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Sacrospinous vaginal fixation – current status

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Abstract

There has been a trend towards increased use of synthetic meshes and abdominal procedures with decreased use of sacrospinous fixation (SSF). A Medline search was performed for the MeSH terms 'sacrospinous ligament', 'sacrospinous fixation', 'sacrospinous ligament suspension' and 'sacrospinous colpopexy'. Published papers from 1996–2010 were selected for analysis. Outcome measures were assessed in terms of efficacy, complications and quality of life after sacrospinous vaginal fixation. Studies on bilateral SSF and fixing uterus to the sacrospinous ligament, use of concomitant anti-incontinence procedures along with SSF were not included in this review. Sacrospinous vaginal fixation provides good long-term objective and subjective outcomes and improves quality of life of women with pelvic organ prolapse. Further, complication rates of SSF are comparable to abdominal sacrocolpopexy and are much less than transvaginal mesh procedures and SSF is a cost-effective procedure. SSF is a time-tested surgical procedure with a reduction in surgical extent and has a definite place in modern pelvic reconstructive surgery.

Abbreviations: POP, pelvic organ prolapse; SSF, sacrospinous ligament fixation; ICFF, iliococcygeal fascial fixation; USLS, uterosacral ligament suspension; ASC, abdominal sacrocolpopexy; POP-Q, pelvic organ prolapse quantification system; SSL, sacrospinous ligament; RCT, randomized control trial; KHQ, King's health questionnaire; CI, confidence interval.

Introduction

Support for the apex of the vagina plays an important role in pelvic organ prolapse (POP) surgery. An ideal procedure for vaginal apical support should provide a durable suspension, have minimal complications, and not affect sexual or visceral function. Vaginal procedures used for restoring the vaginal apex support include sacrospinous ligament fixation (SSF), iliococcygeal fascial fixation (ICFF), uterosacral ligament suspension (USLS), and use of synthetic meshes. Abdominal sacrocolpopexy (ASC) is an intra-abdominal procedure for vaginal apical support. In spite of various available operations, an ideal procedure for the reconstruction of vaginal apical support has yet to be found. Richter first developed and popularized the technique of sacrospinous ligament fixation (1). In this overview we assess the efficacy and safety of SSF and compare this procedure with other surgical methods for vaginal apex fixation.

Sacrospinous ligament fixation is illustrated schematically in Figure 1. The surgical technique of SSF involves a midline half-moon-shaped incision on the posterior vaginal wall with a blunt opening of the pararectal space to reach the SSL (Figure 2). Sharp dissection may be required in women who have undergone previous surgery. Use of anatomical spaces reduces bleeding and shortens the duration of the procedure. After placement of two sutures with fixation at both vaginal fornices, the vaginal wall should be completely approximated. The entire procedure usually takes 25–40 minutes.

Methods

A Medline search was performed for the MeSH terms 'sacrospinous ligament' (SSL), 'sacrospinous fixation', 'sacrospinous ligament suspension' and 'sacrospinous colpopexy'. Published papers from the years 1996 to 2010 were selected for analysis. As there was only a minimal number of randomized control trials on SSF, we included non-randomized studies, and prospective and retrospective case series in our review. Outcome measures are assessed in terms

