Gastroenterology Report, 2022, 1–7

https://doi.org/10.1093/gastro/goac007
Original Article

ORIGINAL ARTICLE

External rectal prolapse: abdominal or perineal repair for men? A retrospective cohort study

Bang Hu[1,2,†], Qi Zou[1,2,†], Zhenyu Xian[1,2,†], Dan Su[1,2], Chao Liu[3], Li Lu[1,2], Minyi Luo[1,2], Zixu Chen[4], Keyu Cai[1,2], Han Gao[1,2], Hui Peng[1,2], Wuteng Cao[5] and Donglin Ren[1,2,*]

[1]Department of Colorectal and Anal Surgery, The Sixth Affiliated Hospital, Sun Yat-sen University, Guangzhou, Guangdong, P. R. China, [2]Guangdong Provincial Key Laboratory of Colorectal and Pelvic Floor Diseases, Guangdong Institute of Gastroenterology, The Sixth Affiliated Hospital, Sun Yat-sen University, Guangzhou, Guangdong, P. R. China, [3]Department of Digestive Center, PanYu Central Hospital, Guangzhou, Guangdong, P. R. China, [4]Department of Microbiology, Zhongshan School of Medicine, Key Laboratory for Tropical Diseases Control of the Ministry of Education, Sun Yat-sen University, Guangzhou, Guangdong, P. R. China and [5]Department of Radiology, The Sixth Affiliated Hospital, Sun Yat-sen University, Guangzhou, Guangdong, P. R. China

*Corresponding author. Department of Colorectal and Anal Surgery, The Sixth Affiliated Hospital of Sun Yat-sen University, 26 Yuancun Erheng Road, Guangzhou, Guangdong 510655, P. R. China. Tel: +86-020-38254005; Email: rendl@mail.sysu.edu.cn
†These authors contributed equally to this paper.

Abstract

Background: External rectal prolapse is a relatively rare disease, in which male patients account for a minority. The selection of abdominal repair or perineal repair for male patients has rarely been investigated.
Methods: Fifty-one male patients receiving abdominal repair (laparoscopic ventral rectopexy) or perineal repair (Delorme or Altemeier procedures) at the Sixth Affiliated Hospital of Sun Yat-sen University (Guangzhou, China) between March 2013 and September 2019 were retrospectively analysed. We compared the recurrence, complication rate, post-operative defecation disorder, length of stay, and quality of life between the abdominal and perineal groups.
Results: Of the 51 patients, 45 had a complete follow-up, with a median of 48.5 months (range, 22.8–101.8 months). A total of 35 patients were under age 40 years. The complication rate associated with abdominal repair was less than that associated with perineal repair (0% vs 20.7%, $P = 0.031$) and the recurrence rate was also lower (9.5% vs 41.7%, $P = 0.018$). Multivariate analysis showed that perineal repair (odds ratio, 9.827; 95% confidence interval, 1.296–74.50; $P = 0.027$) might be a risk factor for recurrence. Moreover, only perineal repair significantly improved post-operative constipation status (preoperative vs post-operative, 72.4% vs 25.0%, $P = 0.001$). There was no reported mortality in either of the groups. No patient's sexual function was affected by the surgery.

Submitted: 1 September 2021; **Revised:** 1 December 2021; **Accepted:** 2 December 2021

Conclusions: Both surgical approaches were safe in men. Compared with perineal repair, the complication rate and recurrence rate for abdominal repair were lower. However, perineal repair was better able to correct constipation.

Key words: external rectal prolapse; male; laparoscopic ventral rectopexy; Altemeier; Delorme

Introduction

External rectal prolapse (ERP) seriously reduces the quality of life of patients because of their rectum protrudes from the anus and may be accompanied by constipation and/or fecal incontinence. The aims of surgical treatment of ERP are to restore the patient's anatomy, minimize the risk of post-operative recurrence, and avoid new intestinal dysfunction [1]. ERP occurs disproportionately in elderly women [2]; the primary goal of treatment is to find a relatively convenient procedure that minimizes the perioperative complication rate and mortality. However, the option of surgical approaches to the treatment of ERP remains controversial.

It is estimated that the incidence of ERP is ~2.5 per 100,000 [3], in which the ratio of men to women is 1:9 [4]. Therefore, due to the relatively small number of men suffering from ERP, the appropriate therapeutic schedule for rectal prolapse treatment in male patients has not been defined and little is known about outcomes as they relate to defecatory or sexual function. Delorme (mucosal sleeve resection and rectal muscular plication) and Altemeier (perineal rectosigmoidectomy with levatorplasty) procedures are the two most commonly used transperineal repair procedures for ERP [5], while laparoscopic ventral rectopexy (LVR) is the most recommended abdominal repair procedure at present [6]. For years the choice of abdominal or perineal repair has depended on the patient's endurance capacity, co-morbidities, age, and bowel function, as well as the surgeon's experience and preference [7, 8]. However, the age of onset and disease characteristics of ERP in men are highly distinct from those in women. Hence, it is not clear whether the surgical experience obtained from the general population is applicable to the male patient subpopulation.

