Pelvic Organ Prolapse: Diagnosis, Treatment, and Avoiding Complications

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Abstract

Pelvic organ prolapse (POP) is defined as the descent of one or more of the anterior vaginal wall, posterior vaginal wall, the uterus (cervix), or the apex of the vagina (vaginal vault or cuff scar after hysterectomy). Prolapse is extremely common and is one of the leading reasons for surgery in the United States.

The main symptom of prolapse is the sensation of bulge or pressure in the vagina. Severe prolapse may interfere with successful urination, defecation, or sexual function. Prolapse diagnosis is usually based on physical exam, though several formal staging systems exist. Asymptomatic or minimally symptomatic prolapse may not require any intervention. Patients with significant bother may elect to use a plastic device (pessary) to hold their prolapsed organs in place, or they may elect for surgery. There are a variety of surgical procedures for prolapse, depending on the patient's health, preferences, degree, and location of prolapse.

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Contents

1 Introduction

Pelvic organ prolapse (POP) is defined as the descent of one or more of the anterior vaginal wall, posterior vaginal wall, uterus (cervix), or apex of the vagina (vaginal vault or cuff after hysterectomy) (Haylen et al. 2010). POP is estimated to affect 3.3 million women in the United States alone, and the number of women affected is projected to increase by nearly 50% by 2050 (Wu et al. 2009). Prolapse is one of the most common reasons for surgery in the United States and is projected to increase from 166,000 surgeries annually in 2010 to 245,970 in 2050 (Wu et al. 2011).

The most common symptom of prolapse is the sensation or discomfort of vaginal or uterine tissue prolapsing from the vagina and between the legs (Fig. 1). Severe prolapse may be associated with sexual complaints and urinary symptoms such as voiding difficulty, bladder outlet obstruction, and detrusor overactivity (Romanzi et al. 1999). It is rare that prolapse will cause significant morbidity or mortality, but it is commonly associated with sexual, urinary, and defecatory symptoms that may interfere with activities of daily living and affect quality of life. It is not uncommon for women to digitally reduce their prolapse (splint) in order to urinate or defecate. In extreme cases, obstructed urination may result in obstructive uropathy causing hydronephrosis and even progressing to renal failure (Sudhakar et al. 2001).

Many patients with prolapse will elect for conservative management or go without treatment altogether (Culligan 2012). Conservative management strategies include pelvic floor muscle training and pessaries. A variety of surgical options are available, depending on the type and degree of prolapse, as well as patient preference and comorbidities. The necessity of hysterectomy at the time of prolapse repair is controversial, as is the need for mesh or graft to augment native tissue repairs.

2 Anatomy/Pathophysiology

Pelvic organ prolapse is the result of disruption of one or more of the supports that normally hold the pelvic organs in place. There are three primary supports of the uterus and upper vagina: 1) the cardinal/uterosacral ligament complex, 2) the lateral/paravaginal attachments of the endopelvic fascia, and 3) the perineal membrane (DeLancey 1992).

2.1 Level 1: The Cardinal and Uterosacral Ligament Complex

First, a note on terminology: Although the cardinal and uterosacral ligaments are commonly described as ligaments, true ligaments attach bone to bone, while the cardinal and uterosacral "ligaments" are more of a condensation of fibrous tissue, collagen, muscle, and nerves.

The cardinal ligament stretches between the base of the uterus and the lateral wall of the pelvis, thereby preventing inferior movement of the

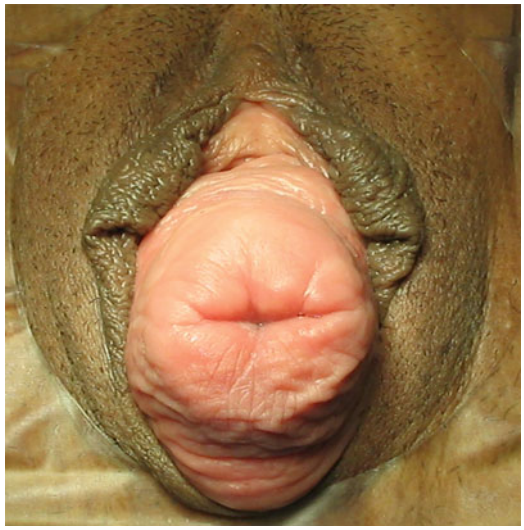

Fig. 1 Pelvic organ prolapse (Photograph courtesy of Dr. Begüm Özel)

uterus. The uterosacral ligament connects the lateral edge of the uterus to the anterior surface of the sacrum, which prevents the uterus from being displaced inferiorly and anteriorly (Drake et al. 2008).

These ligaments may be disrupted through surgical or obstetric trauma. However, it is more common that these ligaments are intact, but stretched out by consistent downward traction of the uterus and vagina. Similarly, collagen vascular disorders may be associated with lengthening and stretching of these ligaments and result in pelvic organ prolapse.

2.2 Level 2: The Endopelvic Fascia

Another note on terminology: The "endopelvic fascia" is not a true fascial layer, rather a condensation of areolar and connective tissue; however, it will hereafter be referred to as "fascia."

The endopelvic fascia is essentially the tendinous insertion of the levator ani complex where it attaches on the arch of the pelvis. This tendinous arch (arcus tendineus fascia pelvis) runs from the bottom of the pubic symphysis to the ischial spine on either side. Injury to this fascial layer or disruption of these lateral attachments is commonly seen after childbirth, even in the absence of a perineal laceration and is thought to be one of the primary causative factors for pelvic organ prolapse.

2.3 Level 3: The Perineal Body

The perineal body is the third and most distal level of support. This layer is made up of the superficial perineal muscles that form the anterior urogenital triangle (bulbocavernosus, ischiocavernosus, and transverse perineal). Within the triangle is a confluence of connective tissue that provides additional support to the vulva and lower vagina. Disruption of this layer may occur during childbirth, or due to chronic traction of the uterus and vagina due to defects in the upper two levels of support.

3 Risk Factors

The causes of prolapse are multifactorial. There are some genetic risk factors; a family history of prolapse is associated with increased risk, as is Caucasian race and Hispanic ethnicity, when compared to Asian and African Americans. The most common risk factors include vaginal childbirth, increasing age, and increasing body mass index. Vaginal childbirth is strongly associated with anatomic disruption of the pelvic organ supports, and pregnancy is associated with laxity/stretching of the pelvic floor ligaments. Increasing age is thought to be associated with changes in the collagen composition of the ligamentous supports, leading to increased risk of prolapse. Body mass index is likely a risk factor for prolapse due to chronic increases in abdominal pressure and straining. In fact, other causes of chronic increase in abdominal pressure have also been associated with prolapse (constipation, chronic cough) (Koelbl et al. 2013).

Although there have not been any proven effective strategies to reduce risk, it is reasonable to think that weight loss, reduction of heavy lifting, treatment of constipation, modification of

obstetric risk factors, and pelvic floor physical therapy may be effective in preventing the development or progression of pelvic organ prolapse.

4 Diagnosis

4.1 Patient History

As pelvic organ prolapse is rarely associated with significant morbidity or mortality, the most important principle in prolapse evaluation is assessing the degree of bother for the patient. The most effective strategy in managing prolapse is to allow the patient to express what aspect of the prolapse bothers her most. This allows the practitioner to tailor treatment plans to the patients' needs and wishes, rather than focusing on the anatomic outcomes that may or may not reflect successful treatment for the patient.

The most specific complaint of women with pelvic organ prolapse is the sensation of bulge or pressure in the vagina. This sensation may be difficult to distinguish from the sensation of pressure in the lower abdomen. Low abdominal pressure is often nonspecific, and, in the absence of vaginal pressure, is unlikely to be due to prolapse. Urinary, defecatory, and sexual symptoms are also common and should be evaluated in women with prolapse.

4.2 Physical Exam

Pelvic organ prolapse can almost always be evaluated completely with physical exam. Ancillary radiologic testing is rarely indicated. A comprehensive physical exam is indicated when considering any surgical intervention for pelvic organ prolapse. A complete evaluation should include: basic sensory testing, visual inspection of the external genitalia and cervix, bimanual and rectovaginal examination and visual assessment of prolapse with Valsalva. Additional testing for incontinence may be indicated in patients with urinary or fecal incontinence and some advocate testing for occult incontinence in women with prolapse considering surgical intervention.

4.3 Sensory Exam

Sensation to the vulva and perineum is primarily provided by the pudendal nerve, a branch of the S2–S4 nerve root. Intact sensation to the inner thigh and perineum to light touch and pinprick confirms function of the pudendal nerve to the cerebral cortex. The anal wink reflex or clitoral reflex requires an intact levator ani and pudendal nerves, as well as connection to the cerebral cortex. The anal wink may be checked by gently stroking perianally with the soft edge of a cotton swab; a positive test will result in contraction of the external anal sphincter. The clitoral reflex may be checked by gently squeezing the clitoris and looking for contraction of the pelvic floor. Both of these tests are specific but not sensitive, meaning that a positive test confirms intact nerves, but the absence of the reflex is not diagnostic of neurologic disruption.

4.4 Pelvic Exam

A careful speculum, bimanual, and rectovaginal exam is important to look for other etiologies of bulge in the vagina and to screen for cervical, vaginal, and vulvar cancers. The presence of prolapse does not increase the risk for any type of cancer, but prolapse may exist concomitantly with other gynecologic conditions, and these need to be ruled out.

Careful evaluation of the degree of prolapse must be documented for all patients with complaints of prolapse. The maximum amount of prolapse that can be elicited should be documented. This usually requires the patient to perform Valsalva or cough and may require the patient to stand in order to demonstrate the maximum descent of her prolapse. Often, it is appropriate to separate a speculum and use the lower half to

reduce the compartment not being evaluated. The posterior wall may be reduced in order to completely see and evaluate the anterior wall, and vice versa.

There are a variety of staging systems that have been proposed for prolapse. The most common are the Baden-Walker grading system and the Pelvic Organ Prolapse Quantification (POP-Q) staging system (Bump et al. 1996), which have been developed and endorsed by the International Continence Society and the International Urogynecological Association (Haylen et al. 2010).

The Baden-Walker grading system divides the vagina into three compartments: anterior, apical, and posterior. The anterior compartment consists of the upper vagina between the cervix and urethra and generally corresponds to the area just under the bladder and urethra. The apical compartment is the upper vagina and cervix, while the posterior compartment is the pelvic floor between the cervix and perineal body. Each compartment is considered separately and the maximum descent of each compartment evaluated. Prolapse in the upper half of the vagina is considered grade 1, in the lower half of the vagina is grade 2, coming out halfway is grade 3, and completely everted is considered grade 4 (Table 1). Such a grading system is easy to understand and remember and is often used by gynecologists to document the degree of prolapse (Baden and Walker 1992).

In an effort to further quantify prolapse and to describe and compare treatment outcomes, the POP-Q examination was developed. This technique is more complicated to learn, but is more quantitative and uses clear anatomic landmarks. It uses 9 points. All points of the POP-Q are measured in cm, relative to the hymen. Inside of the body are negative values, and outside of the body are measured as positive values. GH, PB, and TVL are measured at rest. The remainder of the points should be measured with the maximum prolapse elicited. Prolapse may be elicited with patient on Valsalva maneuver, with standing, or both (Table 2).

Table 1 Baden-Walker grading system for pelvic organ prolapse

Grade of Prolapse	Extent of prolapse in relationship to the hymen
Grade 0	Normal position for each respective site
Grade 1	Descent halfway to the hymen
Grade 2	Descent to the hymen
Grade 3	Descent halfway past the hymen
Grade 4	Maximum possible descent for each site

5 Complications of Prolapse

Significant complications from untreated pelvic organ prolapse are rare. The most common complications include vaginal abrasions, bleeding, and urinary retention. In rare cases, the prolapse may become so edematous that it is difficult or impossible to reduce – an incarcerated prolapse.

