Anterior vaginal wall prolapse:

Innovative surgical approaches

MARK D. WALTERS, MD, AND MARIE FIDELA R. PARAISO, MD

Anterior vaginal wall prolapse occurs commonly and may coexist with disorders of micturition. Mild anterior vaginal wall prolapse often occurs in parous women but usually presents few problems. As prolapse progresses, symptoms may develop and worsen, and treatment becomes indicated. This article reviews the anatomy and pathology of anterior vaginal wall prolapse and describes traditional and innovative methods of vaginal prolapse repair.

ANATOMY AND PATHOLOGY

Anterior vaginal wall prolapse (cystocele) is defined as pathologic descent of the anterior vaginal wall and overlying bladder base. According to the International Continence Society standardized terminology for prolapse grading,[1] the term *anterior vaginal wall prolapse* is preferred over *cystocele*. This is because information obtained at the physical examination does not allow exact identification of structures behind the anterior vaginal wall, although it usually is in fact the bladder.

The etiology of anterior vaginal wall prolapse is not completely understood, but it is probably multifactorial, with different factors implicated in prolapse in individual patients. Normal support for the vagina and adjacent pelvic organs is provided by the interaction of the pelvic muscles and connective tissue.[2] The upper vagina rests on the levator plate and is stabilized by superior and lateral connective tissue attachments; the midvagina is attached to the arcus tendineus fasciae pelvis (white line) on each side.[3] Pathologic loss of that support may occur with damage to the pelvic muscles, connective tissue attachments, or both.

Theories of anterior vaginal wall prolapse

Nichols and Randall[4] described two types of anterior vaginal wall prolapse: distention and displacement. Distention was thought to result from overstretching and attenuation of the anterior vaginal wall, caused by overdistention of the vagina associated with vaginal delivery or atrophic changes associated with aging and menopause. The distinguishing physical feature of this type was described as diminished or absent rugal folds. The other type, displacement, was attributed to pathologic detachment or elongation of the anterolateral vaginal supports to the arcus tendineus fasciae pelvis, resulting in descent of the anterior segment with the rugae intact.

Another theory ascribes most cases of anterior vaginal wall prolapse to disruption or detachment of the lateral connective tissue attachments at the arcus tendineus fasciae pelvis, resulting in a paravaginal defect and corresponding to the displacement type discussed above. This was first described by White in 1909[5] and 1912[6] but was disregarded until redescribed by Richardson et al in 1976.[7] These latter researchers described transverse defects, midline defects, and defects involving isolated loss of integrity of pubourethral ligaments. Transverse defects were said to occur when the "pubocervical" fascia separated from its insertion around the cervix, whereas midline defects represented an anteroposterior separation of the fascia between the bladder and vagina.

Little clarifying evidence to date

There have been few systematic or comprehensive descriptions of anterior vaginal wall prolapse based on physical findings and correlated with findings at surgery to provide objective evidence for any of these theories of pathologic anatomy. In a study of 71 women with anterior vaginal wall prolapse and stress incontinence who underwent retropubic operations,

From the Department of Obstetrics and Gynecology, The Cleveland Clinic Foundation, Cleveland, OH.

Address: Mark D. Walters, MD, Department of Obstetrics and Gynecology, The Cleveland Clinic Foundation, Cleveland, OH 44195; walterm@ccf.org.

Disclosure: Dr. Walters reported that he is on the speakers' bureau of American Medical Systems. Dr. Paraiso reported that she is a consultant to American Medical Systems and to Ethicon Women's Health and Urology (Gynecare).

DeLancey[8] described paravaginal defects on the left in 87% of patients and on the right in 89%. The arcus tendineus fasciae pelvis was usually attached to the pubic bone but detached from the ischial spine for a variable distance. The pubococcygeal muscle was visibly abnormal with localized or generalized atrophy in more than half of the women.

Progress in pelvic imaging

Recent improvements in pelvic imaging have led to a greater understanding of normal pelvic anatomy and the structural and functional abnormalities associated with prolapse. Magnetic resonance imaging (MRI) easily delineates the pelvic organs, pelvic muscles, and connective tissues. Various measurements can be made that may be associated with anterior vaginal wall prolapse or urinary incontinence, such as the urethrovesical angle, the descent of the bladder base, the quality of the levator muscles, and the relationship between the vagina and its lateral connective tissue attachments. Aronson et al[9] used an endoluminal surface coil placed in the vagina to image pelvic anatomy with MRI and compared four continent nulliparous women with four incontinent women with anterior vaginal wall prolapse. Lateral vaginal attachments were identified in all continent women. In the two subjects with clinically apparent paravaginal defects, lateral detachments were evident.

