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Reduced port laparoscopic rectopexy for full-thickness rectal prolapse

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Abstract

Background Laparoscopic rectopexy is an established treatment option for full-thickness rectal prolapse. Recently, reduced port surgery (RPS) has emerged as a novel concept, offering reduced postoperative pain and improved cosmetic outcomes compared with conventional multiport surgery (MPS). This study aimed to evaluate the feasibility and safety of RPS for full-thickness rectal prolapse.

Methods From October 2012 to December 2018, 37 patients (MPS: 10 cases, RPS: 27 cases) underwent laparoscopic rectopexy for full-thickness rectal prolapse. Laparoscopic posterior mesh rectopexy (Wells procedure) is the standard technique for full-thickness rectal prolapse at our hospital. RPS was performed using a multi-channel access device, with an additional 12-mm right-hand port. Short-term outcomes were retrospectively compared between MPS and RPS.

Results No significant differences were observed between MPS and RPS in the median operative time, the median blood loss volume, the postoperative complication rates, and median hospital stay duration after surgery.

Conclusion Reduced port laparoscopic posterior mesh rectopexy may serve as an effective therapeutic option for full-thickness rectal prolapse. However, to establish the superiority of RPS over MPS, a prospective, randomized, controlled trial is warranted.

Keywords Full-thickness rectal prolapse, Reduced port surgery, Laparoscopic posterior mesh rectopexy, Wells method

Background

Rectal prolapse is categorized into full-thickness rectal prolapse and mucosal prolapse. Full-thickness rectal prolapse is characterized by the protrusion of the entire rectal wall beyond the anus. Surgical intervention is pivotal in the management of full-thickness rectal prolapse, as conservative therapies have limited efficacy in providing a lasting resolution or cure. There are two principal approaches: perineal and transabdominal. Altemeier, Delorme, Gant-Miwa-Thiersch, and ALTA procedures are known as the perineal approaches [1, 2], while suture rectopexy, Orr-Loygue method, resection rectopexy (Frykman-Goldberg method), mesh rectopexy (Ripstein method or Wells method), and ventral rectopexy are categorized as abdominal approaches [1–3].

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Laparoscopic rectopexy is a well-recognized treatment option for full-thickness rectal prolapse [4–7].

Compared to open surgery, the recurrence rate and complication rates are comparable. Although the operating time is marginally longer, it offers advantages in terms of reduced postoperative pain and shorter hospital stays [2, 8].

Recently, reduced port surgery (RPS) has emerged as a concept that offers decreased postoperative pain and enhanced cosmetic outcomes compared to conventional multiport surgery (MPS). Our previous work demonstrated the feasibility of single-port laparoscopic surgery for colorectal cancer [9–12]. The expertise gained from single-port laparoscopic surgery for colorectal cancer cases shows significant transferability to RPS for treating benign pelvic diseases. At our institution, we use laparoscopic posterior mesh rectopexy (Wells method) to treat of full-thickness rectal prolapse. This study aims to assess the feasibility and safety of RPS using the Wells method for treating full-thickness rectal prolapse.

Methods

Patients

We retrospectively reviewed the medical data obtained from the surgical records and charts of 37 patients who underwent laparoscopic posterior mesh rectopexy (Wells method) for full-thickness rectal prolapse at our department between October 2012 and December 2018. These data included age, sex, body mass index (BMI), American Society of Anesthesiologists physical status (ASA-PS) classification, history of abdominal surgery, comorbidity of psychiatric disorders, Tuttle classification, and methods of pain control. We reviewed short-term surgical outcomes including blood loss, operating time, postoperative complications, length of postoperative hospital stay, C-reactive protein (CRP) levels and white blood cell (WBC) count in the perioperative period, wound length, and postoperative delirium. Recurrence rates were also assessed. Postoperative complications were classified according to the Clavien-Dindo (C-D) classification, and C-D grade IIIa or higher was defined as a severe complication [13]. The follow-up period was calculated from the date of surgery. The median duration of follow-up was 15 months (14–52.3 months) for MPS and 31.5 months (16–48.3 months) for RPS.