In this study, we retrospectively analysed the outcomes of abdominal and perineal repair procedures in men with ERP, aiming to understand the differences between the two surgical strategies and to provide some evidence for disease management.

Patients and methods

Patient cohort and endpoints definition

We conducted a single-center retrospective cohort study. All patients diagnosed with ERP at the Sixth Affiliated Hospital of Sun Yat-sen University (Guangzhou, China) between March 2013 and September 2019 were considered for inclusion. The data from their medical records were evaluated. The inclusion criteria were as follows: (i) patients who underwent preoperative X-ray defecography or dynamic magnetic resonance (MR) defecography to diagnose ERP; (ii) patients who underwent LVR (a common abdominal repair procedure), a Delorme or Altemeier procedure (the two most commonly used perineal repair procedures); (iii) male patients; and (iv) age ≥15 years. Patients with incomplete medical records were excluded. This retrospective study was approved by the Ethics Committee of the Sixth Affiliated Hospital of Sun Yat-sen University (2021ZSLYEC-537).

The primary endpoint was recurrence. Secondary endpoints were complication rate, post-operative defecation disorder, length of stay (LOS), and quality of life.

Perioperative managements

All patients receiving LVR procedures underwent general anesthesia and patients receiving Altemeier or Delorme procedures underwent general anesthesia or combined spinal–epidural anesthesia depending on the anesthesiologist. The LVR [9], Delorme [10], or Altemeier [11] procedure was performed by a well-trained (performed at least five previous surgeries under supervision) colorectal surgeon according to the surgery protocols published previously. The procedure was selected by the colorectal surgeon by considering the patients' requests after carefully explaining the details (known advantages and disadvantages) of each procedure. Basic patient information, including age, body mass index (BMI), and American Society of Anesthesiologists (ASA) score, was recorded routinely before the operation. ERP length was defined as the distance from the distal rectum margin to the anal margin when straining during defecation under X-ray or MR defecography (Figure 1). The discharge criteria were that the patient had no obvious remaining symptoms, and could ambulate normally and consume a normal diet. Anal stenosis was defined as the inability of a 12-mm colonoscope [12] or one finger to pass through the anastomotic orifice [13]. Since the existing guidelines do not specify that post-operative treatment is routinely required, post-operative adjuvant treatment such as sacral nerve stimulation was not performed.

Follow-up

Patients were followed up at the outpatient clinic of the Sixth Affiliated Hospital of Sun Yat-sen University by a colorectal surgeon and were contacted at 6, 12, 18, and 24 months after surgery. The last follow-up date was 1 August 2021. A telephone follow-up interview was performed annually. The follow-up inquiry included the Cleveland Clinic Constipation score (CCCS) [14], Wexner fecal incontinence score [15], the EuroQol 5-Dimension 5-Levels (EQ-5D-5 L) quality of life questionnaire [16], sexual function, and recurrence. Sexual function affected was defined as a positive response when asked whether post-operative sexual function was better/worse than that before the operation. The follow-up protocol did not include routine imaging examinations. Therefore, recurrence was assessed according to symptoms. When in doubt, defecography was performed to confirm a recurrence. Fecal incontinence was defined as the occurrence of liquid or solid fecal incontinence at least once per month [17]. Constipation was diagnosed according to the Rome III criteria [18].

Statistical analysis

Statistical analysis was performed using SPSS 20.0 software (IBM, Armonk, New York, USA) and GraphPad Prism 8 (GraphPad Software, San Diego, California, USA). Non-normally distributed data are presented as median values with ranges

