Laparoscopic Pelvic Floor Repair Using Polypropylene Mesh

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SUMMARY

Objective: The purpose of this report is to present our experience in laparoscopic pelvic floor repair using polypropylene mesh for the treatment of advanced vaginal vault prolapse and enterocele.

Materials and Methods: A total of 40 patients with Baden-Walker System grade 3 or 4 vaginal vault prolapse and concurrent enterocele were recruited. Twenty patients had undergone at least one previous pelvic floor reconstructive procedure and were categorized as the recurrent prolapse group. The other 20 patients were categorized as the nonrecurrent group. All patients underwent a laparoscopic pelvic floor repair using a single piece of polypropylene mesh combined with uterosacral ligament suspension.

Results: The mean age of the study group was 60.7 years. The mean follow-up period was 26.6 months. The intraoperative major complication rate was 5% (two bladder perforations). No recurrent apical prolapse, anterior vaginal wall or posterior vaginal wall prolapse was observed at postoperative follow-up. The overall mesh erosion rate was 12.5% (5 of 40 patients), with four erosions (20%) in the recurrent prolapse group and one erosion (5%) in the nonrecurrent group. Mesh-related pain syndromes and dyspareunia was reported in 21.4% of patients in the recurrent prolapse group and 6.3% of patients in the nonrecurrent group.

Conclusion: Laparoscopic pelvic floor repair using a single piece of polypropylene mesh combined with uterosacral ligament suspension appears to be a feasible procedure for the treatment of advanced vaginal vault prolapse and enterocele. Fewer mesh erosions and postoperative pain syndromes were seen in patients who had no previous pelvic floor reconstructive surgery. [*Taiwan J Obstet Gynecol* 2008;47(3):312–317]

Key Words: laparoscopy, pelvic floor, polypropylene, surgical mesh, vaginal prolapse

Introduction

Pelvic organ prolapse is caused by a defect in pelvic floor support including the active support provided by the levator ani muscles and the passive support supplied by the endopelvic fascia. The goal of surgery for prolapse is to reconstruct or restore the integrity of the endopelvic fascia. Traditional prolapse repairs utilizing the patients' original supportive tissue are frequently associated with high anatomical recurrence rates [1]. These unsatisfying surgical outcomes of traditional prolapse repairs are a result of poor tissue integrity, defects of the endopelvic fascia or poor surgical techniques.

A variety of prosthetic materials have been developed for the provision of durable support to reduce recurrence rates in traditional surgery for pelvic organ prolapse [2]. Following the success of midurethral slings using synthetic mesh, the number of operations using similar mesh in pelvic floor reconstructive surgery has increased despite the lack of risk-benefit information [3]. Unlike midurethral slings used in anti-incontinence surgery, transvaginal mesh repairs of pelvic organ prolapse are associated with high erosion rates (up to 26%) and an increased incidence of mesh-related pain syndromes and dyspareunia [4]. Mesh-related complications are often caused by postoperative infections or extensive fibrosis around the mesh.

Pelvic floor reconstructive surgery that requires synthetic mesh can be approached by an abdominal,

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vaginal or laparoscopic route. Theoretically, a laparoscopic approach would minimize the possibility of mesh contamination/infection during the operation and induce less vaginal fibrosis postoperatively. Currently, the only laparoscopic procedure using synthetic mesh for the treatment of vaginal vault prolapse described in the literature is laparoscopic sacral colpopexy. The purpose of this study is to present our experience in laparoscopic pelvic floor repair using a single piece of polypropylene mesh for the treatment of advanced pelvic organ prolapse. Perioperative complications associated with this procedure are also discussed.

Materials and Methods

Patients

From December 2002 to November 2006, 40 consecutive patients with symptomatic uterine/vaginal vault prolapse and concurrent enterocele underwent a laparoscopic pelvic floor repair using a single piece of polypropylene mesh. Preoperative evaluation included a full medical history with emphasis on past pelvic floor reconstructive surgery. The physical examination utilized the Baden-Walker System for prolapse grading. All patients included in this study had grade 3 or 4 pelvic organ prolapse preoperatively. Voiding function was assessed by measuring both voided volume and residual volume. A cough stress test was also performed in all patients. Postoperative evaluation and surgical outcomes were determined by physical examination using the Baden-Walker System and by patient self-assessment questionnaire.

