Surgical Management of Apical Prolapse

15

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Introduction

Pelvic organ prolapse (POP) is a common problem and can affect women of all age groups. The lifetime risk of undergoing an operation for POP is estimated to be around 11 % [1, 2]. With increase in life expectancy, the number of women presenting with POP is likely to increase in the future. The only persistent symptom of POP is the sensation of vaginal bulge, while increasing degrees of prolapse can be associated with bladder, sexual, or bowel dysfunction. POP is not a life-threatening condition but can significantly impair the quality of life of the individual.

The role of pelvic floor muscle training (PFMT) in the treatment of prolapse appears to be limited. PFMT appears to alleviate prolapse symptoms for a short term, but their role in long-term improvement is inadequate [3]. Use of mechanical devices, pessaries in prolapse treatment, appears to be effective and has been described in detail in Chapter 13. The fact that pessary needs to be used lifelong with regular changing may influence some women to choose a surgical option for their POP.

Assessment of POP includes identification of defect in all three vaginal compartments – apical, anterior, and posterior. The three levels of endopelvic fascial support described by DeLancey explains failure of specific aspects of the fascia in each of these compartments [4].

Apical compartment prolapse-uterovaginal and post-hysterectomy vaginal vault, results from failure of the uterosacral and cardinal ligament complex. The anterior compartment prolapse (cystocele) and the posterior compartment prolapse (rectocele) result from defects in the pubocervical and rectovaginal endopelvic fascia, respectively. Though these are described as isolated support mechanisms, the endopelvic fascia is a continuous layer extending from the sacrum proximally to the perineal membrane distally and across the pelvis through their attachments to the arcus tendinous fascia pelvis (ATFP) on either side of the pelvic wall. Apical prolapse is therefore usually accompanied by descent of the anterior and/or posterior compartments. In about 70 % of patients presenting with POP, more than one compartment is involved [2]. Apex appears to be the keystone of pelvic organ support, and attention to the apical compartment repair is vital in decreasing the risk of recurrent POP.

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Uterovaginal (UV) prolapse and vaginal vault prolapse can be surgically addressed via the vaginal or abdominal route. In UV prolapse, the decision of

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Table 15.1 Surgical options for apical prolapse

Vaginal approach	Abdominal approach
Vaginal hysterectomy + McCall culdoplasty	Abdominal sacrocolpopexy
Sacrospinous ligament suspension	Abdominal sacrohysteropexy
High uterosacral ligament suspension	Abdominal uterosacral suspension
Iliococcygeus fixation	
High levator myorrhaphy	

whether the uterus is to be retained also needs to be decided. The age of the patient, desire to preserve fertility, presence of precancerous lesions or other pelvic pathology can influence the decision regarding uterine conservation. In general, removal of uterus is practiced to provide easier access for a complete pelvic floor reconstruction.

The route of repair, abdominal versus vaginal, is again determined by several other factors such as the age of patient, pre-existing co-morbid problems, site of prolapse, and the surgeon's preference for a particular technique. Of these, the site of defect appears to be the significant factor influencing the route. The commonly performed apical surgical procedures are mentioned in Table 15.1.

Vaginal Approach

In most parts of the world, surgical treatment of uterovaginal prolapse is the traditional vaginal hysterectomy (VH) with or without anterior and posterior repair [5]. Combining this with plication of the uterosacral ligaments (McCall's culdoplasty) or high uterosacral ligament suspension (HUSL) recreates the level I support of vaginal apex.

McCall's Culdoplasty

McCall described culdoplasty in 1957, where purse-string sutures were used to plicate the uterosacral ligaments along with the peritoneum to support the post-hysterectomy vaginal cuff [6]. The technique has been in regular use since then with modifications.

Culdoplasty technique usually involves placement of internal and external sutures on the uterosacral ligament after hysterectomy and plicating them in the midline. About one to three internal sutures are placed from the uterosacral ligament of one side to the opposite side, incorporating the peritoneum in between. This obliterates the cul-de-sac and reduces the risk of postoperative enterocele. The external or distal sutures on the uterosacral ligament anchor the ligament to the vaginal vault. The close proximity of the ureter at the cervical end of the uterosacral ligament should be borne in mind during McCall's culdoplasty.

