Techniques in Coloproctology (2019) 23:367–372
https://doi.org/10.1007/s10151-019-01962-7

TECHNICAL NOTE

Laparoscopic sphincter reconstruction after abdominoperineal resection: feasibility and technical aspects

H. Albrecht[1] · **S. Gretschel**[1]

Received: 31 October 2018 / Accepted: 7 March 2019 / Published online: 15 April 2019

Abstract

Background Abdominal colostomy has been reported as an option with good quality of life for patients requiring abdominoperineal resection (APR) for very low rectal cancer. Some young, compliant patients, nevertheless, are very motivated to avoid abdominal colostomy following APR. Spiral smooth muscle cuff perineal colostomy as neosphincter reconstruction can be a reasonable alternative. We have published before the results of a series of sphincter reconstruction in the conventional technique following APR. As we developed our technique for colorectal resection sphincter reconstruction, we also changed to a laparoscopic approach. The aim of the present study was to evaluate the feasibility of laparoscopic neosphincteric reconstruction and outline the aspects of the technique.

Methods This retrospective study was conducted on 15 patients treated at our institution during a 6 year period for low rectal cancer by laparoscopic APR and spiral smooth muscle cuff perineal colostomy as sphincter reconstruction. At follow-up at a median time of 3.7 years (range 3–9 years) after surgery, patients underwent functional evaluation which included the modified Holschneider continence score (0–16), assessing consistency of stool, frequency, impulse, discrimination, warning period, incontinence for formed or fluid feces, soiling, wearing pads, drugs, enema where a score of 13–16 is associated with normal continence, as well as neosphincter manometry.

Results Laparoscopic sphincter reconstruction was feasible in all 15 patients. Two of the fifteen patients (13%) required secondary colostomy in the long term due to neosphincter malfunction and neosphincter perforation after enema. Four of the remaining thirteen patients (30%) were partially continent according to the Holschneider continence score (HCS) with a score of 7–12. The other 9 (70%) were continent (HCS: 13–16). Neosphincter manometry showed a median resting pressure of 33 cm H_2O (range 30–41 cm H_2O) and a median squeeze pressure of 95 cm H_2O (range 84–150 cm H_2O).

Conclusions Laparoscopic sphincter reconstruction following APR is a feasible option offering an alternative to abdominal colostomy for selected patients.

Keywords Sphincter reconstruction · Neosphincter · Perineal colostomy · Rectal cancer · Laparoscopic · Abdominoperineal resection

Introduction

The progress of multimodal therapy has changed the treatment of low rectal cancer.

The rate of abdominoperineal resection (APR) for locally advanced low rectal cancer has been reduced due to downsizing of the tumor following neoadjuvant radiochemotherapy. Further factors supporting this fact are implementation of an intersphincteric resection technique and evidence of reduced distance of tumor-free aboral margins necessary for curative resection after neoadjuvant therapy.

Nevertheless, a significant number of patients with very low rectal cancer still requires APR for curative intended surgery.

Spiral smooth muscle cuff perineal colostomy as neosphincter reconstruction following the conventional APR has been described as a reasonable alternative for selected patients with very low rectal cancer to avoid

✉ S. Gretschel
stephan.gretschel@mhb-fontane.de

[1] Department of General and Visceral Surgery, Brandenburg Medical School, University Hospital Neuruppin, Neuruppin, Germany

abdominal colostomy and improve quality of life (QOL) [1–3]. We have previously reported the results of a series on conventional resection and reconstruction [4]. Implementation of laparoscopic resection as standard procedure for low anterior resection with total mesorectal excision (LAR + TME) and APR in our patients also changed the technique for neosphincter reconstruction.

The aim of this retrospective analysis was to demonstrate the feasibility of neosphincter reconstruction using laparoscopic and to outline the technical aspects.

Materials and methods

A retrospective study was conducted on 15 patients treated at our institution from 2009 to 2015 for low rectal cancer by laparoscopic APR and spiral smooth muscle cuff perineal colostomy as sphincter reconstruction. Among the patients having laparoscopic APR for low rectal cancer, only a limited number were evaluated for sphincter reconstruction following the selection criteria below (Table 1).

