Review Article

Sacrospinous ligament suspension and uterosacral ligament suspension in the treatment of apical prolapse

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Abstract: In pelvic organ prolapse, anatomical defects may occur in either the anterior, posterior, or apical vaginal compartment. The apex must be evaluated correctly. Often, defects will occur in more the one compartment with apical defects contributing primarily to the descent of the anterior or posterior vaginal wall. If the vaginal apex, defined as either the cervix or vaginal cuff after total hysterectomy, is displaced downward, it is referred to as apical prolapse and must be addressed. Apical prolapse procedures may be performed via native tissue repair or with the use of mesh augmentation. Sacrospinous ligament suspension and uterosacral ligament suspension are common native tissue repairs, traditionally performed vaginally to re-support the apex. The uterosacral ligament suspension may also be performed laparoscopically. We review the pathophysiology, clinical presentation, evaluation, pre-operative considerations, surgical techniques, complications, and outcomes of these procedures. Both sacrospinous ligament suspension and uterosacral ligament suspension are equally effective with few complications and adverse events. The risks and benefits of each procedure must be considered along with shared patient and physician decision making. Sacrospinous ligament suspension has a higher risk of persistent neurologic pain while uterosacral ligament suspension has a higher risk of ureteral obstruction.

Keywords: Pelvic organ prolapse (POP); apical prolapse; sacrospinous ligament (SSL); uterosacral ligament

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Introduction

According to the International Urogynecological Association (IUGA)/International Continence Society (ICS) joint report on the terminology for female pelvic floor dysfunction, pelvic organ prolapse (POP) is the descent of 1 or more aspects of the vagina and uterus: the anterior vaginal wall, posterior vaginal wall, the uterus (cervix), or the apex of the vagina (vaginal vault or cuff scar after hysterectomy), affecting one in every ten women in the United States (US) (1). Pelvic pressure, the sensation of a vaginal bulge, low backache, voiding dysfunction, defecatory dysfunction, splinting, and sexual dysfunction are symptoms of POP (1). The lifetime risk of undergoing surgery for POP is nearly 1 out of 8 to 9 women in the US with a 30% risk of re-operation (2-5). In the US, more than 50% of women presenting for routine gynecologic care have prolapse clinically classified as stage II or greater, and approximately 200,000 inpatient surgical procedures for prolapse are performed annually in the US (5-7).

If vaginal apex, defined as either the cervix or vaginal cuff after total hysterectomy, is displaced downward, it is referred to as apical prolapse. The continuity of the endopelvic fascia, uterosacral and cardinal ligaments with the levator ani muscle are the main supportive structures for the vaginal apex. Any defects in these normal supports

may cause apical prolapse. Additionally, these defects are not confined to just one site. Therefore, apical prolapse is commonly the main culprit of prolapse, even when prolapse presents with the anterior or posterior vaginal walls as the leading edge (8,9).

Parity, advancing age, and obesity are risk factors for POP (10,11). In addition to these risk factors, levator ani avulsion, advanced prolapse stage, and family history are risk factors for prolapse recurrence after surgical correction (12). The number of vaginal deliveries and previous hysterectomy are the most common risk factors for apical prolapse. If women have prolapse at the time of hysterectomy, they will have higher risk of subsequent surgery for POP. Therefore, gynecologic surgeons should always consider suspension of the vaginal apex when performing hysterectomy for prolapse or other benign gynecologic indications to minimize this risk (13,14).

Evaluating and counseling before the surgery

Indications for apical prolapse repair are indicated for symptomatic prolapse in women who decline or fail conservative therapy and are appropriate surgical candidates. Preoperatively, women who candidates for surgical repair of apical prolapse, each vaginal compartment (apical, anterior, and posterior) should be assessed for the presence of support defects or prolapse. Urinary and defecatory symptoms should also be evaluated due to their common coexistence with POP. The patient's past medical and surgical history should be assessed carefully to determine risk factors for recurrence, previous pelvic floor surgery, or surgical risk to guide the patient and surgeon's shared decision making.

