REVIEW

The sacrospinous ligament: Conveniently effective or effectively convenient?

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Summary

The sacrospinous ligament has been used for over 50 years as a convenient structure for treating vaginal vault and more recently, uterine prolapse. The procedure has evolved over the years and its efficacy has been hotly debated with invariable comparisons made to abdominal sacral colposcopy. Mesh surgery has introduced a newer dimension to the debate. This review is an attempt to clarify the anatomy, reflect on various techniques and offer a critique on the current ‘status’ of the sacrospinous ligament.

Keywords: Sacrospinous ligament, vault prolapse, anatomy, complications, cure rates

Introduction

Zweifel, in 1892, first described this vaginal reconstructive approach when he connected the vaginal vault to the sacrotuberous ligament. Sederl (1958) described the idea of fixing the vaginal vault to the sacrospinous ligament and it gained in popularity (Richter 1968; Richter and Albrich 1981; Randall and Nichols 1971; Nichols 1982). To date, more than 40 different techniques have been described to treat vaginal vault prolapse (Sze and Karram 1997). This paper reviews the available data pertaining to sacrospinous ligament fixation (SSLF) and discusses the justification for adopting this method for vaginal vault suspension.

Anatomy

The sacrospinous ligament extends from the ischial spine to the lateral margin of the sacrum and coccyx. Its anterior surface is muscular and forms the coccygeus muscle; the ligament is the degenerated part of that muscle. SSLF needs to be some distance medial to the ischial spine to avoid various surrounding nerves and vessels. Deciding the most appropriate position of fixation is a matter for debate (Figures 1–3).

The average length of the sacrospinous ligament in various cadaveric studies is 5.43 cm (range 4.8–6.10 cm) (Verdeja et al. 1995), 4.30 ± 0.6 cm (Sagsoz et al. 2002); 5.37 cm (range 4.4–6.0 cm) on right side and 5.36 cm (range 4.40–6.20 cm) on the left side (Roshanravan et al. 2007). Verdeja et al. (1995) found the position of pudendal complex and sciatic nerve to be 0.9–3.10 cm medial to the ischial spine on smaller pelves and 1.30–3.30 cm on larger pelvis. They concluded that the larger the obstetric conjugate, the larger the sacropinous ligament and vice versa. The distance from the ischial spine to sciatic nerve usually travel underneath the lateral one-third of the ligament, suture placement should be medial to that portion of the ligament; as superficial as practical and never across the entire thickness of the ligament. Placing sutures inferomedially and close to the sacrum helps minimise complications. The pudendal complex passed above the spine in 66.6% of cases and a maximum of 0.5 cm medial to spine, while the sciatic nerve was 2.5 ± 0.4 cm lateral to the ischial spine (Sagsoz et al. 2002). Although the pudendal neurovascular bundle traditionally receives the most attention, nerves that supply the coccygeus and levator ani muscles are more likely to be injured during SSLF, as they pass over the ligament at its mid-segment, just in the area where sutures are often placed (Barksdale et al. 1997; Roshanravan et al. 2007). Roshanravan et al. (2007), contradicting Verdeja et al. (1995), suggested placing SSLF sutures in the lateral third of the ligament to decrease the risk of injury to the pudendal vessels. Histological studies found that the internal pudendal artery (IPA) usually coursed behind or in very close proximity to the ischial spine, while the inferior gluteal artery (IGA) was found on average 2.4 cm (range 1.5–3.5) from the ischial spine and 3.4 cm (range 1.0–5.0) from the superior border of the ligament. SSLF sutures are closer to the IGA than to the IPA (Barksdale et al. 1998; Thompson et al. 1999). Several authors have described the extensive collateral circulation and anastomoses between superior gluteal, inferior gluteal, internal pudendal, vertebral, middle sacral, lateral sacral and external iliac via the circumflex femoral artery system (with a frequency of each type of anastomosis varying from 20% to 100%) have been described (Barksdale et al. 1998; Thompson et al. 1999; Roshanravan et al. 2007). Internal iliac artery ligation is not likely to control major haemorrhage during SSLF. Packing and sustained pressure, clipping or ligation of
vessels under direct visualisation or arterial embolisation should be the preferred management. The complexity of all these procedures explains the risk of high morbidity and mortality, when encountering major haemorrhage during SSLF.

Two studies (Sze et al. 2001; Rane et al. 2004) of vaginal configuration following SSLF using magnetic resonance imaging found anatomical distortion of the vaginal axis after SSLF. The desired direction of the vaginal axis is towards the S3 and S4 vertebrae, while in SSLF the vaginal axis is altered in an exaggerated posterior direction. This may contribute to the subsequent increase in recurrence of anterior vaginal wall prolapse.