PATIENT EVALUATION

History

Patients with anterior vaginal wall prolapse report symptoms directly related to vaginal protrusion or associated symptoms such as urinary incontinence or voiding difficulty. Symptoms related to prolapse may include the sensation of a vaginal mass or bulge, pelvic pressure, low back pain, and sexual difficulty. Stress urinary incontinence commonly occurs in association with anterior vaginal wall prolapse. Voiding difficulty may result from advanced prolapse. Women may require vaginal pressure or manual replacement of the prolapse in order to accomplish voiding. Women may relate a history of urinary incontinence that has since resolved with worsening of their prolapse. This can occur with urethral kinking and obstruction to urinary flow; women in this situation are at risk for incomplete bladder emptying and recurrent or persistent urinary tract infections as well as for development of de novo stress incontinence after the prolapse is repaired.

Physical examination

The physical examination should be conducted with the patient in lithotomy position, as for a routine pelvic examination. The examination is first performed with the patient supine. A retractor or Sims speculum can be used to depress the posterior vagina to aid in visualizing the anterior vagina. After the resting examination, the patient is instructed to strain down forcefully or to cough vigorously. During this maneuver, the order of descent of the pelvic organs is noted, as is their relationship at the peak of straining. If physical findings do not correspond to symptoms or if the maximum extent of the prolapse cannot be confirmed, the woman is reexamined in the standing position. In some cases, late-day examination is useful to assess the full extent of prolapse, which typically progresses with straining and standing.

It may be possible to differentiate lateral defects, identified as detachment or effacement of the lateral vaginal sulci, from central defects, seen as midline protrusion but with preservation of the lateral sulci, by using a curved forceps placed in the anterolateral vaginal sulci directed toward the ischial spine. Bulging of the anterior vaginal wall in the midline between the forceps blades implies a midline defect; blunting or descent of the vaginal fornices on either side with straining suggests lateral paravaginal defects. Studies have shown that the physical examination technique to detect paravaginal defects is not particularly reliable or accurate. In a study by Barber et al[10] of 117 women with prolapse, the sensitivity of clinical examination for detecting paravaginal defects was good (92%), yet the specificity was poor (52%) and, despite an unexpectedly high prevalence of paravaginal defects, the positive predictive value was poor (61%). Less than two thirds of women believed to have a paravaginal defect on physical examination were confirmed to possess the same at surgery. Another study, by Whiteside et al,[11] demonstrated poor reproducibility of the clinical examination to detect anterior vaginal wall defects. Thus, the clinical value of determining the location of midline, apical, and lateral paravaginal defects remains unknown.

Anterior vaginal wall descent usually represents bladder descent with or without concomitant urethral hypermobility. In 1.6% of women with anterior vaginal prolapse, an anterior enterocele mimics a cystocele on physical examination.[12]

Diagnostic tests

After a careful history and physical examination, few diagnostic tests are needed to evaluate patients with anterior vaginal wall prolapse. A urinalysis should be performed to evaluate for urinary tract infection if the patient reports any lower urinary tract dysfunction. If