In our practice, we use the Pelvic Organ Prolapse Quantitation System (POP-Q) as recommended by ICS and the American Urogynecologic Society (AUGS) (1,15). Specifically, for the apical prolapse visualization, it is required to withdraw speculum from the upper third of the vagina during the woman straining. In advanced apical prolapse, protrusion of the apex is visible at or beyond the vaginal introitus before the speculum is inserted and a digital exam is helpful in assessing remaining support of the anterior and posterior compartment (8).

The risk of developing stress urinary incontinence (occult incontinence) after surgery should also be evaluated with reduction of the prolapse using cough stress test or urodynamic testing. In case of occult stress incontinence has been confirmed prior to surgery, the counseling should involve mesh (retropubic sling) *vs.* nonmesh (Burch urethropexy) procedures. The risk of persistent or recurrent prolapse should be discussed during surgical counseling. As stated earlier, shared decision making is vital in the counseling as patients will occasionally prefer a staged approach.

Surgical planning

Apical prolapse can be repaired vaginal or abdominal approach. The vaginal route includes the sacrospinous ligament suspension (SSLS) or uterosacral ligament suspension (ULS). The SSLS may be performed with the uterus in place (sacrospinous hysteropexy) but is typically performed in a post-hysterectomy patient. The ULS is primarily performed in conjunction with a vaginal hysterectomy for access to the uterosacral ligaments. However, it may also be performed vaginally in a post-hysterectomy patient. The abdominal sacrocolpopexy (ASC) has better objective anatomic outcomes than vaginal apical support procedures for most women with the risk of mesh related complications (16,17). For patients who choose to avoid mesh, vaginal native tissue repairs such as SSLS and ULS are a good alternative to the sacrocolpopexy as they have lower rates of postoperative adverse events and reoperation rates when compared with ASC (16-18). The other surgeries known to address apical defects, colpocleisis and sacrocolpopexy are out of the scope of this review.

In the previous reports, transvaginal surgery is performed nearly in 80 to 90 percent of prolapse surgeries in the US (4,5,19). The minimally invasive nature of the procedure and the ease of repairing the anterior and posterior compartments at the time of surgery were the possible explanation for preference of transvaginal surgery. Shorter operative duration and recovery with vaginal surgery are other advantages for women with increased surgical risk or who place a high priority on avoiding abdominal incisions. Patients with a definitive need for adnexal or pelvic cavity assessment or removal may benefit from the laparoscopic route. Consideration of the patient's age and sexual activity may also play a role as the SSLS will deviate the vaginal axis more than the ULS.

In the US, most of the surgeons perform SSLS for post-hysterectomy prolapse repair, while ULS is performed more commonly at the time of concomitant vaginal hysterectomy. Nevertheless, in women with a prior hysterectomy or at the time of concomitant hysterectomy, both procedures can be performed. In the OPTIMAL randomized clinical

trial, both procedures have high estimated surgical failure rates (ULS: 61.5 percent and SSLS: 70.3 percent) after 5 years of surgery (20). As there is no clearly superior vaginal approach, procedure selection should be centered on patient factors and goals. As always, surgeon training and preference is also a strong factor in the route of repair.

Methods

SSLS

The sacrospinous ligament (SSL), iliococcygeus fascia, or the uterosacral ligament are the only places in where apex can be re-suspended during transvaginal apical repair. Only the SSL is a true ligament. There should be sufficient vaginal length for the apex to reach the SSL, which should be assessed on physical exam.

SSLS [or sacrospinous ligament fixation (SSLF)] is the most commonly performed and studied vaginal procedure for the treatment of vaginal vault prolapse. In general, it is performed unilaterally and the right side is preferred side on the left side since the bowel enters the rectum on the left side (21). Although the superiority of bilateral SSLF efficacy has not been proven, the surgical decision is on the ability to perform bilateral SSLF depends on having adequate vaginal length and width to accommodate to suspension points (22,23).