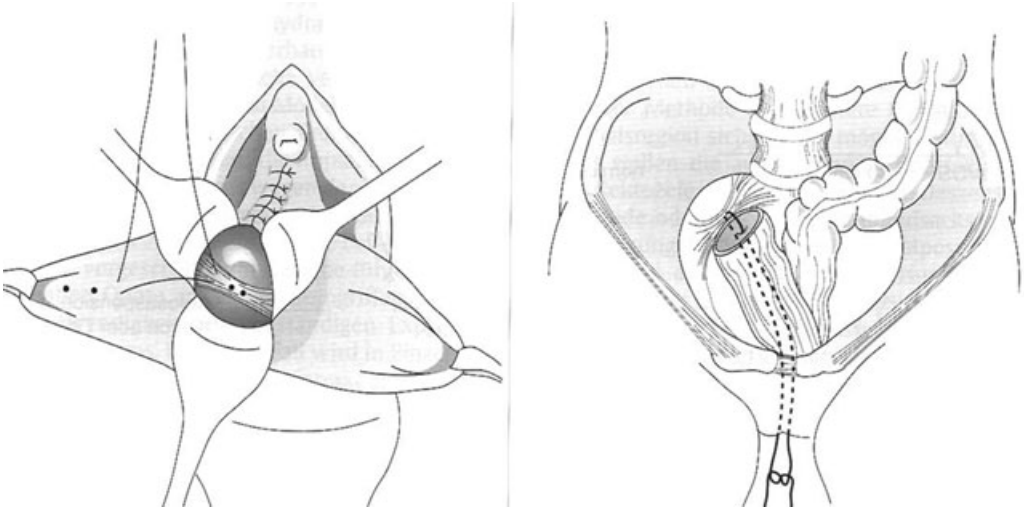

Figure 1. Schematic illustration of sacrospinous ligament fixation.

of efficacy, complications and quality of life after sacrospinous vaginal fixation. Subjective efficacy was assessed using symptoms of vaginal bulging, urinary and defecatory symptoms. Objective success was assessed by maximum protrusion of the vaginal wall in relation to the hymen, the pelvic organ prolapse quantification (POP-Q) system, and half-way system. For efficacy analysis, inclusion criteria were unilateral sacrospinous fixation, a minimum follow-up of 6 months, and fixation of the vagina to the SSL. Studies on bilateral SSF and fixing the uterus to the SSL, and use of concomitant anti-incontinence procedures along with SSF were excluded.

Results

We found nine studies on the efficacy of SSF for apical support (2–10). An analysis of this is shown in Table 1. There were four prospective observational studies, three retrospective case series, one matched case-control study, and only one randomized control trial (RCT), which compared SSF with ASC. It was not possible to pool the results of these studies as they were heterogeneous with respect to surgical technique, the definition of success of the operation, and type of study. However, most of the studies have a long-term follow-up ranging from 6 months to 15 years with median of 5 years.

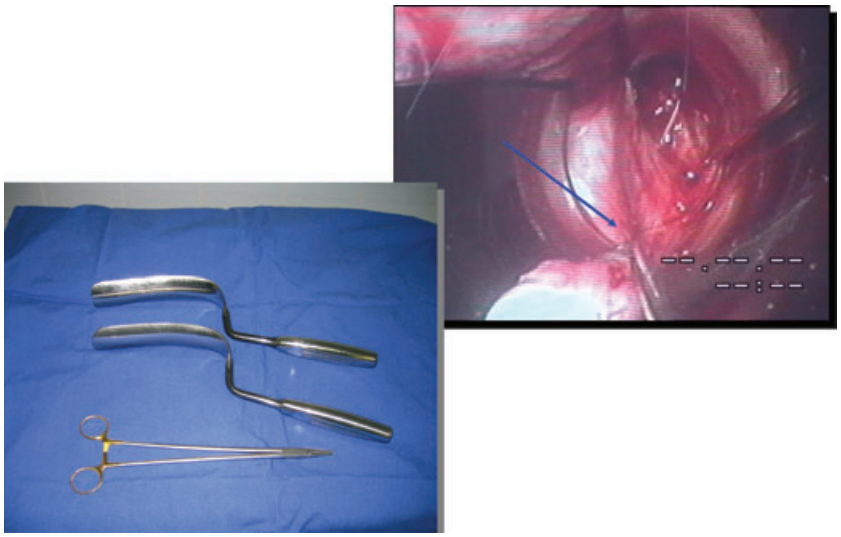

Figure 2. Intra-operative photograph showing sacrospinous ligament (arrow), and instruments used for sacrospinous fixation.

Table 1. Efficacy analysis: success of apical fixation.