The shortening and plication of the distal uterosacral ligaments in midline appears to be effective in apical support. The success rate has been quoted as high as 90 % at the end of a year to about 85 % in a 4–9-year follow-up study [7]. In a study comparing the sacrospinous ligament fixation with McCall's culdoplasty, recurrence in the anterior compartment was less frequent with the culdoplasty [8].

High Uterosacral Ligament Suspension (HUSL)

The technique of HUSL suspension was first described by Miller in 1927 [9]. The suspension procedure can be employed for vault support either at the end of the hysterectomy or for vaginal vault prolapse. In HUSL, the uterosacral ligament portion, proximal to the ischial spine, is used to suspend the vaginal apex along with incorporation of the anterior and posterior vaginal walls to create a pericervical ring.

The technique has been described in detail and popularized by Shull et al. in the last decade [10]. The uterosacral ligaments are identified posteromedial to the ischial spines at the 4 o'clock and 8 o'clock positions. The transverse portions of the pubocervical and rectovaginal fascia are identified, and bowels are packed away. Traction is applied on the uterosacral ligaments, and the strong suspensory ligament tissue towards the sacrum is traced. In the original technique, three double-armed, nonabsorbable sutures were placed through the ligament on the sacral side of ischial spine. The first suture is closer to the ischial spine and the other two sutures are then placed posterior and medial to the initial suture. This is repeated on the opposite uterosacral ligament. Once the sutures are placed on either side,

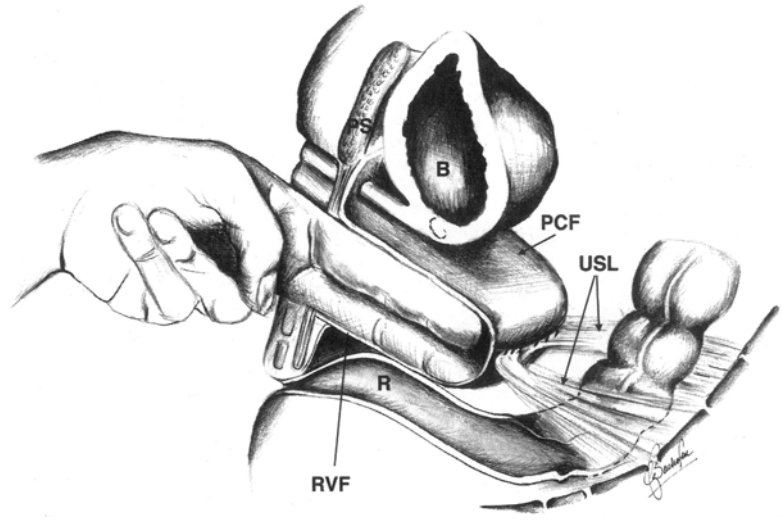

Fig. 15.1 Sagittal section showing suture passing through pubocervical fascia (*PCF*), uterosacral ligament (*USL*), and rectovaginal fascia (*RVF*). *B* bladder, *PS* pubic symphysis, *R* rectum (From Shull et al. [10]; with permission)

pack is removed and the double-armed sutures are used to secure the transverse portions of the pubocervical and rectovaginal fascia. Before the sutures are tied, 5 ml Indigo carmine is given intravenously. The sutures are then tied in sequence bringing the pubocervical and rectovaginal fascia together at the apex. Cystoscopy is performed to check ureteral patency, and the suspensory sutures are trimmed. The risk of ureteral kinking makes it mandatory to perform cystoscopy during this procedure. This technique appears to provide good support using the native tissue in the vaginal approach (Fig. 15.1).