Statistical analysis was performed using the Student's *t* test and Fisher's exact test. A p value of less than 0.05 was considered statistically significant.

Surgical procedures

All laparoscopic pelvic floor repairs were performed by the senior author, Chung-Yuan Liu. After general anesthesia was administered, the patient was prepared and draped in the dorsal lithotomy position. Once pneumoperitoneum was achieved, we used five trocars to facilitate excellent pelvic exposure and easy laparoscopic suturing and knot tying. A 12-mm umbilical trocar was placed in the umbilicus. Two 5-mm reusable trocars were placed in the bilateral lower quadrants and two were placed lateral to the rectus muscles just inferior to the umbilicus. The patient was placed in a steep Trendelenburg position. Bilateral ureterolysis to the level of the uterosacral ligament was performed in all patients. Hysterectomy and/or salpingo-oophorectomy were performed as indicated before the pelvic floor repair.

Pelvic floor repair began with identification of the vaginal apex and the proximal uterosacral ligaments using a vaginal probe and a rectal probe. The enterocele sac could be clearly identified and the overlying peritoneum was opened. The peritoneum overlying the vaginal apex was retained to be used as a barrier between the vaginal epithelium and the synthetic mesh. Dissection using electrocautery was carried out anteriorly until the pubocervical fascia could be seen. Posteriorly, the rectovaginal space was dissected until the rectovaginal fascia was identified or down to the level of the medial fascia of the levator ani muscles bilaterally. A piece of soft polypropylene mesh, 10×15 cm, was cut to match the rectal curvature and to simulate the uterosacral ligament and passed into the abdomen through the umbilical port. 2-0 Prolene sutures were used to affix the mesh to the rectovaginal fascia and the medial fascia of the levator ani muscles bilaterally. Other 2-0 Prolene sutures were used to fix the mesh to the posterior vagina. The mesh was then folded over the vaginal apex. The anterior part of the mesh was sutured to the pubocervical fascia using 2-0 Prolene sutures. The previously cut tails of the mesh were sewn to the uterosacral ligaments at the level of the ischial spine bilaterally using 2-0 Prolene sutures. Additional 2-0 Prolene sutures were used to affix the mesh to the vaginal apex, ensuring that the retained peritoneum was between the mesh and the vagina. The mesh was placed in a very loose manner with no undue tension. Following mesh placement, the vaginal vault was suspended to the level of the ischial spine bilaterally using uterosacral ligament vaginal vault suspension previously described by Liu [5]. The anterior and posterior peritoneums were reapproximated with absorbable sutures in order to completely separate the polypropylene mesh from the intra-abdominal contents. Anti-incontinence procedures including laparoscopic Burch colposuspension, suburethral sling procedure using the fascia lata, or transobturator tension-free vaginal slings were performed as indicated.

After all laparoscopic procedures were accomplished, a cystoscopy was performed to visualize the trigone area and confirm the patency of the ureters. The rest of the bladder was also inspected to identify any evidence of suture involvement or cautery injury. Posterior colporrhaphy or perineorrhaphy was performed as indicated.

Results

The mean age of patients was 60.7 ± 6.7 years (range, 45–75 years). The mean follow-up period was 26.6 ± 15.8

months (range, 6–53 months). Twenty patients (50%) were categorized as the "recurrent prolapse" group, because they had undergone at least one previous pelvic floor reconstructive procedure. Previous procedures included colporrhaphy, cystocele and enterocele repair, vaginal vault suspension, and bladder neck suspension. The other 20 patients were categorized as the "nonrecurrent" group. Of the 40 patients in this study, 38 had a previous hysterectomy. Sixteen patients (40%) had urinary stress incontinence, and anti-incontinence procedures were performed in these patients. Laparoscopic paravaginal repair was performed in patients with paravaginal defects detected during laparoscopic Burch colposuspension or suburethral sling procedures. Concomitant surgical procedures are presented in Table 1.