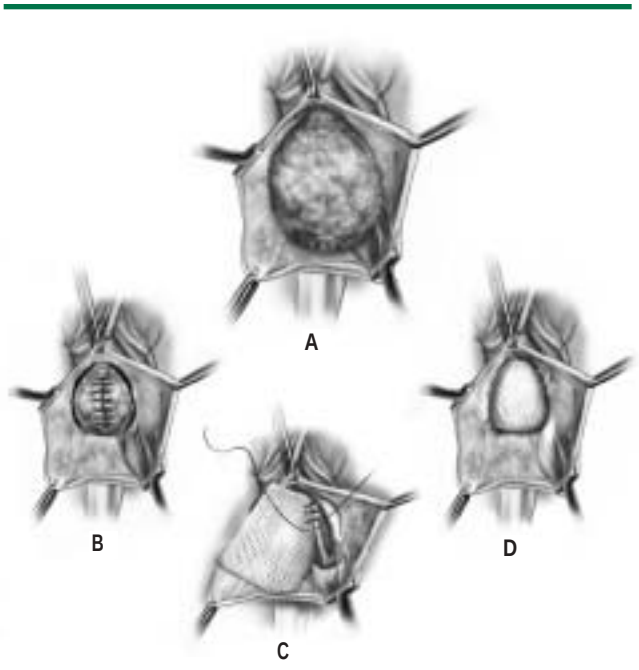


FIGURE 1. Cystocele repair with mesh. (A) The bladder is dissected bilaterally and off the vaginal apex. (B) Midline plication is completed. (C) After entering the left paravaginal space and exposing the arcus tendineus fasciae pelvis (white line), the prosthetic mesh is sewn to it. (D) The mesh is attached bilaterally and all sutures are tied, supporting the bladder. Reprinted from Walters and Karram, eds, Urogynecology and Reconstructive Pelvic Surgery, 2nd ed., copyright 1999, with permission from Elsevier.

urinary incontinence is present, further diagnostic testing is indicated to determine its cause. Urodynamic (simple or complex), endoscopic, or radiologic assessments of filling and voiding function are generally indicated only when symptoms of incontinence or voiding dysfunction are present. In women with severe prolapse, it is important to check urethral function after the prolapse is repositioned. Even if no urologic symptoms are noted, voiding function should be assessed to evaluate for completeness of bladder emptying. This procedure usually involves a timed, measured void followed by urethral catheterization or bladder ultrasonography to measure residual urine volume.

INNOVATIVE SURGICAL REPAIR TECHNIQUES

Anterior colporrhaphy with graft augmentation

The objective of anterior colporrhaphy is to plicate the layers of vaginal muscularis and adventitia overlying the bladder ("pubocervical fascia") or to plicate and reattach the paravaginal tissue in such a way as to reduce the protrusion of the bladder and vagina.

One modification of anterior colporrhaphy involves use of a prosthetic material to aid in support of the anterior vagina. This can be done in several ways, and the surgical techniques continue to evolve. One modification is to place a piece of polyglactin 910 mesh into the fold of imbricated bladder wall below the trigone and apical portion of the anterior colporrhaphy. In a second modification, after the plication sutures have been placed and tied, the prosthetic layer is placed over the stitches and anchored in place at the lateral limit of the previous dissection, using interrupted stitches of No. 2-0 absorbable or nonabsorbable suture. The anchor points are usually at or near the arcus tendineus fasciae pelvis or obturator fascia bilaterally, as shown in Figure 1. Biologic materials that have been used include segments of rectus fascia, fascia lata, cadaveric fascia, or other allograft or xenograft materials. Permanent (usually polypropylene) mesh may be used, although nonabsorbable material carries a risk of infection or erosion, with the need for subsequent revision or removal in 2% to 12% of cases (see Table).

Anti-incontinence operations are often performed at the same time as anterior vaginal wall prolapse repair to treat coexistent stress incontinence; sling placement may also improve the cure rate of the prolapse. Bladder neck suspension procedures (sling procedures or retropubic colposuspension) effectively treat mild anterior vaginal wall prolapse associated with urethral hypermobility and stress incontinence. More advanced anterior vaginal wall prolapse will not be treated adequately; in these cases, anterior segment repair should be performed, usually in conjunction with a midurethral sling. Surgical judgment is required to perform the bladder plication tightly enough to sufficiently reduce the anterior vaginal prolapse while preserving enough mobility of the anterior vagina to allow adequate urethral suspension. If anterior colporrhaphy with or without graft augmentation is combined with a sling procedure (midurethral or bladder neck), the cystocele should be repaired before the final tension is set for the sling. A midurethral sling, such as a tension-free vaginal tape (TVT) or transobturator sling (TOT), is best done through a separate midurethral incision after the cystocele repair is completed.

Vaginal paravaginal repair with and without graft augmentation

The objective of paravaginal defect repair for anterior vaginal wall prolapse is to reattach the detached lateral vagina to its normal place of attachment at the level of the white line or arcus tendineus fasciae pelvis.[13] This can be done using a vaginal or retropubic approach.

TABLE
Literature review of anterior vaginal wall prolapse repair with nonabsorbable mesh*

Study/researchers	Mesh	N	Follow-up (mo)	Success rate (%)	Vaginal erosions
Julian, 1996[19]	Marlex	12	24	100	1 (8.3%)
Nicita, 1998[20]	Polypropylene	44	14	93.2	1 (2.3%)
Flood et al, 1998[21]	Marlex	142	36	94.4	2 (1.4%)
Mage, 1999[22]	Mersuture†	46	26	100	1 (2.2%)
Migliari and Usai, 1999[23]	Mixed fiber‡	15	23.4	93	0
Migliari et al, 2000[24]	Polypropylene	12	20.5	75	0
Hardiman et al, 2000[25]	Polypropylene	18	1.5	100	2 (11.1%)
Salvatore et al, 2002[26]	Polypropylene	32	17	87	4 (13%)
de Tayrac et al, 2005[27]	Polypropylene	87	24	91.6	7 (8.3%)

* Definitions of success and surgical techniques varied among studies.
† Ethicon, Issy-Les-Moulineaux, France.
‡ 60% polyglactin 910 and 40% polyester.