Inclusion criteria

Patients had laparoscopic APR for low rectal cancer with curative intent. Patients with colonic diverticular disease, cardiovascular disease, body mass index > 30 kg/m^2, diabetes mellitus, tobacco abuse, reduced nutritional status, or skin disease were excluded. Patients had to be compliant with intensive postoperative physiotherapy and to be sufficiently mobile.

Table 1 Patients and tumor characteristics

Patients, *n*	15
Mean age (range) in years	49 (39–65)
Sex female/male	6/9
Follow-up time (range) in years	3, 7 (3–9)
Preoperative radiochemotherapy	8
Pathology adenocarcinoma	15
Tumor staging	
pT1	1
pT2	7
pT3	7
pT4	0
Nodal staging	
pN0	10
pN1	5
pN2	0

Surgical technique

All patients received mechanical bowel preparation and perioperative systemic antibiotics, and were operated in the lithotomy position.

Laparoscopic APR was performed with a 4 trocar technique starting with medial dissection for central isolation and ligation of the inferior mesenteric vein at the lower margin of the pancreas. Following this, mobilisation of transverse mesocolon and descending mesocolon was developed as a medial-to-lateral dissection.

Oncologic resection proceeded to central ligation of the inferior mesenteric artery and complete lymphadenectomy, preserving the branches of inferior hypogastric plexus. Lateral dissection completed mobilization of descending colon, splenic flexure, and sigmoid colon. Then, mobilisation of rectum and mesorectum continued to the pelvic floor aiming at a total mesorectal excision (TME) avoiding any coning and sparing the branches of the inferior hypogastric plexus. The laparoscopic part finished in circular incision of the pelvic floor.

In the corresponding oncologic tubular perineal excision (including resection of the external sphincter with sparing of the corrugator cutis ani muscle), we aimed for a tumor-free margin of 5 mm proven by frozen section. The level of dissection of the levator depended on the tumor size and location. We kept a minimal lateral margin of 5 mm. The main part of the puborectalis muscle was spared (Fig. 1).

The specimen was extracted via a suprapubic mini-laparotomy and sent to frozen-section analysis.

In a subgroup of 4 patients, laparoscopic APR was performed with transperineal prolapsing for specimen extraction to avoid the suprapubic mini-laparotomy. Patients

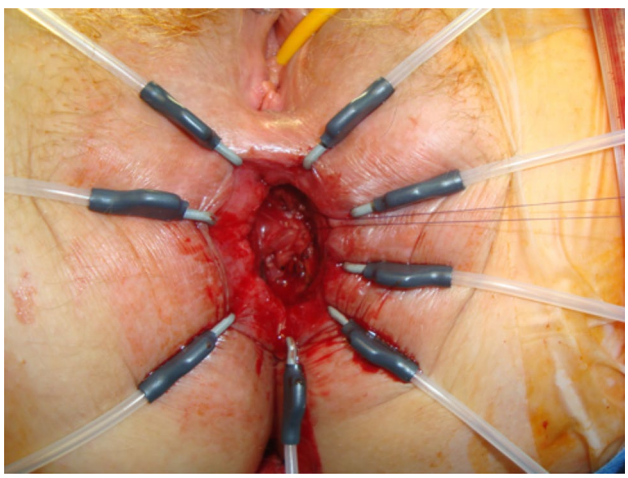

Fig. 1 Site of perineal excision

Fig. 2 Transperineal specimen extraction

qualifying for this technique had a rather thin mesorectum and a long mobilized colon with a good vessel arcade (Fig. 2).

To contruct the spiral smooth muscle flap, it was necessary to bring about 20 cm of descending colon proximal to the proximal resection margin via a mini-laparotomy in the anterior abdominal wall (or transperineally). For this, a complete mobilisation of the transverse mesocolon up to the mesocolic vessels was obligatory.

The neosphincter cuff was prepared as described by Fedorov [1]. Using the distal 10–12 cm of descending colon proximal to the extracted specimen, a seromuscular layer separated from the mucosa and pericolic tissue was formed (Fig. 3). The prepared layer was cut up spirally 2.5 cm wide to provide a 25 cm seromuscular flap with pedicled blood supply.

The seromucular flap was wrapped around the non-dissected distal descending colon and sutured with interrupted stitches PDS 4/0 to the serosa and muscularis (Figs. 4, 5).