Vaginal abrasions or ulcerations with bleeding may be avoided with reduction of prolapse, either surgically or with pessary (Fig. 2). Vaginal abrasions related to atrophy may be treated with topical estrogen cream. Occasionally, the vaginal epithelium is so dry and irritated that additional treatment with Vaseline or vitamin A and D ointment is necessary.

Symptoms of urinary retention may be treated with reduction of prolapse. A recent study showed that in women with stage 3–4 prolapse, the prevalence of hydronephrosis was up to 55% (Dancz et al. 2015; Hui et al. 2011). Therefore, in women who decline intervention, it may be indicated to screen for retention with post-void residual, creatinine level, and renal ultrasound.

Prolapse that is traumatized, usually from a fall or other inadvertent harsh manipulation of the prolapse, may become edematous and irreducible. These may usually be reduced with adequate pain control and gentle, consistent pressure. The fundus must be gently aimed into the body in order to return the uterus to the pelvis.

Table 2 POP-Q staging system for pelvic organ prolapse

Aa – anterior wall 3 cm proximal to the urethral meatus (range, −3 to +3)	Ba – anterior wall Most distal part of the anterior wall	C – cervix or cuff Most distal descent of cervix/vaginal cuff
gh – genital hiatus Mid-urethral meatus to the posterior fourchette	pb – perineal body Posterior fourchette to the mid-anus	tvl – total vaginal length Greatest depth of the vagina when prolapse is reduced
Ap – posterior wall 3 cm proximal to the hymenal remnant (range, −3 to +3)	Bp – posterior wall Most distal part of the posterior wall	D – posterior fornix (omitted if there is no cervix)

Fig. 2 Pelvic organ prolapse with ulcerations (Photograph courtesy of Dr. Begüm Özel)

6 Nonsurgical Management of Prolapse

6.1 Pessary

Pessaries are devices of various shapes and sizes that are placed in the vagina to reduce pelvic organ prolapse and restore normal anatomy. Pessary use can be temporary or long term. It provides immediate relief from pelvic organ prolapse symptoms, but requires some maintenance. Long-term pessary use may be an alternative to surgery in women with multiple comorbidities or in women who prefer to avoid surgical risks (Culligan 2012). Pessary use has been shown to be as effective as surgery in improving patients' symptoms of prolapse including bowel complaints, bladder complaints, sexual function, and overall quality of life (Abdool et al. 2011).

6.1.1 Fitting of Pessary

The success of pessaries lies in a proper fitting. Pessaries can be successfully fitted 60–90% of the time (Clemons et al. 2004; Lone et al. 2011). When a pessary is successful at the 4-week point, most women continue to use a pessary at 5 years (Lone et al. 2011). When choosing a pessary, the provider needs to consider the stage of pelvic organ prolapse, the size of vaginal vault, and the ability of the patient to manage their own pessary. The goal is to find the smallest pessary that effectively treats their prolapse symptoms. Initial fitting may require a trial of several different pessary types and/or sizes to adequately and comfortably reduce their prolapse (Culligan 2012).

Ring with support pessaries (Fig. 3) is widely available and the most commonly used (Cundiff et al. 2000). The initial choice of pessary size should be based on the examiner's bimanual exam and appreciation of the width of the vaginal canal (Culligan 2012). Once the exam is performed, the provider should identify an appropriate size and shape pessary. The pessary should be placed by the provider and tested by the patient. Initial tests for correct sizing can be performed by having the patient cough or stand with the pessary in place. If it stays in place, then the patient should attempt a Valsalva maneuver while sitting. If the

Fig. 3 Ring with support pessary

pessary continues to remain in place with these measures and is comfortable, it is likely the correct size. The patient should also be able to ambulate and urinate with the pessary in place. Well-fit pessaries should not be felt by the patient.

Once a pessary is successfully fit, the patient should return for close follow-up. Typically the patient is given a return appointment in 1–2 weeks to make sure the pessary continues to comfortably reduce the patient's prolapse and allows for normal daily functions (Trowbridge and Fenner 2007). At this time, if the patient is uncomfortable or has lost the pessary with activity, this is an opportunity to change pessary size or type. This visit also provides a good opportunity to educate a motivated patient on how to remove and clean her pessary so that she can manage her pessary at home. Once a patient is comfortable and has learned to manage her pessary, she can then be followed every 3–6 months. She is instructed to remove and clean the pessary with soap and water approximately once a week. If the patient is comfortable, but cannot change her own pessary, she should be seen every 2–3 months for outpatient exchange by her provider (Culligan 2012; Trowbridge and Fenner 2007).

6.1.2 Types of Pessaries

There are two general categories of pessaries – support and space filling. Support pessaries typically sit between the pubic symphysis and posterior fornix. They reduce prolapse by elevating the superior vagina and often have perforations that allow the escape of vaginal secretions. Examples of support pessaries are the ring, ring with support, Gehrung, and Hodge. Space-filling pessaries work by elevating the prolapse and maintaining the normal anatomic position by creating a barrier within the vagina that is larger than the genital hiatus. The cube pessary (Fig. 4) may be used for refractory cases, as it stays in place by creating suction to the vaginal walls. A commonly used option is the Gellhorn pessary, (Fig. 5) which acts both as suction and barrier (Cundiff et al. 2000). A randomized crossover trial showed no difference in patient satisfaction or symptom relief from the ring versus Gellhorn pessary (Cundiff et al. 2007).

The ring with support pessary is relatively easy to place/remove and is well tolerated by patients (Cundiff et al. 2000). If the ring with support does not work, the next choice is typically the Gellhorn. If neither of these work, chances of successful prolapse management with pessary are unlikely (Culligan 2012). A variety of other pessaries may be used, each with slightly different features. Overall, these pessaries are typically more difficult for patients to manage (Culligan 2012; Trowbridge and Fenner 2007). The inflatoball (Fig. 6) is an option for women with stage 3 or 4 pelvic organ prolapse who desire the ability to manage their pessary at home. It is more easily placed and removed by the patient compared to a Gellhorn or donut pessary because it can be inflated after insertion and deflated prior to removal, though the stem does protrude from the vagina and may cause discomfort for the patient (Trowbridge and Fenner 2007).

Pessaries are generally made of surgical-grade silicone; therefore, patients with latex allergies may use them without concern. Over time, the silicone may develop some discoloration. The structural integrity of the pessary is not affected, and discolored pessaries may be used indefinitely. The inflatoball pessary (Fig. 6) is the only pessary that is made of rubber. The rubber material in the inflatoball pessary may absorb a slight odor, and the rubber may dry out over time. Inflatoball pessaries should be checked and replaced periodically.

Fig. 4 Cube pessary

Fig. 5 Gellhorn pessary

6.1.3 Complications

Reported complication rates from pessaries vary, but in a large study of over a thousand women, 88.5% had no complications (Hanson et al. 2006). The most commonly reported complications are vaginal discharge, vaginal ulcerations, and abrasions. It is normal for women to have increased vaginal discharge with a pessary in place, but there is concern for infection if they report itching, foul odor, or burning sensation. With a pessary in place, the vaginal flora is altered, and women are more predisposed to bacterial vaginosis (Alnaif and Drutz 2000). A vaginal wet prep will distinguish between bacterial vaginosis and physiologic discharge and should be used prior to administration of antibiotics. If the patient is bothered by the physiologic vaginal discharge, it may be alleviated by more frequent removal and cleaning of the pessary.

Vaginal ulcerations or abrasions due to local pressure effects are also common and typically occur if the pessary is left in place over time. Symptoms of vaginal ulcerations or abrasions include discharge, odor, and bleeding. If the patient can change it herself, the pessary may be removed for a few hours or overnight and replaced. At each follow-up visit, a speculum exam should be performed to evaluate for the presence of any ulcerations or abrasions. The patient should also be instructed to make an appointment if she notices any vaginal bleeding. Vaginal abrasions and ulcerations may be treated with removal of the pessary for a few weeks, and use vaginal estrogen cream on a daily basis for a short-term course (Clemons et al. 2004; Trowbridge and Fenner 2007). The patient should be followed regularly until the ulceration has resolved, and then the pessary may be replaced with continued use of vaginal estrogen cream two to three times a week (Trowbridge and Fenner 2007).

Another potential side effect of pessary is urinary incontinence. Typically, it is the reduction of prolapse and return of normal anatomic positioning of the urethra that may unmask occult incontinence or worsen existing incontinence. In cases with incontinence, a specific incontinence pessary (incontinence ring, incontinence dish, or incontinence dish with support) may be used. The incontinence pessaries have an additional knob to provide support at the urethrovesical junction (Trowbridge and Fenner 2007).

Severe complications with pessary are rare. Pessary impaction can occur if a pessary is in place for a prolonged period of time without removal. There have been case reports of severe complications from

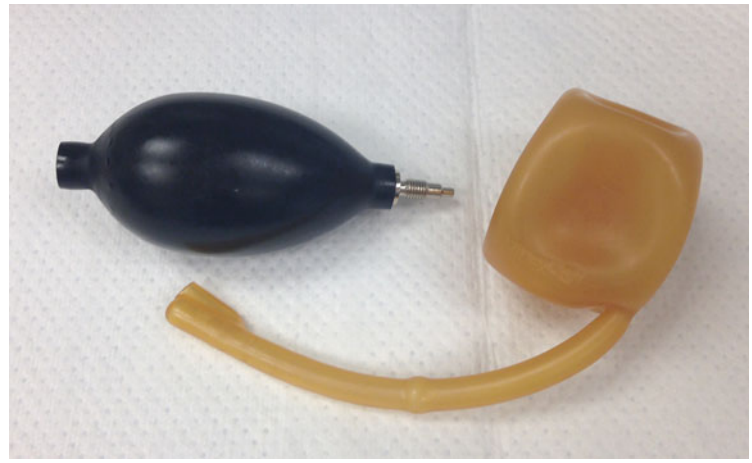

Fig. 6 Inflatoball pessary

pessaries, including impaction of or erosion into the urethra, rectum, or cervix (Figs. 7 and 8). Potential for compression of the urethra should be evaluated at pessary placement; anyone who cannot urinate should have the pessary removed and a smaller one placed. Obstructed voiding may lead to urinary retention, infection, and urosepsis (Wheeler et al. 2004). Rectal compression can lead to obstructed defecation or bowel obstruction (Roberge et al. 2001). Some pessaries are designed with a central space, through which the cervix may prolapse and become incarcerated (Thubert and Deffieux 2014). There are case reports of pessaries left in situ for years that then erode into the bladder or rectum (Arias et al. 2008; Rogo-Gupta et al. 2012).

These severe complications may be avoided with regular pessary removal and replacement. It is also reasonable to advise patients to confide in a family member or close friend of the presence of the pessary. In case of accident or incapacitation, someone should be aware the pessary should be removed at least once every 3 months.

7 Pelvic Floor Muscle Training

Pelvic floor muscle training has been suggested as management for mild to moderate prolapse. It consists of both sessions with a trained therapist to assess muscle strength and teach exercises for muscle strengthening and regimented exercise programs for the patient to complete at home. The goal of pelvic floor muscle training is to increase muscle volume and thereby diminish the size of the levator hiatus and provide improved structural support for the pelvic organs (Bø 2006). A prospective randomized trial demonstrated that with regimented pelvic floor muscle training over the course of 6 months, women with up to stage 3 pelvic organ prolapse were able to symptomatically and objectively improve their pelvic organ prolapse (Braekken et al. 2010). That study also demonstrated increased muscle thickness, elevated location of the bladder and rectum, and decreased hiatal size with the regimented exercises. Similar improvement in symptoms and reduction of prolapse have been reported in women with training as brief as 14 weeks with improved symptoms and up to stage 2 improvement of pelvic organ prolapse as measured by the POP-Q, though the majority showed no change or reduction of stage 1 of pelvic organ prolapse (Hagen et al. 2009; Stüpp et al. 2011). Limitations of this course of therapy are patient motivation and access to trained therapists.

