# A Review of Surgical Treatment for Pelvic Organ Prolapse

**Symphorosa SC CHAN** MD, FRCOG, FHKAM(O&G), FHKCOG
**Rachel YK CHEUNG** MBChB, MRCOG, FHKAM(O&G), FHKCOG
Department of Obstetrics and Gynaecology, Prince of Wales Hospital, The Chinese University of Hong Kong, Hong Kong

Pelvic organ prolapse (POP) is common in women and may impair quality of life. Although vaginal pessary can relieve the symptoms and improve quality of life, women may opt for surgical treatment. This paper reviews some common surgical options for POP and their outcome. Anterior colporrhaphy is commonly performed for anterior compartment prolapse but the reported recurrence rate was high. Reinforcement with mesh can reduce the recurrence and re-operation rate; but there are higher intra-operative and long term complications. It should be performed in well-selected cases and by experienced surgeons. There is insufficient evidence to support mesh repair for posterior compartment prolapse. Vaginal hysterectomy is a commonly performed for uterine prolapse; followed by McCall culdoplasty or sacrospinous ligament fixation (SSLF) to suspend the vaginal vault and prevent the recurrence of vaginal vault prolapse. In women with vaginal vault prolapse, abdominal sacrocolpopexy was shown to have a lower recurrence of vaginal vault prolapse when compared with SSLF although there was no difference in the re-operation rate. Laparoscopic sacrocolpopexy can be a more minimally invasive surgery but it has a longer learning curve. Uterus-preserving POP repair is increasingly popular. Women prefer to preserve their uterus for various reasons. Manchester operation or sacrospinous hysteropexy can be the choices for women who have further fertility wish. Sacrohysteropexy can be the option if women have no fertility wish as there is limited information on pregnancy outcome. Finally, colpoclesis, an obliterative procedure, can be an option for women who are no longer sexually active.
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## Introduction

Pelvic organ prolapse (POP) is common in women and may impair quality of life[1]. It may also give rise to complications such as postmenopausal bleeding or even hydronephrosis[2]. Pelvic floor muscle training has been shown to improve the overall symptoms of mild prolapse (with leading edge above the hymen) compared with watchful waiting, although the difference was below the level of clinical relevance[3]. A vaginal pessary is a non-invasive treatment and has also been shown to relieve the symptoms of prolapse and improve quality of life[4]. Nonetheless, women may opt for surgical treatment because of complications related to vaginal pessary use, concomitant urodynamic stress incontinence, or the severity of the prolapse[1,4]. The reported lifetime risk of POP surgery for an 80-year-old woman is 13 to 19%[5,6].

This paper aims to review the surgical options for POP and their outcome. Brief descriptions of some of the more common procedures are given (Table). In most cases, more than one vaginal compartment is involved, and therefore more than one type of surgical procedure is required.

## Anterior Compartment

***Anterior Vaginal Wall Repair alone***

Anterior colporrhaphy is the most common procedure for anterior vaginal wall repair. It begins with hydrodissection by injection of normal saline with or without vasoconstrictor beneath the vaginal mucosa, followed by a midline incision from the bladder neck to the vaginal apex or anterior fornix. The mucosa is separated from the underlying fibromuscular layer and up to the inferior pubic rami using sharp and/or blunt dissection. The fibromuscular fascia is plicated using two to four stitches, and the excessive vaginal mucosa is trimmed. The anterior vaginal wall is then closed with interrupted or continuous absorbable sutures.

The rate of recurrence of anterior compartment prolapse has been reported to be 40% or more within 1 to 2 years[7,8]. As a result, reinforcement with mesh is added.