Preparation for vaginal paravaginal repair begins as for an anterior colporrhaphy: vaginal flaps are developed by incising the vagina in the midline and dissecting the vaginal muscularis laterally. The dissection is performed bilaterally until the space is developed between the vaginal wall and retropubic space. Blunt dissection using the surgeon's index finger is employed to extend the space anteriorly along the ischiopubic rami, medially to the pubic symphysis, and laterally toward the ischial spine. After dissection is complete, midline plication of the bladder can be performed, either at this point or after placement and tying of the paravaginal sutures.

On the lateral pelvic sidewall, the obturator internus muscle and the arcus tendineus fasciae pelvis are identified by palpation and then visualization. Retraction of the bladder and urethra medially is best accomplished with a Breisky-Navratil retractor. Using No. 0 nonabsorbable suture, the first stitch is placed around the tissue of the white line just anterior to the ischial spine. A Capio device (Boston Scientific, Watertown, MA) works well to facilitate suture placement (Figure 2). If the white line is detached from the pelvic sidewall or clinically not believed to be durable, then the attachment should be to the fascia overlying the obturator internus muscle. Placement of subsequent sutures is aided by placing tension on the first suture. A series of four to six stitches are placed and held, working anteriorly along the white line from the ischial spine to the level of the urethrovesical junction. Starting with the most anterior stitch, the surgeon picks up the edge of the periurethral tissue (vaginal muscularis or pubocervical fascia) at the level of the urethrovesical junction and then tissue from the undersurface of the vaginal flap at the lateral fornix. After all stitches are placed on one side, the same procedure is carried out on the other side. If a biologic or synthetic implant is used for augmentation of the repair, the graft is incorporated into the stitch after the edge of the vaginal muscularis is included. A variation of vaginal paravaginal defect repair with graft augmentation is shown in Figure 1. The stitches are then tied in order from the urethra to the apex. This repair is a three-point closure involving the vaginal epithelium, the vaginal muscularis and endopelvic fascia (pubocervical fascia), and the lateral pelvic sidewall at the level of the arcus tendineus fasciae pelvis. Vaginal tissue should not be trimmed until all the stitches are tied. The vaginal flaps are trimmed and closed with a running subcuticular or interlocking delayed absorbable suture.

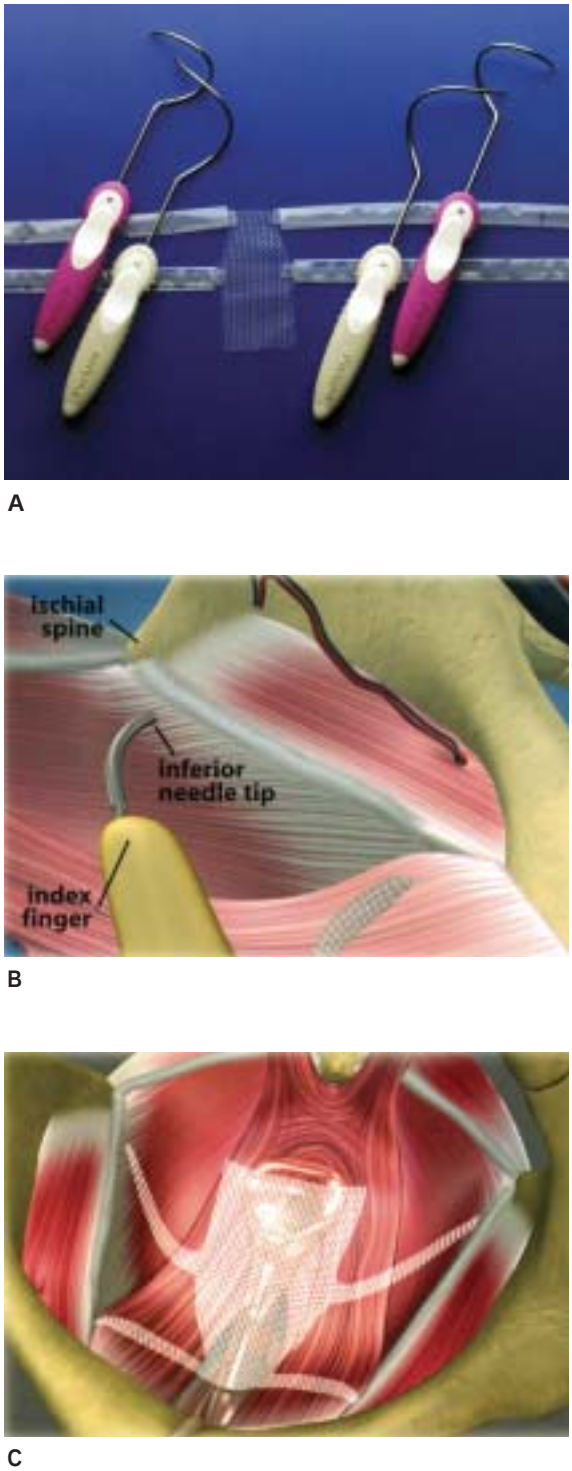
Transobturator tension-free vaginal mesh techniques for anterior vaginal wall prolapse

