ORIGINAL CONTRIBUTION

Risk Factors for Recurrence After Laparoscopic Ventral Rectopexy

Cherylin W. P. Fu, M.B.B.S., M.Med., F.R.C.S.Ed.[1]
Andrew R. L. Stevenson, M.B.B.S., F.R.A.C.S.[2,3]

1 Department of Colorectal Surgery, Singapore General Hospital, Singapore
2 Department of Colorectal Surgery, Royal Brisbane and Women's Hospital, Brisbane, Queensland, Australia
3 Faculty of Medicine and Biomedical Sciences, University of Queensland, Brisbane, Queensland, Australia

BACKGROUND: Laparoscopic ventral rectopexy effectively treats posterior compartment prolapse. However, recurrence after laparoscopic ventral rectopexy is poorly understood.

OBJECTIVE: This study aimed to evaluate factors contributing to recurrence after laparoscopic ventral rectopexy.

DESIGN: A retrospective cohort analysis was performed of patients who underwent laparoscopic ventral rectopexy between June 2008 and June 2014. Patients presenting with full-thickness rectal prolapse were compared against the rest. Cox proportional hazards regression was used to determine predictors for recurrence. Operative findings of redo cases were evaluated.

SETTINGS: This study was conducted under the supervision of a single pelvic floor surgeon.

PATIENTS: A total of 231 patients with a median follow-up of 47 months were included.

MAIN OUTCOME MEASURES: Clinicopathological risk factors and technical failures contributing to recurrence were analyzed.

RESULTS: The overall recurrence rate was 11.7% (n = 27). Twenty-five recurrences occurred in patients with full-thickness rectal prolapse, of which 16 were full-thickness recurrences (14.2% (16/113)). Multivariate analyses showed predictors for recurrence to be prolonged pudendal nerve terminal motor latency (HR = 5.57 (95% CI, 1.13 – 27.42); $p = 0.04$) and the use of synthetic mesh as compared with biologic grafts (HR = 4.24 (95% CI, 1.27–14.20); $p = 0.02$). Age >70 years and poorer preoperative continence were also associated with recurrence on univariate analysis. Technical failures contributing to recurrence included mesh detachment from the sacral promontory and inadequate midrectal mesh fixation.

LIMITATIONS: Modifications to the operative technique were made throughout the study period. A postoperative defecating proctogram was not routinely performed.

CONCLUSIONS: Recurrence after laparoscopic ventral rectopexy is multifactorial, and risk factors are both clinical and technical. The use of biologic grafts was associated with lower recurrence as compared with synthetic mesh. Patients with full-thickness rectal prolapse who are elderly, have poorer baseline continence, and have prolonged pudendal nerve terminal motor latency are at increased risk of recurrence.

KEY WORDS: Biologic; Rectal prolapse; Recurrence; Technique; Ventral rectopexy.

Laparoscopic ventral rectopexy (LVR) is increasingly recognized as an effective surgical treatment for pelvic floor posterior compartment prolapse,[1–7] which ranges from external full-thickness rectal prolapse (FTRP) to internal rectal intussusception and rectocele. LVR has been shown to improve both fecal incontinence and obstructed defecation in these patients, with reported improvements in quality of life and incontinence, as well as constipation scores of 40% to 50%.[1–5]

Supplemental digital content is available for this article. Direct URL citations appear in the printed text, and links to the digital files are provided in the HTML and PDF versions of this article on the journal's Web site (www.dcrjournal.com).

Financial Disclosure: The authors received honorariums and support for proctorship from Cook Medical.

Presented at the 15th Asia Pacific Federation of Coloproctology Congress, Melbourne, Victoria, Australia, October 5 to 7, 2015.

Correspondence: Cherylin W. P. Fu, M.B.B.S., M.Med., F.R.C.S.Ed., Singapore General Hospital, Department of Colorectal Surgery, 20 College Rd, Academia, Singapore 169856. E-mail: cherylin.fu.w.p@singhealth.com.sg

Dis Colon Rectum 2017; 60: 178–186
DOI: 10.1097/DCR.0000000000000710

Recurrence rates of prolapse after LVR are generally low. A systematic review reported prolapse recurrence of 0% to 15%,[8] whereas a recent large series of 919 consecutive LVR patients reported their long-term recurrence rate of 8.2%.[9] However, many aspects regarding recurrence after LVR remain unclear: what causes recurrence after LVR? Are recurrences attributed to technical failures or patient factors? Also, a majority of the reported outcomes for LVR thus far have been for synthetic meshes only. Few reports have looked at the recurrence rates for LVR using biological grafts.[10–14] Given the concern for the safety of synthetic meshes and the increasing adoption of biologics for pelvic floor surgery, it is pertinent to know whether biologic grafts are just as effective as synthetic meshes for LVR.

This study aimed to address the above questions by evaluating the clinicopathological and surgical risk factors associated with recurrence of prolapse after LVR. We also critically evaluated the technical factors that could contribute to failure of the procedure and recurrence.