***Anterior Vaginal Wall Repair with Reinforcement by Graft / Synthetic Absorbable or Non-absorbable Synthetic Mesh***

The anterior vaginal wall prolapse can be reinforced using a biological graft, absorbable synthetic mesh, or non-absorbable synthetic mesh. For the latter, type I mesh of monofilament polypropylene is recommended because of large-pore size (>1 $mm^2$), light weight (<45 $g/m^2$), and

*Correspondence to: Dr Symphorosa SC Chan*
*Email: symphorosa@cuhk.edu.hk*

**Table. Common surgical procedures for pelvic organ prolapse according to the involved vaginal compartment**

| Procedure | Anterior compartment | Apical compartment | Posterior compartment |
|---|---|---|---|
| Vaginal | | | |
| Native tissue | Anterior colporrhaphy | - Vaginal hysterectomy<br>- McCall Culdoplasty<br>- Sacrospinous ligament fixation<br>- Uterosacral ligament suspension | - Posterior colporrhaphy<br>- Rectovaginal septum repair |
| Mesh repair | - Graft reinforcement<br>- Use of absorbable synthetic mesh<br>- Use of non-absorbable synthetic mesh (transobsturator kit) | No evidence to support the use | No evidence to support the use |
| Uterine preservation | Not applicable | - Sacrospinous hysteropexy<br>- Manchester operation | Not applicable |
| Vaginal obliteration | Colpoclesis | Colpoclesis | Colpoclesis |
| Abdominal | | | |
| Mesh repair | Not applicable | Sacrocolpopexy | Not applicable |
| Uterine preservation | Not applicable | Sacrohysteropexy | Not applicable |

lower stiffness[9]. Different types of synthetic mesh are available such as self-styled armless type, tension-free type, or transobturator mesh kit. In Hong Kong, a polypropylene transobturator mesh kit (non-absorbable synthetic mesh) is most commonly used.

Generally, an anterior midline vaginal incision is made following hydrodissection. The vaginal mucosa is dissected from the fibromuscular layer toward the inferior pubic rami and ischial spines without disruption of the arcus tendinous pelvic fascia. The mesh repair system is placed transcutaneously through the medial portion of the obturator foramen and used to anchor the mesh along the arcus tendineus pelvic fascia at the level of the bladder neck and 1 to 2 cm caudal to the ischial spines. The proximal and distal ends of the mesh may be trimmed to fit the vaginal length. The mesh is then secured to the endopelvic fascia and vaginal wall with absorbable sutures. Tension of the mesh is adjusted and should not be tight. The vaginal wall is closed with absorbable sutures. Usually, the vaginal wall is not trimmed, and the midline anterior vaginal incision connected to the apical incision is avoided if a prior hysterectomy has been performed.

***Anterior Vaginal Wall Repair Versus Anterior Vaginal Wall Repair with Permanent Mesh***

According to the Cochrane review up to July 2015, there are 25 trials that compared anterior colporrhaphy with a variety of permanent mesh repair techniques[10]. The mesh groups resulted in more intraoperative complications, higher blood loss[11], and more bladder injury (risk ratio [RR]=3.92; 95% confidence interval [CI], 1.6-9.5)[10].

In 12 trials (involving 1614 women) that reported awareness of prolapse or vaginal bulge at 1 to 3 years after surgery, women with a permanent mesh repair were less likely to report awareness of prolapse than those with a native tissue repair (RR=0.66; 95% CI, 0.5-0.8)[10]. In 13 trials (involving 1406 women) that reported surgical failure (a stage 2 or greater anterior compartment prolapse) at 1 to 3 years after surgery, women with a transvaginal mesh repair were less likely to report failure than those with a native tissue repair (RR=0.45; 95% CI, 0.4-0.6)[10]. The rate of repeat surgery for prolapse recurrence was also lower in the mesh group (RR=0.53; 95% CI, 0.3-0.9)[10].

In three trials that compared absorbable mesh and native tissue repair and 10 trials that compared biological graft and native tissue repair, the evidence to support the use of absorbable mesh or biological graft is insufficient, as it does not reduce the rate of recurrence compared with native tissue repair[10].

In 2011 according to the US Food and Drug Administration, mesh used in transvaginal POP repair introduces risk not present in traditional non-mesh surgery for POP repair; most such risks are related to mesh erosion[12]. 12% of women with mesh repair had mesh exposure; the rate was lower in women with only anterior mesh repair than with multi-compartment repair (10% vs. 17%)[10]. Although mesh exposure is often asymptomatic, symptoms of discharge, bleeding, and dyspareunia have been reported[13,14]. Surgery for mesh exposure was required in 8% of women[10]. Most required only minor outpatient intervention[14,15]. Women with mesh repair were more likely to report de-novo stress urinary

incontinence (RR=1.4; 95% CI, 1.1-1.8) although there was no difference in de-novo voiding disorder, urgency, detrusor overactivity, or overactive bladder[10].

