Diseases of the Colon & Rectum

Does ventral rectopexy improve the pelvic floor function in the long term?

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Abstract:	Background: Information is needed on long-term functional results, sequelae and outcome predictors for laparoscopic ventral mesh rectopexy. Objective: To evaluate long-term function post ventral rectopexy in patients with external rectal prolapse or internal rectal prolapse in a large cohort and identify the possible effects of patient-related factors and operative technical details on patient-reported outcomes. Design: A retrospective review with a cross-sectional questionnaire study. Settings: Data were collated from prospectively collected registries in two university and two central hospitals in Finland. Patients: All 508 consecutive patients treated with ventral rectopexy for external rectal prolapse or symptomatic internal rectal prolapse in 2005-2013 were included. Interventions: A questionnaire concerning disease-related symptoms and effect on quality of life. Main Outcome Measures: Defecatory function measured by the Wexner score, the Obstructive Defecation Score and subjective symptom and quality of life evaluation using the visual analogue scale. The effects of patient-related factors and operative

	technical details were assessed using multivariate analysis. Results: The questionnaire response rate was 70.7% (330/467 living patients) with a median follow-up time of 44 months. The mean Wexner scores were 7.0 (SD 6.1) and 6.9 (SD 5.6) and the mean Obstructive Defecation Scores were 9.7 (SD 7.6) and 12.3 (SD 8.0) for patients presenting with external rectal prolapse and internal rectal prolapse, respectively. Subjective symptom relief was experienced by 76% and reported more often by patients with external rectal prolapse than with internal rectal prolapse (86% vs. 68%, $p<0.001$). Complications occurred in 11.4% of patients, and the recurrence rate for rectal prolapse was 7.1%. Limitations: Lack of preoperative functional data and suboptimal questionnaire response rate. Conclusions: Ventral mesh rectopexy effectively treats posterior pelvic floor dysfunction with a low complication rate and an acceptable recurrence rate. Patients with external rectal prolapse benefit more from the operation than those with symptomatic internal rectal prolapse.
Response to Reviewers:	

Dear Editor-in-chief

Please find as attachment our final version of the accepted manuscript entitled "Does ventral rectopexy improve the pelvic floor function in the long term?" together with the video abstract.

Kind regards,

Johanna Mäkelä-Kaikkonen

TITLE PAGE

1. Does ventral rectopexy improve pelvic floor function in the long term?

2. Ventral rectopexy and functional outcome

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11. Colorectal/Pelvic floor

Abstract

Background: Information is needed on long-term functional results, sequelae and outcome predictors for laparoscopic ventral mesh rectopexy.

Objective: To evaluate long-term function post ventral rectopexy in patients with external rectal prolapse or internal rectal prolapse in a large cohort and identify the possible effects of patient-related factors and operative technical details on patient-reported outcomes.

Design: A retrospective review with a cross-sectional questionnaire study.

Settings: Data were collated from prospectively collected registries in two university and two central hospitals in Finland.

Patients: All 508 consecutive patients treated with ventral rectopexy for external rectal prolapse or symptomatic internal rectal prolapse in 2005–2013 were included.

Interventions: A questionnaire concerning disease-related symptoms and effect on quality of life.

Main Outcome Measures: Defecatory function measured by the Wexner score, the Obstructive Defecation Score and subjective symptom and quality of life evaluation using the visual analogue scale. The effects of patient-related factors and operative technical details were assessed using multivariate analysis.

Results: The questionnaire response rate was 70.7% (330/467 living patients) with a median follow-up time of 44 months. The mean Wexner scores were 7.0 (SD 6.1) and 6.9 (SD 5.6) and the mean Obstructive Defecation Scores were 9.7 (SD 7.6) and 12.3 (SD 8.0) for patients presenting with external rectal prolapse and internal rectal prolapse, respectively. Subjective symptom relief was experienced by 76% and reported more often by patients with external rectal prolapse than with internal rectal prolapse (86% vs. 68%, $p<0.001$). Complications occurred in 11.4% of patients, and the recurrence rate for rectal prolapse was 7.1%.

Limitations: Lack of preoperative functional data and suboptimal questionnaire response rate.

Conclusions: Ventral mesh rectopexy effectively treats posterior pelvic floor dysfunction with a low complication rate and an acceptable recurrence rate. Patients with external rectal prolapse benefit more from the operation than those with symptomatic internal rectal prolapse.