8 Surgical Management

A variety of surgical treatments are available for pelvic organ prolapse. The choice of surgery depends on many factors including compartment of prolapse, severity of prolapse, patient health and overall treatment goals, prior surgeries, and

Fig. 7 Computed tomography (*CT*) of intravesical pessary demonstrating a Gellhorn pessary (*A*) located in the bladder (*B*) (Originally published in Rogo-Gupta L, Le NB, Raz S. Foreign body in the bladder 11 years after intravaginal pessary. Int Urogynecol J 2012; 23:1311–1313; with kind permission of © Springer Science+Business Media. All Rights Reserved)

Fig. 8 Intraoperative image of pessary (*A*) within the bladder (*B*) (Originally published in Rogo-Gupta L, Le NB, Raz S. Foreign body in the bladder 11 years after intravaginal pessary. Int Urogynecol J 2012; 23:1311–1313; with kind permission of © Springer Science+Business Media. All Rights Reserved)

surgeon preference. Graft or mesh augmentation may be considered in select cases. The surgical techniques used for pelvic organ prolapse can broadly be categorized by compartment: anterior, apical, and posterior.

9 Anterior Prolapse

The anterior compartment is the most common site of pelvic organ prolapse and the most difficult to repair. Anatomic and symptomatic outcomes after surgical repair are generally good, but when prolapse recurs, it is most commonly in the anterior compartment.

10 Anterior Colporrhaphy

The mainstay of surgical management of anterior prolapse is the anterior colporrhaphy (Fig. 9). During this procedure, a transverse incision is made at the apex of the anterior vagina (if concurrent hysterectomy is performed, then the anterior colpotomy site may be used). The anterior vagina is then put on traction using Allis clamps, to essentially evert the anterior wall (or ceiling of the vagina). Using Metzenbaum scissors, the anterior vaginal epithelium is undermined to separate it from the underlying muscularis. This epithelium is then incised in a linear fashion from the apex of the vagina to approximately 3–4 cm below the urethral meatus. Allis clamps or Pratt-Smith clamps may be placed on the cut edge of the epithelium, and the epithelium dissected off the underlying muscularis. This dissection is extended laterally to the pelvic sidewall. The underlying muscularis is then plicated with a series of U stitches of 0 polyglactin suture. These stitches should be placed along the junction of where the epithelium has been dissected off the muscularis, taking care that the tissue plicated is the muscularis and not the vaginal epithelium. While these sutures are tied down, the underlying prolapsed tissue is reduced. The result is a midline reduction of the anterior prolapse. The excess vaginal epithelium is then trimmed, and the epithelium is plicated in the midline using 2–0 polyglactin suture.

Studies on the success of prolapse repair are difficult to compare, as different outcomes are often reported. Symptomatic success does not necessarily require anatomic success, and often

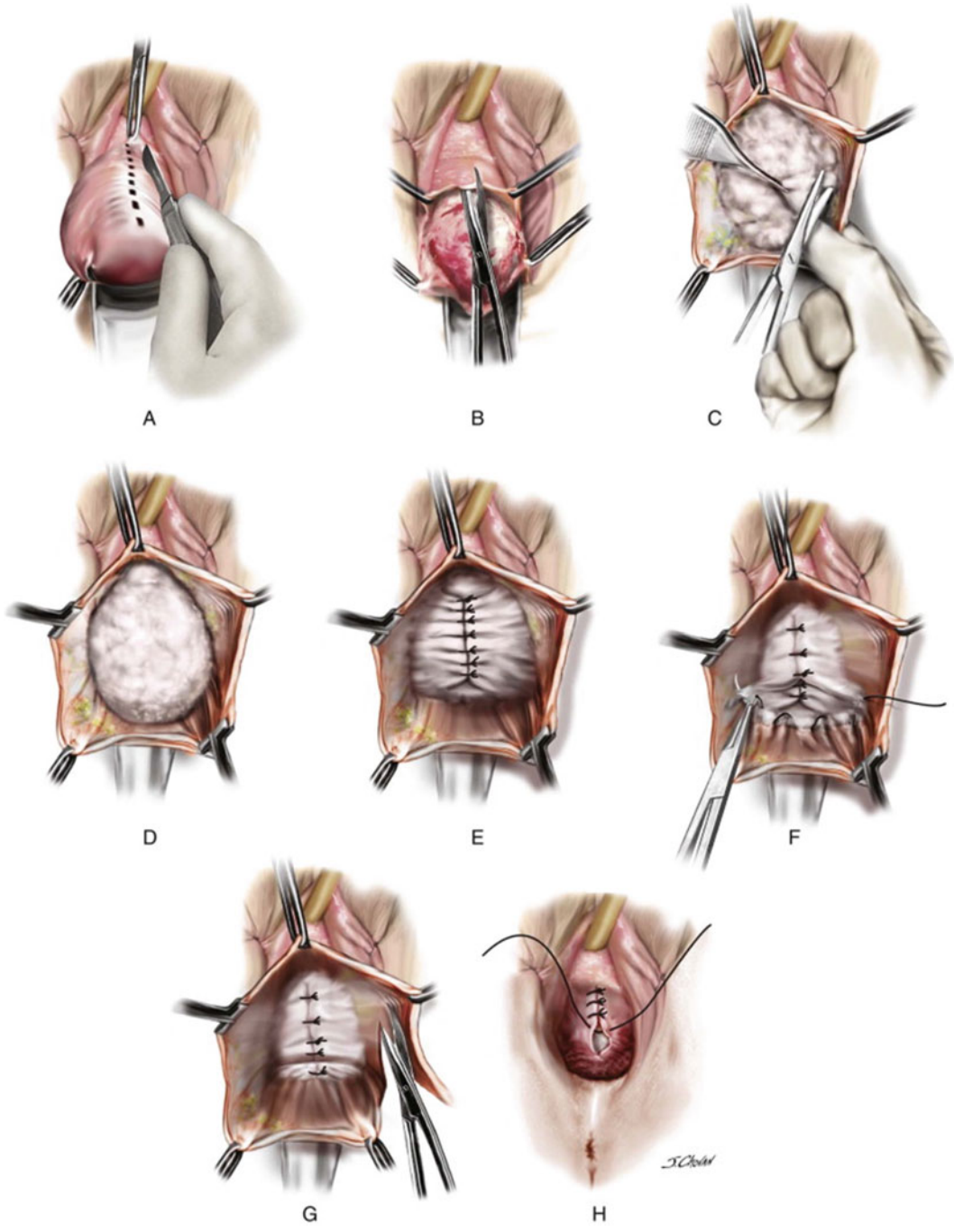

Fig. 9 Traditional anterior colporrhaphy. (**a**) Initial midline anterior vaginal wall incision. (**b**) Midline incision is extended. (**c**) Sharp dissection of the bladder off the vaginal wall. (**d**) The bladder has been mobilized off the vagina. (**e**) Initial plication layer is placed. (**f**) Second plication layer is placed. (**g**) Trimming of excess vaginal epithelium. (**h**) Closure of vaginal epithelium (Reprinted from Surgical Management of Pelvic Organ Prolapse, 1st Edition, Maher CF, Karram M. Surgical Management of Anterior Vaginal Wall Prolapse, p117–137, with kind permission from Elsevier)

both are reported as separate measures. In general, the reported success rates of anterior colporrhaphy range from 80% to 100% in retrospective series, though in prospective studies, the rates are much lower (30–55%) (Menefee et al. 2011; Nguyen and Burchette 2008; Weber et al. 2001).

Multiple procedures have been developed to try to improve anatomic and symptomatic outcomes of anterior colporrhaphy. Variations on the anterior colporrhaphy include the paravaginal (or ultralateral) repair, site-specific repair, anterior colporrhaphy with mesh augmentation, and anterior colporrhaphy with graft augmentation. Several studies have compared reoperation rates, as well as anatomic and symptomatic outcomes between these procedures. In general, anatomic outcomes are slightly better using mesh or graft augmentation, but the symptomatic outcomes and reoperation rates are the same between procedures (Maher et al. 2013).

10.1 Vaginal Paravaginal Repair

Some surgeons advocate an ultralateral approach to anterior colporrhaphy, referred to as a vaginal paravaginal repair (Fig. 10). The paravaginal repair is based on the theory that prolapse may be caused by a detachment of the underlying muscularis from its lateral attachments to the arcus tendineus fascia pelvis (ATFP). This technique involves opening the anterior vaginal wall, similar to the dissection used in a traditional anterior colporrhaphy as described above. The vaginal epithelium is dissected off the underlying muscularis farther laterally than for a traditional anterior colporrhaphy, and the paravaginal space is developed between the obturator internus muscle and the vaginal muscularis layer. This space is extended along the ischiopubic rami using palpation in order to identify the ischial spines and the ATFP. The ATFP runs between the pubic symphysis and the ischial spine on either side. The ATFP is palpated and then visualized using Breisky-Navratil retractors. Upon clear identification of the ATFP, three to six sutures of 0 polyglactin suture are placed through the ATFP. These sutures may be held if a concomitant anterior colporrhaphy or apical suspension is being performed. The sutures through the ATFP are then brought through the muscularis tissue close to the midline, so that the muscularis is brought up and laterally toward the ATFP. The stitch is then carried to the underside of the vaginal epithelium. This technique obliterates the paravaginal space and essentially brings the epithelium, the muscularis, and the ATFP into close approximation. The excess vaginal epithelium is trimmed, and the vaginal epithelium is reapproximated in the midline.

This technique has a high success rate (67–100%), which is tempered by complications including bilateral ureteric obstruction, retropubic hematomas, abscesses, and transfusion (Maher et al. 2013). This procedure may be performed abdominally or laparoscopically, but requires a high degree of surgical skill, and efficacy data is limited.

10.2 Site-Specific Repair

An additional variation of the anterior colporrhaphy is a site-specific repair. The concept behind this repair is that although some cases of anterior prolapse are due to complete separation of the muscularis from its lateral attachments, other cases of anterior prolapse are due to specific defects in the muscularis. When these defects are sought out and identified during anterior colporrhaphy, they should be repaired individually. A midline plication may be performed at the same time as a site-specific repair.

10.3 Graft and Mesh Augmentation

Due to the relatively high failure rates of prolapse repairs, there has been significant interest in augmenting repairs with synthetic or biologic materials. Although mesh and graft augmentation has been used with wide success in the hernia repair literature, vaginal augmentation has been more controversial. Generally, mesh or graft augmentation may be considered for patients who fail a native tissue repair.

The technique for the placement of synthetic mesh or biologic graft is essentially the same. Several companies have developed prefabricated meshes to fit the various vaginal compartments.