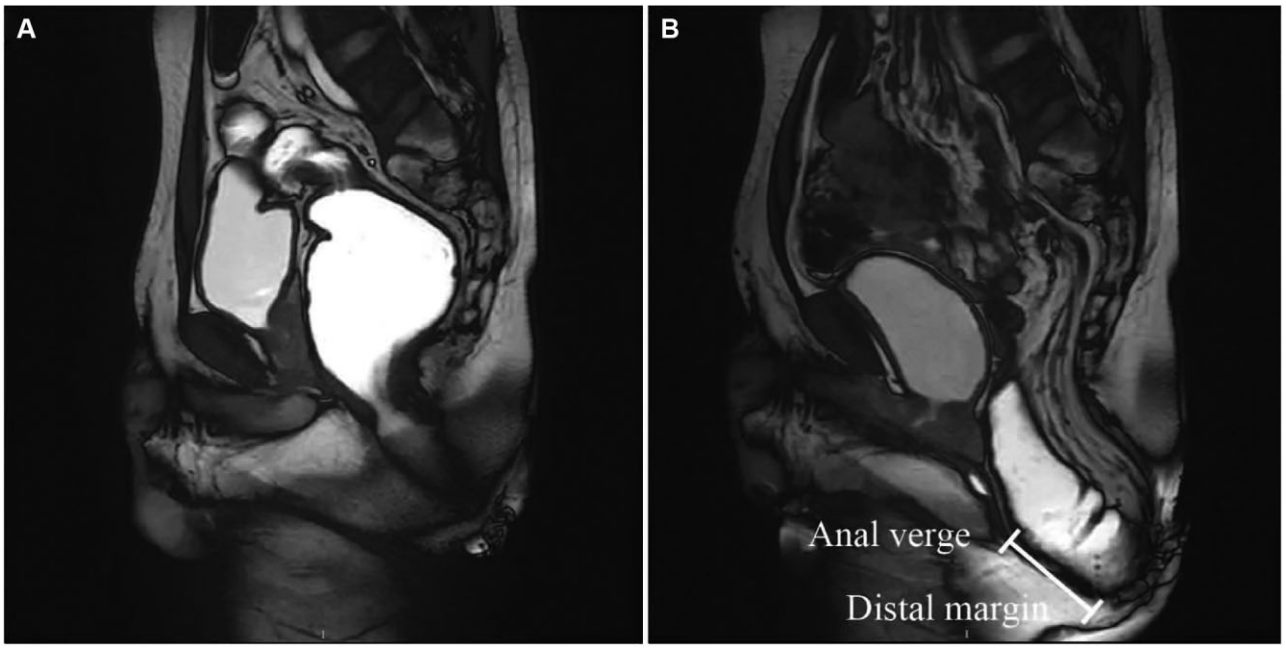

Figure 1. Measurement of external rectal prolapse (ERP) length on magnetic resonance imaging. ERP length was defined as the distance from the distal rectum margin to the anal margin when straining during defecation.

Table 1. Characteristics of 51 patients with ERP who underwent abdominal repair or perineal repair

Characteristic	Abdominal repair ($n = 22$)	Perineal repair ($n = 29$)	P-value
Age, years, median (range)	28.5 (18–78)	26 (15–75)	0.464
BMI, kg/m^2, median (range)	23.9 (16.9–27.8)	22.7 (17.0–34.6)	0.906
ERP length, cm, median (range)	5.5 (1–15)	5.0 (2–12)	0.714
ASA score, *n* (%)			0.002
1	8 (36.4)	1 (3.4)	
2	14 (63.6)	27 (93.1)	
3	0 (0)	1 (3.4)	
4	0 (0)	0 (0)	

ASA, American Society of Anesthesiologists; BMI, body mass index; ERP, external rectal prolapse.

and normally distributed data are expressed as mean ± standard deviation. All numerical variables were assessed by the Kolmogorov-Smirnov test for data normality. Categorical data are presented as frequencies and percentages. The chi-squared test was used to compare the categorical or dichotomous variables between two groups. Normal and non-normal data between the two groups were compared using Student's *t*-test and the Mann–Whitney *U* rank-sum test, respectively. Logistic regression was used to perform multivariate analysis. $P < 0.05$ was considered statistically significant.

Results

Baseline characteristics

A total of 51 male patients with ERP were included in this study: 22 in the abdominal group and 29 in the perineal group. Of the 51 patients, 45 had a complete follow-up, with a median follow-up of 48.5 months (range, 22.8–101.8 months). The last follow-up occurred in August 2021, with complete follow-up rates of 88.2%. The preoperative clinical characteristics are shown in Table 1. No significant difference was seen in age, BMI, or ERP length between the abdominal group and the perineal group; however, the perineal group had higher ASA score ($P = 0.002$). To investigate the age of onset in men, we showed the age distribution of all patients in Figure 2. The maximum frequency in this in-house cohort was 23 years old, with 35 patients under age 40 years.