Keywords: Rectopexy, Rectal prolapse, Incontinence, Obstructed defecation, Laparoscopic

Introduction

Laparoscopic ventral mesh rectopexy (LVMR) has evolved to become the treatment of choice for external rectal prolapse (ERP) in Europe.[1] LVMR is also increasingly used to treat posterior pelvic floor dysfunction (pPFD), such as symptomatic internal rectal prolapse (IRP), enterocele and complex rectocele, where it has shown improved short- and intermediate-term functional results.[2–6] LVMR for ERP is associated with low morbidity and a recurrence rate of 1.5–9.4%.[7–12] Long-term improvement in function and quality of life (QoL) has been shown.[9] However, the use of LVMR for IRP with obstructive defecation symptoms is still under debate.[13]

The use of surgical mesh to treat pelvic organ prolapse has raised some concerns. Recently, a large multicentre study found a 2% mesh erosion rate post rectopexy. The authors recommended an international ventral mesh registry to monitor mesh problems, allowing the assessment of whether the mesh type has any effect on functional outcomes or the need for revisional surgery for other reasons.[14] In addition to the use of different types of mesh prostheses, since D'Hoore and Pennincx first described ventral mesh rectopexy in 2004, reports on LVMR procedures have described a variety of operative modifications or details.[5,15–17] The literature provides no data to indicate the gold standard for the mesh prosthesis type, shape, fixation method or optimal number of sutures.[1,12] Information on factors that could predict successful or adverse operative and functional outcomes is needed for appropriate patient selection and detailed technical performance of the ventral rectopexy procedure.

The aim of this multicentre registry and questionnaire study was to evaluate the clinical outcomes, complications and long-term functional outcomes and recurrence in a large cohort of patients. The possible relationships between patient characteristics, indications and operative technical details and patient-reported functional outcomes were assessed using multivariate analysis.

Patients and Methods

Study population and data collection

All consecutive patients who underwent LVMR for ERP or symptomatic IRP since the introduction of the operative method in two university hospitals (Oulu University Hospital and Helsinki University Hospital) and two central hospitals (Central Finland Central Hospital and Päijät-Häme Central Hospital) in 2005–2013 were included in the study. Operative and clinical data from each institution's prospectively collected registry files were collated into one database for analysis; additional data were retrieved from the patients' medical records. The indications for the LVMR procedure and clinical follow up were determined according to the individual centre's practice. The study received ethical approval from the Oulu University Hospital Ethics Committee.

Surgical technique

In each hospital, experienced colorectal surgeons performed the operations. The surgical technique primarily followed the details described by D'Hoore and Penninckx,[7,15] with minor modifications to the original procedure by some surgeons. The pelvic peritoneum was opened with diathermy scissors or with a Harmonic Scalpel™ (Johnson & Johnson, Ethicon Endosurgery). Dissection towards the levator level was performed only anterior to the rectum, thereby preserving the lateral ligaments and sparing the hypogastric and parasympathetic nerves. The mesh was sutured as distally as possible onto the anterior rectal wall using interrupted seromuscular non-absorbable sutures (2-0 Ethibond®) and to the apex of the vagina in females. As a variation of the original operative technique, some surgeons sutured the mesh to the levator muscle or through the pelvic floor with either absorbable or non-absorbable sutures (2-0 Polysorb®, Vicryl® or Ethibond®), as described previously.[17] The upper part of the mesh was fixated to the sacral promontory using spiral attachments (Pro-Tack TM Fixation Device, Covidien). The peritoneum was closed over the mesh with intermittent or continuous sutures. For the robotic operations with

the da Vinci Surgical System (Intuitive Surgical Inc., Sunnyvale, CA, USA), side docking with five trocar placements was used. Perioperative care was conducted per the enhanced recovery after surgery protocol.

Follow up and questionnaires

All patients alive at follow up were sent a questionnaire that included the Wexner Continence Grading Scale[18] for incontinence symptoms and ODS[19] for constipation/obstructed defecation symptoms. Patients reported possible discomfort experienced because of the incontinence and obstructed defecation/constipation symptoms with a 100 mm visual analogue scale (VAS; no discomfort–great discomfort). The change before and after the operation in bowel/defecatory symptoms and the effect of symptoms on QoL was also reported using a simple VAS scale (much worse–much better). Questions on the appearance of de novo symptoms during the first 6 months postoperatively specified urinary incontinence, incomplete bladder emptying, pelvic pain, the loss of sensation for defecation and urge; the patients were free to comment on additional symptoms. Another item on the possible effects resulting from the operation was included concerning the impact on sexual function and symptoms that were present before the operation (urinary incontinence, bladder emptying, pelvic pain, pelvic organ prolapse in females). The preoperative–postoperative change regarding each symptom was assessed using a VAS (much worse–much better. Finally, the patients were asked whether they were satisfied with the operation results (yes/no/cannot say).