Study	Type	Follow-up	Subjects (*n*)	Definition of failure	Success
Cruikshank & Muniz (2003) (2)	Prospective observation	5 years	173-SSF only	Not mentioned	87.3%
			221 –SSF, culdoplasty & fascial placation		95%
			301-SSF, site-specific repair with permanent sutures		99%
Aigmueller (2008) (3)	Prospective observation	2–15 years (mean 7 years)	55	Objective Point C>0	93%
				Subjective	84%
Toglia (2008) (4)	Retrospective cohort	2 years	64	Symptom recurrence/apex Beyond introitus	90.63%
Hefni (2006) (5)	Prospective observational	57 months	305	Objective	96%
				Subjective	99%
Lovatsis (2002) (6)	Retrospective	1–5 years	293	Any vault prolapse requiring re-operation	97%
Lantzsch (2001) (7)	Retrospective	6 months-9 years	123	Recurrent vault prolapse	96.7%
Hardiman (1996) (8)	Prospective series	6 months-5 years	125	Recurrent vault prolapse	96.6%
Maher (2004) (9)	RCT-SSF Vs ASC	6 months-5 years (mean 2 years)	48	Objective	69%
				Subjective	91%
Maher (2001) (10)	Matched case control	19 months	36- SSF	Objective	67%
			36 iliococcygeus fixation	Subjective	94%

The only RCT of unilateral SSF vs. ASC from Maher et al. (9) reported that 2 years after the operation (range 6–60 months), the subjective success rate was 94% in the abdominal group and 91% in the vaginal group (p=0.19). The objective success rate was 76% in the abdominal group and 69% in the vaginal group (not statistically significant). In this study women with no symptoms of prolapse were classified as a subjective success and objective successes were those who, on examination, had no vaginal prolapse beyond the halfway point of the vagina during a valsalva maneuver. The abdominal approach was reported to be associated with a longer operating time, a slower return to daily living activities, and more expensive than sacrospinous colpopexy (p<0.01). Both operative procedures significantly improved quality of life (p<0.05). Cruikshank and Muniz (2) followed for 16 years a cohort of 695 women who underwent SSF and reported that the success rate of SSF could be increased by combining SSF with site-specific repairs of POP. Morgan et al. (11) found that success rates in different studies were variable depending on the site and grade of vaginal support (p<0.05). The meta-analysis by Morgan et al. concluded that among studies using prolapse of grade 2 or more as the criterion for objective failure, the pooled measures of objective failure were 10.3% (95% confidence interval (CI) 4.4–16.2%) and subjective failure was 13.0% (95%CI 7.4–18.6%). In a prospective matched case-control study, Maher et al. (10) reported a subjective success rate of 94% and an objective success rate of 67% for SSF. Overall, available studies (2–10) indicate that SSF has a subjective success rate of 84–99% and an objective success of 67–93% (Table 1).

Risk factors for failure (defined as presence of vault prolapse >POP-Q stage 2) were analyzed by Chen et al. (12). Using multivariable logistic regression, they reported that women with POP-Q points C or D (point C is the position of the cervix in relation to the hymenal plane, and point D is the position of the maximal bulge of enterocele in relation to the hymenal plane; Figure 3) at stage I postoperatively, had a significant risk of surgical failure after sacrospinous suspension (odds ratio (OR), 35.34; 95%CI 8.75–162.75; p<0.001). In their study, the success rate during the 18-month follow-up decreased significantly in women with a C or D point at stage I immediately after operation, compared to women having the C or D point at stage 0 (12). Vaginal cuff infection raised the odds for recurrence to 6.13 (CI 1.80–20.83) and for urinary tract infection to 3.65 (CI 1.40–9.47). Vaginal cuff infection in the postoperative phase and urinary tract infection were also found to be factors related to recurrence of prolapse after SSF (13). Surgical experience is an important factor because dissection and the use of anatomical spaces require anatomical knowledge and surgical skills. Although an SSF suture can be done with a regular needle holder, various specially designed instruments are available for this, such as the