The SSL-coccygeus muscle complex can be identified on pelvic examination by palpating the ischial spine and tracing posteriorly and medially to the sacrum (24). First, a marking suture for the apex should be placed on the vaginal epithelium at the place where it will attach to the SSL. Several techniques are described for SSLS. The SSL can be accessed through a vaginal dissection from the anterior, apical or posterior compartment of the vagina. Here we will describe the dissection in the posterior compartment.

In first technique, the surgeon can easily enter perirectal space with the dissection of the posterior vagina in the midline from the perineal body to the apex. Blunt dissection using the surgeon's finger against the levator ani muscle complex in a lateral to medial manner towards the ischial spine and perirectal space is performed. Once the surgeon has reached to the level of the ischial spine with the dissection, the rectum is pushed gently to the medial side with dissection of the rectal pillars (25). The ischial spine can be palpated, and SSL is found medially. Attachment of the suspension sutures may be performed blindly or visually. Visualization may be performed with Breisky-Navratil retractors placed to protect the pudendal neurovascular bundle and retract the bladder superiorly and the rectum medially. When SSL is clearly visible, 2 to 3 sutures are placed on the ligament starting approximately 1.5–2.5 cm (one and one-half fingerbreadths) medial to the ischial spine. Deschamps ligature carrier, Miya hook, laparoscopic or Capio (Boston Scientific Natick, MA, USA) suture capturing device are available to assist placing the suture through the ligament. In our practice, we perform the suspension blindly with the aid of the Capio suture capturing device, also 2–3 fingerbreadths medial to the ischial spine in the mid-portion of the SSL-Coccygeus muscle complex.

When the sutures are secured to the ligament complex, each one of the sutures are placed through the muscularis on the undersurface of the posterior vaginal epithelium and tied by a pulley stitch, while the free end of the suture is held. Traction on the free end of the suture draws the vaginal apex directly onto the SSL and the suture is tied.

In second technique (Michigan Modification), four points are chosen and are directly approximated to the SSL (26). The vaginal epithelium is excised to the intervening a diamond shape. The placement of the sutures through the SSL is the same as aforementioned, then placed through to the previously marked anterior and posterior vagina and tied to the ligament. A long-lasting absorbable suture is used. The decreased the risk of recurrence to the anterior vaginal wall is main goal of this technique. Although it has not been evaluated in comparative studies with standard SSLS.

Complications

A risk of SSLS is nerve entrapment. Some techniques for suture placement on SSL are described to decrease the risk of entrapment of the pudendal nerve, sciatic nerve, even sacral nerve roots or its branches. Perforation of the SSL with the needle in a vertical orientation rather than horizontal may place the suture parallel to the course of these nerves. Targeting the placement of the fixation sutures at the mid-portion of the SSL is another approach to decrease the risk of nerve injury since these nerves do not travel in this region. Avoid placing the stich superiorly and without excess pressure against the suture capturing device as this may increase the risk of entrapping the sciatic nerve.

Significant hemorrhage has been reported in up to 2 percent of SSLS procedures (27). The superior gluteal, inferior gluteal, and internal pudendal are well known vessels at risk for injury (28). The small space, lack of

visualization, and close approximation of vessels and nerves are challenges for controlling hemorrhage. Applying pressure, topical hemostatic agents, direct repair, vaginal packing, and embolization are the choices to control bleeding. Rarely, abdominal exploration is indicated to control the bleeding. However, current gynecology training is a limiting factor for neuropelviology and retroperitoneum to address these surgical complications.

The cure rates of prolapse-related symptoms and the range of objective cure rates ranged from 70 to 98 percent and 67 to 97 percent, respectively (21). However, according to the recently published OPTIMAL study, subjective failure rates of 41.8 percent and objective failure rates of 61.8 percent are reported with a 5-year follow-up with 8 percent of women undergoing retreatment for prolapse (20).

Cystitis, fever, secondary wound healing, abscess, septicemia, ureteral kinking, problems with urination, gluteal or bladder pain, hemorrhage/blood transfusion, sciatic nerve damage, injury to pelvic organs, and pelvic or vaginal vault hematoma are other reported complications in the literature (21).