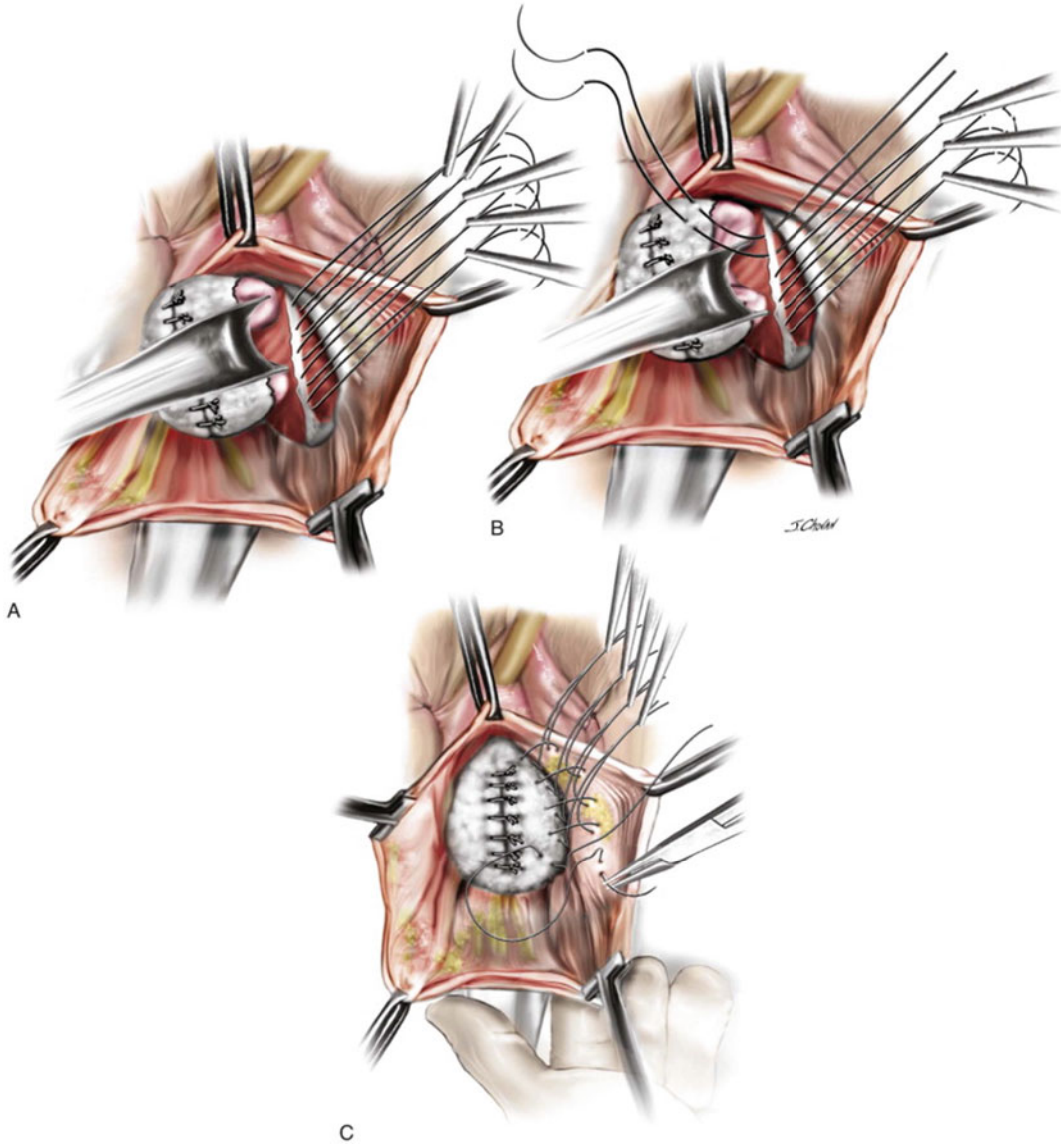

Fig. 10 Vaginal paravaginal repair. (**a**) Numerous sutures are passed through the arcus tendineus fascia pelvis (*white line*). (**b**) Each suture is passed through the edge of the detached fascia. (**c**) Each suture is passed through the vaginal wall excluding the epithelium (Reprinted from Surgical Management of Pelvic Organ Prolapse, 1st Edition, Maher CF, Karram M. Surgical Management of Anterior Vaginal Wall Prolapse, p117–137, with kind permission from Elsevier)

These mesh kits vary in size and shape of the mesh, as well as the introducer to fix the mesh to the vaginal tissues. Many of the kits use a trocar introducer to fix the apical portion of the mesh to the sacrospinous ligament, and the lateral or distal portion of the mesh may be sutured to the ATFP (as described above for a paravaginal repair) or may be trocar guided through the obturator space.

When a kit is not used, the mesh or graft may be cut to fit the patient's anterior vaginal wall. The vaginal wall is incised in the midline, taking care to dissect full thickness through the vaginal muscularis down to the bladder. This is in contrast

to the anterior colporrhaphy, where the vaginal epithelium is split from the underlying muscularis. After dissection of the epithelium and muscularis off the bladder, the graft/mesh is placed loosely under the tissue and sutured to the ATFP laterally. The overlying vagina is not trimmed and is then reapproximated in the midline.

10.4 Types of Grafts

10.4.1 Biologic Grafts

Biologic grafts may be used as an alternative to synthetic mesh grafts. Biologic graft options include:

Autograft – graft material is harvested from the patient herself. Generally it is taken from the rectus sheath or fascia lata. The use of autologous fascia has the advantage of lower risk of infection and host rejection. The size of the graft is generally 6–8 cm long and 4 cm wide. The harvest of an autologous fascial graft of this size may be associated with significant morbidity and is rarely used. It may be considered in patients with contraindications to mesh (Cormio et al. 2015).

Allograft – fascial material is harvested from donor or cadaveric tissue. Several small studies have demonstrated success rates ranging from 81% to 100%, with acceptable complication rates, though the only randomized controlled trial failed to show an improvement over traditional anterior colporrhaphy. Concerns regarding prior transmission and residual antigenicity resulting in host-graft reactions have limited the acceptance of allograft materials for prolapse repair.

Xenograft – Porcine dermis, porcine small intestine submucosa, bovine pericardium, or bovine dermis. Xenografts have been used in the anterior compartment with mixed results. One study retrospectively compared anterior colporrhaphy, porcine dermis, and polypropylene graft, with the porcine dermis significantly less effective than the other two treatments, with a 21% rate of vaginal extrusion of the porcine dermis. Other groups have found much better success rates, with graft extrusion rates of 1–17% (Maher et al. 2013). A Cochrane meta-analysis found that when graft was used to augment the anterior compartment, the objective failure rate was higher than when no graft was used (Maher et al. 2013).

Overall, some advocate biologic grafts as an alternative to synthetic mesh, although no subjective benefit has been reported by patients, and the complication rates are similar to synthetic meshes. Biologic grafts should be considered in patients who refuse synthetic meshes or those with contraindications to synthetic mesh. Synthetic mesh is contraindicated in patients who have had a prior mesh complication and those who desire future fertility (as the synthetic meshes do not stretch). Biologic grafts may be preferred to synthetic meshes in patients with impaired wound healing such as those with prior pelvic irradiation. Both meshes and grafts should be used with caution in patients with chronic pelvic pain, endometriosis, painful bladder syndrome, vulvodynia, and other vulvar pain disorders.

11 Transvaginal Mesh for Anterior/Apical Prolapse

Starting in 2004, a variety of prepackaged kits were introduced to augment prolapse repair in the vagina (Figs. 11 and 12). These kits use a variety of techniques to augment the anterior, apical, and posterior compartments. There is reasonable evidence to support that anatomic outcomes in the anterior and apical compartments are improved relative to native tissue repairs (Maher et al. 2013). However, there is no difference in patient subjective improvement, quality of life measures, or reoperation rates for prolapse. The improvement in anatomic outcomes comes at the cost of increased complications related to the mesh, with mesh erosion rates reported up to 25% (Maher et al. 2013). The consequences of mesh

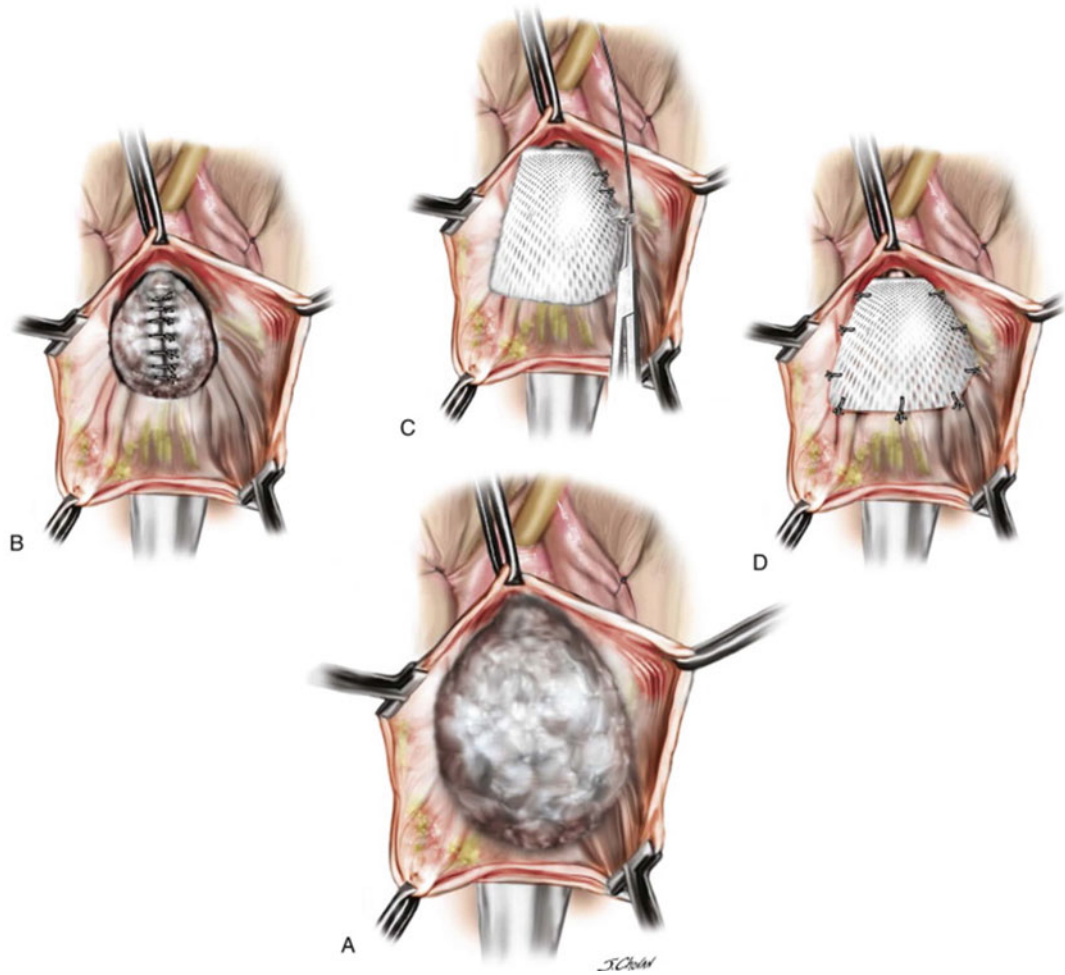

Fig. 11 Mesh augmentation of anterior wall prolapse repair. (**a**) Anterior prolapse is visualized. (**b**) Midline plication is completed. (**c**–**d**) Self-styled mesh is sutured in place (Reprinted from Surgical Management of Pelvic Organ Prolapse, 1st Edition, Maher CF, Karram M. Surgical Management of Anterior Vaginal Wall Prolapse, p117–137, with kind permission from Elsevier)

complications can be significant and often result in reoperation. These findings prompted the FDA to release an alert about transvaginal mesh placement in 2011. The alert essentially states that mesh may improve outcomes, but the complications in most cases outweigh the benefits. However, it is important to note that no transvaginal mesh has been recalled and that in selected patients who are appropriately counseled, transvaginal mesh augmentation may be preferred to more invasive, abdominal procedures.