Surgical technique

The patient was placed in the lithotomy position under general anesthesia. A multi-channel access device (EZ Access / LAP PROTECTOR Mini™, Hakko Medical, Nagano, Japan) was attached to a 2.5–3.0 cm umbilical incision. In the MPS approach, a 12-mm camera port was inserted through the access device at the umbilicus, with the surgeon's right-hand 12-mm port in the lower right abdomen, and left-hand 5-mm port at the umbilical level on the right side. Two 5-mm assistant ports were placed laterally on the left abdomen. In the RPS method, a 12-mm camera port and a 5-mm left-hand working port were inserted through the umbilical access device, with the surgeon's right-hand 12-mm port placed in the lower right abdomen (Fig. 1). An internal organ retractor (IOR, AESCULAP,B. Braun, Tokyo, Japan) was used to stabilize the operative field.

For RPS, three-dimensional retraction of the sigmoid colon was achieved by attaching three traction sutures

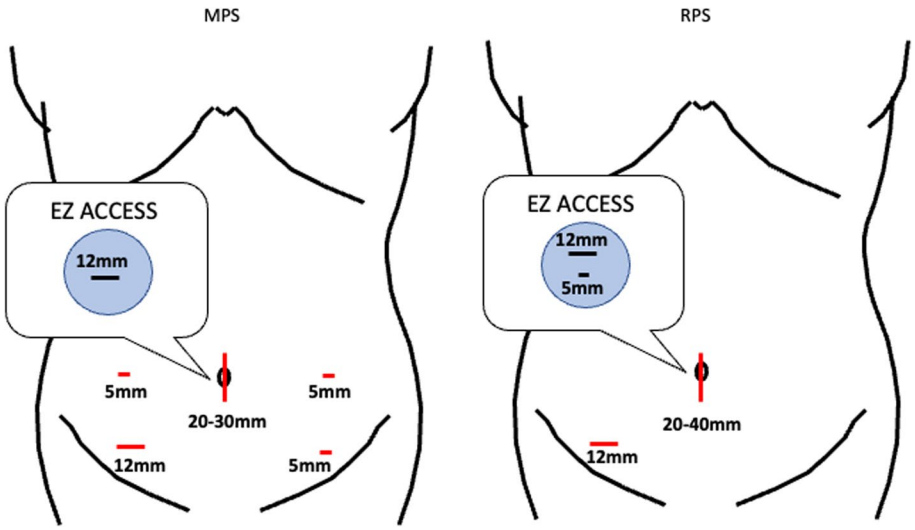

Fig. 1 Port position. MPS was performed using a five-port technique. RPS was performed with single-incision plus one additional puncture

to the IOR, each of which was led out of the body cavity to different locations. This setup allowed for the precise adjustment of each suture's tension, facilitating an optimal surgical field for the procedure (Fig. 2A, B).

Using an ultrasonically activated device (USAD), the peritoneum was incised and dissection was carefully performed from the right side, ensuring the preservation of the hypogastric nerves while mobilizing the bowel along the mesorectal fascia. Subsequently, the peritoneum was also detached from the left side (Fig. 2B), continuing the dissection layer initiated from the right, thus allowing for complete mobilization of the rectum (Fig. 2C).

A microporous partially absorbable mesh (ULTRAPRO, ETHICON, US) was securely attached to cover the anterior surface of the sacrum from S2 to S3 (Fig. 2D) by using a 5 mm coil-shaped staple (ProTack™, Medtronic, Ireland). The mobilized rectum was then drawn cephalad and enveloped within the mesh, where it was firmly fixed using 2–0 nylon sutures (Fig. 2E). Subsequently, the peritoneum was meticulously closed using a wound closure device (V-Loc™, Medtronic, Ireland) (Fig. 2F).

Statistical analysis

Numerical data are presented as the median with interquartile ranges (IQRs). Categorical variables were analyzed using Fisher's exact test or the chi-square test, as appropriate. Differences in quantitative parameters were compared using the Wilcoxon signed-rank test. A p-value of less than 0.05 was considered statistically significant. All statistical analyses were carried out using JMP Pro software, version 17.0.0 for Mac (SAS Institute Inc., Cary, NC, USA).

Results

Patient characteristics

Patient characteristics are summarized in Table 1. Thirty-seven patients underwent laparoscopic posterior mesh rectopexy (Wells method). Among these, 27 received rectopexy with reduced port surgery (RPS), and 10 underwent multiport surgery (MPS). One patient was converted from RPS to MPS due to postoperative adhesions following a previous uterine myoma surgery. There were no conversions to open surgery or surgical reintervention during the initial admission.