In the case series by Shull et al., the anatomical success rate using Baden-Walker scoring system was 87 % for all sites with follow-up over 3.5 years [10]. A meta-analysis of the HUSL suspension has shown successful outcome for apical compartment to be 98 %, for anterior compartment 81 %, and 87 % for posterior compartment [11]. With a low overall recurrence of 4–18 % and a reoperation rate of less than 7 %, it is an effective procedure addressing the apical prolapse. In addition, the procedure also maintains the normal vaginal axis and appropriate vaginal length.

Complications

The major disadvantage of the procedure is the risk of ureteric injury varying from 1 to 11 % [10, 12]. The average distance between the uterosacral ligaments and the ureter at the cervical end is 0.9–1.4 cm, and moving towards the sacrum, the distance between the two is increased. At the intermediate portion beyond the ischial spines, where the suspension sutures are placed, the ureter is about 2.3–2.7 cm away from the ligament. Ureteral kinking can occur at this site and cystoscopy is important to visualize a free spill of dye on either side after suture placement. If there is no spill of dye-colored urine on any side, the sutures on that side should be cut one by one until spill is visualized. Once patency is established, there is no need to catheterize the ureter (Fig. 15.2).

New-onset neuropathic pain postoperatively has been reported following HUSL suspension. The presenting feature being sharp, stabbing pain radiating from buttocks posteriorly to the legs usually after the first 24 h of the procedure [13]. Entrapment of S1 to S4 nerves appears to be the cause of neuropathic pain. Removal of the uterosacral ligament suture on the affected side has been shown to relieve the pain, with complete resolution of symptoms in 6 weeks [14]. The close relationship of the sacral plexus to the uterosacral ligament makes it vulnerable to injury. The S1 trunk of the sacral plexus passes under the ligament about 3.9 cm superior to the ischial spine, the S2 trunk passes at 2.6 cm under the ligament, the S3 trunk passes at 1.5 cm, and the S4 trunk passes under the ligament at 0.9 cm,

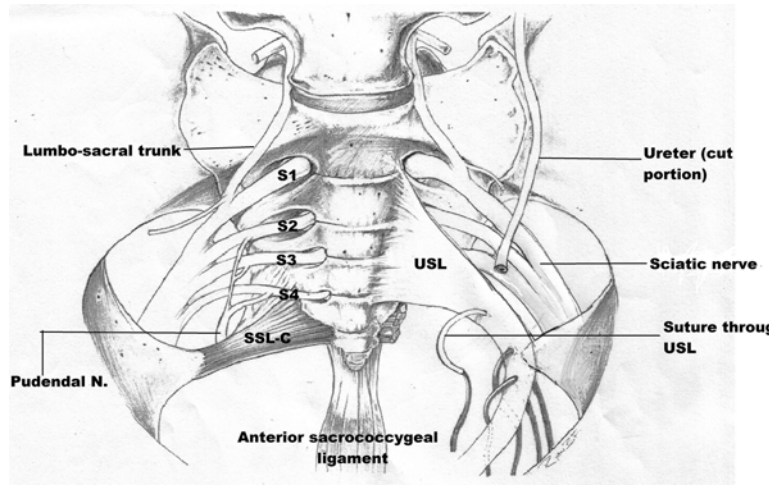

Fig. 15.2 Relation of the uterosacral ligaments to the S1–S4 trunk of the sacral plexus and their close proximity to uterosacral ligament sutures. Ureter cut portion to depict its relationship to uterosacral ligament and sacral plexus. *USL* uterosacral ligament, *SSL-C* sacrospinous ligament coccygeus muscle complex

superior to the ischial spine [15]. The close relationship makes the sacral nerves vulnerable to injury and entrapment.

HUSL in experienced hands is an effective procedure for apical prolapse using the native tissue, but the risk of ureteric injury mandates assessment of ureteral patency when this procedure is undertaken.