11.1 Concomitant Hysterectomy

The role of concomitant hysterectomy for anterior prolapse is controversial. The uterus, if normal and not significantly prolapsed, may be left in situ during anterior colporrhaphy. However, anterior prolapse rarely occurs in isolation and is most commonly associated with apical (uterine) prolapse. Support of the apex is important to creating a durable and effective repair of the anterior wall (Hsu et al. 2008; Rooney et al. 2006). Many of the

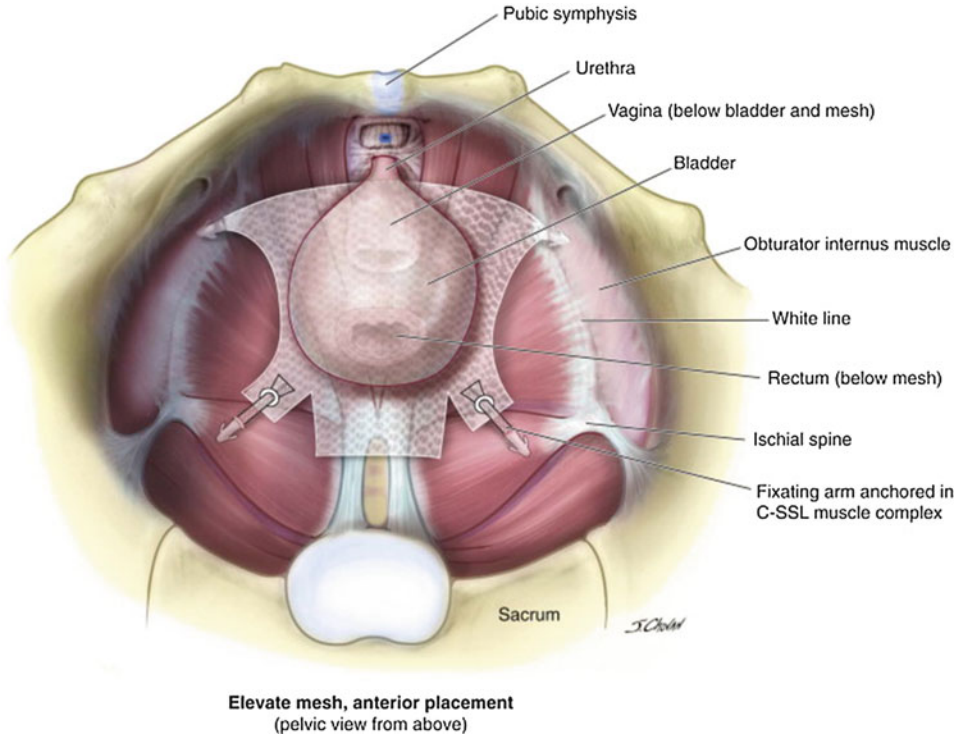

Fig. 12 Transvaginal mesh kit for anterior/apical prolapse. The elevate incisionless mesh (American Medical Systems) is bilaterally anchored to the sacrospinous ligament and obturator internus muscle near the distal end of the arcus tendineus fascia pelvis (Reprinted from Surgical Management of Pelvic Organ Prolapse, 1st Edition, Maher CF, Karram M. Surgical Management of Anterior Vaginal Wall Prolapse, p117–137 (2013); with kind permission from Elsevier)

apical suspension techniques described below can be adapted to leave the uterus in situ. The decision to remove the uterus must be approached by the physician in consultation with the patient and take into account the patient's comorbidities, degree of prolapse, and preferences, as well as the surgeon's experience with the surgical procedures.

12 Apical Prolapse

Apical prolapse includes descent of the uterus and the vault after prior hysterectomy. Apical prolapse repairs generally have good results, and there are a variety of approaches to apical prolapse. Apical repairs can broadly be categorized into vaginal, abdominal, and obliterative approaches. Abdominal repairs may be performed via laparotomy, laparoscopy, or robotically.

13 Vaginal Approach for Apical Prolapse

13.1 Mayo/McCall Culdoplasty

One of the most common procedures for apical suspension, the Mayo/McCall culdoplasty, is often performed at the time of vaginal hysterectomy for non-prolapse indications. There are a number of variations, but there are several key steps to the Mayo/McCall culdoplasty (Fig. 13). After removal of the uterus, the vaginal cuff is examined for hemostasis. The vaginal cuff is transfixed to the cut edges of the uterosacral ligaments in order to suspend the cuff within the vagina. One to three sutures are placed through the uterosacral ligament as high as possible. Sequential bites are taken superficially across the peritoneum overlying the rectum until the opposite uterosacral

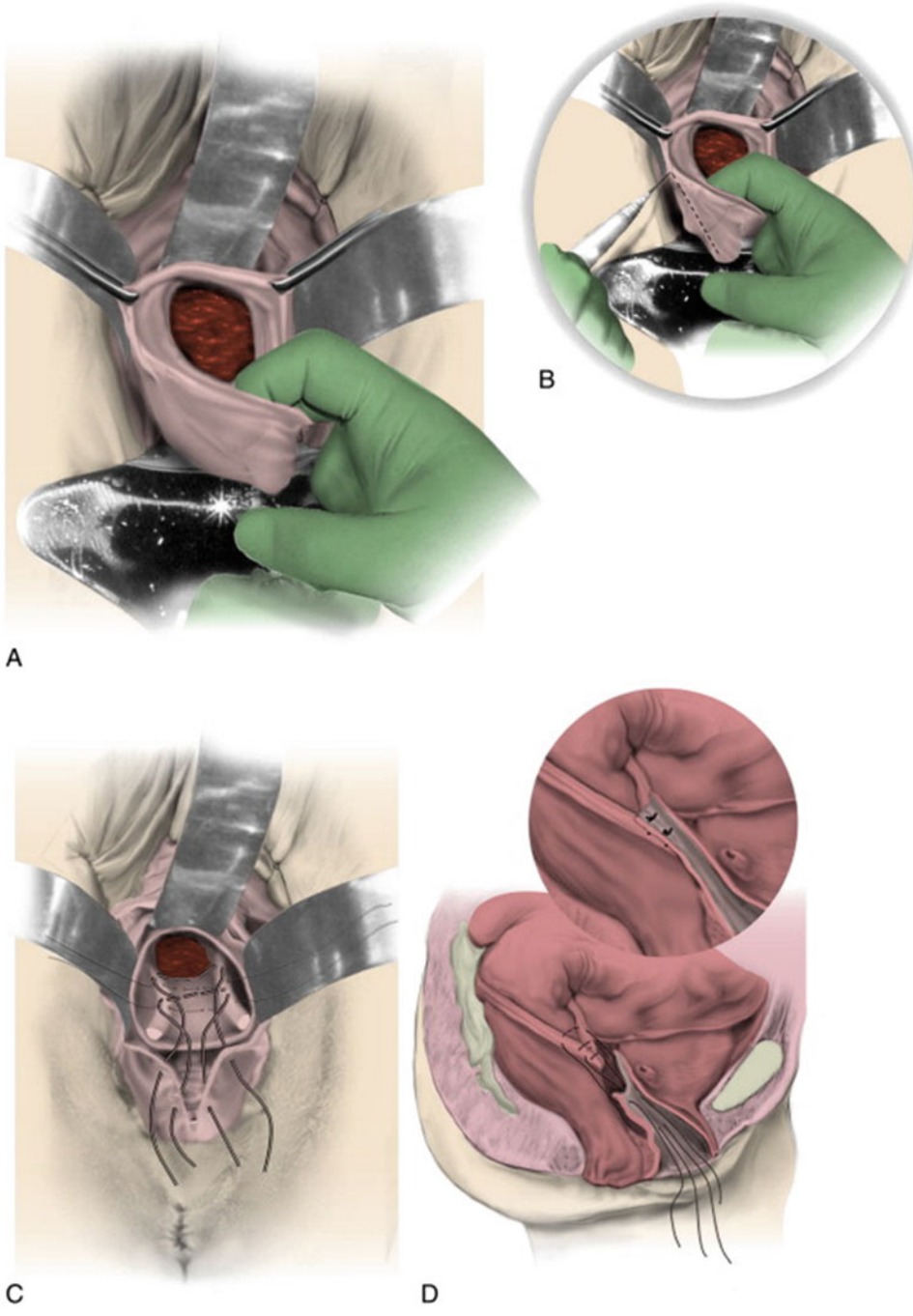

Fig. 13 Modified McCall culdoplasty. (**a**) The cul-de-sac is palpated and excessive peritoneum and posterior vaginal wall are noted. (**b**) A wedge of tissue (*dotted line*) is excised to decrease the caliber of the upper portion of the posterior vaginal wall. (**c**) External McCall stitches are placed in the traditional fashion. (**d**) Tying these sutures obliterates the cul-de-sac, supports the vaginal cuff, and increases posterior vaginal wall length (Reprinted from Urogynecology and reconstructive pelvic surgery, 4th Edition, Karram MM, Ridgeway BM, Walters MD. Surgical treatment of vaginal apex prolapse, p360–382. (2015); with kind permission from Elsevier)

ligament is sutured. When tied down, the uterosacral ligaments are plicated in the midline, and the posterior cul-de-sac is obliterated. Variations on this procedure are commonly performed, but outcome data is limited. The few retrospective studies available show success rates of up to 85%, with reoperation rates ranging from 0% to 14% (Barber and Maher 2013).

14 Uterosacral Ligament Suspension

14.1 Technique

Much of the support of the uterus comes from the cardinal/uterosacral ligament complex (Level 1 support). Uterosacral ligament suspension uses the patient's own ligaments to suspend the vaginal cuff above the level where the uterus has been amputated (Fig. 14). After the uterus is removed, the cuff is examined for hemostasis (if hysterectomy is not performed, the vaginal apex is grasped and incised). The ischial spines are identified and palpated intraperitoneally. The cut edge of the uterosacral ligament is grasped with Allis clamps on either side (at approximately 5:00 and 7:00 on the clockface). Traction allows for palpation of the uterosacral ligaments. Several sutures of permanent or delayed absorbable suture are placed through the uterosacral ligament at the level of the ischial spine. This procedure is repeated on the opposite side. The distal edge of the uterosacral ligaments is then plicated in the midline to obliterate the cul-de-sac. The highest delayed absorbable suture is placed full thickness through the posterior vaginal wall. If necessary, an anterior colporrhaphy may be performed. The vagina is trimmed and closed with 0 or 2-0 absorbable suture. After closure of the vagina, the uterosacral sutures are tied down on either side with suspension of the vault. Abdominal and laparoscopic approaches to this procedure have also been described.

14.2 Outcomes and Complications

Outcomes after uterosacral ligament suspension are generally good, with anatomic success ranging from 81% to 98%, and symptomatic improvement in 82–100% of patients (Margulies et al. 2010). In a recent large, prospective, randomized, controlled trial, the composite outcome of anatomic success and subjective success and lack of reoperation were reported to be 59.2% (Barber et al. 2014). The most commonly identified complication is ureteral injury or kinking, which should be looked for and identified intraoperatively. Ureteral kinking can be managed by removal of the offending suture and usually requires no further intervention. The incidence of ureteral injury or kinking ranges from 1% to 11% (Margulies et al. 2010) with most studies reporting a low incidence. However, intraoperative cystoscopy is highly recommended to ensure ureteral patency.

15 Sacrospinous Ligament Fixation

15.1 Technique

The sacrospinous ligaments extend from the ischial spines to the lower portion of the sacrum and coccyx and should be palpated prior to initiation of the procedure. The vagina is typically fixed unilaterally to the sacrospinous ligament, though bilateral fixations have been described. The posterior vaginal wall is incised in the midline and the vaginal epithelium dissected off the rectovaginal fascia. If an enterocele is encountered, it should be dissected off the posterior vaginal wall and closed with a high purse-string suture. The dissection of the epithelium off the rectovaginal fascia is extended laterally to identify the arcus tendineus fascia pelvis. The perirectal space is identified in this area by using blunt or sharp dissection and by mobilizing the rectum medially. The ischial spine is identified, and the

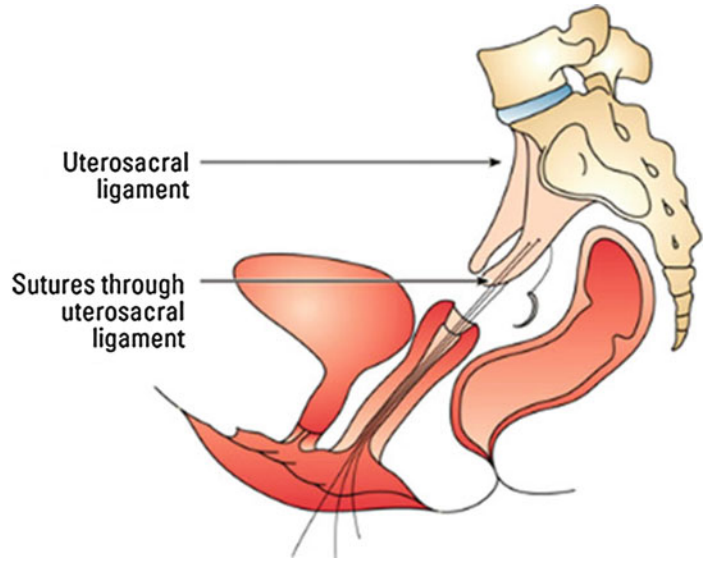

Fig. 14 Uterosacral ligament suspension. The vaginal cuff is fixed to the cut uterosacral ligaments on either side at the level of the ischial spines (Originally published in Cvach K, Dwyer P. Surgical management of pelvic organ prolapse: abdominal and vaginal approaches. World J Urol 2011;30 (4):471–7; with kind permission of Springer Science+Business Media. All Rights Reserved)

sacrospinous ligament is palpated dorsal and medial to the ischial spine. Once the ligament is identified, a rectal exam should be performed to confirm that no inadvertent injury has occurred. A suture is then passed through the sacrospinous ligament. The position of the ligament makes this suture passage difficult, and a variety of instruments have been designed to facilitate passage of the suture through the sacrospinous ligament. Commonly used techniques include the long-handled Deschamps ligature carrier, the Miya Hook, or proprietary instruments such as the Capio Suture device (Boston Scientific) (Figs. 15 and 16) or the Nichols-Veronikis ligature carrier (Cooper).