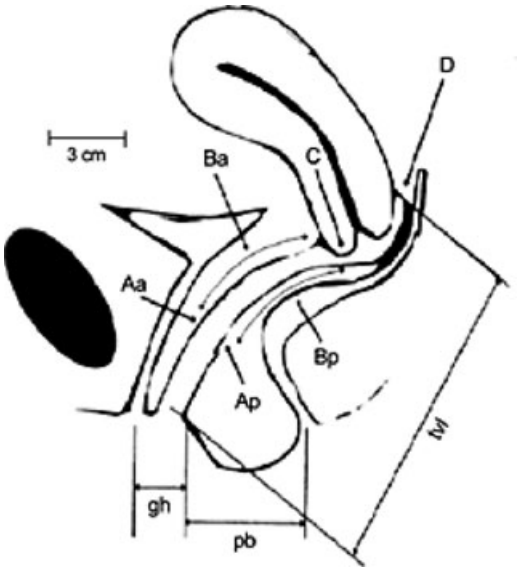

Figure 3. Pelvic organ prolapse quantification system.

Miya hook ligature carrier (Thomas Medical, IN, USA) (14), Autosuture Endostitch (United States Surgical Corp, Norwalk, CT, USA) (15), Deschamps ligature carrier (Thomas Medical) (16), and Veronikis ligature carrier (Marina Medical, Sunrise, FL, USA) (17).

Suture materials for sacrospinous vaginal fixation

Both absorbable and non-absorbable suture materials can be used for fixing the vaginal vault to the SSL and include polydiaxonone (PDS®) braided polyester and polypropylene (Prolene®) sutures. Cruikshank and Muniz (2) used absorbable polyglactin sutures and later non-absorbable braided polyester sutures Although the failures rates in the group who had polyglactin sutures was significantly higher compared to the group with polyester sutures, the difference could not be attributed to the use of suture material alone. Permanent sutures are supposed to provide a durable support and reduce the chances of recurrence but they may be associated with increased risk of suture erosion, granuloma formation, vaginal bleeding and re-operation (4). In a retrospective study (4) of 92 women undergoing SSF with braided polyester suture material, at a mean follow-up of 26 months there was suture exposure in 57%, granulation tissue in 61% and vaginal bleeding in 74% of the women. Also, 16 of 92 women in the suture complication group required re-operation. It has been suggested that the decision to use non-absorbable suture should be based on factors that might indicate an increased risk of recurrent prolapse, such as obesity, prior failed prolapse surgery or thinned vaginal tissues (6). However, it is precisely in these circumstances that the risk of suture exposure is increased. Absorbable sutures may be passed through the full thickness of the vagina and tied over the vaginal mucosa, but when non-absorbable sutures are used, they should be passed submucosally in a double helix and tied beneath the vaginal mucosa to avoid the risk of suture exposure and granuloma formation in the postoperative period (8).

Postoperative development of anterior compartment prolapse

The most frequent criticism of SSF is the development of cystocele with incidences ranging from 5.8 to 21.3% (4–7,9,11,18) (Table 2). Anatomically, the anterior compartment is the most common site of failure for any given grade of prolapse following SSF (11). In a meta-analysis by Morgan et al. (11), the overall risk of development of anterior compartment prolapse of grade 2 or more following SSF was estimated to be around 21.3%. Although anatomical descent of the anterior vaginal wall appears to be common, it is asymptomatic in most patients. Symptomatic anterior vaginal wall descent requiring treatment occurs in 3–5% of patients undergoing SSF (Table 2). The high rate of recurrent cystocele could be due to excessive posterior deviation of the vagina, leading to loss of support for the anterior compartment or may be related to the primary damage of neuromuscular support (18).

Complications of sacrospinous vaginal fixation

Common intra-operative complications of SSF procedure include bleeding, injury to rectum, bladder or ureter. The incidence of intra-operative bleeding requiring transfusion ranges from 0.5 to 2.5% in various studies (2,5,7,9,18,19) and is mainly correlated with the extent of surgical preparation. From anatomical studies it has been claimed that the most common vessel injured during SSF is the inferior gluteal artery (20). However, bleeding during SSF can occur because of injury to the pudendal artery, the coccygeal branches of the inferior gluteal artery, the sacral veins, and arterial anastomoses or anomalous vessels adjacent to the posterior aspect of the SSL (20–22). Intra-operative bleeding is commonly due to venous plexus injury, which can be controlled by pressure and packing. When vaginal packing does not control bleeding, use of vascular clips or arterial embolization under angiographic guidance may be tried (22). Injuries to bladder or rectum are a rare complication, the risk of which increases with prior colporrhaphy. The incidence of rectal injury during SSF is low at 0.6–0.8% (5,12,23) and bladder injury is usually secondary to surgery on the anterior vaginal wall rather than to the SSF procedure itself.