Sacrospinous Ligament Suspension (SSLS)

Sacrospinous ligament suspension was first described by Sederl (1958) and was popularized by Nichols and Randall [16]. SSL suspension aims to suspend the vault to the sacrospinous ligament. The ligament can be approached either via the anterior or posterior approach, most surgeons commonly choosing the posterior approach. Sutures are placed on the sacrospinous ligament and are secured to the vaginal vault. Tying these sutures, moves the vault towards the sacrospinous ligament and suspends the apex.

The technique involves a midline posterior vaginal wall incision and entering the rectovaginal space laterally. The ischial spine is palpated and the rectal pillars are dissected by a combination of sharp and blunt dissection. The sacrospinous ligament is palpated and viewed, passing medially and posteriorly from the ischial spine. The upper border of the ligament is palpated and delayed absorbable sutures are placed about one to two fingerbreadths medial to the spine, ensuring the suture lies inferior to the upper border and not around the upper border. The pudendal neurovascular bundle, sacral plexus, and sciatic nerve are in close proximity to the ischial spine and above the superior border of the ligament. Care is also taken to avoid the whole thickness of the ligament during suture placement. Two sutures are usually taken, and in bilateral procedures, the technique is repeated on the opposite side. The sutures are then passed through the vaginal wall on either side of midline and are held. The enterocele, anterior and posterior vaginal walls are repaired if indicated, and the upper portion of the posterior vaginal wall incision is closed. The sacrospinous ligament suspension sutures are then tied, moving the vaginal vault towards the ligament, making sure there is no suture bridge in between. The posterior vaginal incision is then closed entirely.

Success rate of SSLS has been quoted to vary from 67 to 94 % in several case series, with the mean follow-up varying from 22 to 83 months in different studies [17]. The variation partly being related to the fact that the anatomical outcomes have not been evaluated using a common grading system in all studies and also the recurrence in different compartments have been reported together in some (Table 15.2) [18].

Table 15.2 Cure rates for sacrospinous ligament suspension

	Authors	No. of patients	Follow-up (mean duration of follow-up) (years)	Cure rate (%)
1	Benson et al. (1996) [19]	42	1–5	67
2	Sze et al. (1999) [20]	54	0.6–6	77
3	Shull et al. (1992) [21]	81	1–5	82
4	Morley and DeLancey (1988) [22]	92	0.1–11	90
5	Maher et al. (2004) [23]	48	0.6–5	69
6	Meschia et al. (1999) [24]	91	1–6.8	94

In evaluating the recurrence of POP in different compartments following SSLS, the change in vaginal axis appears to be a determinant factor. The vaginal configuration is altered with the suspension, and the study by Rane et al. and Sze et al. using MRI showed there is alteration of the vaginal axis to an exaggerated posterior direction with SSLS [25, 26]. This increases the stress on the anterior compartment in standing and Valsalva disproportionately, which in turn amplifies the risk of anterior compartment prolapse. A study on long-term follow-up after SSLS shows the recurrence in anterior compartment 29 %, posterior compartment 5 %, and the apical 7 % [27]. Several case series have shown similar recurrence rates with anterior wall recurrence around 6–28.5 % and apical recurrence 2.4–19 % with SSLS [28].

Complications

The intraoperative complications reported in an analysis of 195 cases by David-Montefiore includes, vascular injury in 0.5 %, rectal injury in 0.4 %, and the need for blood transfusion in 5.2 % [29]. Buttock pain is a problem with SSLS, reported in about 3 % of patients and usually resolves in 6 weeks time. In pain persisting beyond 6 weeks, there appears to be a 50 % risk of significant long-term pain, and release of suture may have to be considered in these patients [30].

Pudendal and sacral neurovascular injuries are the serious complications of SSLF. The efficacy of the SSLS as a vaginal procedure for apical prolapse is well recognized and studies assessing the route of repair have largely compared SSLS with abdominal sacrocolpopexy.

Iliococcygeus Suspension

The iliococcygeus suspension recommended as an alternative to SSLS was first described by Inmon and involves fixing the vaginal vault to the iliococcygeus fascia just anterior to the ischial spines. The vault is secured bilaterally to the iliococcygeus fascia on either side [31, 32]. It is easier to perform than SSLS, but there are no RCTs favoring the iliococcygeus fixation over SSLS. The objective cure rate of 96 % has been reported in a case series with follow-up over 13 years [33].