We compared certain important post-operative outcomes between the abdominal group and perineal group to explore the differences between the two surgical approaches (Table 2). All patients in the abdominal group underwent LVR without conversion to open surgery. As expected, the mean duration of surgery in the abdominal group was significantly longer than that in the perineal group (166 ± 43 vs 97 ± 36 min, $P < 0.001$). Interestingly, the post-operative LOS tended to be longer in the perineal group, although the difference was not statistically significant. In our study, the main post-operative complications included rectal/anastomotic bleeding, anal stenosis, rectal/anastomotic leakage, and perineal infection. There were no serious complications in the abdominal group; however, although no mortality occurred within 30 days after surgery, six patients

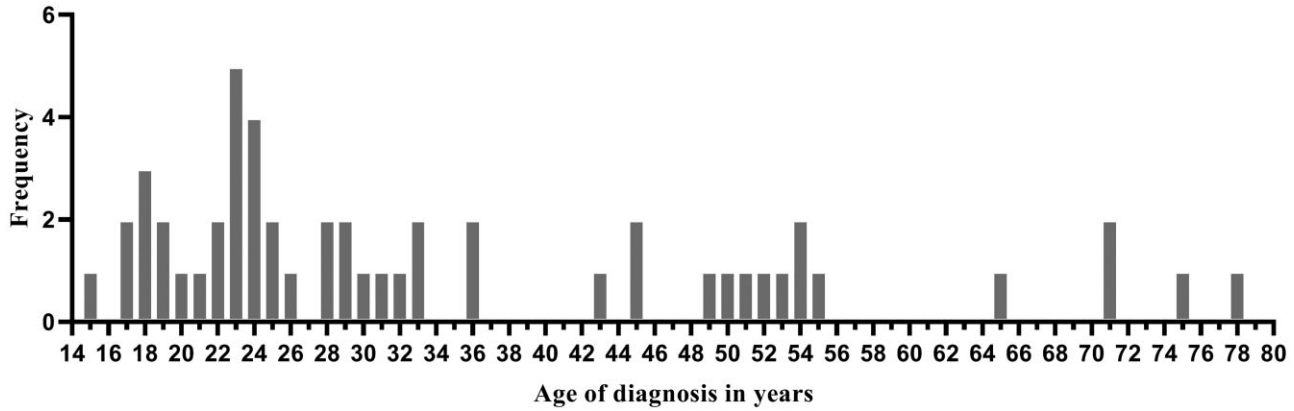

Figure 2. Age distribution of all patients with external rectal prolapse included in this study.

Table 2. Surgical outcomes of 51 patients with ERP who underwent abdominal repair or perineal repair

Characteristic	Abdominal repair ($n = 22$)	Perineal repair ($n = 29$)	P-value
Operation duration, mins, mean ± SD	166 ± 43	97 ± 36	<0.001
Post-operative length of stay, days, median (range)	8 (3–15)	11 (5–26)	0.082
Complication rate, *n* (%)	0 (0%)	6 (20.7%)	0.031
Rectal/anastomotic bleeding	0	2	
Anal stenosis	0	2	
Rectal/anastomotic leakage	0	1	
Perianal infection	0	1	
Recurrence[a], *n* (%)	2 (9.5%)	10 (41.7%)	0.018
Sexual function affected, *n*	0	0	

ERP, external rectal prolapse; SD, standard deviation.
[a]Abdominal repair and perineal repair were followed up in 21 and 24 patients, respectively.

in the perineal group suffered complications: two anastomotic bleeding, two anal stenosis, one anastomotic leakage, and one perianal infection. Anastomotic bleeding was cured by endoscopy, and anastomotic leakage was treated conservatively by anal drainage. We cured anal stenosis and perianal infection using anal dilatation and drainage, respectively.

During the follow-up period, the recurrence rate in the perineal group was significantly higher than that in the abdominal group (41.7% vs 9.5%, $P = 0.018$). In this work, no patient's sexual function was affected after surgery in either group. Although Altemeier and Delorme are both transperineal, they are two distinct approaches. Thus, we further compared the main results of the three surgical procedures (LVR, Altemeier, and Delorme; Table 3). Interestingly, the results between Altemeier and Delorme were not statistically significant. Thus, the Delorme and Altemeier procedures were combined into the single perineal repair category. Through multivariate analysis (Table 4), we found that perineal repair (odds ratio, 9.827; 95% confidence interval [CI], 1.296–74.50; $P = 0.027$) might be a risk factor for recurrence.

ERP is characterized by physical changes and functional abnormalities, such as constipation and fecal incontinence. One key goal of surgery is to correct these symptoms and avoid the creation of de novo bowel dysfunction. In the present study, constipation status was improved by both surgical approaches (40.9% to 28.6% for abdominal repair, $P = 0.396$; and 72.4% to 25.0% for perineal repair, $P = 0.001$; Table 5). Fecal incontinence was aggravated in abdominal repair, yet corrected in perineal repair, although without statistical significance. To better illustrate these results, we further quantified the preoperative and post-operative defecation function using Wexner scores and CCCS (Figure 3). Only perineal repair significantly improved the post-operative constipation status ($P < 0.01$).