PATIENTS AND METHODS

Patient Selection

All of the consecutive patients who underwent LVR between June 2008 and June 2014 under the care of a single pelvic floor surgeon in 2 tertiary care institutions (Royal Brisbane and Women's Hospital and Holy Spirit Northside Private Hospital, Chermside, Queensland, Australia) were identified from a prospectively collected database using a predesigned template (Australian Colorectal Endosurgery version 1.04; Bento, Filemaker, Santa Clara, CA).

All of the patients were included in the study. Patients who had previous posterior pelvic floor prolapse surgery via either the perineal or abdominal approach were not excluded.

The presenting symptoms, preoperative Cleveland Clinic incontinence score (CCIS), and physical examination were recorded for each patient. Colonoscopy was performed to exclude intraluminal pathologies. All of the patients who did not have overt external rectal prolapse or mucosal prolapse on clinical examination were additionally evaluated with a defecating proctogram and/or examination under anesthesia with a circular anal dilator to document evidence of internal rectal intussusception and/or rectocele. Furthermore, all of the patients underwent preoperative anal manometry, pudendal nerve terminal motor latency (PNTML) testing, and endoanal ultrasound to evaluate sphincter integrity where possible.

Patient characteristics recorded include age, BMI, baseline CCIS, anorectal physiology results, and previous surgeries for pelvic floor prolapse. Surgical factors, such as type of mesh used, method of sacral fixation, operative time, and postoperative complications, were assessed.

Surgical Technique and Postoperative Management

All of the procedures were performed by or under the direct supervision of a single surgeon experienced in the LVR technique. The procedure was fully laparoscopic, and either a synthetic mesh or a biologic graft was used. Preoperatively, all of the patients received a phosphate enema, and a single dose of broad-spectrum intravenous antibiotic was administered at induction.

Technical details of the operation have been described previously.[15,16] Modifications to the technique evolved throughout the study period (Fig. 1). This included the shape of the graft (straight 3×17 cm changed to L-shaped), fixation of graft to the midrectum (initially not performed), and method of fixation of the graft to the sacral promontory (initially nonabsorbable tacks, then nonabsorbable sutures, and, more recently, absorbable sutures (PDS; Ethicon, Johnson & Johnson, Somerville, NJ)). The type of mesh used also changed during this period; in the initial period (2008–2010), synthetic meshes such as Prolene and Ultrapro (Ethicon, Johnson & Johnson) were used for LVRs in this study. However, since 2011, a majority of LVRs were performed using biologic grafts (Biodesign Surgisis, Cook Medical, Bloomington, IN) instead of synthetic meshes. A different type of biologic graft, Permacol (Tissue Science Laboratories Limited, Aldershot, United Kingdom), was used in only 1 case. The composition of the Biodesign Surgisis biologic graft also changed from 4-ply initially to vacuum-pressed 8-ply when this became available in Australia in 2010.

Postoperatively, the indwelling urinary catheter was removed at the end of surgery, full diet resumed at the earliest occasion, and the patient discharged either on the same or the next day. Patients were provided with simple oral analgesia, stool softeners, and strict instructions to avoid straining. Postoperative antibiotics were not routinely given.

The patients were followed up at regular intervals, with the first clinic visit scheduled at 6 weeks after surgery. If the patient was well and reported a satisfactory outcome, she was seen subsequently at 6 months and yearly thereafter. At each follow-up, the postoperative CCIS was recorded, and a physical examination with a proctoscope or a circular anal dilator was performed. *Recurrence* was defined as anatomical recurrence of external FTRP, rectal mucosal prolapse, internal rectal prolapse or intussusception, rectocele, or solitary rectal ulcer syndrome (SRUS). Recurrent FTRP or rectal mucosal prolapse was diagnosed clinically. If these were not evident during physical examination and the patient reported persistent or recurrent symptoms, a defecating proctogram was performed to exclude recurrent internal rectal intussusception and/or rectocele.

Statistical Analysis

Data are presented as median values with interquartile ranges unless otherwise specified. Categorical data are

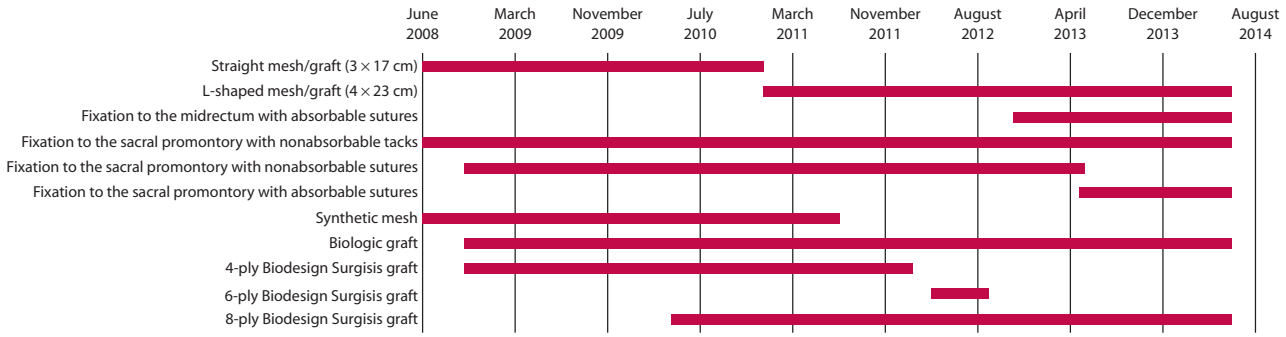


FIGURE 1. Gantt chart showing time line of modifications to laparoscopic ventral rectopexy (LVR) technique.