15.2 Outcomes and Complications

Overall, outcomes for sacrospinous ligament fixation are similar to uterosacral ligament suspension. A large randomized trial compared the two and found no significant difference in composite outcome of 60.5% at 2 years (composite outcome combines: anatomic success and subjective success and no reoperation) (Barber et al. 2014). The most commonly reported complication of sacrospinous ligament fixation is buttock pain, which is seen in 12.4% of cases (Barber et al. 2014). Such pain is usually self-limiting and should resolve completely by 6 weeks postoperatively. Additional rare but serious intraoperative complications have been reported, including hemorrhage (0.2%) and rectal injury (0.4%) (Sze and Karram 1997). Hemorrhage may result from laceration of the inferior gluteal vessels, the hypogastric venous plexus, or the internal pudendal vessels. If a rectal injury occurs, it can usually be repaired transvaginally.

16 Alternative Vaginal Approaches

Several procedures have been described for the suspension of the vaginal vault, with or without hysterectomy. The most notable of which are the levator myorrhaphy and the iliococcygeus fascial suspension.

The technique for the levator myorrhaphy involves a wide plication of the levator muscles and fixation of the vaginal cuff to the plicated

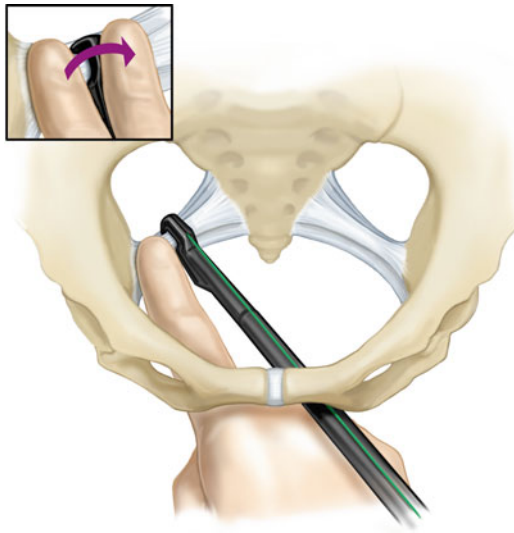

Fig. 15 Suture device for sacrospinous ligament fixation. The sacrospinous ligament is palpated at the level of the ischial spine. The suture device is placed medial to the operator finger, and the suture is passed through the ligament (Image reproduced with kind permission from Boston Scientific)

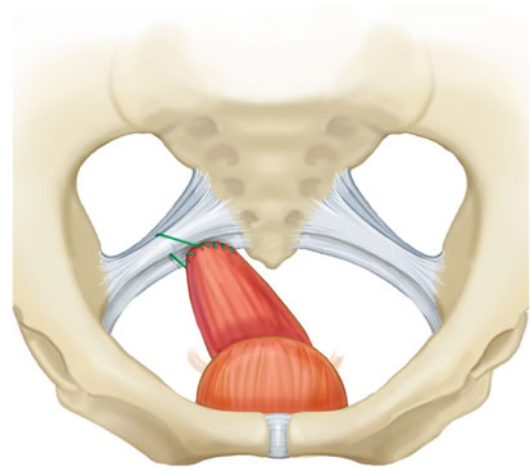

Fig. 16 Sacrospinous ligament fixation. The apex of the vagina is fixed unilaterally to the sacrospinous ligament (Image reproduced with kind permission from Boston Scientific)

muscles (Francis and Jeffcoate 1961). Packing is placed in the rectum to avoid narrowing of the rectum. Comparative studies to uterosacral ligament suspension have shown no difference in anatomic success or subjective outcomes; however, the total vaginal length was shorter after levator myorrhaphy (7.9 vs. 8.9 cm, $p = 0.04$) (Natale et al. 2010).

Iliococcygeus fascial suspension is also known as the Inmon technique (Inmon 1963). It is used to suspend the vaginal apex to the iliococcygeus fascia just below the ischial spine. The initial studies describing the procedure reported a case series of 152 patients. In that initial series, four intraoperative complications occurred (one rectal and one bladder laceration and two cases of hemorrhage requiring transfusion) (Shull et al. 1993; Meeks et al. 1994).

Retrospective reviews have shown that iliococcygeus fascial suspension is similar in outcomes to abdominal procedures and sacrospinous ligament fixation (Barber and Maher 2013). However, there are no randomized trials that evaluate this technique.

17 Abdominal Approach to Apical Prolapse

17.1 Sacral Colpopexy

Sacral colpopexy has been shown to be effective and durable for the correction of apical prolapse. Traditionally, sacral colpopexy is performed via laparotomy; however, laparoscopic and robotic approaches are also commonly used.

Regardless of approach, the basic steps of the procedure stay the same (Fig. 17). The peritoneal cavity is entered, and if indicated, hysterectomy is performed and the cuff is closed. The vagina is elevated using a sponge stick, probe, or end-to-end anastomosis sizer. The bladder is dissected off of the anterior vagina. Attention is then turned to the posterior vagina, and the peritoneum over the posterior wall is incised and dissected off of the vaginal tissue for several centimeters on either side. The mesh is trimmed to fit the anterior and posterior vaginal walls and transfixed using three to six stitches of nonabsorbable suture. Sutures are placed full thickness through the fibromuscular layer of the vagina, but not through the vaginal epithelium. The mesh is placed such that it reaches approximately two-thirds of the way down the

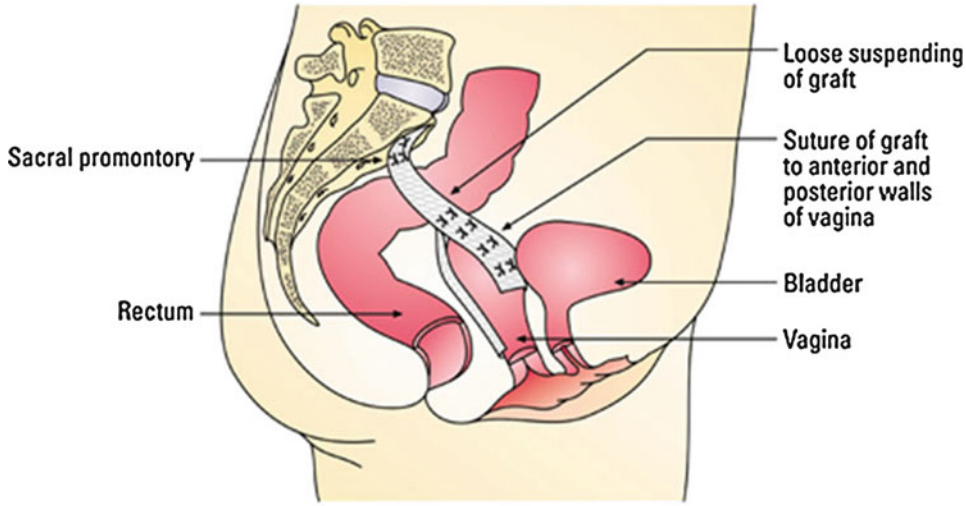

Fig. 17 Abdominal sacral colpopexy. The vaginal cuff is fixed to the anterior longitudinal ligament over the sacral promontory, using a piece of mesh or graft (Originally published in Cvach K, Dwyer P. Surgical management of pelvic organ prolapse: abdominal and vaginal approaches. World J Urol 2011;30(4):471–7; with kind permission of Springer Science+Business Media. All Rights Reserved)

anterior vagina, and a separate piece is placed at least halfway down the posterior vaginal wall. The two meshes are then sutured together above the cuff. The cul-de-sac is then obliterated using a Halban or Moschcowitz procedure.

Attention is then turned to the sacral promontory. The sigmoid colon, right ureter, aortic bifurcation, and common iliac vessels should be identified. The peritoneum over the sacral promontory is incised longitudinally and the underlying fatty tissue dissected off of the promontory. The middle sacral artery and vein should be identified at this step. The mesh is then transfixed to the anterior longitudinal ligament using two to three stitches of nonabsorbable suture. The mesh should be tensioned to avoid undue traction on the vagina. The peritoneum is then closed over the mesh.

Additional procedures at the time of sacral colpopexy may be indicated. A large randomized controlled trial showed that the addition of Burch urethropexy at the time of open sacral colpopexy reduced the rate of postoperative stress incontinence at 2 years from 57% to 37% in women who did not have stress incontinence preoperatively (Brubaker et al. 2008). As apical prolapse rarely occurs in isolation, repair of posterior prolapse may also be indicated at the time of colpopexy.

Outcomes and Complications

The success rate of abdominal sacral colpopexy for apical suspension ranges from 78% to 100% (Barber and Maher 2013). Over time, anatomic and subjective success rates tend to decrease, as prolapse tends to recur between 2 and 7 years (Nygaard et al. 2013). Severe intraoperative complications specific to colpopexy are rare and include hemorrhage from the sacral vascular plexus; complications from laparotomy may include enterotomy, ureteral damage, cystotomy, and wound infections.

The most common long-term complications after sacral colpopexy include recurrent prolapse, de novo stress incontinence, and mesh exposure. The median reoperation rates are 4.4% for recurrent prolapse, 4.9% for postoperative stress incontinence, and 3.4–5.1% for mesh exposure (Nygaard et al. 2004, 2013).

Abdominal Uterosacral Ligament Suspension

The abdominal approach to the uterosacral ligament suspension involves the same principles as the vaginal approach as described previously. The remnants of the uterosacral ligament are identified

and tagged at the level of the ischial spines. The ureters are identified, and the uterosacral ligaments are fixed to the vaginal cuff using permanent or delayed absorbable sutures.

17.2 Obliterative Procedures

All of the above procedures focus on reconstructing the vagina. An alternative approach is to obliterate the vagina. This approach may be considered in women who are no longer sexually active and do not have plans to have vaginal intercourse in the future. Obliterative procedures may be performed for post-hysterectomy vault prolapse or for uterovaginal prolapse (colpectomy/colpocleisis). The uterus may be left in situ (LeFort colpocleisis) or removed. Even with removal of the uterus, these procedures offer a relatively quick operative time, low risk of morbidity, and high rate of success.

17.3 Technique/Considerations

As these procedures are generally performed on older women with multiple comorbidities, the focus of the preoperative evaluation should be on optimization of their functional status and control of their comorbidities. These patients should be carefully counseled on the procedure and the permanent loss of access to the vagina for sexual function. When the uterus is to be left in situ, these patients should be carefully screened for risk factors for endometrial and cervical pathology. They should be screened for postmenopausal vaginal bleeding and consider a pelvic ultrasound to evaluate the endometrium. Cervical cytologic screening should be up to date and negative.

17.4 Total Colpectomy/Colpocleisis

Total colpocleisis refers to the removal of the vaginal epithelium (Fig. 18) within the hymenal ring posteriorly to within 0.5–2 cm of the external urethral meatus anteriorly (FitzGerald et al. 2006). Generally, the vaginal tissue is grasped and everted. The vaginal epithelium is excised in strips from the underlying vaginal muscularis. The muscularis is then inverted using a series of purse-string stitches. Once the prolapse is reduced, an aggressive perineorrhaphy and/or levator plication is performed. The anterior and posterior epithelia are sutured together with closure of the vagina.