Finally, we used the widely accepted EQ-5D-5 L questionnaire to assess the impact of abdominal or perineal repair on the patients' quality of life (Figure 4). The median score increased from 65 (range, 50–75) to 80 (range, 40–100) in the abdominal group, and from 50 (range, 25–70) to 90 (range, 50–100) in the perineal group (both $P < 0.001$). Together, the post-operative quality of life of patients in both groups was remarkably improved.

Discussion

Rectal prolapse is a relatively rare disease with obvious sex differences. Consequently, few studies have comprehensively explored the surgical approach to male ERP. In the present work, we retrospectively analysed a cohort of 51 male patients who received abdominal or perineal repair, compared the perioperative results, and evaluated the long-term outcomes, including recurrence, sexual function, quality of life, and defecation function based on follow-up investigations.

In this study, a significant proportion of male ERP patients were young, consistently with previously reported data [19]. Female ERP is related to pelvic floor prolapse caused by repeated vaginal deliveries and aging [20, 21], while a proportion of male ERP cases seem to be caused by congenital factors [22], despite a lack of sufficient evidence [23]. Consistently with most studies,

Table 3. Surgical outcomes of 51 patients with ERP in LVR, Altemeier, and Delorme groups

Characteristic	LVR ($n = 22$)	Altemeier ($n = 22$)	Delorme ($n = 7$)	*P*-value
Operation duration, mins, mean ± SD	166 ± 43	102 ± 37	80 ± 32	<0.001[b]
Post-operative length of stay, days, median (range)	8 (3–15)	11 (5–26)	8 (6–14)	0.121
Morbidity, *n* (%)	0 (0%)	5 (22.7%)	1 (14.3%)	0.073
Rectal/anastomotic bleeding	0	2	0	
Anal stenosis	0	2	0	
Rectal/anastomotic leakage	0	1	0	
Perianal infection	0	0	1	
Recurrence[a], *n* (%)	2 (9.5%)	7 (36.8%)	3 (60.0%)	0.026[c]
Sexual function affected, *n*	0	0	0	

ERP, external rectal prolapse; LVR, laparoscopic ventral rectopexy; SD, standard deviation.
[a]LVR, Altemeier, and Delorme groups were followed up in 21, 19, and 5 patients, respectively.
[b]The difference between the Altemeier group and the Delorme group was not statistically significant ($P = 0.192$).
[c]The difference between the Altemeier group and the Delorme group was not statistically significant ($P = 0.092$).

Table 4. Multivariate analysis for recurrence in patients with ERP

Characteristic	OR (95% CI)	*P*-value
Age	1.002 (0.953–1.054)	0.931
BMI	1.215 (0.957–1.543)	0.109
ERP length	0.975 (0.738–1.289)	0.860
Perineal repair	9.827 (1.296–74.50)	0.027
ASA score	0.547 (0.058–5.187)	0.599

BMI, body mass index; CI, confidence interval; ERP, external rectal prolapse; ASA, American Society of Anesthesiologists; OR, odds ratio.

Table 5. Pre- and post-operative defecation status in 51 patients with ERP

Factor	Preoperative	Post-operative[a]	*P*-value
Constipation, *n* (%)			
Abdominal repair	9/22 (40.9%)	6/21 (28.6%)	0.396
Perineal repair	21/29 (72.4%)	6/24 (25.0%)	0.001
Fecal incontinence, *n* (%)			
Abdominal repair	2/22 (9.1%)	5/21 (23.8%)	0.372
Perineal repair	12/29 (41.4%)	7/24 (29.2%)	0.356

[a]Abdominal repair and perineal repair were followed up in 21 and 24 patients, respectively.
ERP, external rectal prolapse.

patients who underwent abdominal repair had lower ASA scores, implying that surgeons tend to choose perineal repair for patients at high anesthesia risk, which is consistent with previous studies [4, 7, 24].

Notably, in our institution, we preferred laparoscopic abdominal repair of ERP to achieve a minimally invasive repair. Therefore, all participants in the abdominal group underwent LVR without conversion to laparotomy. The surgical duration of abdominal repair was significantly longer than that of perineal repair owing to the complexity of the mesh fixation technique, consistently with the previous literature [8, 25]. However, the median post-operative LOS of perineal repair was shorter (but not statistically significant). Patients receiving perineal repair had higher ASA scores and took longer before healing of the anastomosis, which was not required in the LVR group. Post-operative mortality, complication rate, and recurrence are the key outcomes for rectal prolapse. No patient in this study cohort died within 30 days post-operatively. No major complications occurred in the abdominal group. Patients with anastomotic bleeding and stenosis in the perineal group healed after conservative or endoscopic treatment. Anastomotic leakage and perineal infection were cured after local drainage and antibiotic treatment without reoperation. Even though the morbidity of perineal repair was higher, both approaches were safe. The recurrence rate during follow-up after LVR was similar to that in previous studies [26]. Previous opinions on the recurrence of perineal repair for ERP are controversial, but some have reported that the recurrence rate increased during long-term follow-up [27], which was similar to the data in our work. Few studies have reached a conclusion about post-operative sexual function [24, 28–30]. Compared with women, male sexual function is easier to measure. We found that the patients' sexual function was barely affected after surgery. This was not surprising because neither approach damages the pelvic plexus, which is responsible for sexual function [31].