presented as percentages. Recurrence-free time was calculated as the time elapsed between the LVR operation and clinical or radiological confirmation of anatomical recurrence. Recurrence-free survival was estimated using the Kaplan–Meier method, and survival curves were compared using the log-rank test.

The primary outcome was to determine the clinicopathological and surgical risk factors for prolapse recurrence after LVR. Subgroup analysis of patients with FTRP was performed. Univariate and multivariate analyses using Cox proportional hazards regression modeling was performed to examine the association between predictor variables and the time to prolapse recurrence post-LVR. The strength of these associations was quantified using HRs with 95% CIs. The following variables were analyzed: age >70 years, previous posterior compartment repair via an abdominal approach, preoperative CCIS, preoperative resting and squeeze anal pressures on manometry, prolonged PNTML, the use of synthetic mesh as compared with a biologic graft, the use of an absorbable material for sacral fixation, and the addition of colposuspension during LVR. A p value of ≤0.05 was considered to be statistically significant. Statistical analysis was performed using the SPSS statistical software program (version 21.0 for Windows, IBM Corp, Armonk, NY).

The secondary outcome was to determine the technical factors that could contribute to recurrence after LVR. This was performed by critically evaluating the operative findings from the cases of redo-LVR that were performed throughout the study period.

RESULTS

Between June 2008 and June 2014, a total of 231 LVRs were performed, with a median follow-up time of 47 months (interquartile range, 29–63 months). Follow-up data regarding recurrence were complete for all of the patients at the time of data analysis. No deaths had occurred during the follow-up period. Table 1 summarizes the patient demographics and preoperative characteristics.

A total of 113 LVRs (48.9%) were performed for FTRP, 111 (48.1%) for rectocele or internal prolapse, and 7 (3.0%) for SRUS. The most common presenting symptom was that of fecal incontinence (55.4% (n = 128)), followed by obstructed defecation (34.2% (n = 79)). Other indications included pelvic pain or discomfort (9.1% (n = 21)), bleeding per rectum (0.9% (n = 2)), and the feeling of a lump at the anus (0.4% (n = 1)).

Patients who had FTRP were significantly older than those with rectocele, internal prolapse, or SRUS, with 41.6% of FTRP patients being over the age of 70 years, as compared with 23.7% in those without FTRP ($p = 0.005$). Patients with FTRP also had significantly lower BMI (24.0 vs 25.7; $p = 0.02$), were more likely to have sphincter defects (55.7% vs 28.2%; $p = 0.01$), and were more likely to have had undergone previous posterior pelvic floor repair via an abdominal approach (10.6% vs 2.5%; $p = 0.02$).

Clinical Outcomes

The operative procedures and patient outcomes are summarized in Table 2. The overall surgical complication rate was 5.2% (n = 12), with 4 patients requiring return to the operating room; 2 underwent laparoscopic washout for pelvic abscess or intra-abdominal hemorrhage, 1 underwent laparoscopic adhesiolysis for small-bowel obstruction because of a loop of small bowel stuck on the end of a V-Loc suture, and 1 patient underwent laparoscopic ventral hernia mesh repair. There were no complications directly related to synthetic or biologic mesh or mortalities in this study group.

The majority of patients reported satisfactory outcomes, with 63.9% reporting complete resolution of their primary symptom. Median CCIS improved from 14 preoperatively to 5 postoperatively 6 months after LVR ($p < 0.0001$). This improvement remained sustained even after 3 years (Table 2).

The overall cumulative incidence of anatomical recurrence after LVR was 11.7% (n = 27). Twenty five of 27 recurrences occurred in patients who presented initially with FTRP, with a recurrence rate of 22.1% (25/113) in this subgroup (Table 2). Using Kaplan–Meier survival analysis, the overall 5-year recurrence-free survival in the