Levator Myorrhaphy

A wide midline plication of the levator muscle is performed, and the vaginal cuff is attached to it in levator myorrhaphy [34]. In a prospective randomized study, comparing the high levator myorrhaphy with HUSL suspension, apical suspension is achieved in 96.7 %. However, the mean total vaginal length was significantly shorter after levator myorrhaphy [35], and sexual function is likely to be compromised with this technique.

Abdominal Route

Abdominal Sacrocolpopexy (ASC)

In abdominal sacrocolpopexy, the vault is secured to the anterior surface of sacrum at the level of S1–S2 by a graft material. The procedure was originally described by Lane [36]. Conventionally done as an open technique, ASC can also be performed using laparoscopic and robotic approaches.

In the open technique, the vaginal vault is lifted from below using an end-to-end anastomosis sizer (EEA) or a similar instrument (Fig. 15.3). The peritoneum over the vault is incised, and the vesicovaginal and rectovaginal spaces are entered along the proximal portion of the anterior and

Fig. 15.3 End-to-end anastomosis sizer used for elevating the vaginal vault

Fig. 15.4 Y-shaped manufactured mesh

posterior vaginal wall. This area is used for securing the graft to the vaginal walls. Polypropylene mesh is commonly used as a graft material. Addison et al. promoted the use of two separate graft strips for the anterior and posterior vaginal wall, so that the tension on both is varied and spread out [37]. Two straps of meshes are secured, each to the anterior and posterior vaginal walls using multiple delayed absorbable or permanent sutures. In the recent past, commercially designed Y-shaped meshes have become available for use in ASC (Fig. 15.4). The depth of the graft extent distally is determined by the extent of anterior and posterior wall prolapse. In cases of perineal descent associated with vault prolapse, extending the posterior graft up to the perineal body, termed as colpoperineopexy, has been described [38].

The anterior longitudinal ligament overlying the sacrum is exposed, taking care to identify the sacral vessels in this area and avoiding them. The close proximity of common iliac vein, middle sacral artery, ureter, sigmoid mesocolon, and sacral vessels in this area demands meticulous dissection. Apart from the median sacral artery, other accessory vessels have been shown to traverse the presacral space, and dissection in this area should take into account these anatomical aberrations.

The proximal free ends of both the anterior and posterior graft materials are secured to the anterior longitudinal ligament at the level of S1–S2, using a nonabsorbable suture or bone anchors. It is important to anchor the graft without tension. Anchoring the graft to sacral promontory will place the vagina under tension and alter the vaginal axis. If graft fixation is attempted below the level of S3, risk of hemorrhage in the presacral space is increased. The graft material once secured is placed along the sacral curvature and re-peritonealized. It is recommended that the peritoneum is closed over the graft material to reduce the risk of bowel obstruction.

Several studies have confirmed a good long-term success rate with ASC ranging from 77 to 100 % for the apical compartment [23, 38–42]. It is considered a durable technique for apical prolapse repair (Table 15.3). When success is defined by no recurrence in any compartment, the success rate quoted is 56–100 % [43]. In the study by Sze et al. and Rane et al. evaluating the vaginal axis postoperatively, both showed that with ASC there was better anatomical restoration of the vaginal axis and the near normal vaginal configuration is maintained [25, 26].

The incidence of postoperative stress urinary incontinence following ASC is reported as 4.9 % in a review by Nygaard et al. [44]. In the RCT by Brubaker et al., it was shown that combining abdominal sacrocolpopexy with Burch colposuspension reduced the postoperative symptoms of stress incontinence, without increasing other lower urinary tract symptoms [45].