Major complications were defined as bowel injury, bladder injury, ureteral injury, and blood loss greater than 500 mL. The intraoperative major complication rate was 5% (2 of 40 patients). There were two incidental bladder perforations, both of which occurred in the recurrent prolapse group. Prompt bladder repairs using absorbable sutures were carried out laparoscopically and no postoperative sequelae were noted. No bowel or ureteral injury was encountered. The estimated blood loss of most patients was less than 100 mL. The maximal blood loss was 250 mL in one patient. All patients were discharged in a stable condition within 1–2 days postoperatively. Two patients (5%) complained of persistent unilateral buttock pain which was felt to be due to sciatic nerve involvement. For relief of intractable buttock pain, both patients underwent laparoscopic release and replacement of the uterosacral ligament suspension sutures within 1 week.

A total of five patients experienced mesh erosion (12.5%). Four mesh erosions occurred in the recurrent prolapse group at intervals of 2, 3, 9 and 22 months postoperatively. In the nonrecurrent group, there was one mesh erosion which occurred 40 months after placement. Among these five patients, four received only local debridement and partial excision of the mesh transvaginally; the other patient underwent laparoscopic total removal of the mesh. However, the postoperative courses were all uneventful. The mesh erosion rate was 5% (1 of 20 patients) in the nonrecurrent group, while the rate of mesh erosion was 20% (4 of 20 patients) in the recurrent prolapse group.

The patient who underwent total removal of the mesh was excluded from postoperative outcome evaluation. Of the remaining 39 patients, no patient had an anatomical recurrence of apical prolapse, anterior vaginal wall or posterior vaginal wall prolapse at postoperative follow-up.

Postoperative mesh-related pain syndromes including bladder and vaginal pain, dyspareunia, and dyschezia were evaluated by patient self-assessment questionnaires. Of the 39 patients, 30 patients (76.9%) returned completed questionnaires (recurrent group, 14/19; nonrecurrent group, 16/20). The overall incidence of mesh-related pain syndromes was 13.3% (4 of 30 patients). In the recurrent prolapse group, 3 of 14 patients (21.4%) reported pain syndromes. None of these patients' recovery had been complicated by mesh erosion. One of 16 patients (6.3%) in the nonrecurrent group complained of severe dyspareunia and dyschezia related to mesh erosion. Although intraoperative major complications, mesh erosions and postoperative pain syndromes occurred more frequently in the recurrent prolapse group, no significant differences were identified between the two groups. The mean ages, follow-up periods, and complication rates are summarized in Table 2.

Table 1. Concomitant procedures

Procedures	*n* (%)
Laparoscopic hysterectomy	2 (5.0)
Laparoscopic salpingo-oophorectomy	17 (42.5)
Laparoscopic Burch colposuspension	9 (22.5)
Laparoscopic suburethral sling using fascia lata	5 (12.5)
Laparoscopic paravaginal repair	9 (22.5)
Midurethral sling (transobturator)	2 (5.0)
Posterior colporrhaphy/perineorrhaphy	20 (50)

Table 2. Ages, follow-up periods and complication rates*

	Total ($n=40$)	Recurrent group ($n=20$)	Nonrecurrent group ($n=20$)	*p*
Age (yr)	60.7 ± 6.7	60.4 ± 6.7	60.9 ± 7.1	0.82
Follow-up period (mo)	26.6 ± 15.8	25.4 ± 14.6	27.8 ± 17.3	0.83
Intraoperative major complication	2 (5)	2 (10)	0	0.48
Mesh erosion	5 (12.5)	4 (20)	1 (5)	0.34
Mesh-related pain syndromes	13.3%	21.4%	6.3%	0.31

**Data are presented as mean ± standard deviation or n (%).*

Discussion

Vaginal vault prolapse results from weakness or detachment of the superior suspension of the vagina to the cardinal–uterosacral ligament complex [6]. An enterocele is formed when the pelvic epithelium has direct contact with the vaginal epithelium without intervening endopelvic fascia [7]. The aims of pelvic floor reconstruction for the treatment of vaginal vault prolapse and enterocele repair are to restore the integrity of the endopelvic fascia and to resuspend the apex of the vaginal vault to the level of the ischial spine. Many vaginal, abdominal and laparoscopic techniques, including the use of a variety of biomaterial grafts, have been described to achieve these goals. However, the laparoscopic approach appears to be the least utilized, most likely because of the technical difficulty associated with laparoscopic suturing. Up to now, the only laparoscopic procedure using synthetic mesh to treat vaginal vault prolapse with concurrent enterocele described in the literature is laparoscopic sacral colpopexy.