**Results and complications**

We surveyed all articles about SSLF for the period January 2004 to December 2009. Keywords used for the search on Medline were: sacrospinous ligament fixation, sacrospinous ligament suspension, sacrospinous colpopexy, vaginal vault prolapse. Few studies include long-term follow-up and it is therefore difficult to evaluate the results (Table I). Short term, cure rates were between 84% and 100%. Recurrence of prolapse of the anterior vaginal wall ranged as high as 15.7%. Prolapse of the vaginal apex occurred in up to 6% (Baumann et al. 2009). Factors such as sample size and characteristics, assessment method of follow-up (objective or subjective), concomitant surgery in other compartments, skill and comfort level of the operating surgeon and choice of different techniques, may affect the subsequent outcome. Few comparative studies are available in the literature.

Although infrequently reported, serious intraoperative and postoperative complications may occur with SSLF (Table II). There are also a few case reports on debilitating complications following SSLF such as perineal necrotising infection, perineal herniae, left lateral enterocele after right SSLF (Silva-Filho et al. 2005), ischiorectal abscess (Hibner et al. 2005) and myositis of the gluteal region (Faber et al. 2008).

**Surgical techniques**

Pohl and Frattarelli (1997) concluded that the bilateral suspension is different from the unilateral suspension in that the former requires significant intraoperative judgement in its feasibility and in maintaining the width of the vaginal cuff to allow a bilateral suspension without tension. A bilateral fixation appears more attainable in a patient with post-hysterectomy vaginal vault prolapse than in one with uterine prolapse. Schlesinger (1997) used the auto suture Endostitch device for vaginal sacrospinous ligament fixation. This device, although designed for endoscopic surgery, is helpful in the performance of sacrospinous ligament fixation of the vaginal vault. Decreasing the length of the instrument has assisted with its surgical utility.

Lee (2000) modified the traditional sacrospinous fixation laparoscopically, using an extraperitoneal approach. The author claimed that laparoscopic extraperitoneal sacrospinous suspension can eliminate the procedure of opening and closing the peritoneum and avoid interference with the bowel during surgery. Giberti (2001) introduced a new minimally invasive procedure using the Raz Anchoring System (RAS) for transvaginal sacrospinous colpopexy by palpation. He used a penetration-limiting tube with this system that allows one to penetrate the sacrospinous ligament up to the desired depth. Hefni et al. (2003) suggested sacrospinous cervicocolpopexy
with uterine conservation as a safe and effective surgical option that could benefit elderly patients with uterovaginal prolapse. They argued that it avoids the potential morbidity of vaginal hysterectomy and is associated with a high success rate. Chang et al. (2006) used the Veronikis ligature carrier (VLC) for SSLF. The device was designed to facilitate suture placement and retrieval under direct visualisation within the confines of the pararectal space. He compared it with SSLF, performed with a straight needle holder and concluded that VLC allows rapid and safe introduction of the suspending suture through the SSL making SSLF easy to perform. Pollak et al. (2007) compared the complications of three techniques used to pass the suture through the sacrospinous ligament when performing SSLF. (1) The standard needle driver with direct visualisation; (2) the Deschamps ligature carrier with palpation and (3) the Miya hook ligature carrier also by palpation. The result was that 12 women (5%) had intraoperative and 40 women (17%) had postoperative complications suspected to be caused directly from the suture placement. The proportion of patients with postoperative complications related to the suture passage technique was significantly higher in the Deschamps group compared with the direct visualisation group (18% vs 2%, \( p = 0.002 \)). They concluded that passing the suture through the sacrosinous ligament under direct visualisation may result in less intra- and postoperative complications. However, there was no statistically significant difference in the rates of total intraoperative complications among the three groups. Toglia and Fagan (2008) concluded that permanent braided polyester sutures are associated with a high rate of suture-related complications over the long term and frequently require additional intervention to resolve associated symptoms. They used the ‘Michigan technique’ (Kearney and DeLancey 2003) for SSLF and found that two aspects of the technique may increase the risk of suture erosion. First, this technique typically places the vaginal incision directly over the leading edge of the prolapsed vagina, which is usually the thinnest part of the wall of the prolapsed tissue. Second, the sutures for the suspension are placed directly underneath the line of this incision, which may be the most likely site for wound separation. They also noticed that bilateral suspension may increase the risk of a subsequent ‘high cystocoele’, by stretching the already-weakened fibroconnective vaginal layer between the two spines.