Outcome parameters

Data were collected for multivariate analysis on the following patient-related characteristics: age; sex; body mass index (BMI); the American Society of Anesthesiologists (ASA) classification; number of medical conditions; previous abdominal, pelvic and prolapse surgery;

previous hysterectomy; previous posterior colporaphy; indications/symptoms for the operation; and the anatomical diagnosis of a pelvic floor defect. The operative technical details for multivariate analysis included the technique (laparoscopic/robotic) and instrument used for dissection, the mesh type and fixation method to the pelvic floor, the suturing method and the number of sutures used and whether vaginal sutures were applied as well as the occurrence of complications. The clinical outcome parameters studied were the operative time, complications and conversion, length of stay (LOS), recurrence, any revisional surgery and surgery for complications. The Wexner score was used for the evaluation of incontinence (range: 0–20, with 20 representing complete incontinence and >9 regarded as disturbing incontinence symptoms). Constipation/obstructed defecation was assessed with the ODS (range: 0–40, with a score >20 regarded as disturbing constipation). Patients marking a point (much worse–much better) at 61–100 mm on the VAS scale were considered to have experienced a change for the better; the effect of the operation on symptom relief was therefore successful.

Statistical analysis

Summary statistics are presented as mean and standard deviation (SD) unless stated otherwise. Student's *t*-test (continuous variables) or analysis of variance (continuous variables, >2 groups) and Pearson's χ^2 test (categorical variables) were used for between-group analyses. Comparisons between preoperative and follow-up measurements were analysed using the paired-samples *t*-test. A multivariate logistic regression model was generated to assess possible risk factors for symptom relief or symptom-related QoL. Variables with $p<0.3$ or clinical interest were included in the analyses. A variable was left in the model if $p<0.05$ or its influence on the log likelihood function was significant. Two-tailed *p*-values are reported. Analyses were performed using SPSS for Windows (IBM SPSS Statistics for Windows, Version 21.0, IBM Corp., Armonk, NY).

Results

In all, 508 consecutive patients (481 female and 27 male) underwent LVMR or robotic ventral mesh rectopexy (RVMR) over an 8-year period in the four participating hospitals (Oulu: 124, Jyväskylä: 186, Lahti: 111, Helsinki: 87). Thirty-seven (7.3%) patients underwent reoperation for prolapse. Clinical follow-up information was available for 369/508 (72.6%) patients.

Patient demographics are presented in Table 1. The main indications for LVMR were ERP in 286 (56%) and symptomatic IRP with/without an enterocele in 214 (42%) patients. Of the IRP patients, 168 (79%) presented with obstructed defecation symptoms, 37 (17%) with incontinence symptoms and 42 (20%) with combined symptoms. The median follow-up length was 44 months (range: 1–105).

Operation details and complications

The operation details and additional combination procedures are summarised in Table 2. Most mesh prostheses (426/508; 83.9%) were made of polyester. No biological grafts were implanted. Eighteen patients (3.5%) had additional procedures in combination with LVMR; these are listed in Table 2. Conversion to laparotomy occurred in seven operations and was due to intraoperative complications in four patients (three intraoperative bleeding, one vaginal perforation). Fifty-eight (11.4%) patients faced complications, and the median LOS was 4 days (range: <1–30).

Fifty-eight (11.4%) patients faced complications and seven (1.4%) complications were mesh-related with five mesh erosions to the vagina and two recto-vaginal fistulas; these are listed in Table 3. The median time from the operation to the identification of mesh erosion was 8.5 months (range: 2–29). In 3/5 (60%) operations leading to mesh erosion, the vaginal wall was perforated and sutured intraoperatively; one patient had adhesive rectovaginal space following a previous posterior

colporrhaphy and a stapled transanal rectal resection (STARR) operation; and in one case, the perioperative course was uneventful. In two of these patients, the mesh was resected transvaginally, and the defect was sutured without need for further intervention. One combined laparoscopic and transvaginal mesh removal was carried out following a failed transvaginal local resection. Two mesh removals needed laparotomy. The other was followed by an advancement flap-plasty reconstruction at 6 months postoperatively, after which the patient underwent laparoscopic ventral re-rectopexy 17 months after the primary operation. Mesh erosion reoccurred, and the mesh was removed during another re-laparotomy. There was no postoperative 60-day mortality.

Long-term functional outcomes and recurrence

Forty-one of 508 patients (8%) died during the follow-up time for reasons unrelated to the operative treatment. A total of 330 questionnaires were returned by the 467 patients alive at follow up, giving a response rate of 70.7% and a response rate of 65% of all 508 patients.

