Transvaginal Suture-Based Repair

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KEYWORDS
• Apical prolapse • Transvaginal repair • Native tissue repair • Posthysterectomy

KEY POINTS
• An estimated 300,000 women undergo pelvic organ prolapse (POP) surgery in the United States every year at a cost of more than 1 billion dollars per year.
• Apical support is required to achieve successful prolapse repair.
• Transvaginal native tissue repairs have the advantage of providing minimally invasive surgical repairs without the added risk of abdominal, laparoscopic, or robotic surgery while avoiding the risk of mesh augmentation.

INTRODUCTION
An estimated 300,000 women undergo pelvic organ prolapse (POP) surgery in the United States every year at an annual cost of more than 1 billion dollars. 1–3 The prevalence of POP is approximately 2.9% to 8% and increases with age. 4–6 POP is often associated with urinary, anorectal, and/or sexual dysfunction, all of which can negatively affect a woman’s quality of life. As the population ages and women live longer and more active lives, the search for safe, durable surgical repairs continues. The estimated lifetime risk of undergoing POP surgery is as high as 20% with reoperation rates up to 30%. 7–9

Risk factors for POP are well-defined, including advanced age, parity, obesity, and postmenopausal status. 7,10 POP occurs as a result of pelvic floor support defects. Defects in the level 1 support (uterosacral and cardinal ligament) can cause uterine prolapse or, in the posthysterectomy woman, descent of the vaginal cuff with herniation of the small or large bowel, also known as an enterocele.

Apical support is required to achieve successful prolapse repair. 11–13 Chen and colleagues, 12 confirmed the importance of good apical support for successful POP repair surgery in a study involving dynamic MRI. 15 The investigators radiographically demonstrated the significance of apical support disruption on the magnitude of anterior wall prolapse. 14

Surgical management options are divided into obliterative or restorative techniques. Obliterative repairs have high success rates; however, they are reserved for women who no longer wish to be sexually active. Restorative repairs aim to restore vaginal length, axis, and function. These repairs can be approached vaginally or abdominally, and performed with or without biological or synthetic mesh augmentation. The surgical approach should be individualized based on patient factors, including suitability for surgical approach, desire for future sexual function, and past surgical history. The goal is to relieve bothersome symptoms. Historically, success was defined based on anatomic outcomes. However, among the most important recent developments...
in POP outcomes research is the realization that patient-reported outcomes are perhaps more important than anatomic outcomes.\(^{15}\)

The open abdominal sacrocolpopexy is considered the gold standard approach for apical POP repair due to its superior anatomic outcomes, long-term durability, and lower rates of dyspareunia.\(^{16}\) However, the open approach has largely been replaced by minimally invasive techniques using laparoscopic and robotic techniques. Diwadkar and colleagues\(^{17}\) performed a systematic review and found that abdominal sacrocolpopexy and mesh-augmented repairs have superior outcomes. However, they also reported higher reoperation rates in mesh-augmented repairs than in native tissue transvaginal repairs. Transvaginal native tissue repairs have the advantage of providing minimally invasive surgical repairs without the added risk of abdominal, laparoscopic, or robotic surgery while avoiding the risk of mesh augmentation.\(^{2}\) This article reviews transvaginal native tissue repairs for posthysterectomy vault prolapse.

**TRANSVAGINAL NATIVE TISSUE TECHNIQUES**

Historically, native tissue transvaginal techniques have involved suspension of the vaginal cuff to the sacrotuberous, sacrospinous, or uterosacral ligaments. Currently, the most commonly performed transvaginal vaginal vault repairs are the sacrospinous ligament fixation (SSLF) and the uterosacral ligament suspension (ULS). The iliococcygeus suspension is a modification of the SSLF that was originally developed to address the high rates of postoperative cystocele repair.\(^{14}\) However, the procedure is typically performed bilaterally in the woman with a foreshortened vagina that fails to reach the sacrospinous ligament or with significant scarring that precludes safe exposure of the sacrospinous ligament.