Constipation and incontinence are the two main symptoms of ERP [1, 32, 33]. Although a number of studies have reported that LVR can better improve incontinence than other approaches [34, 35], few conclusions are available for men. In this study, neither approach improved the existing incontinence of ERP in male patients. ERP may cause stretching of the anal sphincter and may set up a chronic inflammatory state with perianal fibrotic changes, which further damages the sphincter and leads to incontinence [36]. These irreversible changes are difficult to correct by surgery. In contrast, consistently with most published studies [37–39], both approaches improved constipation, although only perineal repair reached statistical significance. Finally, the quality of life of patients in both groups was significantly improved, affirming the value of the two surgical approaches.

The main limitations of this study are as follows: (i) this was a single-center retrospective study with a small sample size, so potential bias may exist; (ii) the Delorme and Altemeier procedures were combined into the single perineal repair category, yet there were differences between the two operations; (iii) the patients' sexual function changes were collected post-operatively, thus recall bias could not be completely excluded.

In this study, we retrospectively analysed the results of abdominal and perineal repair of 51 patients with ERP and identified that both surgical approaches were safe in men. Compared

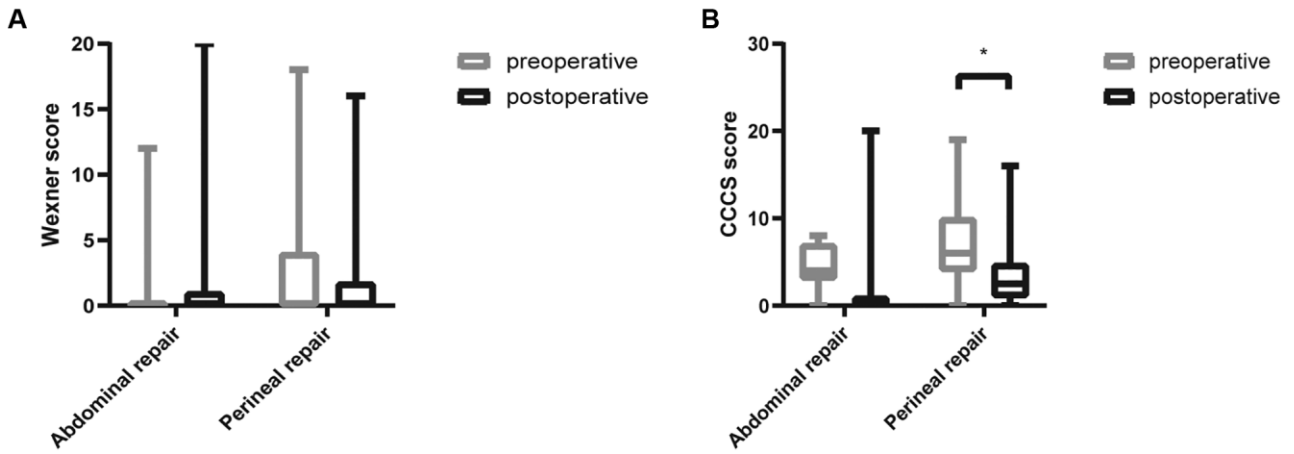

Figure 3. Alterations in preoperative and post-operative Wexner fecal incontinence scores and CCCS of patients with ERP who underwent abdominal or perineal repair. *$P < 0.01$; CCCS, Cleveland Clinic Constipation scores; ERP, external rectal prolapse.