Two MPS patients had psychiatric disorders: one with schizophrenia and one with obsessive–compulsive disorder. In the RPS group, six patients had psychiatric disorders: one with anorexia, one with panic disorder, two with depression, one with schizophrenia, and one with a hyperkinetic disorder. Epidural anesthesia was performed at the discretion of the anesthesiologist, and intravenous patient-controlled analgesia (ivPCA) was also administered in the same manner. The follow-up duration was 15 months (14–52.25 months) for MPS and 31.5 months (16–48.25 months) for RPS.

No significant differences were observed between the groups in terms of age ($p=0.3643$), sex ($p=0.3130$), ASA-PS classification ($p=0.2954$), history of abdominal surgery ($p=0.4597$), comorbidity of mental disorders ($p=1.0000$), Tuttle classification ($p=0.7856$), pain control ($p=0.3652$), or follow-up duration ($p=0.5027$). However, a significant difference was noted in BMI, with MPS patients having higher BMI compared to RPS patients ($p=0.0045$).

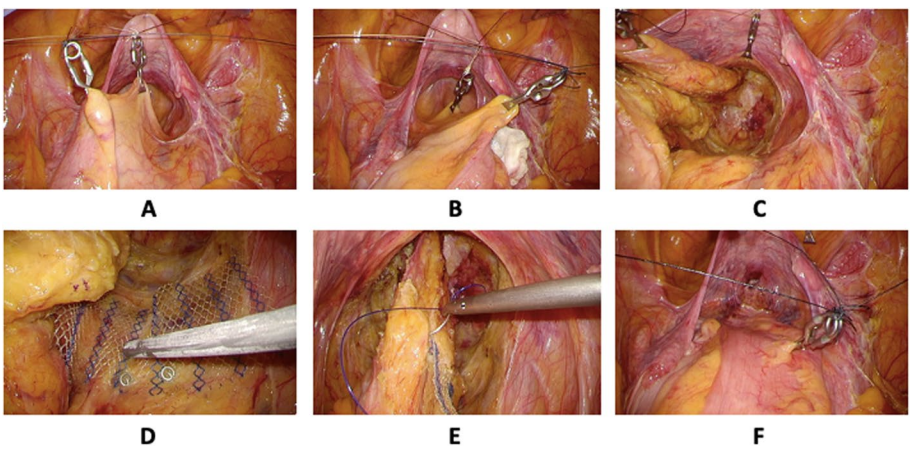

Figure2 Surgical steps of the procedure. **A** Three-dimensional retraction of the sigmoid colon using IOR with 4 black strings and IOR with 3 white strings. **B** Adjusting the tension of strings for left-side surgical field. **C** Peritoneal incision and full mobilization of sigmoid colon and rectum. **D** Fixation of microporous partially absorbable mesh to the presacral fascia (S2-3). **E** Wrapping the rectum with mesh and securing it with 2–0 nylon. **F** Peritoneal repair using wound closure device

Table 1 Patient demographics and clinical characteristics

	MPS[a] (n = 10)	RPS[b] (n = 27)	p value
Age (years), median (IQR[c])	70.5 (50.5–80.75)	75 (58–85)	0.3643
Sex, n (%)			0.3130
Male	3 (30.0)	3 (11.1)	
Female	7 (70.0)	24 (88.9)	
BMI[d] (kg/m^3), median (IQR)	23.96 (21.53–29.05)	20.41 (19–21.72)	0.0045
ASA Physical Status[e], n (%)			0.2954
< III	10 (100.0)	22 (81.5)	
≧III	0 (0.0)	5 (18.5)	
Abdominal operation history			0.4597
Yes, n (%)	6 (60.0)	11 (40.7)	
No, n (%)	4 (40.0)	16 (59.3)	
Psychiatric disorder			1.0000
Yes, n (%)	2 (20.0)	6 (22.2)	
No, n (%)	8 (80.0)	21 (77.8)	
Tuttle Classification			0.7856
I, n (%)	0 (0.0)	1 (3.7)	
II, n (%)	5 (50.0)	16 (59.2)	
III, n (%)	3 (30.0)	7 (25.9)	
unknown, n (%)	2 (20.0)	3 (11.1)	
Pain Control			0.3652
Epidural Anesthesia, n (%)	8 (80.0)	16 (59.26)	
Intravenous Patient Controlled Analgesia, n (%)	1 (10.0)	9 (33.33)	
Other	1 (10.0)	2 (7.4)	
Follow up period (month), median (IQR)	15 (14–52.25)	31.5 (16–48.25)	0.5027