Postoperative complications include febrile morbidity due to fever or abscess in 4.1% and substantial hemorrhage in 1.9% (23). Gluteal pain, bladder pain or non-classified pain occurs in 2.0%. One unique postoperative complication is

Table 2. Incidence of anterior vaginal wall prolapse following SSF.

Study	Type	Follow-up	Subjects (*n*)	Anterior vaginal prolapse	Symptomatic
Toglia (2008) (4)	Retrospective cohort	2 years	64	17.18%	3%
Hefni (2006) (5)	Prospective observational	57 months	305	13%	5%
Lovatsis (2002) (6)	Retrospective	1–5 years	293	5.8%	
Lantzsch (2001) (7)	Retrospective	6 months–9 years	123	8.1%	
Maher (2004) (9)	RCT-SSF Vs ASC	6 months–5 years	48	14%	4.6%
Dietz (2008) (18)	Prospective cohort	12.7 months	72	13.9%	
Morgan (2007) (11)	Meta-analysis			Grade 1 – 40.1% Grade 2 – 21.3% Grade 3 – 3.7%	

buttock or posterior thigh pain, which in most instances resolves spontaneously within 3–6 months. The incidence of temporary buttock and posterior thigh pain ranges from 6.1 to 13.7% (5–7,10,18). Temporary foot drop, recovering in 6 weeks, and transient loss of sensation over the posterior thigh have been reported (5,6). Anatomic studies have shown that nerves to the coccygeus and levator ani course over the midportion of the SSL where SSF sutures are placed and the pudendal nerve is closely related to the superior aspect of SSL at its midpoint and hence may be at risk of injury (24). Wallner explains that pain can be because of injury of the 'levator ani nerve', i.e. the nerve that lies on the superior surface of the sacrospinous ligament and in the area of the operative field (25). However, anatomical variations are common and a nerve-free zone is described only in the medial third of SSL (26).

Lower urinary tract function after sacrospinous vaginal fixation

The effect of SSF on lower urinary tract function is difficult to determine, as there are multiple contributory factors. In most studies, SSF is combined with an anterior colporrhaphy for cystocele or an anti-incontinence operation for either actual or occult stress incontinence. This makes assessment of *de novo* stress incontinence and development of voiding dysfunction after SSF impossible.

Ano-rectal function after sacrospinous vaginal fixation

Theoretically, occult pudendal nerve injury from the sacrospinous suspension can be expected to have an impact on anal continence. Maher et al. (9) found no change in pre- and postoperative obstructed defecation and constipation following SSF. Lovatis et al. (6) followed 200 women with SSF for a period of 1 year and found that 14 women (7%) developed *de novo* anal incontinence. In their study, 43 women complained of anal incontinence preoperatively; in 38 of these women (88.4%) symptoms had resolved postoperatively. Similar results on improvement of anal incontinence following SSF were reported by Hefni et al. (5). In their study, of the 14 patients who had fecal incontinence before surgery, 10 (71%) reported no further fecal incontinence after surgery and three (21%) reported improvement in their symptom and did not request any further surgery. None of the 305 women in their study group reported new bowel symptoms (such as incomplete emptying or difficult defecation) during follow-up. However, it was difficult to attribute cure of anal incontinence to SSF as there was no control group included. One explanation could be the integral theory which postulates that connective tissue damage in the anterior and posterior suspensory ligaments may be a significant cause of idiopathic fecal incontinence (27).