Since 2011, many mesh manufacturers have withdrawn from the market. Balancing the risk-benefit profile, it is concluded that a transvaginal mesh has limited utility in primary surgery[10]. In women with a higher risk of recurrence, the benefits may outweigh the risks[10]. In 186 women (most were postmenopausal) in Taiwan followed up for at least three years, transvaginal mesh surgery resulted in a high subjective and objective success rate and a low mesh exposure rate of 3.5%, even though 91% had concomitant hysterectomy[15]. This suggests that transvaginal mesh surgery may be beneficial in well-selected cases and when performed by an experienced surgeon.

## Posterior Compartment

***Posterior Vaginal Wall Repair alone***

The posterior vaginal wall repair generally begins with a transverse incision made at the mucocutaneous junction and the posterior vaginal wall is incised at the midline to the posterior fornix. The rectal wall and rectovaginal connective tissue are separated from the vaginal wall. The rectovaginal fascia is united at the midline with interrupted absorbable sutures. The perineorrhaphy is performed with one or two horizontal sutures. Excess vaginal mucosa is then excised, and the vaginal wall is closed with absorbable sutures.

Another way to repair the posterior compartment prolapse is to repair the rectovaginal septum. The rectovaginal septum may have defects at different sites, for example detachment from the uterosacral ligaments, central or lateral defects in the midvaginal portion of the septum, detachment of the septum from the perineal body, or disruption of the perineal body. An incision is made transversely at the junction of the perineal skin and posterior vaginal wall. The vaginal epithelium is dissected from the underlying connective tissue in the relatively avascular plane just beneath the epithelium and the rectovaginal septum is exposed. Defects, if any, on the rectovaginal septum are repaired with interrupted sutures along the defects at each site starting from the perineal body, mid-rectovaginal septum, and uterosacral ligament attachments to the rectovaginal septum[16].

***Transanal Approach Versus Vaginal Approach***

Few trials have compared methods to repair posterior compartment prolapse. In two trials (involving 57 and 30 women) that compared the vaginal approach with the transanal approach to rectocoele repair, the transvaginal approach was superior to transanal approach for posterior vaginal wall repair in terms of subjective (RR=0.4; 95% CI, 0.13-1) and objective (RR=0.2; 95% CI, 0.1-0.6) failure rates[17,18]. Nonetheless, the two approaches were comparable in the rate of postoperative difficulty in bowel evacuation, faecal incontinence, or dyspareunia[17,18]. In addition, both trials were limited by small sample size[17,18].

***Native Tissue Repair Versus Augmentation with Mesh***

In two trials that compared native tissue repair with repair with absorbable or non-absorbable mesh, there was no difference in the rate of recurrence or cure rate, patient satisfaction, or subjective improvement at one year[8,19]. In another study, the reoperation rate was 1% in both groups, and there were no complications associated with the use of mesh[10]. On the contrary, in another study, the mesh erosion rate was 13%, and the dyspareunia rate increased from 6 to 69% postoperatively[20]. This suggests that there is insufficient evidence to support the use of mesh for posterior compartment repair[10].

## Apical Compartment: Uterine Prolapse or Vaginal Vault Prolapse

***Uterine Prolapse***

**Vaginal Hysterectomy and McCall Culdoplasty or Sacrospinous Ligament Fixation**

Generally, women with uterine prolapse are offered vaginal hysterectomy. After completion of vaginal hysterectomy, some procedures are performed to suspend the vaginal vault and prevent the risk of recurrence of vaginal vault prolapse, for example McCall culdoplasty or sacrospinous ligament fixation (SSLF).