17.5 Partial/LeFort Colpocleisis

A partial colpocleisis refers to when portions of the vaginal epithelium are left in place (Fig. 19). The LeFort modification is when the uterus is left in situ, and the epithelium is reconstructed in a manner to leave channels, through which vaginal discharge or blood can escape. The procedure is started by grasping the cervix and applying gentle traction. Rectangle sections are marked on the anterior and posterior vaginal walls; these are the areas to be denuded. The uterus is then reduced, and the cut edges of the remaining epithelium above and below the cervix are sewn together using interrupted sutures, such that the epithelium is inverted and it creates a tunnel in front of the cervix. A urinary catheter may be placed in this tunnel to ensure it is adequate and patent. The plication sutures are then continued laterally on either side to create lateral channels. As these sutures are placed, the prolapse is gradually reduced until it is entirely within the body. The final sutures may be placed at the level of the hymenal ring. The anterior and posterior epithelia are then reapproximated, using care to leave the lateral channels open. As above, an aggressive perineorrhaphy and levator plication are often performed to augment this repair (Evans et al. 2015).

Multiple studies have shown low rates of prolapse recurrence, high rates of patient satisfaction, and low rates of regret in appropriately counseled patients. Major complications of these procedures tend to be related to the performance of procedures on the elderly (cardiac, pulmonary, and cerebrovascular complications) and occur at a rate of

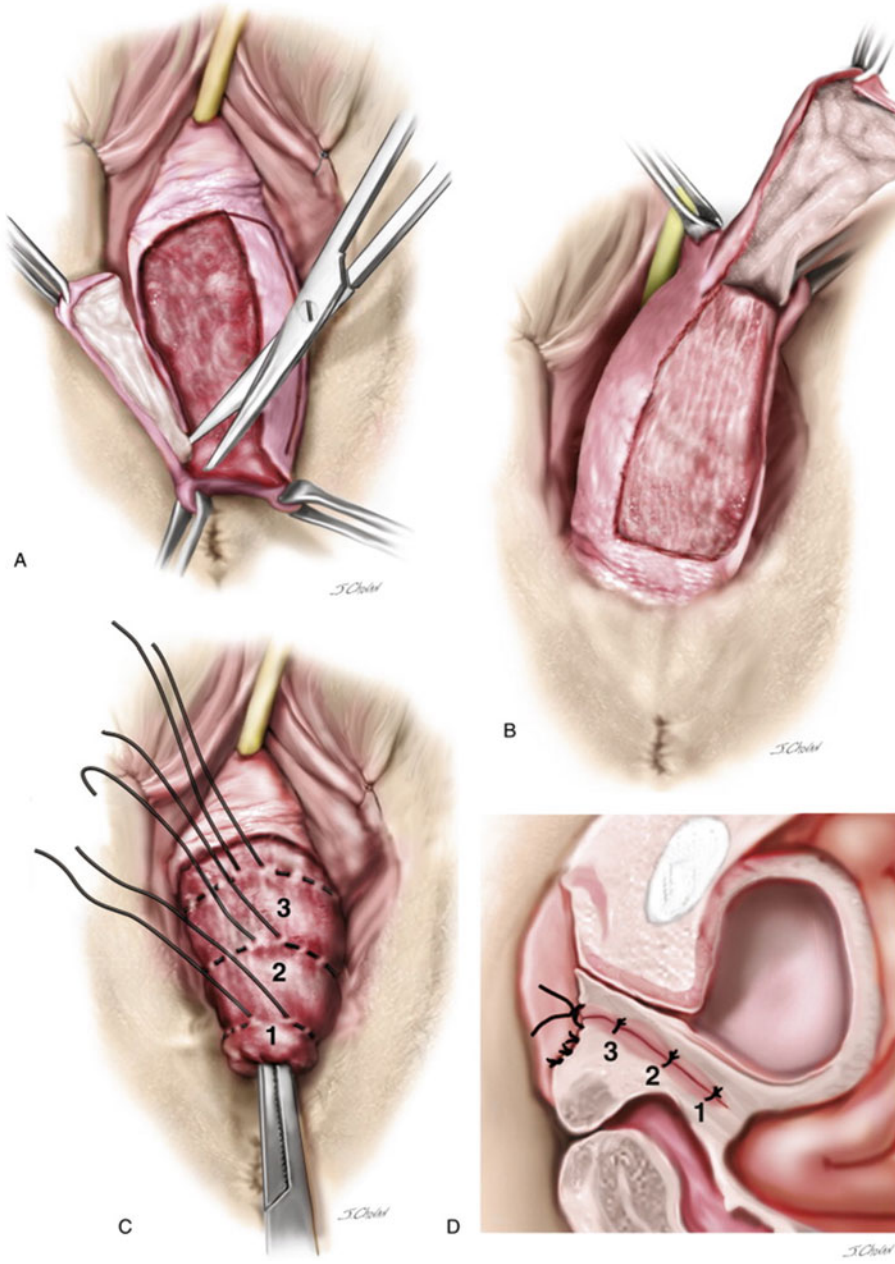

Fig. 18 Total colpectomy/colpocleisis. (**a**, **b**) The vagina is circumscribed and marked into quadrants. Each quadrant is removed by sharp dissection. (**c**) Purse-string sutures are placed; the leading edge is inverted by the tip of the forceps. Purse-string sutures are tied 1 before 2 and 2 before 3, with progressive inversion of the tissue. (**d**) The final relationship is shown in cross section (Reprinted from Urogynecology and reconstructive pelvic surgery, 4th Edition, Evans J, Silva WA, Karram MM. Obliterative procedures for pelvic organ prolapse, p400–410 (2015); with kind permission from Elsevier)

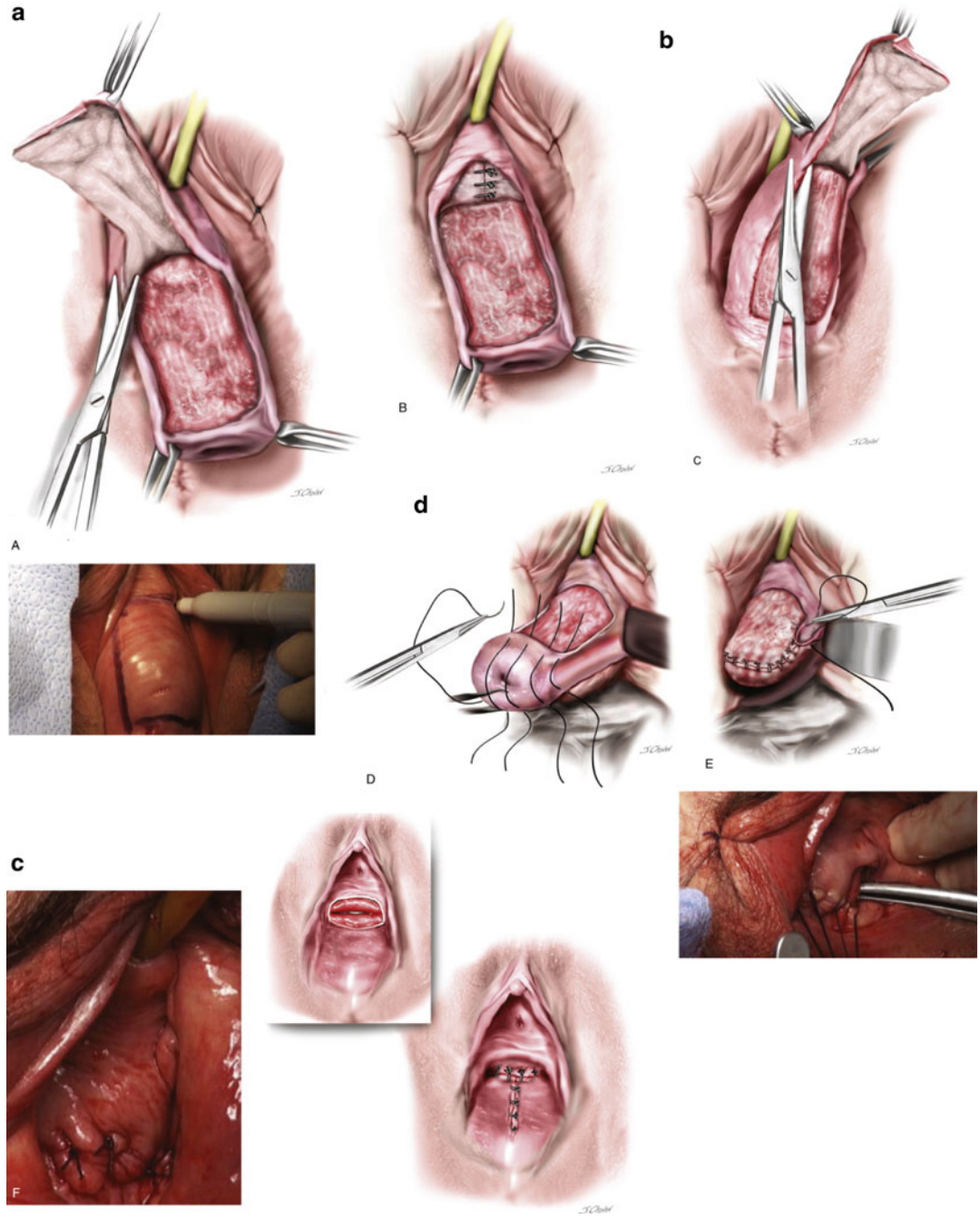

Fig. 19 LeFort colpocleisis. (**a**) A rectangular piece of the vagina has been removed. (**b**) A similar rectangular piece of the posterior vagina has been removed. (**c**) The cut edge of the interior incision is sewn to the distal cut edge of the posterior incision. Once the cervix is inverted, the sutures are continued up the lateral edges of the incisions on either side. (**d**) The entire vagina is inverted and the proximal incisions are sewn together horizontally. Note: draining channels are left in the lateral portions of the vagina to allow drainage of cervical discharge or uterine bleeding (Reprinted from Urogynecology and reconstructive pelvic surgery, 4th Edition, Evans J, Silva WA, Karram MM. Obliterative procedures for pelvic organ prolapse, p400–410 (2015); with kind permission from Elsevier)

approximately 2% (FitzGerald et al. 2006). Specific complications of the procedure include hemorrhage and pyelonephritis and appear at a rate of about 4%.

18 Posterior Prolapse

Women with symptomatic pelvic organ prolapse often have defects of the posterior vaginal wall. One study found that in women undergoing surgery for prolapse, 40% had posterior vaginal wall defects (Olsen et al. 1997). The posterior vaginal wall must usually be addressed separately from an anterior or apical suspension.

18.1 Technique

The traditional repair for posterior vaginal wall defects is the posterior colporrhaphy (Fig. 20). Two Allis clamps are placed on the perineum, which is then incised in a transverse fashion. If a perineorrhaphy is to be included, an inverted triangle of the skin is removed from the perineal body. The posterior vaginal wall is placed on gentle tension, and the vaginal epithelium is undermined using the Metzenbaum scissors up to the apex of the rectocele. The edges of the incision are grasped, and the epithelium is dissected off the underlying rectovaginal fascia bilaterally to expose the lateral attachments to the levator ani muscles. At this point, a traditional midline plication or a site-specific repair may be performed.

18.1.1 Midline Plication

The rectovaginal fascia is plicated in the midline with interrupted sutures, starting proximally and progressing toward the hymenal ring. Placement of these sutures should incorporate good purchase of the fibromuscularis and should be placed close to the junction with the epithelium to avoid injury to the rectum. The redundant vaginal epithelium is trimmed and the incision closed in a running, locked fashion. The caliber of the vagina at the end of the procedure should allow three fingerbreadths to fit comfortably.