TABLE 1. Patient demographics and preoperative characteristics

Variable	Overall (N = 231)	Full-thickness prolapse (N = 113)	Rectocele, internal intussusception, or SRUS (N = 118)	p
Women, n (%)	231 (100)	113 (100)	118 (100)	1.00
Age at time of surgery, median (interquartile range), y	63.5 (51.4–72.5)	65.3 (55.5–77.9)	58.7 (49.6–69.1)	0.002[a]
Age >70 y, n (%)	75 (32.5)	47 (41.6)	28 (23.7)	0.005[a]
Age ≤70 y, n (%)	156 (67.5)	66 (58.4)	90 (76.3)	
BMI, median (interquartile range)	25.0 (22.0–28.2)	24.0 (21.1 –27.7)	25.7 (23.5–28.4)	0.02[a]
ASA, n (%)[b]				
1	43 (19.7)	20 (18.5)	23 (20.9)	0.10
2	119 (54.6)	53 (49.1)	66 (60.0)	
3	54 (24.8)	33 (30.6)	21 (19.1)	
4	2 (0.9)	2 (1.9)	0	
Previous posterior compartment repair, n (%)	39 (16.9)	19 (16.8)	20 (16.9)	1.00
Previous abdominal approach, n (%)[c]	15 (6.5)	12 (10.6)	3 (2.5)	0.02[a]
Previous perineal approach only, n (%)[d]	24 (10.4)	7 (6.2)	17 (14.4)	0.05[a]
Preoperative CCIS, median (interquartile range)	14.0 (10.0–16.0)	14.0 (10.0–16.3)	13.0 (11.0–16.0)	0.47
Preoperative anal manometry, median (interquartile range), mm Hg[e]				
Resting pressure	29.0 (15.0–45.0)	20.0 (13.0–30.0)	35.0 (25.0–52.8)	<0.0001[a]
Squeeze pressure	55.0 (36.0–80.0)	44.0 (28.0–62.0)	70.0 (50.0–87.3)	<0.0001[a]
PNTML, n (%)[f]				
Normal	76 (47.8)	33 (44.0)	43 (51.2)	0.43
Unilateral abnormal	44 (27.7)	19 (25.3)	25 (29.8)	
Bilateral abnormal	39 (24.5)	23 (30.7)	16 (19.0)	
Sphincter defect on endoanal ultrasound, n (%)[g]				
None	59 (54.1)	31 (44.3)	28 (71.8)	0.01[a]
Internal sphincter defect only	2 (1.8)	2 (2.9)	0	
External sphincter defect only	44 (40.4)	34 (48.6)	10 (25.6)	
Both internal and external sphincter defect	3 (2.8)	2 (2.9)	1 (2.6)	
Previous sphincter repair	1 (0.9)	1 (1.4)	0	

SRUS = solitary rectal ulcer syndrome; CCIS = Cleveland Clinic incontinence score; PNTML = pudendal nerve terminal motor latency.
[a]*p* value is ≤0.05.
[b]ASA status was not available in 13 patients.
[c]Data include resection rectopexy, ventral rectopexy, or other unspecified transabdominal prolapse repair surgery.
[d]Data include Delorme procedure or sutured transanal mucosectomy and plication.
[e]Manometry was not performed in 68 patients.
[f]PNTML was not performed in 72 patients.
[g]Endoanal ultrasound was not performed in 122 patients.

FTRP group was 73.4%. (Fig. 2). The largest number of recurrences occurred within the first 12 months from surgery, with an actuarial recurrence rate of 15.9% (n = 18), 19.5% (n = 22), 21.2% (n = 24), and 21.2% (n = 24) at 12, 24, 36, and 48 months.

Sixteen patients in the FTRP group (14.2% (16/113)) recurred as FTRP, 8 patients (7.1% (8/113)) recurred as mucosal prolapse only, and 1 patient (0.9% (1/113)) recurred as an internal intussusception. One patient with a rectocele and internal rectal prolapse recurred as an internal intussusception, whereas the remaining recurrence was in a patient with SRUS that had healed post-LVR but developed recurrent mucosal prolapse.

A majority of the 27 patients who had prolapse recurrence after LVR went on to additional surgical procedures to treat their residual symptoms, most commonly being redo LVR (n = 13) and sutured transanal mucosectomy and plication (n = 9). Other procedures are described in Table 3. Other than recurrence, there were no significant differences in the other operative procedures and surgical outcomes between patients with FTRP and those with rectocele, internal prolapse, or SRUS (Table 2).

Clinicopathological and Surgical Risk Factors for Recurrence After LVR

Because a majority of the recurrences (n = 25/27) after LVR occurred in patients with FTRP rather than those with rectocele, internal prolapse, or SRUS, this group of patients was analyzed separately for other risk factors associated with recurrence. On univariate analysis,