The McCall culdoplasty begins with the passage of an absorbable suture to the uterosacral and cardinal ligament and the peritoneal surface of the vaginal wall. Two arms of the sutures are then tied. This process closes off the cul-de-sac, draws the posterior vaginal apex up to the supporting structures and elevates it. The vaginal vault is then closed[21]. For SSLF, the posterior vaginal wall is opened longitudinally from the introitus to the vaginal vault. The right rectovaginal space is entered by sharp and blunt dissection to the level of the ischial spine. The sacrospinous ligament is then traced medially. Long-acting absorbable sutures are placed through the ligament, approximately 2 cm medial to the ischial spine using an instrument such as a Miya hook. These sutures are passed through the vaginal epithelium at the vaginal vault and left untied. The vaginal wall is closed, followed by tying of the sutures which brings the vaginal vault to the ligament[21]. Recently, some devices enable self-retrieval of the suture

while passing through the ligament and thus facilitate SSLF. SSLF carries a risk of pudendal vascular or nerve injury. Intra-operative bleeding requiring transfusion has been reported in 0.5% to 2.5% of cases and rectal injury in 0.6% to 0.8%[22]. When SSLF was first invented, the 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[22,23]. Therefore, usually only unilateral SSLF is performed. Bilateral fixation may fix the lateral parts of the vagina and leave the central part of the apex without support and vulnerable to intra-pelvic pressure on the genital hiatus, although there is no evidence to support this theory[22]. Both McCall culdoplasty and SSLF may shorten the vaginal length, which does not affect sexual function in women[24]. Generally, McCall culdoplasty is for women with vaginal cuff up to hymen level, whereas SSLF is for women with more severe prolapse. The options of uterine preserving surgery are discussed below.

## Vaginal Vault Prolapse

***Sacrospinous Ligament Fixation***

SSLF for vaginal vault prolapse has the advantage of being performed through the vagina under regional rather than general anaesthesia.

***Sacrocolpopexy***

Sacrocolpopexy uses a piece of Y-shaped mesh or two pieces of rectangular mesh to suspend the anterior and posterior vaginal wall from the medial longitudinal ligament of the sacral promontory. The peritoneum over the sacral promontory is opened and the medial longitudinal ligament is identified. Then, the peritoneum along the right pelvic side wall is opened with caution to prevent injury to the right ureter. A Breisky retractor or a vaginal probe is inserted into the vagina to facilitate the following dissections. The peritoneum and bowel that cover the posterior vaginal wall are dissected from the vaginal wall, whereas the peritoneum and urinary bladder are dissected from the anterior vaginal wall. Generally, it is adequate to free 3 to 4 cm on each side of the anterior and posterior vaginal wall. Some surgeons may advocate dissecting until the levator ani muscle is reached. The distal arms of Y-shaped mesh or one side of the rectangular meshes are then anchored to each side of the vaginal wall using absorbable sutures. The proximal arm(s) are anchored to the medial ligament of the sacral promontory using non-absorbable sutures or helical tackers. The peritoneum is closed to avoid bowel adhesion to the mesh and intestinal obstruction. In a report of 450 women, the reoperation rate for bowel complications was similar in women with or without reperitonealisation (1.5% vs. 1.0%, p=0.9)[25]. Some surgeons perform site-specific vaginal repairs (anterior and or posterior colporrhaphy) in conjunction with laparoscopic sacrocolpopexy (LSC)[26].

***Sacrospinous Ligament Fixation Versus Sacrocolpopexy***

According to the Cochrane review in 2008, three trials compared abdominal sacrocolpopexy with vaginal SSLF[27-29]. Abdominal sacrocolpopexy was superior to vaginal SSLF in terms of a lower rate of recurrent vaginal vault prolapse (RR=0.23; 95% CI, 0.07-0.77) and less postoperative dyspareunia (RR=0.39; 95% CI, 0.18-0.86) [27-29]. Nonetheless, abdominal sacrocolpopexy resulted in a longer operating time and higher cost[27,29]. There was no significant difference in the re-operation rate between the two surgeries[30].