**Sacrospinous Ligament Fixation**

The sacrospinous ligament extends from the ischial spine to the lateral sacrum, dividing the sciatic notch into the greater and lesser sciatic foramen. Numerous vessels and nerves lie posterior and lateral to the sacrospinous ligament, including the inferior gluteal vessels, the hypogastric venous plexus, the sciatic nerve, and the pudendal nerve and vessels. The sciatic nerve courses superior and lateral to sacrospinous ligament, whereas the pudendal nerve and vessels lie directly posterior to the ischial spine.

The SSLF procedure was first described in 1958 by Sederl.\(^{18}\) Indications include total procidentia, posthysterectomy vaginal vault prolapse,\(^{19}\) and hysteropexy. Traditionally, the SSLF is approached posteriorly. The extraperitoneal approach provides the added advantage of avoiding the peritoneal cavity, particularly in women with prior abdominal surgery and risk of pelvic adhesions. In the posthysterectomy setting, an enterocele sac is often encountered and should be dissected off the vaginal wall. The enterocele sac can be entered and the abdominal contents reduced. The peritoneum is then closed in a purse-string fashion, incorporating the uterosacral ligaments and the anterior or posterior peritoneum. When the sacrospinous ligament is identified, 2 narrow retractors (eg, Breisky-Navratil) can be placed to protect the rectum and expose the ligament. The surgical technique then involves fixation of the vaginal vault using a combination of 2 to 4 nonabsorbable or delayed absorbable sutures and a Miya hook, Deschamps ligature carrier, Capio automatic suture capturing device (Boston Scientific, Marlborough, MA, USA), or (alternatively) suture passage under direct visualization. The sutures are placed 2 cm medial to the ischial spine and 0.5 cm below the superior edge of the sacrospinous ligament. Avoidance of an intervening suture bridge is important to allow adequate fibrosis and scarring. Therefore, vaginal length and the position of the vaginal apex should be assessed before attempting this approach to ensure the vaginal cuff is able to make direct contact with the sacrospinous ligament. If indicated, anterior colporrhaphy is performed and the SSLF sutures are subsequently passed through the posterior surface of the vaginal apex. The procedure can be performed either unilaterally or bilaterally. Bilateral placement has been reported in patients with recurrent vault prolapse or desire to maintain symmetry and a wide vaginal vault.\(^{20}\) Jones and colleagues\(^{21}\) performed a retrospective review of 103 women undergoing SSLF. Sixty-two women (60%) underwent bilateral suspension, whereas the remaining 41 (40%) underwent unilateral suspension. Although the follow-up was short (mean 4.6–8.6 months), the investigators observed no difference in anatomic cure rates in the unilateral and bilateral groups (90.2% and 85.5%, respectively) and did not observe increased morbidity or anterior prolapse recurrence in the bilateral group.

Alternatively, the sacrospinous ligament can be approached anteriorly using a paravaginal dissection. The Michigan 4-wall technique describes an apical approach that differs from the original technique by attaching both the anterior and posterior walls to the sacrospinous ligament. The investigators report that this allows proper selection of suspension points and reduces the risk of anterior vaginal wall recurrence.\(^{22}\)
When the vaginal cuff does not reach the sacrospinous ligament, an iliococcygeus suspension can be performed. The dissection is performed in a similar fashion to the SSLF, with the dissection extending toward the ischial spine. Rather than exposing the SSLF, the tissue overlaying the iliococcygeus muscle and fascia are mobilized bilaterally and a delayed absorbable suture is placed in the muscle and fascia.

Several retrospective cohort studies examine and report single-center SSLF safety and outcomes. Overall, success rates are high, except for an outlier that reports 8% success rate. Sze and Karram published a review in which surgical success varied widely depending on the definition used. They found success rates up to 94% (mean 75%) in more than 1000 subjects. Paraiso and colleagues followed 243 women for a mean time of 73 months and observed apical recurrences in 8.2% of women and prolapse-free survival rates of 88.3%, 79.7%, and 51.9% at 1, 5, and 10 years, respectively. Maher and colleagues compared the outcomes of SSLF and iliococcygeus suspension in a matched case controlled study and found no difference in recurrence or complication rates. For the SSLF group, the investigators reported a 94% success rate at a mean follow-up time of 19 months, with recurrence rates of 3%, 25%, and 6% for the apical, anterior, and posterior compartments, respectively. They observed similar rates of buttock pain, intraoperative hemorrhage, and subsequent cystocele in both groups.