The patient-reported functional outcomes are presented in Figure 1 and the functional results per indication are shown in Table 4. Seventy-six percent of patients experienced defecatory symptom relief post operation, and ERP patients reported more symptoms relief (85.9%) than IRP patients with/without an enterocele (E) (68.4%), $p<0.001$. The impact on symptom-related QoL was positive in 73.9% of patients. A change for the better was seen in more ERP patients (84.9%) than IRP+E (64.6%), IRP (65.5%) or isolated rectocele patients (71.4%), $p<0.001$. The mean Wexner scores were 7.0 (SD 6.1) and 6.9 (SD 5.6), and the mean ODSs were 9.7 (7.6 SD) and 12.3 (8.0 SD) for ERP and IRP patients, respectively. Discomfort levels experienced because of continuing incontinence and obstructed defecation symptoms were a median of 12/100 mm (1–60, 25th and 75th percentiles) and 37/100 mm (11–80, 25th and 75th percentiles), respectively.

Pre-existing urinary incontinence was reported by 148 (46%), bladder emptying problems by 123 (39%), feelings of pelvic organ bulging by 108 (36%) and pelvic pain by 150 (48%) patients. Changes for the better in the pre-existing symptoms of urinary incontinence, bladder emptying problems, feelings of pelvic organ bulging and pelvic organ pain were seen in 43%, 27%, 53% and 49% of patients, respectively. The similarly assessed effect on sexual function was positive in 56% of patients.

De novo symptoms were reported by 124 (38.9%) patients; the urge sensation was the most common, in 77 (24.3%) patients, and this was more often reported by patients with IRP (49/166, 29.5%) as a primary diagnosis. The loss of sensation to defecate was reported by 13 (4.1%) and urinary related symptoms by 15 (4.7%) patients after operation.

Forty-eight (9.1%) patients had a reoperation; in 21 cases, this was performed because of a recurrence of ERP, giving an overall recurrence rate of 7.1% for ERP post LVMR. The reoperations are listed in Table 5. In all, 215/328 (66%) of respondents were subjectively satisfied with the LVMR results, 56 (17%) were dissatisfied and 57 (17%) patients could not say.

The effects of patient-related and operative technical details on outcomes

Of all variables studied, better symptom relief was identified in patients with no previous pelvic operations (80.2%) than in those who had undergone surgery before (68.1%), p=0.016. However, the association disappeared in multivariate logistic regression models. According to the logistic regression models, more than one underlying disease was a negative predicting factor for symptom relief, (OR 0.35, 95%CI 0.15–0.80), p=0.019, but no other included patient-related variable (age, gender, BMI, previous pelvic or prolapse surgery) or operative technical detail (mesh fixation techniques, number of sutures) had a statistically significant effect on either symptom relief or symptom-related QoL. An indication of IRP with ODS symptoms appeared as a negative predictive factor for symptom relief (OR 0.21, 95%CI 0.10– 0.44), p=<0.001

and for improved QoL (OR 0.31, 95%CI 0.17–0.58), $p<0.001$. IRP with both ODS and incontinence symptoms was a negative predictor for improved quality of life (OR0.26, 95%CI 0.12–1.65), $p=0.001$, but IRP with incontinence symptoms alone did not have an effect in neither outcome measure (Table 6).

Discussion

Ventral mesh rectopexy has gained popularity in the treatment of ERP and symptomatic IRP. Our results showed LVMR to be safe and effective in treating pPFD with good patient satisfaction and low rates of recurrence and reoperations. The rates of complications and mesh-related problems were limited, and the number of de novo symptoms was acceptable. Out of a set of several factors, we found that better symptom relief was more likely in patients with no previous pelvic operation and in patients undergoing an operation for ERP in comparison to patients with IRP. However, our study could not characterize more detailed patient- and operative technique-related factors predicting successful or non-successful outcomes.

The current study presents the third-largest material so far, consisting of 508 patients with the longest median follow up of 44 months.[12,14,20] There is some heterogeneity in diagnostic and treatment protocols amongst the participating institutions, but as such, the results reflect "real-life" policy. The cross-sectional nature of the study has several methodological limitations. The disease-related severity scores were not routinely determined at each institution preoperatively during the evaluation period, and we only had information available about the preoperative incidences of symptoms. Therefore, VAS evaluation of patients' current symptom profile was used, reflecting patients' subjective experience of defecatory function. The subjective assessment of symptom relief in the VAS and the improvement seen in the ODS and Wexner scores in a subset of patients confirm that LVMR improves patients' defecatory function. In addition, a recall of

symptoms retrospectively may be exposed to memory bias. The loss of patients to follow up was notable, but a 71% response rate for the questionnaires should be considered acceptable.