The distal colon with the fixed smooth muscle cuff was then returned to the abdomen and passed through to the perineum.

The formed cuff was fixed to the pelvic floor using 4–6 interrupted stitches Vicryl 3/0 including the anococcygeal ligament and levator muscles; both had been pre-marked during resection part (Fig. 6). Closing of the perineum proceeded with 4–6 interrupted stitches (Vicryl 3/0) of the ischiorectal fatty tissue to the neosphincter cuff. Then, the distal margin of the neosphincter was attached to the skin covering the corrugator muscle using another 4–6 interrupted stitches.

Fig. 3 Separating the mucosa and pericolic tissue from the seromuscular layer

Postoperative care

All patients received a protective ileostomy and, therefore, rapidly resumed normal oral alimentation. They did not require perineal bags, just pads. General physiotherapy started on postoperative day 2.

Besides patient selection, intensive postoperative physiotherapy is considered crucial for a promising outcome. Special physiotherapy included training of pelvic floor, gluteus, and thigh muscles using biofeedback as well as electrostimulation with an endoluminal probe. Patients were instructed how to use the endoluminal probe at home starting about 2 weeks after surgery. Patients were discharged from hospital on day 10–14.

The physiotherapy was continued for 6 months and lifelong exercise of the pelvic floor muscles at home was recommended.

Follow-up

At a medium time of 3.7 years (range 3–9 years) after surgery, patients were scheduled for follow-up.

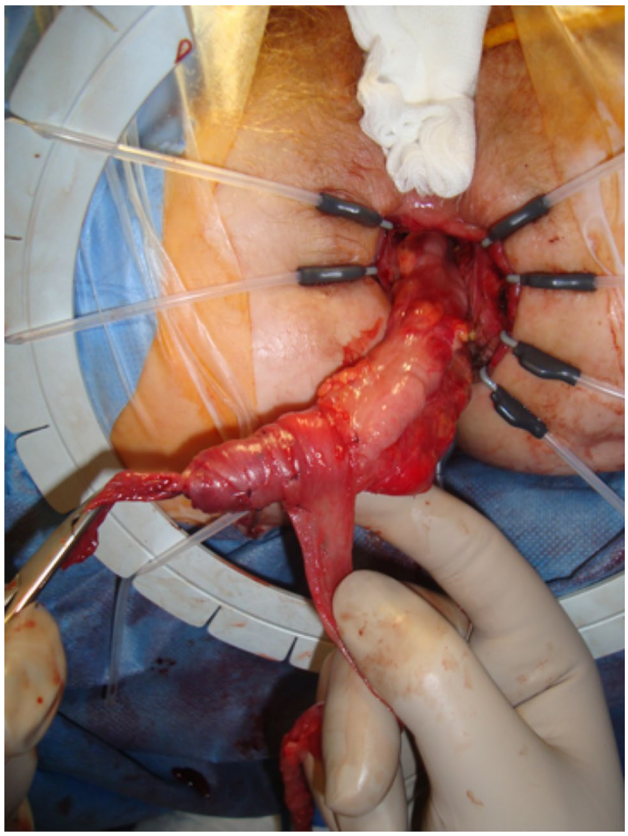

Fig. 4 Wrapping the prestretched seromuscular flap around the non-dissected distal colon

Fig. 5 The neosphincter before fixation

Patients underwent functional evaluation which included the modified Holschneider continence score (0–16) [5, 6]. This score assesses consistency of stool, frequency, impulse, discrimination, warning period, incontinence for formed or fluid feces, soiling, wearing pads, drugs, and enema.

Partially continent was defined as a cumulative score of 7–12 points; continent as 13–16 points.

Patients also had pull-through neosphincter manometry (Solar, Medical Measurement Systems).The catheter was inserted 5 cm into the neosphincter cuff and manually withdrawn. The pressure was registered 1–2 cm proximal to the anal verge.

Results

The laparoscopic approach was a feasible option for all 15 patients.

There were 6 female and 9 male patients with a median age of 49 years (range 39–65 years).

Eight patients received neoadjuvant chemoradiation therapy. Tumor and nodal staging were as follows: pT1–1 patient, pT2–7 patients, pT3–7 patients and pN0–10 patients, and pN1–5 patients. The median operation time was 420 min (349–440 min). All patients received a protective ileostomy. There was no perioperative mortality.