18.1.2 Site-Specific Repair

The operator finger is placed in the rectum, and specific, palpable, or visual defects are repaired using interrupted, delayed, absorbable sutures (Fig. 21). If diffuse attenuation of the fascia is identified, a site-specific repair may not be technically feasible, and a midline plication is preferred. The redundant vaginal epithelium is trimmed and the incision closed in a running, locked fashion.

18.1.3 Graft or Mesh Augmentation

A posterior colporrhaphy may be augmented using graft or mesh. The material is cut to fit the space and sewn with permanent suture to the rectovaginal fascia at the level of the attachment to the levator ani muscles on either side. If the patient is undergoing a concomitant apical suspension, the graft may be fixed to the apical support sutures. The distal end is sutured to the perineum using absorbable sutures. The epithelium is then closed over the graft or mesh.

18.2 Outcomes and Complications

Traditional midline plication has success rates ranging from 76% to 97%. The most common complication of posterior colporrhaphy is dyspareunia. Postoperative dyspareunia is found in 11–27% after traditional posterior colporrhaphy, with de novo dyspareunia reported in 4–16% (Arnold et al. 1990; Lopez et al. 2001; Mellgren et al. 1995; Maher 2004). A three-way randomized controlled trial comparing traditional colporrhaphy to site-specific repair to porcine-derived graft showed that traditional colporrhaphy and site-specific repair had similar anatomic and functional outcomes. Porcine-derived graft augmentation resulted in improvement in symptoms similar to the other methods, but graft augmentation had significantly greater anatomic failures than the other two techniques (Paraiso et al. 2006). Graft augmentation may be considered in selected patients who have failed primary native tissue repair, with adequate preoperative counseling.

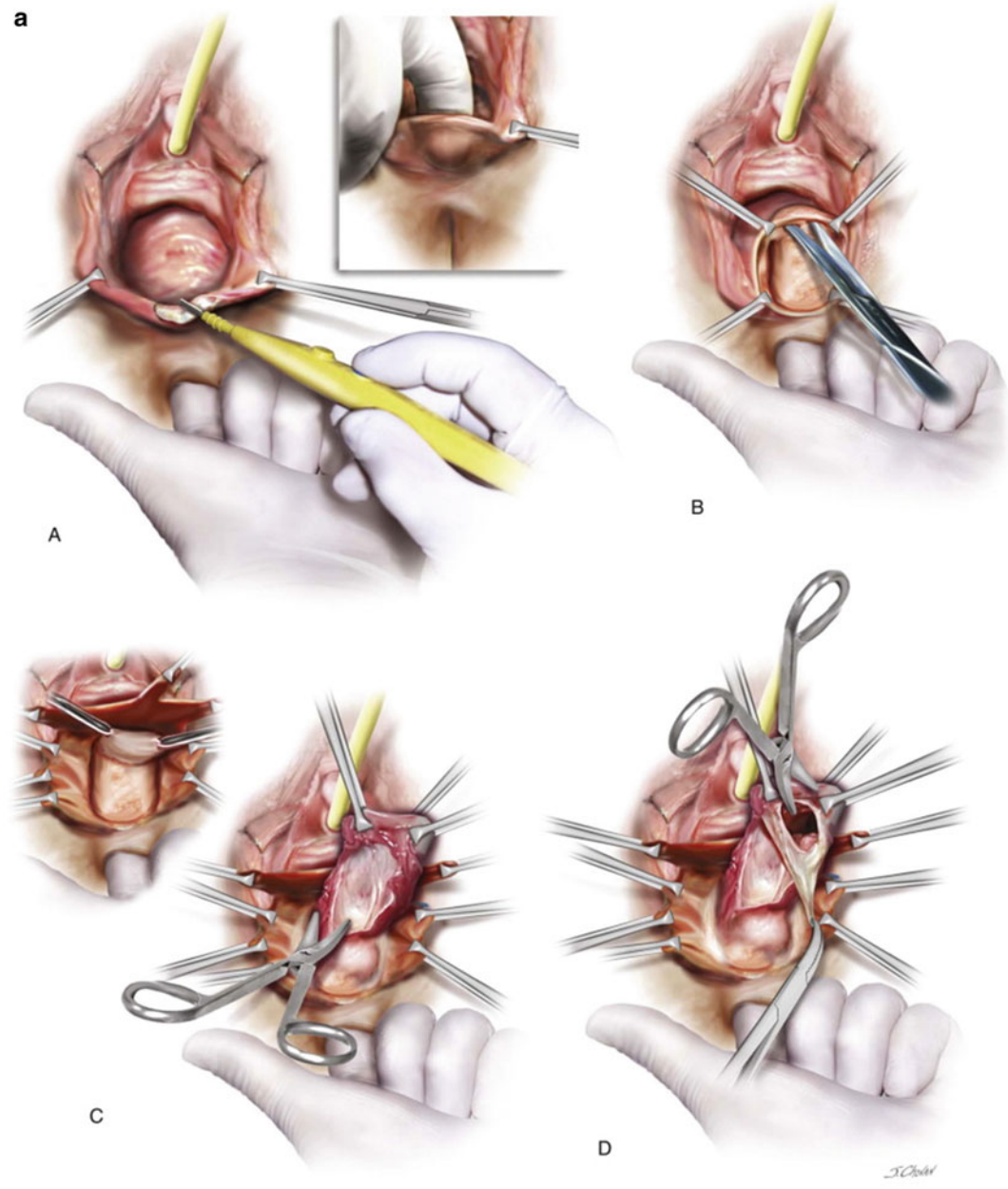

Fig. 20 (continued)

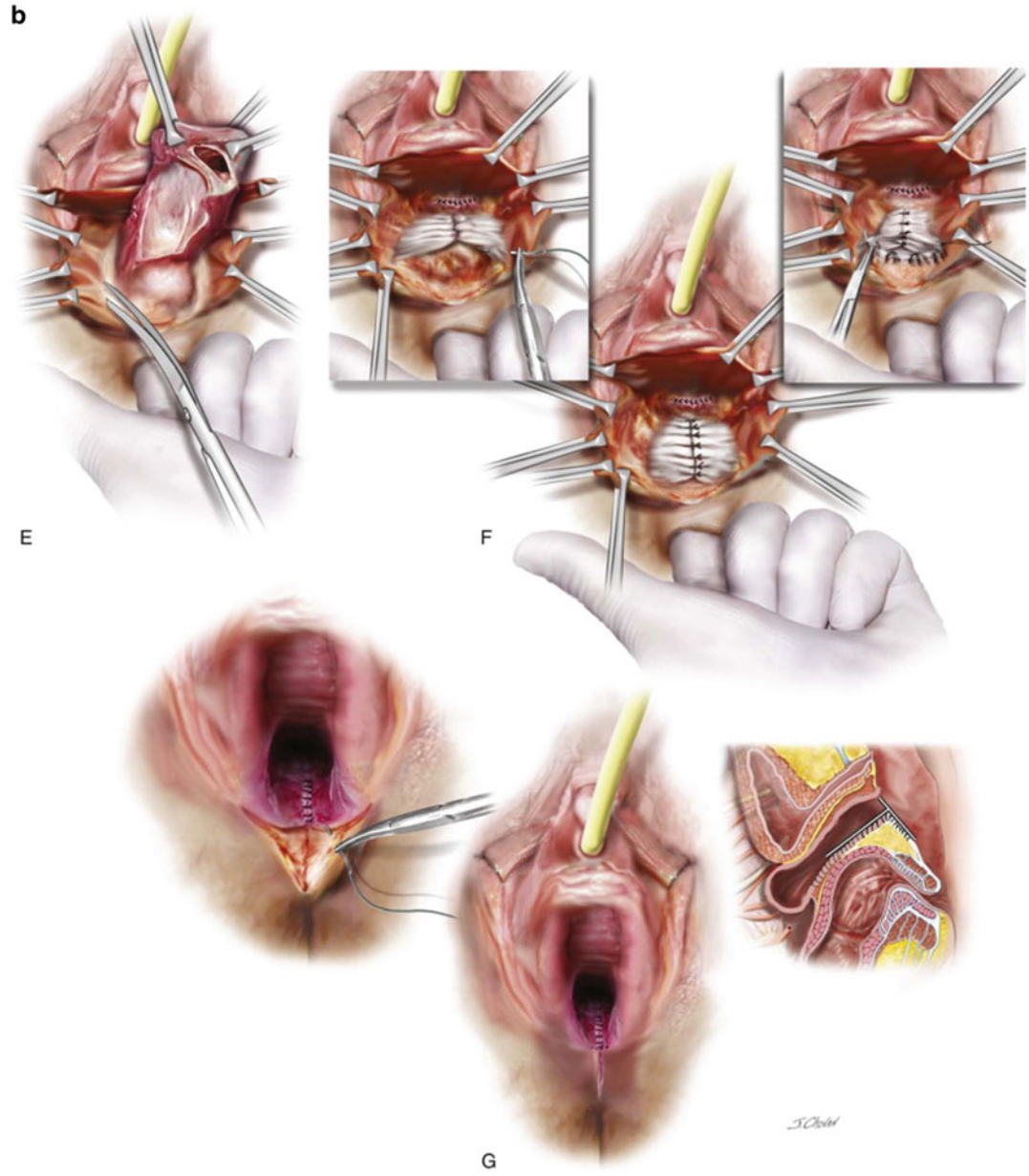

Fig. 20 Traditional posterior colporrhaphy. (**a**) The perineal skin is incised in the midline. (**b**) The posterior vaginal epithelium is mobilized off the rectum. (**c**, **d**) The enterocele sac is mobilized and entered. (**e**) The enterocele sac is excised or reduced, and the fibromuscular layer of the vagina is plicated in the midline. (**f**) A second layer may be plicated across the midline. (**g**) Perineorrhaphy is performed (Reprinted from Surgical Management of Pelvic Organ Prolapse, 1st Edition, Karram M. Surgical Correction of posterior pelvic floor defects, p139–164; with kind permission from Elsevier)

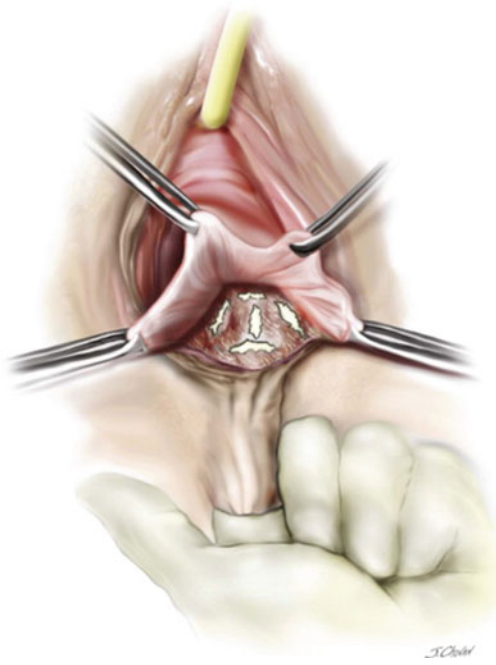

Fig. 21 Site-specific posterior defect repair. With finger in the rectum, discrete defects in the fibromuscular layer are identified. These defects are subsequently repaired using interrupted sutures (Reprinted from Surgical Management of Pelvic Organ Prolapse, 1st Edition, Karram M. Surgical Correction of posterior pelvic floor defects, p139–164; with kind permission from Elsevier)

19 Conclusion

Pelvic organ prolapse is a common problem that affects the daily activities for millions of women. The sensation of bulge in the vagina can be easily assessed and characterized by pelvic examination. Many patients may elect for expectant management or conservative management with a pessary. Radiologic testing is rarely indicated, and ancillary urodynamic testing may be indicated if the patient desires surgical intervention. Surgical treatment of prolapse is highly varied and depends greatly on the location of the prolapse, the degree of prolapse, and the patients' comorbidities and preferences. Surgical procedures are generally safe and well tolerated. Procedural success rates are hard to interpret, as success is generally considered anatomic success, symptomatic success, and absence of reoperation.

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