Long-term functional outcomes of larger cohorts have recently been published.[12,14,20] The recurrence rate of 7.1% for ERP and the need for reoperation in 6.1% of patients primarily operated on for IRP are in accordance with the literature.[20] Our results are also comparable with previous reports presenting improvements in incontinence in 70–90% and obstructed defecation in 60–80% of patients post LVMR.[8,21] In addition to defecatory symptoms, the patients reported improvemenst in other pre-existing pelvic symptoms, although no specific symptom severity scores were used for their evaluation. Our findings also suggested a positive impact of LVMR on sexual function, as reported also in previous studies.[12,22] Patients with faecal incontinence associated with IRP or ERP have been reported to gain an equivalent benefit of LVMR, but reports on the appropriate treatment for obstructed defecation are conflicting.[23,24] In our series, IRP patients with obstructed defecation symptoms showed the least satisfaction.

Undertaking surgical intervention for a benign disease calls for minimizing the risk of any adverse event. The overall complication rate of 11.4% is in accordance with previous studies reporting rates of 0–23.5%[14] and most complications were minor. Although concerns have also been raised regarding potential mesh-related erosion, fistulation, dyspareunia and stricturing after LVMR, the transabdominal route appears to be safer for rectovaginal septum reinforcement.[14,25,26] In the current study, mesh complications occurred in 1.4% of patients, which correlates with previously reported multicentre studies showing 1.3 –2% mesh erosion rates.[14,20] It is noteworthy that the most common mesh material used in our cohort was polyester, and although this has been associated with a significantly increased risk of mesh-erosion complications in some studies,[12,14] in our analysis, no specific mesh material could be identified as a risk factor. Stitch sinuses and perineotomy to correct low rectoceles have been previously associated with erosion problems. Our finding of perioperative vaginal perforation arising in 60% of patients facing later erosion

complications confirms that mesh placement should be avoided in case of vaginal perforation.[14,20] We observed that adverse events seemed to have no effect on patient satisfaction or patient-reported outcomes in the long run.

Some of our findings are either new or inconsistent with the results of previous studies. De novo constipation and incontinence post ventral rectopexy have been demonstrated with incidences of 1.4–3.7% and 1–6%, respectively.[8,12,20,27] In general, comprehensive analyses of new-onset symptoms have not been previously surveyed or included in LVMR outcome reports. In all, 39% of the patients reported some new-onset symptoms after surgery; the urge to defecate was the most common, at 24.3%. Urge symptoms occurred more often post LVMR for IRP than for ERP. The risk of urgency has been associated with stapled transanal rectal resections reducing the rectal ampulla volume, with a one-year incidence of 26.8% in patients registered with the European STARR registry.[28] Unexpectedly, the incidence of postoperative urgency following LVMR in our study seemed to be similar. However, the true incidence and reasons for urgency arising post LVMR need further research. Also more profound prospective assessment to confirm and define our findings of the LVMR to urinary symptoms is necessary.

Conclusions

Ventral mesh rectopexy is an effective procedure for treating pPFD, exhibiting a low rate of complications and an acceptable rate of recurrence. Patients' satisfaction and subjective improvements of defecatory symptoms are long-lasting. In the long run, patients with ERP seem to benefit more from surgery than those with IRP associated with obstructed defecation symptoms. More studies are needed to identify predictive factors for successful and non-successful operative results, with an emphasis on preoperative diagnostic findings and patients' symptom profiles.

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Legends

Legend for Table 1

Baseline Characteristics

Nominal variables are reported as counts and percentages (in parentheses); continuous variables are reported as means and standard deviations; BMI: body mass index; ASA: American Society of Anesthesiologists; ODS: obstructed defecation syndrome; ERP: external rectal prolapse; IRP internal rectal prolapse.

Legend for Table 2

Operative Details

Nominal variables are reported as counts and percentages (in parentheses); continuous variables are reported as means and standard deviations.

Legend for Table 3

Complications

Nominal variables are reported as counts and percentages (in parentheses); continuous variables are reported as means and standard deviations.