In spite of its good success rates, not all surgeons offer ASC in patients with apical prolapse. Concerns such as longer operating time, longer duration of hospital stay, and complications of laparotomy limit its use, especially in the elderly,

Table 15.3 Cure rate for abdominal sacrocolpopexy

	Authors	No. of patients	Follow-up (mean duration of follow-up)	Cure rate
1	Cundiff et al. (1997) [38]	19	11 weeks	100 %
2	Timmons et al. (1992) [39]	163	33 months	99 %
3	Reddy and Malik (2002) [40]	11	60 months	100 %
4	Maher et al. (2004) [23]	47	24 months	94 % subjective
5	Addison et al. (1985) [41]	56	39 months	96 %
6	Tate et al. (2010) [42]	100	60 months	77 %

where preexisting comorbid problems favor a vaginal approach rather than an abdominal route. The risk of mesh erosion is also a concern with ASC. In an attempt to reduce the morbidity associated with complications of mesh erosion, several types of graft material have been tried in ASC. Biological graft materials such as fascia lata and rectus sheath have been used in an attempt to reduce the risk of mesh erosion from synthetic grafts. In a case series using biological graft material, the risk of mesh erosion was nil, but the failure rate of ASC was 83 % within a median follow-up of 17 months [46]. In a study by Tate et al. comparing polypropylene mesh with cadaveric fascia lata over a 5 year follow-up, the anatomical success rate with polypropylene was 93 % compared to 62 % with fascia lata [42]. The risk of mesh erosion also varies with the type of synthetic mesh used. With the use of polypropylene mesh, the risk of erosion is around 0.5 %, with Mersilene 3.1 %, with Gore-tex 3.4 %, and with Teflon 5.5 % [44]. It is recommended that some form of graft material is however used between the apex and sacrum, rather than affixing the apex directly to the anterior longitudinal ligament with sutures.

The risk of mesh erosion has been suspected to be increased with concomitant hysterectomy. Procedures such as supracervical hysterectomy or abdominosacral hysteropexy have been proposed to reduce this risk. The evidence on the role of hysterectomy and mesh erosion is however conflicting.

Abdominal sacrocolpopexy can be performed laparoscopically and as robotic-assisted approach as well. The laparoscopic approach to ASC aims to maintain the success rate of open technique with a decrease in morbidity associated with laparotomy. Case series have shown success rates ranging from 60 to 100 % with no increased complication rate with laparoscopic approach [47–49]. The use of laparoscopic approach for ASC is limited by the steep learning curve needed in this technique. In robotic sacral colpopexy, case series has shown that the success rate with the robotic approach is similar to that of open abdominal approach with a failure rate of 6 %. The data obviously is limited with no long-term case series yet [50]. In a study by Paraiso, comparing laparoscopic and robotic approaches in ASC, the operating time was longer with increased cost in robotic approach [51].

Abdominal Versus Vaginal Route in Apical Prolapse

Studies comparing ASC with SSL suspension have been analyzed in the Cochrane review on surgical management of pelvic organ prolapse [52]. The review reported that there was no statistically significant difference between the abdominal and vaginal approach in the number of women reporting prolapse symptoms, although there were more reports of subjective failure in the vaginal group (subjective failure after abdominal surgery 9/84 versus 18/85 after vaginal surgery). This also reported that there was no statistical significant differences in objective failure at any site. ASC was however better in terms of lower rate of recurrent vault prolapse, less postoperative dyspareunia, and less postoperative SUI, but the reoperation rate for SUI was similar in both groups. The operating time was longer, with longer time to recovery and it was more expensive with ASC compared to vaginal SSLS.

Uterus Preserving Surgeries in Apical POP

Hysterectomy as a component of prolapse repair may not be favored by some women though preferring a surgical intervention over conservative measures. The concept of uterine preservation in prolapse surgery is almost a century old, suggested by Bonney in the 1900s. The fact that the uterus is not the cause but rather the effect in uterine prolapse has been clearly defined with anatomical studies. Abdominal sacrohysteropexy, abdominal uterosacral suspension, sacrospinous hysteropexy, and Manchester procedure are some of the commonly employed procedures in uterine preservation.