More recent innovative approaches for anterior vaginal wall repair anchor an allograft, xenograft, or polypropylene mesh without tension via strips placed through the obturator foramen with a special device (Perigee, American Medical Systems, Minnetonka, MN; and Anterior Prolift, Gynecare, Somerville, NJ). These techniques await safety and efficacy studies but are increasing in use. The advantage of this approach is that all defects (central, lateral, proximal, and distal) can be treated in a time-efficient manner. In an experienced

FIGURE 2. The Capio device, used to aid suture placement in vaginal paravaginal repair.

surgeon's pilot study of 11 patients, the average operative time for the Perigee procedure was 18.4 minutes (range, 11 to 26).[14] The goal of the procedure is to reestablish level II support of the vagina.

The Perigee procedure requires a dissection similar to that for the anterior colporrhaphy following an incision 4 cm from the bladder neck toward the apex of the vagina. The surgeon may or may not break through into the space of Retzius. When synthetic mesh is used, the plane of dissection of the anterior vaginal wall should be deeper, leaving muscularis on the vaginal epithelium in order to reduce risk of vaginal mesh extrusion. Plication sutures are placed in the midline to reduce the bulge and decrease risk of bladder perforation. External skin incisions are made at the medial border of the obturator foramen. The superior incisions are made at the base of the adductor longus tendon at the level of clitoris lateral to the ischiopubic ramus. The inferior incision is made 2 cm lateral and 3 cm inferior to the superior incision. A 5 cm × 10 cm biologic (porcine dermis) or synthetic (macroporous polypropylene) implant with four polypropylene arms (mesh identical to that used for SPARC or Monarc midurethral slings with tensioning suture) is introduced and secured in a tension-free manner using narrow-diameter helical needles. The four arms of the graft are fixed to four points in the arcus tendineus fasciae pelvis (proximally 1.5 to 2 cm distal to the ischial spine and distally at the bladder neck bilaterally). Figure 3 shows the kit for the procedure (3A) as well as the insertion of the helical needle at the level of the ischial spine in the space of Retzius (3B) and the anatomy of the pelvic floor after mesh placement (3C). The graft is secured distally and apically in the midline with No. 3-0 absorbable suture. Concomitant sling procedures may be performed with the plastic sheaths for the Perigee in place so that the superior arms of the procedure are not disrupted. Cystoscopy should be per-



A

B

C

FIGURE 3. The Perigee procedure. (A) Procedure kit with mesh and helical trocars. (B) Anatomy of the retropubic space and insertion of the helical needle at the level of the ischial spine. (C) Mesh placement and anatomy of the pelvic floor. Reproduced with permission from American Medical Systems, Inc.

formed before removal of the plastic sheaths to ensure that the bladder and ureters have not been injured.

The Perigee procedure may be performed with or without the uterus in place. The procedure is contraindicated in pregnant women, in poor surgical candidates, and in the presence of active infection of the bladder or vagina.