Randomized controlled trials comparing SSLF to mesh techniques are lacking. Maher and colleagues randomized 95 women to SSLF or abdominal sacral colpopexy (ASC). After 2 years, they found no statistically significant difference in subjective (94% ASC and 91% SSLF) or objective success rates (76% ASC and 69% SSLF). They reported higher cost, slower return to activity, and longer operating room time with ASC. The group did not report reoperation rates. In a multicenter randomized controlled trial, Halaska and colleagues randomized 168 women with posthysterectomy vaginal vault prolapse to SSLF or vaginal mesh (VM) repair. At 1-year follow-up, prolapse recurrence was 16.9% in the VM group and 39.4% in the SSLF group (P = .003). They observed no difference in quality of life improvements but observed a 20.8% mesh exposure rate in the VM group. In a single-center randomized controlled trial, Svabik and colleagues randomized 142 women with posthysterectomy vaginal vault prolapse and levator ani avulsion injury to VM or SSLF. At 1 year, they observed objective success rates of 97% in the VM group and 35% in the SSLF group on clinical examination and ultrasound (P<.001). However, they did not detect any difference in subjective outcomes, which they attributed to being under-powered. The mesh erosion rate was 8.3% in the VM group.

Marguiles and colleagues performed a systematic review of vaginal SSLF and reported anatomic cure rates of 98.3% apically, and 81.2% and 87.4% in the anterior and posterior vaginal compartments, respectively. POP symptoms resolved in 82% to 100% of subjects in 5 of the 11 studies reviewed.

Complications
Serious intraoperative and postoperative complications, such as hemorrhage, nerve injury, and rectal injury, are uncommon. The most common complication reported is buttocck pain (0.4%–9.3%), which can be caused by injury or entrapment of a small nerve that runs through the SSLF-iliococcygeus muscle complex. Buttocck pain should be self-limited with complete resolution within 6 weeks. The pain is often managed expectantly with reassurance, antiinflammatory medications, and donut pillows to relieve discomfort while sitting. Pain that radiates down the leg is more likely caused by sciatic nerve or root entrapment. This occurs as a result of suture placement cephalad to the SSLF and warrants immediate reoperation for suture removal. Vulvovaginal pain and/or numbness can occur as a result of pudendal nerve injury or entrapment. Immediate reoperation for suture removal should be performed. Persistent buttocck pain and paresthesia suggest nerve injuries and warrant reoperation to remove the sutures.

Other complications are relatively rare. Risk of intraoperative hemorrhage requiring blood transfusions is low (~2%). Intraoperative hemorrhage can occur as a result of inferior gluteal vessel, hypogastric venous plexus, pudendal vessel injuries, and perirectal veins. These injuries can often be managed with tight vaginal packing and hemostatic agents. Given the location of the SSLF, bleeding in this area is difficult to manage abdominally or with selective embolization. Due to the proximity of the sacrospinous ligament to the rectum, a rectal injury can occur during dissection of the perirectal space or dissection of the SSLF. Rectal examination should always be performed. Intraoperative recognition and repair using standard technique is imperative to avoid complications. Pelvic infections, urinary retention, and urinary tract infections are uncommon and short-lived, as long the issue is identified and treated in a timely fashion. Finally, sexual dysfunction and dyspareunia due to vaginal shortening or narrowing have been reported in case series. Avoidance...
of excessive vaginal wall trimming and prescribing postoperative estrogen cream can minimize this risk. Finally, although ureteral obstruction or injury is a rare complication of the SSLF procedure, intraoperative cystoscopy should always be performed if there is any concern for ureteral injury.