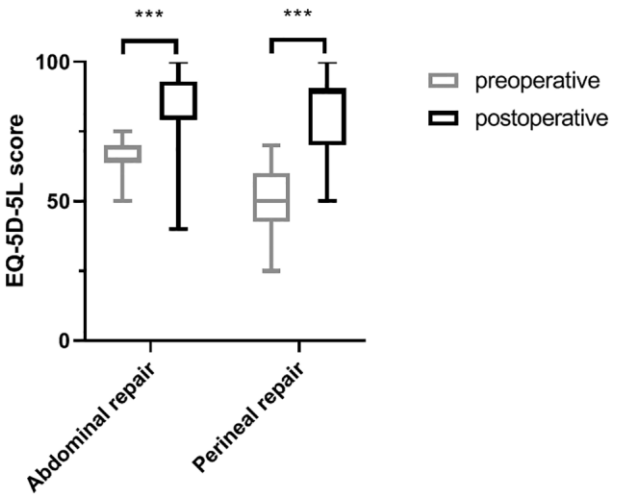

Figure 4. Alterations in preoperative and post-operative EQ-5D-5 L scores of patients with ERP who underwent abdominal or perineal repair. ***$P < 0.001$; ERP, external rectal prolapse; EQ-5D-5 L, EuroQol 5-Dimension 5-Levels.

with perineal repair, the morbidity and recurrence rates for abdominal repair were lower. However, perineal repair was better able to correct constipation.

Authors' contributions

This study was designed by B.H., Q.Z., and D.R. D.R. and H.P. performed the operations. B.H., Q.Z., C.L., W.C., Z.X., M.L., and L.L. were responsible for follow-up and data analysis. B.H. and Q.Z. drafted the manuscript. B.H., Q.Z., C.L., D.S., K.C., H.G., W.C., and Z.C. revised the manuscript. All authors have read and approved the final version of the manuscript.

Funding

This work was supported by the Guangdong Medical Research Fund Project [grant number A2021171].

Acknowledgements

We are grateful to the Little Black Room in the 17B area as well as team members from all over the country for providing us with a generous amount of unencumbered time to finish this substantial research work. The data sets used and analysed during the current study are available from the corresponding author on reasonable request.

Conflict of Interest

None declared.

References

1. Bordeianou L, Paquette I, Johnson E *et al.* Clinical practice guidelines for the treatment of rectal prolapse. *Dis Colon Rectum* 2017;**60**:1121–31.
2. Bordeianou L, Hicks CW, Kaiser AM *et al.* Rectal prolapse: an overview of clinical features, diagnosis, and patient-specific management strategies. *J Gastrointest Surg* 2014;**18**:1059–69.
3. Kairaluoma MV, Kellokumpu IH. Epidemiologic aspects of complete rectal prolapse. *Scand J Surg* 2005;**94**:207–10.
4. Fang SH, Cromwell JW, Wilkins KB *et al.* Is the abdominal repair of rectal prolapse safer than perineal repair in the highest risk patients? An NSQIP analysis. *Dis Colon Rectum* 2012;**55**:1167–72.
5. Elagili F, Gurland B, Liu X *et al.* Comparing perineal repairs for rectal prolapse: Delorme versus Altemeier. *Tech Coloproctol* 2015;**19**:521–5.
6. Reche F, Faucheron JL. Laparoscopic ventral rectopexy is the gold standard treatment for rectal prolapse. *Tech Coloproctol* 2015;**19**:565–6.
7. Riansuwan W, Hull TL, Bast J *et al.* Comparison of perineal operations with abdominal operations for full-thickness rectal prolapse. *World J Surg* 2010;**34**:1116–22.
8. Lee A, Kin C, Syan R *et al.* Surgical decision-making for rectal prolapse: one size does not fit all. *Postgrad Med* 2020;**132**:256–62.
9. D'Hoore A, Penninckx F. Laparoscopic ventral recto(colpo)-pexy for rectal prolapse: surgical technique and outcome for 109 patients. *Surg Endosc* 2006;**20**:1919–23.
10. Tobin SA, Scott IH. Delorme operation for rectal prolapse. *Br J Surg* 1994;**81**:1681–4.
11. Altemeier WA, Culbertson WR, Schowengerdt C *et al.* Nineteen years' experience with the one-stage perineal repair of rectal prolapse. *Ann Surg* 1971;**173**:993–1006.