Sexual function after sacrospinous vaginal fixation

Baumann et al. (28) investigated 52 women who had SSF with a female sexual function index questionnaire and found that three women experienced *de novo* dyspareunia, which resolved in two cases after stitch removal. They concluded that sexual function after SSF was good, rating higher than three points for each of the domains including satisfaction, lubrication, desire, orgasm and pain. New-onset dyspareunia after SSF is reported to occur in 3.2% of patients (6). In a long-term follow-up of 55 women with SSF, Aignmuller et al. (3) found that only two women had sexual dysfunction as a result of the operation. Hefni et al. (5) reported that all sexually active patients in their series resumed sexual activity after surgery, 43% (of sexually active women) had an overall improvement in sexual function 2 years after surgery, whereas two patients (1%) complained of new-onset dyspareunia secondary to narrowing of the introital ring caused by the perineorrhaphy. Maher et al. (9) did not find a change in pre- and postoperative sexual activity, but *de novo* dyspareunia occurred after SSF in approximately 5–7% of cases.

Quality of life after sacrospinous vaginal fixation

Maher et al. (9) compared pre- and postoperative quality of life after SSF using Short Urinary Distress Inventory and Short Incontinence Impact Questionnaire scores and found a significant reduction in both scores after the procedure. There was also a significant improvement in the physical function and bodily pain in the group of patients who underwent SSF. In a small RCT comparing SSF with transvaginal mesh, Lopes et al. (29) used the King's Health questionnaire to assess quality of life and reported a trend towards better quality of life outcomes among women who had SSF compared to transvaginal mesh.

Comparison of sacrospinous vaginal fixation with other procedures

A recent Cochrane review (30) reported that ASC is associated with a lower rate of recurrent vault prolapse compared with SSF. To assess recurrent vault prolapse rates, this Cochrane review considered only the studies of Benson et al. (31) and Maher et al. (9). There was no difference in subjective and objective outcome in the study by Maher et al. (9). In the other study (31) recurrent vault prolapse and failure rates were significantly higher among the SSF group. Maher et al. performed unilateral SSF whereas Benson et al. used bilateral SSF. Benson et al. (31) reported a higher rate of urinary incontinence in the SSF group. They used a needle suspension procedure for incontinence in the SSF group and Burch colposuspension in the abdominal group, with the latter having better success rates than the former (32).

Two studies have compared SSF with ASC. In a prospective case series with follow-up of 6 months to 5 years, Hardiman and Drutz (8) compared SSF (n=125) with ASC (n=80) and reported that recurrent vault prolapse occurred in 2.4% in SSF group and 1.3% in ASC group. This difference was not significant. The incidence of postoperative febrile morbidity was 10% after sacrospinous vault suspension and 6% after ASC. In the study by Maher et al. (9) comparing ASC with SSF, the abdominal approach was associated with a longer operating time, a slower return to daily living activities and a greater cost than the sacrospinous colpopexy; there was no difference in the patient's quality of life in the two procedures.

Only in one RCT was SSF compared with transvaginal polypropylene mesh repair. Lopes et al. (29) randomized only 32 women to receive either unilateral SSF with braided polyester sutures or transvaginal monofilament polypropylene mesh for correction of apical support. At 1-year follow-up, there was no significant difference in the position of POP-Q point C in the two groups (−3.9 in mesh vs. −4.4 in SSF; p=0.243). Although quality of life assessment showed a trend for better quality of life outcomes in SSF group, this difference was not significant. There were five cases of mesh exposure in the group of women receiving the vaginal mesh.

In a prospective matched case-control study Maher et al. (10) compared iliococcygeus fixation with SSF and reported that subjective success rate was 91% for iliococcygeus group and 94% for the sacrospinous group (p=0.73). The objective success rates were 53 and 67% (p=0.36) and the patient satisfaction with surgery was 78 of 100 and 91 of 100 (p=0.01) on a visual analogue scale, for iliococcygeus fixation and SSF, respectively. There was no significant difference in the incidence of postoperative cystocele or damage to the pudendal neurovascular bundle. The authors concluded that sacrospinous and iliococcygeus fixation were equally effective for vaginal vault prolapse with similar rates of postoperative cystocele, buttock pain, and hemorrhage requiring transfusion. Although there are no studies comparing re-operation rates between transvaginal mesh and SSF, one study (36) reported a 24% re-operation rate for correction of uterovaginal and vault prolapse using posterior intravaginal slingplasty. This is in contrast to the 6.5% re-operation rate in SSF (5). At present there are no studies in which SSF has been compared with high uterosacral ligament suspension.