Laparoscopic sacral colpopexy evolved from abdominal sacral colpopexy and was first introduced by Nezhat et al in 1994 [8]. This technique uses two pieces of polypropylene mesh sutured to the pubocervical fascia anteriorly and the rectovaginal fascia posteriorly. The free end of the Y-shaped mesh is then sutured to the presacral ligament of the sacral promontory. Wattiez et al described a modified laparoscopic sacral colpopexy which included the fixation of the mesh complex to the puborectal muscle and the uterosacral ligament [9]. High surgical efficacy of laparoscopic sacral colpopexy was reported. The rate of recurrent vaginal apical prolapse was only 4–7%. However, anterior and posterior vaginal wall prolapse recurred in up to 32% of patients [3]. Another laparoscopic procedure used to treat vaginal vault prolapse is uterosacral ligament suspension. In the largest case series to date, Lin et al reported on 133 patients who underwent laparoscopic vaginal vault suspension using uterosacral ligaments [10]. The success rate was 87.2% at follow-up from 2.0 to 7.3 years.

Our technique presented in this study differed from laparoscopic sacral colpopexy in two aspects. Firstly, we used a single piece of polypropylene mesh rather than two separate pieces. After the posterior part of the mesh was fixed to the rectovaginal fascia and the medial fascia of the levator ani muscles bilaterally, the mesh was folded over the vaginal apex to reach the pubocervical fascia anteriorly. By doing this, we recreated the integrity of the endopelvic fascia with the aid of polypropylene mesh. Secondly, we suspended the vaginal vault together with the mesh complex to the level of the ischial spine by performing laparoscopic uterosacral ligament suspension, sparing the highly vascularized presacral area. In our study, no apical prolapse recurred at a mean follow-up of 26.6 months. Furthermore, no recurrent anterior and posterior vaginal wall prolapse was observed at postoperative follow-up. By attaching the vaginal vault to the sacral promontory in laparoscopic sacral colpopexy, the vaginal axis is distorted posteriorly and this may predispose to future prolapse in anterior and posterior vaginal wall. Our technique suspends the vaginal vault to the uterosacral ligaments in a more natural position and, therefore, maintains a normal vaginal axis.

The overall intraoperative complication rate was 5% in our study. There were two bladder perforations which occurred during dissection of the pubocervical fascia. Both patients had undergone multiple pelvic floor surgeries previously and extensive fibrosis and adhesive disease was found in the surgical field. The estimated blood loss in our study was minimal in most patients. This may be partially due to the avoidance of entering the highly vascularized presacral area in our procedure. No ureteral injury or bowel injury was identified. When compared with transvaginal uterosacral ligament suspension in which a high ureteral injury rate of 11% has been reported [11], our technique appears safer. It is obvious that the laparoscopic approach offers more direct vision of the ureter than the transvaginal approach for uterosacral ligament suspension. In our opinion, routine bilateral ureterolysis and intraoperative cystoscopy also help to minimize the risk of urinary tract injury during laparoscopic uterosacral ligament suspension.

Mesh erosion remains a major concern in pelvic floor reconstructive surgery using permanent mesh grafts. An accurate erosion rate is difficult to determine, because mesh erosions can occur at variable time intervals after placement, ranging from weeks to years. In addition to the mesh characteristics, many factors may impact the incidence of mesh erosion, including operative techniques, surgical routes and concomitant procedures. Microorganism contamination during and after the operation also plays a significant role in determining the risk of postoperative infection and the rate of mesh erosion. In 2004, Nygaard et al conducted a comprehensive review on abdominal sacral colpopexy and reported an overall mesh erosion rate of 3.4% [12]. The reported rates of mesh erosion in laparoscopic sacral colpopexy were similar to those in the open procedure, ranging from 2% to 8% [9,13,14]. In our series, the overall mesh erosion rate was 12.5%. The mesh erosion rate in the nonrecurrent group was 5%, which was comparable to that of laparoscopic sacral colpopexy. However, the rate of mesh erosion was unacceptably high (20%) in the recurrent prolapse group. This rate was consistent with