Table 4. Functional Outcome by Diagnosis

SD, Standard deviation

VAS, visual analogue scale; the severity of the symptoms were estimated by VAS from 0–100

1) Values are medians with (25th and 75th percentiles)
2) Values are frequencies and (%)
3) Wexner (min–max; 0–20) > 9 considered as significant ongoing incontinence symptoms

4) ODS (min–max; 0–40) > 20 considered as significant ongoing obstructed defecation symptoms

Legend for Table 5

Reoperations per Primary Diagnosis

Variables are reported as counts and (percentages). ERP: external rectal prolapse; IRP: internal rectal prolapse; LVMR: laparoscopic ventral mesh rectopexy; STARR: stapled transanal rectal resection; PPH: procedure for prolapse and haemorrhoids.

Legend for Table 6

Logistic regression models for positive subjective symptom relief and improved quality of life

CI, confidence interval; OR, odds ratio; ODS, obstructed defecation syndrome; ERP, external rectal prolapse; IRP, internal rectal prolapse.

Legend for Figure 1

Impact of operation on pelvic floor dysfunction

ODS: obstructive defecation syndrome; QoL: quality of life. VAS: visual analogue scale; severity of the symptoms were estimated by VAS from 0–100; Symptom-related discomfort was assessed from no discomfort to great discomfort; the impact of the operation and change in the symptoms was assessed from much worse to much better.

Table 1. Baseline Characteristics.

Age	64.0±16.3	Diagnosis	
Females	481 (94.7)	ERP	286 (56.3)
Body mass index	24.7±4.1	IRP with enterocele	146 (28.7)
ASA	76 (15.0)	IRP without enterocele	68 (13.4)
1	174 (34.3)	Rectocele	8 (1.6)
2	145 (28.5)	Preoperative imaging*	218 (42.9)
3	19 (3.7)	ERP	
4	185 (76.6)	No imaging	212(74.1)
Previous abdominal surgery	227 (44.7)	Defecography	43(15.0)
Previous hysterectomy	168 (33.0)	MRI Defecography	20(7.0)
Previous pelvic surgery	115 (22.6)	Transanal ultrasound	6(2.1)
Posterior colporraphy	14 (2.8)	IRP with enterocele	
Posterior vaginal mesh	11 (2.2)	Defecography	111(76)
STARR	3 (0.6)	MRI Defecography	35(24)
Anterior Delorme	24 (4.7)	IRP without enterocele	
Other	37 (7.2)	No imaging	1(1.5)
Previous prolapse surgery	19 (3.7)	Defecography	59(86.8)
Dorsal mesh rectopexy	3 (0.6)	MRI Defecography	7(10.3)
Sutured rectopexy	5 (1.0)	Transanal ultrasound	1(1.5)
Resection rectopexy	8 (1.6)	Recto/enterocele	
Ventral rectopexy		Defecography	8(100)
Indication	279 (54.9)		
Prolapse	181 (35.6)		
ODS	44 (8.7)		
Anal incontinence	1 (0.2)		
Bulge feeling	2 (0.4)		
Solitary rectal ulcer	1 (0.2)		
Pain			

*Primary imaging method used for diagnosis

Table 2.

Table 2. Operative Details

Technique	
Laparoscopic	455 (89.6)
Robotic	46 (9.1)
Open	7 (1.4)
Instrument	
Diathermy	286 (56.3)
Harmonic	158 (31.1)
Ligasure	58 (11.4)
Mesh used	
Polyesther	426 (83.9)
Polypropylene	52 (10.2)
Other	17 (3.3)
Caudal mesh fixation	
To rectum only	287 (56.5)
To levator muscles	124 (24.4)
Through perineum	86 (16.9)
To perineum, open method	4 (0.8)
Number of stitches to rectum	
≤5	49 (9.7)
6-9	199 (39.3)
≥10	62 (12.2)
Tissue glue in addition to sutures	17 (3.3)
Vaginal stitches used (females)	375 (73.8)
Suturing technique	
Intracorporeal	136 (26.8)
Extracorporeal	177 (34.8)
Combination procedure	18 (3.5)
Transvaginal tape (TVT)	2 (0.4)
Anterior vaginal mesh	7 (1.4)
Hernioplasty	2 (0.4)
Sphincteroplasty	2 (0.4)
Operating time	122 (37.1)
Operating theatre time	212 (50.0)