[a] *MPS* Multiple port surgery

[b] *RPS* Reduced port surgery

[c] *IQR* Interquartile Range

[d] *BMI* Body mass index

[e] *ASA* physical status American Society of Anesthesiologists physical status

Surgical outcomes

Table 2 details the short-term outcomes of the surgical procedures. No significant differences were observed in blood loss ($p = 0.7847$), length of surgery ($p = 0.1878$), or postoperative C-D class II complications ($p = 1.000$). Specifically, surgical site infections (SSI) ($p = 1.000$) and ileus ($p = 0.4730$) did not differ significantly.

The length of postoperative hospital stay was similar ($p = 0.4730$), as were perioperative CRP and WBC levels. The umbilical wound length was comparable (MPS: 30 mm [25–30 mm] vs. RPS: 30 mm [25–30 mm], $p = 0.8062$); however, the total wound size was significantly smaller in the RPS group (MPS: 51 mm [46.5–57 mm] vs. RPS: 42 mm [37–42 mm], $p = 0.0005$), suggesting better cosmesis. No significant difference in postoperative delirium rates or recurrence rates was noted ($p = 0.5531$, $p = 1.0000$).

Discussion

The Cochrane Review in 2008 [2] reported that there is not enough data to determine whether the abdominal or perineal approach is superior, and no difference is observed in the methods used for fixation during rectopexy. Additionally, this review noted that division of the lateral ligaments during rectopexy reduces the recurrence rate, but is also associated with an increased incidence of postoperative constipation. Furthermore, operating time is significantly longer, but hospital stay is significantly shorter, and postoperative complications are significantly less common in the laparoscopic group compared with the open group.

The PROSPER trial [14]; the largest randomized trial in rectal prolapse that included patient-assessed quality of life with longer follow-up time was published in 2013. The results showed that there was no significant difference in recurrence rates, bowel function, or quality of life between any of the treatments (abdominal vs. perineal surgery, suture vs. resection rectopexy for those receiving

Table 2 Comparative analysis of short-term surgical outcomes

	MPS[a] (n = 10)	RPS[b] (n = 27)	p value
Blood loss (ml), median (IQR[c])	0 (0–5)	0 (0–10)	0.7847
Operation time (min), median (IQR)	168 (130.5–196.75)	179 (154–201)	0.1878
Postoperative Complication, Clavian Dindo, n (%)			
I	3 (60.0)	7 (63.6)	1.0000
II	2 (40.0)	4 (36.3)	
Postoperative Complication			
SSI[d], n (%)	2 (20.0)	6 (22.2)	1.0000
Ileus, n (%)	1 (10.0)	1 (3.7)	0.4730
Postoperative Hospital Stay, days (IQR)	9 (6.75–12.75)	8 (6–12)	0.5471
CRP[e] (mg/dL), median (IQR)			
Preoperative	0.14 (0.08–0.41)	0.075 (0.03–0.25)	0.2759
POD 0	0.09 (0.04–0.16)	0.1 (0.04–1.02)	0.4267
POD 3or4	2.66 (1.61–5.48)	2.77 (1.62–4.03)	0.7982
WBC[f] (/μL), median (IQR)			
Preoperative	6500 (4200–7550)	5100 (4400–6100)	0.2516
POD 0	9500 (6975–11,675)	9150 (6875–12,125)	0.8876
POD 3or4	5850 (4725–6975)	5450 (4775–7075)	0.7908
Length of wound (mm), median (IQR)			
Umbilical wound	30 (25–30)	30 (25–30)	0.8062
Total wound	51 (46.5–57)	42 (37–42)	0.0005
Postoperative Delirium			
Yes, n (%)	0 (0.0)	4 (11.43)	0.5531
Recurrence, n (%)	0 (0.0)	3 (11.1)	1.0000

[a] *MPS* Multiple port surgery

[b] *RPS* Reduced port surgery

[c] *IQR* Interquartile Range

[d] *SSI* Surgical site infection

[e] *CRP* C-reactive protein

[f] *WBC* White blood cell

an abdominal procedure, and Altemeir's vs. Delorme's for those receiving a perineal procedure). The recurrence rate was higher after abdominal surgery than previously reported.