In the long term, 2 of the 15 patients (13%) required a secondary colostomy: one because of malfunction of the neosphincter 12 months after initial surgery and the other following perforation of the neosphincter during enema followed by abscess formation 27 months after the initial surgery.

Of the remaining 13 patients 4 patients (30%) were partially continent according to the Holschneider continence score (HCS) with a score of 7–12. Nine patients (70%) were continent, with an HCS of 13–16 (Table 2). Neosphincter manometry of the 13 patients showed a median resting pressure of 33 cm H_2O (30–41 cm H_2O) and a median squeeze pressure of 95 cm H_2O (84–150 cm H_2O).

Discussion

Among the methods introduced to imitate anal sphincter function are reconstructions using skeletal muscle, colonic smooth muscle grafts, as well as artificial sphincter implants [1–4, 7, 8]. The latter frequently cause complications such as

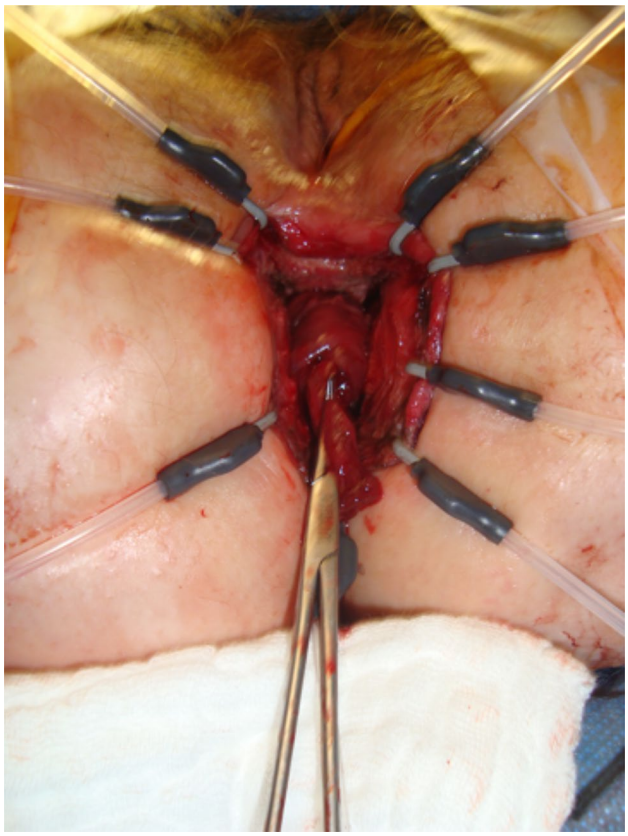

Fig. 6 Fixation of the neosphincter to the perineal wall, levator muscles, and anococcygeal ligament

infection, fistula, migration, and erosion. Numerous authors for this reason prefer autologous reconstruction.

Continuous contraction tonus is required to gain a continent reconstruction. Skeletal muscle as used for gracilo-plasty is not perfectly suited for continuous contraction.

Colonic smooth muscle grafts first introduced for continent abdominal wall colostomy are best due to their type I and type II fibrils [8].

This retrospective study demonstrates that laparoscopic neosphincter reconstruction is a feasible option. Operation time is satisfactory, patients have a comparable outcomes to the published studies on open techniques [4].

The laparoscopic approach and transperineal specimen extraction technique offer all advantages of minimally invasive surgery to patients evaluated for neosphincter reconstruction.

Nevertheless, a debate remains concerning abdominal colostomy as a good option for most patients with very low rectal cancer. Several studies described no difference in global QOL after resection of low rectal cancer with or without permanent colostomy. Furthermore, QOL of patients after resection of low rectal cancer is associated with the severity of the low anterior resection syndrome.