Table 3. Complications

Complication, total	58 (11.4)
Peroperative Complication	
Vascular complication	10 (2.0)
Vaginal perforation	10 (2.0)
Bowel perforation	3 (0.6)
Ureter lesion	1 (0.2)
Surgical complication	
Port site haematoma	2 (0.4)
Port site hernia	2 (0.4)
Small-bowel obstruction/Ileus	2 (0.4)
Bowel occlusion	2 (0.4)
Fever	2 (0.4)
Intra-abdominal infection	2 (0.4)
Mesh related complication	7 (1.4)
Erosion	5 (1.0)
Recto-vaginal fistula	2 (0.2)
Anismus	1 (0.2)
Chronic pelvic pain	1 (0.2)
Urinary incontinence	1 (0.2)
Retrograde ejaculation	1 (0.2)
Medical complication	
Pneumonia	2 (0.4)
Pulmonary embolism	1 (0.2)
Urinary tract infection	4 (0.8)
Urinary retention	2 (0.4)
Heart insufficience	1 (0.2)
Delirium	1 (0.2)
Surgery for complication	
Laparoscopic haematoma evacuation	1 (0.2)
Laparoscopy and lavation	1 (0.2)
Mesh removal (transabdominal)	4 (0.8)
Transvaginal mesh resection	4 (0.8)
Suturation of bowel perforation	1 (0.2)
Ureter stent placement	1 (0.2)

Table 4.

Table 4. Functional Outcome by Diagnosis

	Total		ERP		IRP with enterocele		IRP without enterocele		*p*-value
Wexner score for fecal incontinence[1]	5 (2-11)	n=323	5 (2-11)	n=145	4(2-11)	n=114	7(3-12)	n=57	0.31
Improvement, Mean (SD)	2.1 (6.8)	n=164	4.3 (5.9)	n=57	0.51(6.8)	n=69	1.3(7.2)	n=37	0.004
Wexner score >9[2,3]	111 (34.9)	n=318	54 (38.6)	n=140	34(29.8)	n=114	23(40.4)	n=57	0.26
Discomfort of incontinence symptoms (VAS)	12 (1- 60)	n=306	10 (1-66)	n=136	13(1-55)	n=108	16(3-58)	n=68	0.93
ODS score for obstructed defecation[1]	10 (4-17)	n=330	8 (3-15)	n=149	12(5-18)	n=117	11(7-18)	n=57	0.011
Improvement, Mean (SD)	3.5 (9.2)	n=50	1.7 (9.2)	n=14	4.2(8.7)	n=28	4.1(11.7)	n=8	0.70
ODS >20[2,4]	51 (15.5)	n= 323	16 (10.7)	n=149	24(20.5)	n=117	8(14)	n=57	0.08
Discomfort of obstructed defecation symptoms (VAS)	37 (11-80)	n=322	24 (5-76)	n=144	39(12-83)	n=114	47(29-80)	n=57	0.09
Postoperative defecatory symptom improvement (VAS)[1]	83 (61-96)	n=321	87(74-96)	n=142	75(47-93)	n=115	76(57-92)	n=57	<0.001
Patients experiencing symptom improvement (VAS 61-100mm)[2]	237 (76.0)	n=312	122 (85.9)	n=142	76(66.1)	n=115	39(68.4)	n=57	<0.001
Postoperative improvement in QoL (VAS)[1]	82 (59-94)	n=320	87(74-95)	n=141	87(74-95)	n=115	74(47-90)	n=57	<0.001
Patients experiencing improved QoL (VAS 61-100mm)[2]	232 (74.4)	n=312	120 (85.1)	n=141	75(65.2)	n=115	37(66.1)	n=56	<0.001

Table 5.

Table 5. Reoperations per Primary Diagnosis

Reoperation after surgery for	ERP n=286	IRP with enterocele n=146	IRP without enterocele N=68
Re-operation total	25 (8.7)	15 (10.3)	6 (8.8)
D'Hoore LVMR	10 (3.5)	8 (5.4)	2 (2.9)
STARR	2 (0.7)	1 (0.7)	0
Delorme	2 (0.7)	2 (1.4)	1 (1.5)
Other rectopexy	4 (1.4)	0	1 (1.5)
Sfincteroplasty	1 (0.3)	0	0
Altemeyer procedure	1 (0.3)	0	0
PPH	2 (0.7)	0	0
Other	3 (1.0)	1 (0.7)	0
Posterior colporraphy	0	3 (2.0)	2 (2.9)

Table 6. Logistic regression models for positive subjective symptom relief and improved quality of life