TABLE 2. Operative procedures and outcomes

Variable	Overall (N = 231)	Full-thickness prolapse (N = 113)	Rectocele, internal intussusception, or SRUS (N = 118)	p
Type of mesh, n (%)				
Synthetic	32 (13.9)	20 (17.7)	12 (10.2)	0.13
Biologic	199 (86.1)	93 (82.3)	106 (89.8)	
4-ply biodesign	59 (25.2)	21 (18.6)	38 (32.2)	
6-ply biodesign	3 (1.3)	1 (0.9)	2 (1.7)	
8-ply biodesign	136 (58.9)	70 (61.9)	66 (55.9)	
Permacol	1 (0.4)	1 (0.9)	0	
Sacral fixation method, n (%)				
Absorbable sutures	41 (17.7)	20 (17.7)	21 (17.8)	1.00
Nonabsorbable sutures or tacks	190 (82.3)	93 (82.3)	97 (82.2)	
Colposuspension	130 (56.3)	61 (54.0)	69 (58.5)	0.51
Operative time, median (interquartile range), min	90.0 (75.0–110.0)	85.0 (75.0–110.0)	90.0 (75.0–115.0)	0.23
Length of stay, median (interquartile range), d	1.0 (0–1.0)	1.0 (1.0–1.0)	1.0 (0–1.0)	0.13
Total complications, n (%)	19 (8.2)	7 (6.2)	12 (10.2)	0.34
Surgical complications, n (%)	11 (4.8)	3 (2.7)	8 (6.8)	
Abdominal/pelvic collection, n	2		2	
Intra-abdominal hemorrhage, n	1		1	
Rectovaginal seroma/hematoma, n	1		1	
Lumbar discitis, n	1		1	
Small-bowel obstruction, n	1	1		
Vaginal discharge, n	1	1		
Wound hernia, n	3	1	2	
Wound infection, n	1		1	
Medical complications, n (%)	7 (3.0)	4 (3.5)	3 (2.5)	
Cardiac arrhythmia, n	1	1		
Hypotension, n	1		1	
Nausea, n	1		1	
Pulmonary atelectasis, n	1	1		
Urinary retention, n	3	2	1	
Satisfactory outcome, n (%)[a]				
No	0	0	0	
Partly	90 (40.5)	44 (40.7)	46 (40.4)	1.00
Completely	132 (59.5)	64 (59.3)	68 (59.6)	
Primary symptoms improved, n (%)[b]				
No	3 (1.4)	0	3 (2.6)	0.23
Partly	76 (34.7)	38 (36.5)	38 (33.0)	
Completely	140 (63.9)	66 (63.5)	74 (64.3)	
Postoperative CCIS, median (interquartile range)				
6 wk	6.0 (4.0–10.0)	6.0 (4.0–10.0)	5.0 (3.0–9.0)	0.44
6 mo	5.0 (3.0–9.0)	6.0 (3.0–9.0)	5.0 (2.0–8.8)	0.58
1 y	5.0 (3.0–8.0)	5.0 (3.0–8.0)	4.5 (2.3–8.5)	0.46
2 y	4.5 (3.0–8.0)	5.0 (3.3–8.0)	3.0 (2.0–7.3)	0.07
3 y	5.0 (3.0–8.8)	5.0 (4.0–8.5)	3.0 (2.0–3.0)	0.72
Postoperative anal manometry, median (interquartile range), mm Hg[c]				
Resting pressure	26.0 (17.5–43.3)	20.0 (14.0–25.0)	30.0 (20.5–44.5)	0.15
Squeeze pressure	47.0 (29.3–74.3)	36.0 (28.0–67.5)	47.0 (31.0–82.0)	0.61
Recurrence, n (%)				
Yes	27 (11.7)	25 (22.1)	2 (1.7)	<0.0001[d]
No	204 (88.3)	88 (77.9)	116 (98.3)	

SRUS = solitary rectal ulcer syndrome; CCIS = Cleveland Clinic incontinence score.
[a]Data were not available for 9 patients.
[b]Data were not available for 12 patients.
[c]Postoperative anal manometry was performed in 14 patients only.
[d]*P* value is ≤0.05.

significant predictors for recurrence included age >70 years, worse preoperative CCIS, prolonged PNTML, and the use of synthetic mesh as compared with that of biologic graft (Table 4). However, on multivariate analysis, only prolonged PNTML and the use of synthetic mesh were found to be independent variables associated with

a significantly increased risk of recurrence after LVR (Table 4). Patients who had either unilateral or bilateral prolonged PNTML were 5.6 times more likely to develop recurrence than those who had normal PNTML bilaterally. The use of synthetic mesh for LVR was 4.2 times more likely to result in recurrence as compared with biologic grafts. In patients who had synthetic mesh used, the recurrence rate was 45.0% (9/20) after a median follow-up time of 69.0 months (interquartile range, 62.3–74.0 months), whereas that for patients with biologic grafts was 17.2% (16/93) after a median follow-up time of 37 months (interquartile range, 26.5–52.0 months).

The Kaplan–Meier curves comparing patients who experienced FTRP with normal versus prolonged PNTML and the use of biologic graft versus synthetic mesh are shown in Figures 3 and 4. At 5 years post-LVR, the recurrence-free survival was 92.1% for those with normal PNTML vs 51.5% for patients with prolonged PNTML ($p = 0.004$) and 66.8% for patients who had biologic graft vs 55.0% for those who had synthetic mesh ($p = 0.02$).

Technical Failures of LVR

We evaluated the operative findings of the 13 patients for whom we performed redo LVR for recurrent prolapse. The most common findings during laparoscopy were that either the mesh/graft used in the previous LVR had come off its sacral attachment or the mesh/graft that was previously placed was not adequately attached or adhered to the midrectal body, causing recurrent prolapse of the midrectum and internal intussusception.