Therefore, if the patient's general condition permits, it is preferable to perform rectopexy, and if technically possible, laparoscopic rectopexy is the preferred option. It has been reported that in elderly patients with full-thickness rectal prolapse, laparoscopic ventral mesh rectopexy is associated with fewer postoperative complications and a lower recurrence rate compared to perineal stapler resection [15]. While a perineal approach may be considered for elderly patients or those with comorbidities, laparoscopic rectopexy is also considered feasible for this population [16]. Previously, we performed open rectopexy, but we began laparoscopic surgery around 2006, and have been performing laparoscopic rectopexy using the Wells method as the standard procedure since around 2012. The Wells method is reported to have a recurrence rate of 3–10% and a mortality rate of 1–2%, which is comparable to other rectopexy techniques [16].

Rectal prolapse is common in elderly people. In this study, the median age was 75 years, with the oldest patient being 89 years old, and patients aged 80 years or older accounted for 15 of the 37 cases. Important postoperative complications in elderly patients include respiratory complications, circulatory complications, liver failure, and psychiatric disorders such as postoperative delirium. Postoperative delirium is a major complication in elderly patients undergoing surgery, and postoperative pain is a well-known precipitating factor. Tei et al. reported that there was no significant difference in the incidence of delirium between open and laparoscopic surgery for colorectal cancer [17].

We previously reported that single-site laparoscopic colectomy significantly reduced postoperative pain compared to conventional multiport laparoscopic colectomy [12]. Nishizawa et al. reported that the rate of postoperative delirium was significantly lower in the single-incision

laparoscopic surgery group than in the conventional multiport laparoscopic surgery group for colorectal cancer [18]. As demonstrated in our previous study, reduced port surgery (RPS) is considered to have the advantage of reducing pain. This reduction in pain may be particularly beneficial in the context of rehabilitation for elderly patients, where early mobilization is crucial. Therefore, RPS may prove to be a valuable approach for this population. In this study, the methods for postoperative pain control in both RPS and MPS, such as epidural anesthesia and intravenous patient-controlled analgesia, were chosen at the discretion of the attending physician and anesthesiologist, resulting in effective pain management.

This study, being a retrospective analysis conducted at a single institution, has its limitations, one of which is the small number of cases examined. The second limitation is the absence of statistical matching. The third limitation is that there were more patients with high BMI in the MPS group, leading to differences in patient backgrounds. Additionally, rectal prolapse is a benign disease, and patients often discontinue follow-up appointments once their symptoms improve, if no further issues arise. Consequently, cases with a favorable course tend to have shorter follow-up periods, potentially leading to insufficient monitoring for recurrence.

Conclusion

In this study, we compared the short-term outcomes of MPS and RPS in full-thickness rectal prolapse. Our findings indicate no significant differences in blood loss, operating time, postoperative complications, hospital stay, perioperative inflammatory response, or recurrence rates between the groups. The RPS group demonstrated smaller wound sizes, suggesting better cosmetic outcomes. Overall, RPS appears to be a feasible and safe alternative to MPS. Future studies should include a prospective, randomized, controlled trial to further evaluate RPS versus MPS.

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Authors'contributions
Conception and design of the study, CK and MU; analysis and interpretation of data, CK, MU, MO and AN; acquisition of data, CK, MU, MO, AN and MM; drafting of manuscript, CK and MU; critical revision of manuscript, CK, MU, ST, KK, YT, MM, MM, MI and TK; final approval of the article: MU and TK. All authors have read and approved the manuscript.

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Availability of data and materials
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Data availability
Thank you for your consideration of our manuscript. I understand that you encourage us to share our raw data. But, the datasets generated and analyzed during the current study are not publicly available due to data involving other facilities as a multiple analyses and publications are currently underway, but are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate
This study was approved by the Ethics Committee of the NHO Osaka National Hospital, and it conforms to the provisions of the Declaration of Helsinki. All informed consent was obtained from the participates.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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