**Discussion**

High reported rates of postoperative cystocele formation following SSLF, and, newer laparoscopic techniques, have diminished the popularity of the procedure in recent years. It is enjoying a resurgence with the introduction of tailored, mesh kits from several equipment companies that utilise the ligament to fix polypropylene mesh to both sacrospinous ligaments instead of the vagina directly. It seems unlikely that

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**Table I. Reported results of sacrospinous ligament fixation (SSLF).**

<table>
<thead>
<tr>
<th>Investigator</th>
<th>Follow-up (months)</th>
<th>Patients (n)</th>
<th>Apical</th>
<th>Ant</th>
<th>Post</th>
<th>Unsp</th>
<th>Cure (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Malinowski et al. (2004)</td>
<td>12 (ob)</td>
<td>10</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>Allahdin et al. (2005)</td>
<td>24 (6–36)</td>
<td>25</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>2 (8%)*</td>
<td>92 (Sub)</td>
</tr>
<tr>
<td>Estrade et al. (2005)</td>
<td>47 (12–156)</td>
<td>92</td>
<td>9*12 (13.5%)</td>
<td>14 (15.7%)</td>
<td>0</td>
<td>0</td>
<td>87.5</td>
</tr>
<tr>
<td>Argirović et al. (2005)</td>
<td>12 (Sub)</td>
<td>37</td>
<td>1 (2.7%)</td>
<td>3 (8.1%)</td>
<td>0</td>
<td>–</td>
<td>89 (33/37)</td>
</tr>
<tr>
<td>David-Monteﬁore et al. (2007)</td>
<td>–</td>
<td>51</td>
<td>–</td>
<td>3 (5.8%)</td>
<td>–</td>
<td>–</td>
<td>93</td>
</tr>
<tr>
<td>Dietz et al. (2007)</td>
<td>22.8 (3–55)</td>
<td>133</td>
<td>2.3%*</td>
<td>35%</td>
<td>0</td>
<td>–</td>
<td>84</td>
</tr>
<tr>
<td>Baumann et al. (2009)</td>
<td>38</td>
<td>52</td>
<td>6%</td>
<td>13.5%</td>
<td>–</td>
<td>–</td>
<td>94</td>
</tr>
</tbody>
</table>

*Required surgery. Unsp, unspecified; Ob, objective; Sub, subjective.

**Table II. Reported complications of sacrospinous ligament fixation (SSLF).**

<table>
<thead>
<tr>
<th>Investigator</th>
<th>Patients (n)</th>
<th>Intraoperative</th>
<th>Postoperative</th>
<th>Long term</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estrade et al. (2004)</td>
<td>277</td>
<td>1 vascular haematoma</td>
<td>6 vaginal haematoma</td>
<td>Perineal pain</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4 rectal injuries</td>
<td>2 abscesses</td>
<td>Sciatic neuralgia</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2 (8%) immediate</td>
<td>7 (28%) late</td>
<td>Dyspareunia</td>
</tr>
<tr>
<td>Allahdin et al. (2005)</td>
<td>25</td>
<td>–</td>
<td>1 vaginal haematoma</td>
<td>–</td>
</tr>
<tr>
<td>Estrade et al. (2005)</td>
<td>92</td>
<td>1 bladder injury</td>
<td>3 acute urinary retention</td>
<td>–</td>
</tr>
<tr>
<td>Argirović et al. (2005)</td>
<td>37</td>
<td>–</td>
<td>3 urination disturbance</td>
<td>–</td>
</tr>
<tr>
<td>Demirici et al. (2007)</td>
<td>60</td>
<td>1 rectal injury</td>
<td>1 vaginal vault infection</td>
<td>–</td>
</tr>
<tr>
<td>David-Monteﬁore et al. (2007)</td>
<td>51</td>
<td>Overall rate 17.3%</td>
<td>Rectal injury 1.9% (1 pararectal haematoma required repeat surgery)</td>
<td>–</td>
</tr>
<tr>
<td>Dietz et al. (2007)</td>
<td>133 (R = 99, NR = 34)</td>
<td>R = 8 (8.1%)</td>
<td>R = 42 (43.4%)</td>
<td>–</td>
</tr>
<tr>
<td>Baumann et al. (2009)</td>
<td>52</td>
<td>None</td>
<td>NR = 3 (8.8%)</td>
<td>NR = 10 (29.4%)</td>
</tr>
</tbody>
</table>

R, responders; NR, Non-responders.
the new mesh kits will altogether avoid the problem of recurrent cystocele in association with SSLF and there is already some suggestion that the same problem is occurring after mesh procedures on the posterior vaginal wall. De Cuypere and Frazer (2009) report a recurrent cystocele incidence of 18.5% at 12 months follow-up after a Posterior Prolift™. It is hoped that the newer mesh kits designed for the anterior compartment, by achieving a four-point fixation bilaterally, to the obturator internus muscles and SSLF, will help reduce cystocele recurrences.

Differing views exist regarding the anatomical relationships of the ligament and respective innervations, length and histology. Two studies have shown dramatic distortions in the vaginal axis after SSLF and it is suggested that this change in axis is the actiology of cystocele formation (Sze et al. 2001; Rane et al. 2004).

The sacrospinous ligament remains a structure with temptingly easy access. Is it simply the most ‘convenient’ structure rather than the most effective and appropriate structure for vaginal suspension? Do we avoid using alternatives such as the uterosacral ligaments because it is too difficult technically (see Shull and Karram 2005)? Although newer mesh kits are showing some promise, we believe that it would wise to exercise caution until further observational and comparative data are available.

**Declaration of interest:** The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

**References**


