-015-9830-z>
10. Ambe P, Zirngibl H, Möslein G (2017) Routine virtual ileostomy following restorative proctocolectomy for familial adenomatous polyposis. *World J Surg*. <https://doi.org/10.1007/s00268-017-4365-0>
11. Zhao WT, Hu FL, Li YY, Li HJ, Luo WM, Sun F (2013) Use of a transanal drainage tube for prevention of anastomotic leakage and bleeding after anterior resection for rectal cancer. *World J Surg* 37:227–232
12. Kneist W, Wächter N, Paschold M, Kauff W, Rink AD, Lang H (2016) Midterm functional results of taTME with neuromapping for low rectal cancer. *Tech Coloproctol* 20:41. <https://doi.org/10.1007/s10151-015-1390-6>
13. Coffey CJ, Dillon MF, O'Driscoll JS, Faul E (2015) Transanal total mesocolic excision (taTME) as part of ileoanal pouch formation in ulcerative colitis—first report of a case. *Int J Colorectal Dis*. <https://doi.org/10.1007/s00384-015-2236-4>
14. Ambe P, Zirngibl H, Möslein G (2017) Initial experience with taTME in patients undergoing laparoscopic restorative proctocolectomy for familial adenomatous polyposis. *Tech Coloproctol*. <https://doi.org/10.1007/s10151-017-1730-9>
15. Bartels SAL, Gardenbroek TJ, Aarts M, Ponsion CY, Tanis PJ, Buskens CJ, Bemelman WA (2015) Short-term morbidity and quality of life from a randomized clinical trial of close rectal dissection and total mesorectal excision in ileal pouch–anal anastomosis. *Br J Surg* 102:281–287. <https://doi.org/10.1002/bjs.9701>