Discussion

There has been an increasing trend towards the use of meshes, abdominal and laparoscopic procedures for the support of the vaginal vault. Also, training in vaginal procedures in residency programs seems to be less than optimal. Laparoscopic sacrocolpopexy provides good anatomical results (37) but has the disadvantages of requiring general anesthesia, steep head-down position, risk of mesh erosion (6%) and increased cost. Robotic-assisted sacrocolpopexy is another new development for vaginal apical fixation but its efficacy has only been assessed in short-term studies (38). This overview shows that the long-term success rates for SSF range from 84%–99% with no significant re-operation differences for prolapse between ASC and SSF (RR 0.46, 95%CI 0.19–1.11), while vaginal sacrospinous colpopexy is quicker and cheaper with an earlier return to daily living activities (30).

Anatomical results after ASC appear to be better than after SSF. Magnetic resonance imaging studies have demonstrated that abdominal sacrocolpopexy with retropubic colposuspension more closely restores the vagina to its normal configuration, whereas sacrospinous fixation with transvaginal needle suspension creates an abnormal vaginal axis (33,34). Using only objective measures as a standard of success may not be as clinically significant as using subjective outcomes. In an editorial comment, Haliloglu & Rizk (35) opine that while objective measures demonstrate the ability to correct anatomical defects at operation, representing the likelihood of success of the surgeon and procedure, subjective improvement in postoperative quality of life reflects the satisfaction of the individual patient with the surgical procedure. Subjective results with SSF are no different from those with ASC.

We have been reducing the extensive surgical dissection of the original Amrich–Richter sacrospinous fixation procedure by making a smaller incision and separating the anatomic structures with a minimal approach to the SSL using two long Breisky retractors (Aesculap Inc., Center Valley, PA, USA). Our best experience using different suture materials is with monofilament long-term resorbable sutures and intraepithelial fixation in both vaginal fornices. In contrast to the original procedure, we do not attach the SSL completely to the bone, but only place two 'Z' stitches in the full thickness of the anatomical structure. With this modification, SSF can be a minimal procedure that can be done under spinal anesthesia, is cost-effective and allows early recovery, although it requires surgical skills and a good knowledge of anatomy. Disadvantages of SSF are possible development of cystocele, which is mostly asymptomatic.

When Richter originally invented SSF, his idea was to take away the vaginal apex from the midline so as to protect it from the effect of high abdominal pressure acting on the genital hiatus. The use of a bilateral fixation will lead to fixing the lateral parts of vagina and leaving the central part of apex without support and vulnerable to intra-pelvic pressure on the genital hiatus. Although there is no evidence in the literature, it is our opinion that logically this (bilateral fixation) predisposes to apical prolapse and enterocele.

In cases where there is difficulty in dissection and identification of anatomical landmarks during SSF (e.g. where there has been previous SSF or posterior compartment surgery, where adhesions between and rectum and vagina are common), iliococcygeus fixation may be used as the alternative procedure. In terms of anatomical cure and quality of life assessments, SSF compares favorably with ASC and vaginal mesh procedures. Complication rates seem to be more common in the transvaginal mesh group, but comparable between SSF and ASC.

The literature on sacrospinous vaginal fixation is small and more randomized control trials are needed to evaluate the best treatment for vaginal apical prolapse. Sacrospinous vaginal fixation provides good long-term objective and subjective outcomes and improves quality of life in women with pelvic organ prolapse. Further, complication rates of sacrospinous vaginal fixation are comparable to abdominal sacrocolpopexy and are much less than for transvaginal mesh procedures. Sacrospinous vaginal fixation is a time-tested surgical procedure and has a definite place in modern pelvic reconstructive surgery.

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