the erosion rate of 12–24% with polypropylene mesh in transvaginal mesh repair described in a literature review by Baessler and Maher [4]. In general, most patients who have undergone multiple pelvic floor reconstructive surgeries have less healthy tissue and more fibrosis with subsequent poor blood perfusion. This condition may have contributed to the high erosion rate in the recurrent prolapse group. Because most mesh erosions occurred at the apical area, our technique used a piece of retained peritoneum over the vaginal apex as a barrier between the mesh and the vaginal epithelium. The efficacy of this technique to decrease apical mesh erosion needs further evaluation in the future. Among patients with mesh erosions in our study, most patients recovered quickly without any sequelae. Unfortunately, one patient continued to experience severe dyspareunia and dyschezia. Prompt and appropriate surgical intervention is absolutely crucial to the treatment of mesh erosion. In addition, continuous long-term follow-up is necessary after mesh placement, because mesh erosion may occur several years later.

Another frustrating complication associated with permanent mesh in pelvic floor repair is postoperative pain syndromes and dyspareunia, especially when the mesh is placed transvaginally. These symptoms may come from mesh erosion, mesh shrinkage, and extensive fibrosis caused by the mesh. Milani et al reported that dyspareunia increased by 20% in anterior and 63% in posterior vaginal prolapse repair with Prolene mesh [15]. In a comparative study using polypropylene mesh for transvaginal cystocele repair, Deffieux et al reported a 9% incidence of *de novo* dyspareunia in patients with and 11% in patients without mesh erosions [16]. Our study revealed a lower incidence (6.3%) of mesh-related pain syndromes in the nonrecurrent group. This seems to be feasible, because laparoscopic mesh placement may induce less vaginal fibrosis than transvaginal placement. However, a relatively high incidence (21.4%) of pain syndromes was noted in the recurrent prolapse group even though no mesh erosion occurred in these patients. In addition to the high mesh erosion rate, laparoscopic mesh placement in patients with previous pelvic floor reconstructive surgeries is also associated with a high incidence of mesh-related pain syndromes.

The use of prosthetic mesh in pelvic floor reconstructive surgery is still controversial. Recently, the American College of Obstetricians and Gynecologists recommended that transvaginal mesh placement for pelvic floor reconstruction should be considered experimental [3]. Although mesh placement in abdominal surgery has a lower complication rate than transvaginal placement, the risks and benefits of laparoscopic mesh placement remain unclear. To our knowledge, this study is the first preliminary report on the laparoscopic procedure using a single piece of polypropylene mesh for total pelvic floor repair. We think these findings on mesh-related morbidity are significant and important for the use of prosthetic mesh in laparoscopic pelvic floor reconstruction. However, there are some limitations in our report. First, our study is limited by its retrospective nature. Second, the patient's functional outcome from this technique was not addressed. Furthermore, the case number was small and the length of postoperative follow-up was short and variable in our study. Our practice is referral-based and many of our patients were from out-of-state. Usually, most of these patients return to their local healthcare providers postoperatively. Therefore, we do not have long-term outcomes on all patients. Finally, the evaluation of mesh-related pain syndromes was based on the analysis of a patient self-assessment questionnaire. Since the questionnaire reply rate was not as high as expected, the reported incidence of mesh-related pain syndromes may not have been identical to the real incidence of the study group.

Here, we present our experience in laparoscopic pelvic floor repair using a single piece of polypropylene mesh combined with uterosacral ligament suspension for the treatment of advanced vaginal vault prolapse and concurrent enterocele. This laparoscopic technique appears to be safe and effective for pelvic floor repair in selected patients who have not undergone previous pelvic floor reconstructive procedures. Due to the high incidence of mesh-related morbidity, the polypropylene mesh should be used conservatively in pelvic floor repair for recurrent prolapse patients. Surgeons should be aware of the potential risk and provide prompt and effective management for the complications associated with mesh placement.

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