We also noted in some patients that, although the previous mesh or graft was correctly positioned on the right anterolateral aspect of the rectum, the left mid-to-low rectum remained unsupported and appeared to prolapse downward, reforming a large left cul-du-sac or Pouch of Douglas. This could explain the recurrence of a low rectal prolapse, although it is asymmetric. One reason may be that the mesh used in the initial LVR may have been too narrow distally, with inadequate support of the lateral surfaces of the rectum (see Video, Supplemental Digital Content 1, http://links.lww.com/DCR/A268).

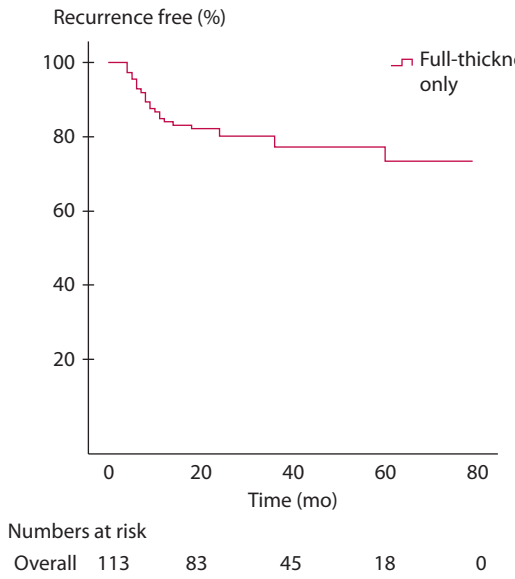


FIGURE 2. Kaplan–Meier analysis of recurrence-free survival after laparoscopic ventral rectopexy (LVR) for patients who presented with full-thickness rectal prolapse.

TABLE 3. Additional procedures performed after recurrence post-LVR

Additional procedures performed for persistent or recurrent symptoms	*No. of patients (N = 26)*
Redo LVR	13
Sutured transanal mucosectomy and plication	9
Sacral nerve modulation	5
Ligation of hemorrhoids	3
Stoma	3
Prosthetic sphincter augmentation	1

LVR = laparoscopic ventral rectopexy.

Both synthetic meshes and biologic grafts from the previous LVR could be identified during repeat laparoscopy. In patients who had a biologic graft used for the initial LVR, the original graft could be clearly visualized as firm, remodeled tissue on the right anterolateral surface of the rectum, with rectal suspension maintained, even up to 4 years after the initial LVR (Fig. 5).

DISCUSSION

LVR is currently adopted by many pelvic floor surgeons as the procedure of choice for the treatment of internal and external rectal prolapse, as well as symptomatic rectocele.[1–7] Although success rates are generally high, little is understood about recurrence after LVR and its causes.

The recurrence rate after LVR in our study seems to be relatively higher than what has been reported previously,[8,9] with almost all of the recurrences occurring in patients presenting with FTRP as compared with those with internal intussusception, rectocele, or SRUS. A number of factors may account for this. First, we have taken a more liberal definition of recurrence to include not just FTRP but also recurrence in terms of other forms of posterior compartment prolapse, for example, mucosal prolapse, internal intussusception, and rectocele. Many of the other studies reporting recurrence after LVR for FTRP take into account only recurrent FTRP.[8] When considering only FTRP recurrence, the recurrence rate of 14.2% in our study is comparable with that of other published data (0%–15%).[8] When compared with other methods of abdominal rectopexy as reported in the Prospective Study of Pravastatin in the Elderly at Risk (PROSPER) trial, the FTRP recurrence rate after LVR in our study (14.2%) was lower than that of suture rectopexy (26%) but comparable with that of

TABLE 4. Cox proportional hazards regression of risk factors for recurrence after LVR in patients with full-thickness rectal prolapse

	Univariate		*Multivariate*	
Risk factors	*HR (95% CI)*	*p*	*HR (95% CI)*	*p*
Age >70 y	2.22 (1.00–4.95)	0.05[a]	3.68 (0.96–14.17)	0.06
Previous abdominal approach posterior compartment repair	1.53 (0.52–4.47)	0.44	3.96 (0.56–28.08)	0.17
Preoperative CCIS	1.18 (1.03–1.34)	0.02[a]	1.02 (0.85–1.22)	0.86
Preoperative manometry (resting)	0.99 (0.96–1.02)	0.43	0.98 (0.92–1.04)	0.56
Preoperative manometry (squeeze)	0.98 (0.96–1.01)	0.17	1.00 (0.97–1.03)	0.96
Abnormal PNTML (unilateral or bilateral)	6.69 (1.52– 29.52)	0.01[a]	5.57 (1.13–27.42)	0.04[a]
Synthetic mesh (vs biologic graft)	2.71 (1.18–6.22)	0.02[a]	4.24 (1.27–14.20)	0.02[a]
Absorbable material for sacral fixation	1.15 (0.39–3.42)	0.80	2.59 (0.46–14.57)	0.28
Colposuspension	2.50 (0.99–6.31)	0.052	3.36 (0.69–16.43)	0.14