***Laparotomy Versus Laparoscopic Sacrocolpopexy Versus Robotic-assisted Laparoscopic Sacrocolpopexy***

LSC was first reported in 1994[31]. Generally, laparoscopic surgery is associated with less blood loss, a lower transfusion rate, and a shorter length of hospital stay than open surgery. In a review of 11 reports involving 1197 women, the rate of conversion to laparotomy was 2.7%[32]. The success rate and patient satisfaction rate at a mean of 25 months were 75% to 100% and 79% to 98%, respectively, and only 1.8% of patients required mesh removal[32]. In two studies reporting the long-term outcome at 5 years, the anatomical recurrence rate was 7 to 16%, the reoperation rate was 3.5%, and the rate of mesh exposure was 0 to 9%[26,33]. LSC for vaginal vault prolapse has a long learning curve. In experienced surgeons, the operating time decreased significantly after 30 cases and stabilised after 90[34]. It took a trainee 31 cases to achieve an operation time comparable with that of an experienced surgeon in terms of dissecting the vaginal vault if he had practiced endoscopic suturing for 15 hours before learning LSC[35].

Robotic-assisted laparoscopic sacrocolpopexy (RALSC) was first performed in 2004[36]. In a review of 27 studies involving 1488 women, the conversion rate to laparotomy was <1%, the objective and subjective cure rates were 84 to 100% and 92 to 95% respectively, the mesh erosion rate was 2%, and the learning curve was 10 to 20 procedures[37]. Although RALSC and LSC were comparable in terms of the complication rate and short-term outcome, in a recent meta-analysis of seven trials that involved 264 RALSC and 267 LSC, RALSC was associated with a longer operating time by a mean of 40 minutes and higher costs[38].

## Uterine Preserving Surgeries

Recently, uterus-preserving POP repair is increasingly popular. Women prefer to preserve their

uterus for various reasons, such as a concern about female sexuality and body image.

***Sacrospinous Hysteropexy***

Sacrospinous hysteropexy is mostly performed unilaterally to the right sacrospinous ligament. A midline incision is made in the posterior vaginal wall and extended to the posterior part of the cervix. The right sacrospinous ligament is identified. Sutures are placed through the right sacrospinous ligament about 2 cm medial to the ischial spine and then through the posterior side of the cervix. The cervix is placed in close contact with the ligament without a suture bridge[39]. In one trial that compared sacrospinous hysteropexy with vaginal hysterectomy, sacrospinous hysteropexy resulted in shorter length of stay in hospital and earlier return to working activities, with no operative complication reported[39]. 57% of women needed >3 months to recover from vaginal hysterectomy; this is longer than our clinical experience suggests. Nonetheless, sacrospinous hysteropexy resulted in a higher recurrence of apical prolapse (21% vs. 3%) and 6% of patients required repeat surgery by one year[39]. Six successful pregnancies and vaginal deliveries have been reported in five out of 19 women[40]. In four of the five women, normal anatomic restoration was accomplished after pregnancy and vaginal delivery[40].

***Sacrohysteropexy (Uterus Preserving and Sacrocolpopexy)***

The anterior and posterior vaginal walls are prepared by dissecting the bladder, peritoneum, and bowel from the walls. An anterior Y-shaped mesh is positioned on the anterior vaginal wall, and the two sides of the mesh are passed through the broad ligaments. The rectangular posterior mesh is attached to the posterior vaginal wall. Both meshes are fixed to the sacral promontory and the peritoneum is closed over the meshes[41]. Open, laparoscopic, and robotic surgical options have been reported[41,42]. In 52 women followed up for a mean of 60 months, there was no recurrence of uterine prolapse, and the recurrence of anterior and posterior compartment prolapse (defined as ≥stage 2) was 8% and 6%, respectively[41]. Patient satisfaction was high; only 5% of patients had mesh erosion and underwent successful vaginal repair[41].