12. Ambrosetti P, Francis K, De Peyer R *et al.* Colorectal anastomotic stenosis after elective laparoscopic sigmoidectomy for diverticular disease: a prospective evaluation of 68 patients. *Dis Colon Rectum* 2008;**51**:1345–9.
13. Rashid KA, Wakhlu A, Tandon RK *et al.* Anorectal junction stenosis: diagnosis and management. *Eur J Pediatr Surg* 2008; **18**:303–6.
14. Agachan F, Chen T, Pfeifer J *et al.* A constipation scoring system to simplify evaluation and management of constipated patients. *Dis Colon Rectum* 1996;**39**:681–5.
15. Jorge JM, Wexner SD. Etiology and management of fecal incontinence. *Dis Colon Rectum* 1993;**36**:77–97.
16. EuroQol Group. EuroQol: a new facility for the measurement of health-related quality of life. *Health Policy* 1990;**16**:199–208.
17. Albayati S, Morgan MJ, Turner CE. Laparoscopic ventral rectopexy for rectal prolapse and rectal intussusception using a biological mesh. *Colorectal Dis* 2017;**19**:857–62.
18. Drossman DA. The functional gastrointestinal disorders and the Rome III process. *Gastroenterology* 2006;**130**:1377–90.
19. Vogel JD, de Campos-Lobato LF, Chapman BC *et al.* Rectal prolapse surgery in males and females: an ACS NSQIP-based comparative analysis of over 12,000 patients. *Am J Surg* 2020; **220**:697–705.
20. Keag OE, Norman JE, Stock SJ. Long-term risks and benefits associated with cesarean delivery for mother, baby, and subsequent pregnancies: systematic review and meta-analysis. *PLoS Med* 2018;**15**:e1002494.
21. Caretto M, Misasi G, Giannini A *et al.* Menopause, aging and the failing pelvic floor: a clinician's view. *Climacteric* 2021;**24**: 531–2.
22. Zorenkov D, Otto S, Böttner M *et al.* Morphological alterations of the enteric nervous system in young male patients with rectal prolapse. *Int J Colorectal Dis* 2011;**26**:1483–91.
23. Hotouras A, Murphy J, Abeles A *et al.* Symptom distribution and anorectal physiology results in male patients with rectal intussusception and prolapse. *J Surg Res* 2014;**188**:298–302.
24. Poylin VY, Irani JL, Rahbar R *et al.* Rectal-prolapse repair in men is safe, but outcomes are not well understood. *Gastroenterol Rep (Oxf)* 2019;**7**:279–82.
25. Rogers AC, McCawley N, Hanly AM *et al.* Trends in the treatment of rectal prolapse: a population analysis. *Int J Colorectal Dis* 2018;**33**:459–65.
26. Albayati S, Chen P, Morgan MJ *et al.* Robotic vs. laparoscopic ventral mesh rectopexy for external rectal prolapse and rectal intussusception: a systematic review. *Tech Coloproctol* 2019; **23**:529–35.
27. Gleditsch D, Wexels WA, Nesbakken A. Surgical options and trends in treating rectal prolapse: long-term results in a 19-year follow-up study. *Langenbecks Arch Surg* 2018;**403**:991–8.
28. Rondelli F, Bugiantella W, Villa F *et al.* Robot-assisted or conventional laparoscoic rectopexy for rectal prolapse? Systematic review and meta-analysis. *Int J Surg* 2014;**12(Suppl 2)**:S153–9.
29. Formijne Jonkers HA, Poierrié N, Draaisma WA *et al.* Impact of rectopexy on sexual function: a cohort analysis. *Int J Colorectal Dis* 2013;**28**:1579–82.
30. van Iersel JJ, de Witte CJ, Verheijen PM *et al.* Robot-assisted sacrocolporectopexy for multicompartment prolapse of the pelvic floor: a prospective cohort study evaluating functional and sexual outcome. *Dis Colon Rectum* 2016;**59**:968–74.
31. Masui H, Ike H, Yamaguchi S *et al.* Male sexual function after autonomic nerve-preserving operation for rectal cancer. *Dis Colon Rectum* 1996;**39**:1140–5.
32. Joubert K, Laryea JA. Abdominal approaches to rectal prolapse. *Clin Colon Rectal Surg* 2017;**30**:57–62.
33. Siproudhis L, Eléouet M, Rousselle A *et al.* Overt rectal prolapse and fecal incontinence. *Dis Colon Rectum* 2008;**51**: 1356–60.
34. Wallenhorst T, Bouguen G, Brochard C *et al.* Long-term impact of full-thickness rectal prolapse treatment on fecal incontinence. *Surgery* 2015;**158**:104–11.
35. Tsunoda A, Takahashi T, Ohta T *et al.* Quality of life after laparoscopic ventral rectopexy. *Colorectal Dis* 2016;**18**:O301–10.
36. Emile SH, Youssef M, Thabet W *et al.* Role of endoanal ultrasonography in grading anal sphincter integrity in rectal prolapse and in predicting improvement in the continence state after surgical treatment. *Surg Laparosc Endosc Percutan Tech* 2020;**30**:62–8.
37. Boons P, Collinson R, Cunningham C *et al.* Laparoscopic ventral rectopexy for external rectal prolapse improves constipation and avoids de novo constipation. *Colorectal Dis* 2009;**12**: 526–32.
38. Lieberth M, Kondylis LA, Reilly JC *et al.* The Delorme repair for full-thickness rectal prolapse: a retrospective review. *Am J Surg* 2009;**197**:418–23.
39. Cirocco WC. The Altemeier procedure for rectal prolapse: an operation for all ages. *Dis Colon Rectum* 2010;**53**:1618–23.