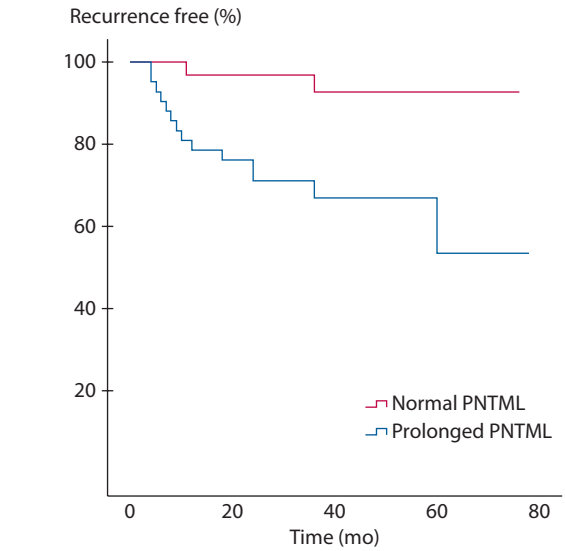
LVR = laparoscopic ventral rectopexy; CCIS = Cleveland Clinic incontinence score; PNTML = pudendal nerve terminal motor latency.
[a]*P* value is ≤0.05.

resection rectopexy (13%).[17] However, the sample size of the PROSPER trial was considerably smaller than the number of patients evaluated in our study. Second, 8 (29.6%) of the 27 patients who experienced recurrence had previously undergone prolapse repair operations, including perineal procedures or abdominal rectopexy. Considering that these patients had failed previous surgeries may suggest that they have more severe prolapse and chronic pelvic floor laxity contributing to a higher risk of recurrence. Lastly, the longer median follow-up time in this study of ≈4 years, as compared with other studies reporting LVR outcomes,[8] could result in a higher recurrence rate over time.

From our study, we have identified both clinical and technical factors that can contribute to prolapse recurrence after LVR. Among patients with FTRP, elderly patients (age >70 years) with higher preoperative CCISs and prolonged PNTML tended to be at even higher risk of recurrence. This is likely to be a reflection of an inherently weaker pelvic floor and poorer anal sphincter function in such patients, rendering repair of the prolapse futile. Indeed, there were 5 patients in our study who developed multiple recurrences within 1 to 2 years despite various abdominal and perineal prolapse repair operations, including resection rectopexy and LVR. It is possible that elderly patients with FTRP, poor pelvic floor function, and prolonged PNTML could be considered for alternative operations, such as resection rectopexy or modified LVR techniques. However, the efficacy of these alternatives has not been directly compared with LVR.

Our study showed that the use of synthetic mesh for LVR was independently associated with a higher recurrence rate as compared with biologic grafts. This is an interesting finding, because many would assume that using biologic grafts would result in more recurrences given their absorbable nature. Other studies comparing the use of biologic versus synthetic meshes for LVR have demonstrated that biologics are equally as effective as synthetic meshes in the short term with no difference in recurrence rates.[14,18] We postulate that the result of our study could be contributed by 2 factors, modifications in our LVR technique across the study period that had improved the technical results of LVR over time, which may have coincided with the switch from using synthetic meshes to using biologic grafts rather than because of the type of mesh per se, and patients who had a synthetic mesh had longer median follow-up compared with those with a biologic graft, hence contributing to a higher recurrence rate over time.

There has been growing concern over the safety of synthetic meshes in pelvic floor surgery, with a significant number of lawsuits against pelvic and vaginal mesh products, particularly in the United States. Given that current



Numbers at risk					
Normal PNTML	33	29	21	6	0
Prolonged PNTML	42	30	13	4	0

FIGURE 3. Kaplan–Meier analysis of recurrence-free survival after laparoscopic ventral rectopexy (LVR) for patients with full-thickness rectal prolapse who had normal pudendal nerve terminal motor latency (PNTML) bilaterally vs those with prolonged PNTML (either unilateral or bilateral).

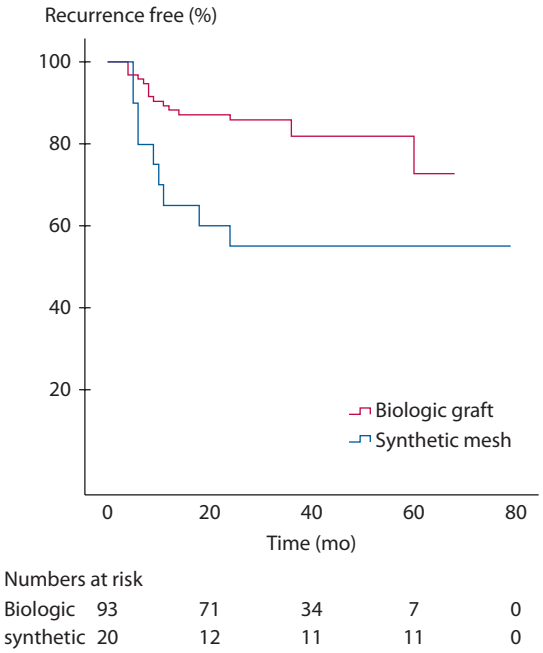


FIGURE 4. Kaplan–Meier analysis of recurrence-free survival after laparoscopic ventral rectopexy (LVR) for patients with full-thickness rectal prolapse who had biologic graft vs synthetic mesh.

evidence shows that biologic grafts are at least as effective as synthetic meshes in terms of recurrence,[14,18] with possibly a better safety profile,[19] biologics may increasingly be the material of choice for LVR.