Manchester procedure (Fothergill's Operation) is employed in the management of uterine prolapse due to cervical elongation. In this vaginal procedure, the cervix is amputated, and the cardinal ligaments are plicated and secured to the front of the cervix. This shortens the ligament and supports the uterus in its normal position. This is usually combined with an anterior and posterior repair.

Sacrospinous hysteropexy provides the transvaginal approach to apical compartment repair with preservation of the uterus. The technique being similar to SSLS, the sacrospinous ligament is approached via the posterior vaginal wall incision, but the incision is extended up to the posterior part of cervix. The sutures passed through the sacrospinous ligament are subsequently attached to the posterior side of the cervix just close to the midline. The sutures are secured to approximate the cervix to the ligament without a suture bridge. In a randomized study comparing the sacrospinous hysteropexy with vaginal hysterectomy for uterine descent, the risk of recurrent prolapse needing surgery was 11 % in the hysteropexy group compared to 7 % in the hysterectomy group [53].

High uterosacral ligament suspension is traditionally a vaginal procedure, but there are case series of laparoscopic uterosacral suspension with uterine preservation, showing good success rates [54]. To be precise, the techniques employed are more of plication of the uterosacral ligaments either involving them in a purse-string manner or plicating them in the midline. The sutures are passed from the left uterosacral ligament through the posterior vaginal wall and cervix and then through the right uterosacral and the serosa of the rectosigmoid in a purse-string manner, ending at the left uterosacral ligament. The case series by Wu using this technique was however small in number with seven patients with a follow-up of less than 2 years [55]. In the case series by Maher et al., the pouch of Douglas was obliterated by culdoplasty, and the uterosacral ligaments were plicated and reattached to the cervix using the laparoscopic technique [56]. The technique had a success rate of 81 % over a follow-up period of 6–32 months with two successful term pregnancies in this group.

In abdominal sacrohysteropexy where the uterus is retained, the proximal ends of the graft strips are secured to the anterior longitudinal ligament. The posterior strip is rectangular, and the distal end of the strip is attached to the posterior wall of the cervix and extended down the vagina depending on the extent of posterior vaginal prolapse. The distal end of the anterior mesh strip is cut into a Y shape, and the two arms are passed through the broad ligament to be secured to the anterior portion of the cervix. In a 5-year follow-up of abdominal sacrohysteropexy, no recurrence of uterine prolapse was observed, with an anterior wall recurrence of 7.7 % and a posterior wall recurrence of 5.7 % [57]. It thus appears to be an effective option in women requiring uterine preservation with apical prolapse.

Most procedures with uterine preservation provide good anatomical outcomes in prolapse surgery. However if the uterus is to be retained, a thorough preoperative evaluation to rule out any associated uterine or cervical pathology and appropriate preoperative counseling are important.

Obliterative Procedures

Rarely, when sexual function is no longer desired and reconstructive procedures are not ideal for the patient, obliterative procedure such as colpocleisis may be more appropriate. Colpocleisis involves denuding the vaginal epithelium off the anterior and posterior vaginal wall and suturing

the walls together. This effectively obliterates the vaginal canal except for the lateral portions, to provide drainage in women with intact uterus. This is referred to as LeFort's partial colpocleisis. A total colpocleisis on the other hand involves removal of all vaginal epithelium and suturing it together. Colpocleisis is an effective option for apical prolapse with low morbidity and usually used in frail elderly. One of the major concerns of colpocleisis is new-onset urinary incontinence, attributed to correction of urethral kinking.

Conclusion

In any patient presenting with POP, there are varied surgical options available. There are patient factors which can determine the route and technique such as age, associated comorbid factors, or other pelvic pathology. In addition, the surgeon's training and experience can also influence this decision-making process. A single approach or procedure based on the surgeon's preference is not always optimal. It is therefore essential for the pelvic surgeon to be skilful in the different surgical techniques employed in the correction of pelvic organ prolapse and tailor the surgery to the patient appropriately.

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