Uterosacral Ligament Suspension

The uterosacral ligament and cardinal ligaments are fascial condensations that suspend the vaginal apex. In 1927, Miller34 first described plication and suspension of vaginal vault using these ligaments. In 2000, Shull and colleagues35 described a modification of the technique. Although the original technique described an intraperitoneal approach, an extraperitoneal approach can be taken. However, an extraperitoneal allows proper palpation and, in some cases, visualization of important structures and landmarks. If performed concomitantly with hysterectomy, the ligaments should be tagged for subsequent identification. In the posthysterectomy setting, an enterocoele sac may be encountered. The sac should be dissected off the vaginal cuff, the peritoneum carefully entered, and the bowels reduced. The ischial spines are important landmarks. The uterosacral ligament is located posterior and medial to the ischial spines, whereas the ureter is located ventral and lateral to the ischial spines. Occasionally, the ureters can be palpated. Intraoperative ureteral catheters can also aid in identification of the ureters, if needed. 2 to 3 delayed absorbable sutures are placed through each ligament bilaterally, with or without the assistance of an Allis clamp. The sutures can then be passed through the layers of anterior and posterior vaginal walls. Nonabsorbable suture can be placed using a pulley-type stitch to avoid the presence of permanent suture in the vaginal lumen. The pulley stitch technique is performed by including the muscular layer of the vaginal wall while excluding the epithelial layer. Finally, cystoscopy should always be performed to ensure patency of bilateral ureters before and after tying the sutures.

Similar to the SSLF technique, numerous outcomes studies exist in the medical literature. Silva and colleagues34 observed a recurrence rate of 15% in a single-center cohort study in which failure was defined as symptomatic prolapse of stage 2 or greater. Shull and colleagues35 performed a retrospective review of 298 women undergoing ULS and reported a recurrence rate of 13% in 1 or more compartment.

In a cohort of 983 subjects, Unger and colleagues36 observed that 14.4% of cases had POP recurrences, 11% had recurrences beyond the hymen, 10.6% were symptomatic with bulge symptoms, and 3.4% required reoperation.

Complications

Serious complications are infrequent. Ureteral obstruction was the most commonly reported complication (4.8%) in 1 large cohort.35 A metaanalysis by Marguiles and colleagues30 reported a rate of 1.8%. In most cases, removal of the offending suture relieved the obstruction. In rare cases, ureteral reimplantation was required (0%–0.6%). Cystotomy (1%), small bowel obstruction (0.8%) and ileus (0.1%) were also reported.

SACROSPINOUS LIGAMENT FIXATION VERSUS UTEROSACRAL LIGAMENT SUSPENSION

One randomized controlled trial comparing the efficacy and safety of the ULS and SSLF has been reported in the literature. In the randomized multicenter Operations and Pelvic Muscle Training in the Management of Apical Support Loss (OPTIMAL) trial, Barber and colleagues37 randomized 374 women with stage 2 to 4 POP to ULS or SSLF. Success was defined as (1) no apical descent greater than one-third in the vaginal vault, (2) no bothersome vaginal bulge symptoms, and (3) no retreatment for POP. At 24 months, no significant differences were observed in anatomic outcomes, length of hospitalization, blood loss, and surgical time. Anatomic success rates were 59.2% and 60.5% for ULS and SSLF, respectively. Recently, the same group published a follow-up in which 285 (86%) women completed the 5-year extension of the OPTIMAL trial.38 Overall, 5.1% required reoperation at 2 years. Combined, 18% developed bulge symptoms, and 17.5% developed anterior or posterior POP beyond the hymen.

Adverse events were unique to each repair. For SSLF, neurologic pain occurred more frequently, at a rate of 12.4% compared with 6.9% in the ULS group. Ureteral obstruction was more common in the ULS group, with a rate of 3.2%. Five cases (2.7%) resolved with suture removal, 1 (0.5%) required stent placement, and 1 (0.5%) was not recognized intraoperatively.

SUMMARY

Transvaginal apical native tissue POP repairs are safe and effective. Although studies suggest transvaginal mesh-augmented repairs are more durable, the risk of mesh-related complications is not insignificant. The risk and benefits of each technique should be discussed with the patient and weighed against individual patient factors.
REFERENCES