***Manchester Operation***

The Manchester operation includes diagnostic curettage; detachment, suturing and reattachment of both cardinal and uterosacral ligaments to the anterior aspect of the uterine isthmus; amputation of the cervix; and covering of the cervical stump with vaginal mucosa[43]. Postoperative urinary retention has been reported in up to 22% of women and cervical stenosis in 0 to 11%[43]. If symptomatic, cervical dilation under general anaesthesia or repeat dilation is needed[43,44]. One woman ultimately required hysterectomy because of recurrent cervical stenosis[43]. The cure rates for the apical, anterior, and posterior compartments were 93 to 100%, 95%, and 99 to 100% respectively, whereas the reoperation rate for recurrence of prolapse was 0 to 4% for apical prolapse and 0 to 4% for any prolapse[43,44]. Pregnancies and successful deliveries after this operation have been reported[43,45]. The Manchester operation is a viable option for young women who wish to become pregnant in future.

There is no comparison study of different types of uterine preserving surgery, which is usually reserved for women with no uterine or cervical pathology. The choice of surgery depends on the expertise of the surgeon. In women without abnormal per vaginal bleeding, the incidence of concurrent uterine malignancy during hysterectomy for POP surgery was 0.2%, and the incidence of pre-malignant uterine pathology was 0.4%[46]. Pap smear screening should be performed before surgery and continue afterwards. Although successful pregnancies and vaginal deliveries have been reported following sacrospinous hysteropexy or Manchester operation, information about the risks in pregnancy and delivery is limited, and there is potential for prolapse recurrence.

***Colpoclesis***

Colpoclesis is an obliterative procedure for POP for women who are no longer sexually active. The anterior vaginal wall that extends from 2 cm proximal to the tip of the cervix to 4 to 5 cm below the external urethral meatus is denuded. A mirror image on the posterior aspect of the cervix is removed by sharp dissection. A maximum amount of fibromuscular vaginal wall should be left behind on the bladder and rectum. The cut edges of the anterior and posterior vaginal wall are sewn together with interrupted delayed absorbable sutures. The uterus and vaginal apex are gradually turned inward and the inferior margin is sutured after plication of the bladder neck. An aggressive perineorrhaphy is recommended[47]. 90% of women achieved good anatomic results, and 85% had relief of symptoms[48]. The incidence of postoperative urinary stress incontinence was 10 to 30%; some reported incomplete bladder emptying[47,49]. Significant improvement occurred not only in symptoms and quality of life, but also in body image; the rate of regret or dissatisfaction was 10%[49]. Nonetheless, future evaluation of any uterine bleeding or cervical pathology is difficult, and these limitations should be explained to women. Endometrial biopsy and Pap smear must be considered before surgery.

## Concomitant Continent Surgery

Women frequently report symptoms of stress urinary incontinence (SUI) after correction of POP. About 40 to

50% of women with POP have concomitant SUI; they are at highest risk of SUI postoperatively[50]. Continent women can also develop SUI after surgery, particularly in about 20-30% of women with occult SUI[51,52]. A combination of a prolapse surgery and an anti-incontinence procedure is usually performed to treat or prevent SUI. In women with co-existing SUI, the combined surgery significantly reduced the risk of SUI at 1 year (5% vs. 23%)[53]. In continent women following POP surgery, the combined surgery reduced the subjective SUI (24% vs. 41%, RR=0.6; 95% CI, 0.2-1.4), and the number needed to treat to prevent one woman from developing de-novo subjective SUI following prolapse repair was six[54]. The prevalence of occult SUI in the CARE trial and OPUS trial was 27% and 33% respectively[55,56]. Both studies showed a lower rate of postoperative SUI after combined surgery and lower risk of objective SUI (22% vs. 52%, RR=0.4; 95% CI, 0.3-0.8)[55,56]. The number needed to treat to prevent one woman with occult SUI from developing de-novo objective SUI was three[55,56]. The bladder storage function following combined surgery remained unchanged, but women may need longer catheterisation after continent surgery and adverse events such as bladder perforation, urinary tract infection, and major bleeding complications may increase[55,56]. In our local population, the efficacy of a concomitant continent procedure was not inferior to continence procedure alone and the complication rate was also similar[57].

## Conclusion

In addition to assessing the stage and site of POP and planning for prolapse surgery, symptoms of urinary incontinence should also be evaluated. It is worthwhile to discuss whether to combine continent surgery with surgical repair for POP.

## Declaration

The authors have declared no conflicts of interest in this manuscript.

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