Since the initial description of the LVR technique by D'Hoore and Penninckx in 2006,[20] various authors have described their version of the LVR technique,[7,21,22] with numerous differences arising in the type of mesh used, shape and size of mesh, placement of sutures on the rectum or pelvic floor, type of sutures used, and method of sacral fixation. However, these differences in techniques of LVR are not well discussed in current literature and are difficult to compare because of the heterogeneity of patient characteristics and operative methods.

In our study, we have identified certain technical aspects of LVR that can contribute to failure and prolapse recurrence. These include the following: 1) inadequate apposition of the mesh/graft to the lateral and anterior surfaces of the rectum, especially at the midrectum, resulting in inadequate rectal suspension and recurrent internal prolapse or rectoanal intussusception; 2) slippage of mesh attachment from the sacral promontory, which may be attributed to excessive tension on the mesh or poor anchoring technique to the sacral promontory; and 3) the distal part of the mesh/graft being too narrow, resulting in inadequate support of the lateral aspects of the rectum and pelvic floor. In some patients, LVR may not adequately reduce the excess mucosa despite restoring the anatomy of the posterior compartment, in which case additional procedures, such as sutured transanal mucosectomy and plication, may be useful and necessary adjuncts.

Hence, to ensure the best results for LVR and to minimize recurrence, it is important to ensure that a wide enough mesh/graft is attached to the anterior and lateral aspects of the rectum, with adequate placement of sutures in the midrectum (**see Video, Supplemental Digital Content 2**, http://links.lww.com/DCR/A269). The best method of attachment to the sacral promontory is still debatable; our current preference is to secure the graft to the sacral promontory with sutures rather than tacks.

Most of the procedures in this study done were by a single surgeon adept at performing LVR; because LVR techniques vary widely among surgeons, the results from this study may differ from those of other series. A postoperative defecating proctogram was not routinely performed; hence, occult recurrences could have been missed in patients who did not report persistent or recurrent symptoms after surgery. Patients who had synthetic mesh used had longer median follow-up compared with those with biologic graft, hence they were potentially at risk of a higher recurrence rate over time. Lastly, modifications to the LVR technique and materials used throughout the study period make it more difficult to interpret the results of this study.

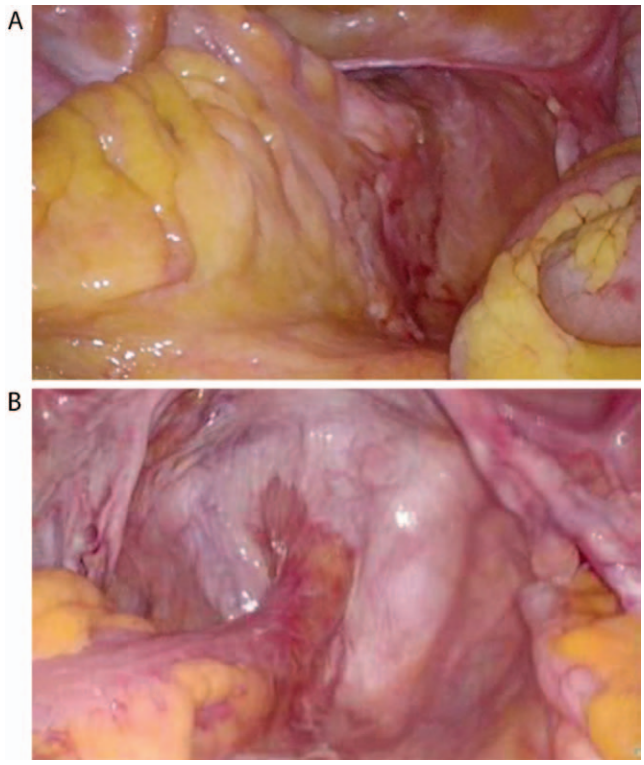


FIGURE 5. A, Biologic graft from previous laparoscopic ventral rectopexy (LVR) still visible on laparoscopy 4 years after initial surgery. B, Rectal suspension remains adequate after previous LVR with biologic graft >3 years ago.

CONCLUSION

LVR is an effective operation for posterior compartment prolapse, especially for patients with internal intussusception and rectocele. Recurrence may be related to both clinical and technical factors, and it is necessary to define key technical steps to ensure the long-term success of LVR. In this series, the use of biologic grafts for LVR was associated with lower recurrence as compared with that of synthetic mesh. Patients with full-thickness external rectal prolapse who are elderly, have poorer baseline continence, and have prolonged PNTML are also at increased risk of recurrence despite LVR. Whether such patients may be better suited to alternative operations or operative techniques should be explored in future studies.

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