Table 2 Modified Holschneider score

Measure	Points	Patients, $n=13$
Frequency of stool		
1–2/d	2	6
3–5/d	1	7
More frequent	0	0
Consistency of stool		
Normal	2	4
Pasty	1	9
Liquid	0	0
Urge to defecate		
Normal	2	7
Unsure	1	6
Absent	0	0
Discrimination		
Normal	2	7
Insufficient	1	6
Missing	0	0
Warning period		
Normal (min)	2	4
Shortened	1	9
Absent (s)	0	0
Incontinence for formed or fluid feces		
Absent	4	4
1–2/month	3	5
1/week	2	0
> 3/week	1	4
> 1/day	0	0
Fecal soiling		
Never	2	8
During stress	1	5
Always	0	0
Wearing pads use of drugs/enema		
Yes	0	10
No	1	3
Continence score		
Continent	13–16	9
Partially continent	7–12	4
Incontinent	0–6	0

Underlying sphincter function and impairment of continence were shown to correlate with the resection-type performed (anterior resection, LAR, and intersphincteric resection) and the resulting level of the anastomosis, besides additional factors as radiochemotherapy and reservoir reconstruction (J-pouch). An additional smooth muscle graft in reconstruction after intersphincteric resection was described as a further option to improve functional outcome and increase the continence rate [9]. Instead of the expected compromised function, reduced continence, and low anterior resection

syndrome, a high overall patient satisfaction after sphincter preserving surgery was reported.

Despite the reduced rate of APR due to multimodal therapy concepts, the advent of intersphincteric resection, and advances in reconstruction techniques, abdominal colostomy is still a good option with reasonable QOL for the majority of patients requiring this procedure.

Some young, compliant patients without relevant comorbidity are very motivated to avoid abdominal colostomy following APR. Perineal colostomy with a spiral colonic smooth muscle graft as sphincter reconstruction is an alternative option for selected patients with functional outcome and QOL comparable to coloanal anastomosis [4, 10].

Limitations of the study are the small number of patients treated with the laparoscopic technique and in the retrospective design. The study, therefore, can state feasibility and demonstrate technical features rather than deliver broad data in comparison to the already published open series. Hence, quality of life and patients' satisfaction were not assessed at the small number of patients.

Conclusions

Our results suggest that neosphincter construction with a laparoscopic technique is feasible and safe. Regarding complications such as incontinence, the outcomes are similar to those after neosphincter reconstruction with open technique.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethical approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the international and national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent For this type of study, formal consent is not required.

References

1. Federov VD, Odaryuk TS, Shelygin YA, Tsarkov PV, Frolov SA (1989) Method of creation of a smooth-muscle cuff at the site of the perineal colostomy after extirpation of the rectum. Dis Colon Rectum 32:562–566
2. Schlag PM, Slisow W, Moesta KT (1998) Seromuscular spiral cuff perineal colostomy: an alternative to abdominal wall colostomy after abdominoperineal excision for rectal cancer. Recent Results Cancer Res 146:95–103
3. Gamagami RA, Chiotasso P, Lazorthes F (1999) Continent perineal colostomy after ab dominoperineal resection: outcome after 63 cases. Dis Colon Rectum 42:626–630
4. Hirche C, Mrak K, Kneif S et al (2010) Perineal colostomy with spiral smooth muscle graft for neosphincter reconstruction following abdominoperineal resection of very low rectal cancer: long-term outcome. Dis Colon Rectum 53(9):1272–1279
5. Holschneider AM (1983) Treatment and functional results of anorectal continence in children with imperforate anus. Acta Chir Belg 82:191–204
6. Herold A, Bruch HP (1996) Staged diagnosis of anorectal incontinence [in German]. Zentralbl Chir 121:632–638
7. Romano G, LaTorre F, Cutini G, Bianco F, Esposito P, Montori A (2003) Total anorectal recon struction with the artificial bowel sphincter: report of eight cases. A quality-of-life assessment. Dis Colon Rectum 46:730 – 734
8. Schmidt E, Bruch HP, Greulich M et al (1979) Continent colostomy through free transplanta tion of autologous colon muscles [in German]. Chirurg 50:96–100
9. Pescatori M, Spyrou M, Bilali S et al (2005) Low anterior intersphincteric resection, total mesorectal excision, coloplasty and coloanal anastomosis with neoanal smooth muscle encir clement for low rectal cancer. Tech Coloproctol 9:185
10. Pocard M, Sideris L, Zenasni F et al (2007) Functional results and quality of life for patients with very low rectal cancer undergoing coloanal anastomosis or perineal colostomy with colo nic muscular graft. Eur J Surg Oncol 33:459–462