	Outcome			
	Symptom relief	*p*-value	Improved quality of life	*p*-value
Risk factor	OR (95% CI)		OR (95% CI)	
Medical conditions				
None	1.0			
1	1.30 (0.53 to 3.18)	0.57		
>1	0.35 (0.15 to 0.80)	0.013		
Diagnosis				
Prolapse	1.0		1.0	
IRP with enterocele	0.23 (0.11 to 0.48)	<0.001	0.33 (0.18 to 0.60)	<0.001
IRP without enterocele	0.30 (0.15 to 0.80)	0.018	0.34 (0.17 to 0.70)	0.003
Underlying diseases				
None	1.0			
1	1.22 (0.49 to 3.02)	0.67		
>1	0.37 (0.16 to 0.85)	0.019		
Indication				
Prolapse	1.0		1.0	
IRP with ODS symptoms	0.21 (0.10 to 0.44)	<0.001	0.31 (0.17 to 0.58)	<0.001
IRP witn incontinence symptoms	0.30 (0.08 to 1.19)	0.087	0.50 (0.20 to 1.27)	0.26
IRP with both ODS and incontinence symptoms	0.45 (0.12 to 1.65)	0.45	0.26 (0.12 to 0.57)	0.001

Figure 1.

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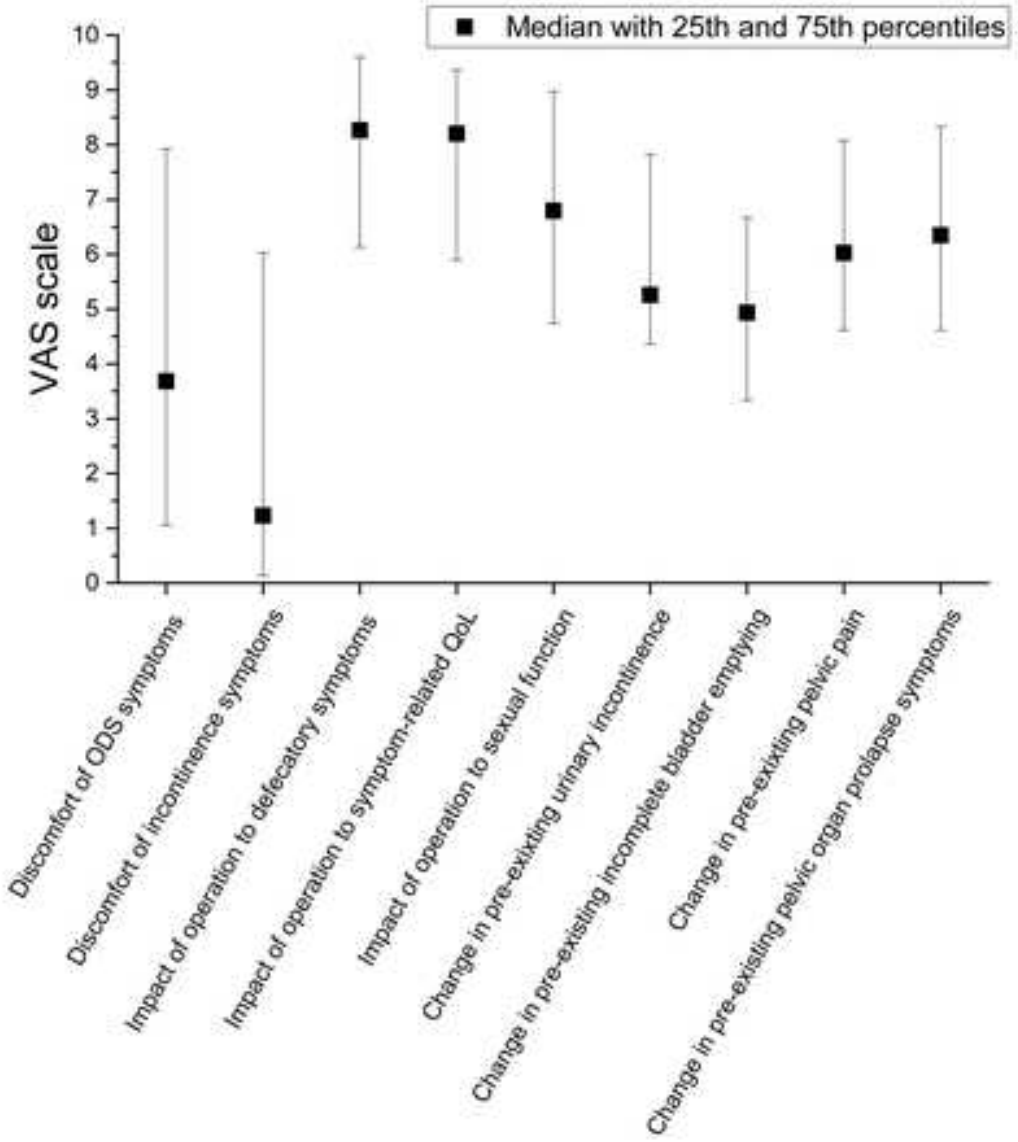

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