ULS

Recently, ULS has increased in popularity. The uterosacral ligament is vital in providing upper, Level 1 support of the vagina, based on DeLancey's levels of support. This procedure can be done transvaginally or laparoscopically (29). The uterosacral ligaments which can be defined anatomically based on gross findings of its fibers coursing from sacrum to cervix along the pelvic sidewall are made of smooth muscle, connective tissue, and nerves. They originate from the inferior aspect of the first three sacral vertebrae and occasionally the fourth to insert near the cervix (29).

The ULS is typically performed with a hysterectomy but may also be performed post hysterectomy. In the post hysterectomy patient, the anterior and posterior vaginal walls are opened in the midline and if present, the enterocele sac is identified. Cuff marking is performed previously to pull on traction to help identify the uterosacral ligaments. The peritoneal cavity is entered then the uterosacral ligaments are identified. While the rectum is retracted medially, an Allis clamp can be used to tent the uterosacral ligament.

We perform the ULS with three sutures on each side. You may use permanent or delayed absorbable sutures. In a chart review study, using permanent suture had better anatomic support when compared to delayed absorbable suture (anatomic failure rate was 1 *vs.* 6 percent, respectively) (30).

The sutures are passed through the UL on each side with the goal to place them at or above the level of the ischial spine. Labeled Kelly clamps are used to tag the sutures sequentially to facilitate vaginal placement. In serial fashion, one arm of each suture is passed through the anterior muscularis surrounding the vaginal apex and the other through the posterior endopelvic fascia. The sutures thereby cross the width of the vaginal apex. All the sutures are then tied, re-approximating the anterior and posterior vaginal muscularis, closing any potential enterocele defect, elevating the vaginal apex toward the sacrum, and closing the cuff when performed with a hysterectomy.

Complications and outcomes

Although the average distance from the lateral aspect of the suspension sutures to the medial border of the ureters is 14 mm, ureteral injury is a concern during this procedure and cystoscopy should be performed after tying the sutures (31). Another potential intraoperative complication is nerve entrapment of the sacral nerve roots if placed too superiorly and medially. Sacral nerve injury may be minimized by tenting the ligament ventrally prior to placing sutures (32).

In a meta-analysis of 10 observational studies, the rates of a successful outcome (POP-Q stage 0 or 1) for each compartment after ULS were as follows; apical (98 percent), anterior (81 percent), and posterior (87 percent). Relief of prolapse symptoms was reported by 82 to 100 percent of patients and reoperation for symptomatic prolapse was reported in 9 percent of women (33).

Ureteral obstruction, blood transfusion, and pelvic organ injury are reported complications and seen up to 1.8 percent (33).

Conclusion: outcomes of SSLS *vs.* ULS

Randomized trial data suggest that the efficacy of ULS and SSLS are comparable for treating apical prolapse; however, the risks and benefits of the procedures differ slightly. Anterior vaginal wall support is better with ULS when compared with SSLS. However, the risk of ureteral injury is a disadvantage for ULS compared with SSLS.

As mentioned previously, the OPTIMAL trial compared objective and subjective success rates for sacrospinous and ULS, which were 59.2 percent for ULS and 60.5 percent for SSLS [odds ratio (OR) 0.9, 95% CI: 0.6–1.5] after 2 years (34). However, these numbers declined to 44 and

33 percent, respectively, by 5 years (35). Women who underwent ULS had a significantly lower rate of neurologic pain requiring intervention (6.9 *vs.* 12.4 percent, OR 0.5, 95% CI: 0.2–1.0). Ureteral obstruction occurred in six women in the ULS group (3.2 percent) and none in the SSLS group. However, most cases were detected and treated intraoperatively. Studies suggest ULS results in excellent apical outcomes; however, anterior compartment success (stage 0 or I) rates were only 67 percent in women with preoperative stage III prolapse (33).

In conclusion, given the available data, outcomes appear similar for ULS and SSLS. However, the surgical risk profile differs slightly. Therefore, patients should be counseled regarding a slightly higher risk of persistent neurologic pain that may require reintervention after SSLS compared with the increased risk for ureteral obstruction with ULS.

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