Another alternative for mesh placement in prolapse repair is the Anterior Prolift procedure, which involves implantation of a large sheet of high-porosity monofilament polypropylene "tension-free" mesh featuring an anterior intervesicovaginal and/or posterior interrectovaginal prosthesis. The anterior prosthesis is retained by two nonsecured bilateral transobturator arms anteriorly at a point 1 to 2 cm from the proximal arcus tendineus fasciae pelvis and posteriorly at a point 1 to 2 cm distal from the arcus tendineus fasciae pelvis (Figure 4; mesh pictured in green). The diameter of the portion of the mesh used to support the anterior vaginal wall is greater in width in the Anterior Prolift procedure than in the Perigee procedure. Four cannulas are inserted at the fixation points with the use of a single trocar needle; the mesh arms are retrieved with a plastic loop and secured after implantation of the mesh and removal of the cannulas. Plication of the anterior vaginal wall and excision of excess vaginal epithelium are not recommended with the Anterior Prolift procedure. Concomitant anti-incontinence procedures are performed as indicated.

Cystoscopy

Cystoscopy is usually performed after cystocele repair, especially if slings or apical suspension procedures are also being done. The purpose is to ensure that no sutures or mesh have been placed in the bladder and to verify patency of both ureters.

RESULTS

The main indication for surgical repair of anterior vaginal wall prolapse is to relieve symptoms when they exist, or as part of a comprehensive pelvic reconstructive procedure for multiple sites of pelvic organ prolapse with or without urinary incontinence.

Few studies have addressed the long-term success of surgical treatments for anterior vaginal wall prolapse. Most published studies are uncontrolled series. Definitions of recurrence vary and sometimes are not stated, and loss to follow-up often is not stated. In our review of surgical techniques for the correction of anterior vaginal wall prolapse,[2] reported failure rates ranged from 0% to 20% for anterior colporrhaphy without graft augmentation and from 3% to 14% for

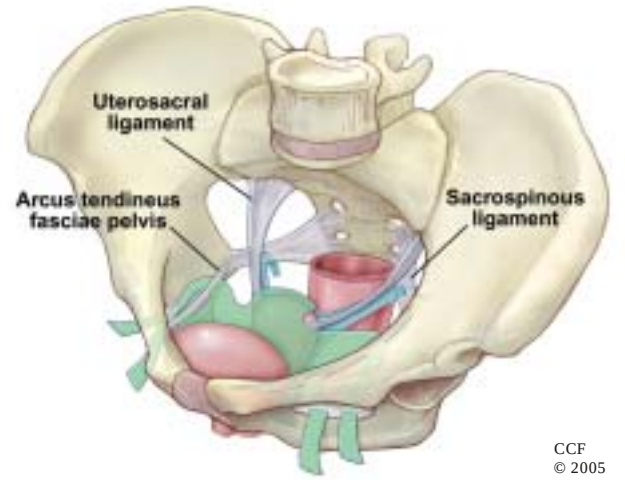


FIGURE 4. Prolift mesh (green) in the pelvis.

paravaginal repair without graft augmentation.

Weber et al[15] studied three variations of anterior colporrhaphy using a prospective randomized design and a very strict definition of success (Aa and Ba points at −3 or −2 cm; Stage 0 or I). An optimal or satisfactory anatomic result was achieved in 30% of patients undergoing standard anterior colporrhaphy, 42% of those undergoing anterior colporrhaphy with polyglactin 910 mesh overlay, and 46% of those undergoing ultralateral plication under tension. No differences were seen in anatomic or functional outcomes, and most patients reported satisfaction with their symptom improvement. In another randomized controlled trial using a different staging system, Sand et al[16] reported fewer recurrent cystoceles when polyglactin 910 mesh was incorporated into the imbrication of the repair.

Prosthetic augmentation of cystocele repair is a promising although evolving innovation. There are many variations in techniques and materials used but few quality studies to date; two technique variations are shown in Figures 3 and 4. Biologic prosthetic materials have been placed over a midline cystocele plication as a simple overlay and anchored laterally, but this does not seem to offer significant lasting improvement over standard repair.[17] However, anchoring the mesh to the obturator fascia, the addition of suburethral slings,[18] and anchoring of the prosthesis to the apical portion of the repair may significantly improve long-term results.

Placement of nonabsorbable mesh into an anterior vaginal wall prolapse repair is a promising but more controversial variation. Polypropylene mesh has limited foreign body reaction in general and is probably the best choice. Technique variations include mesh over-

lays, modified four-corner attachments, transobturator attachments, and anterior flaps as part of an apical mesh procedure. Cure rates appear high (Table), but comparative trials with more traditional sutured repairs have not been done. Vaginal mesh erosions continue to be a problem; they occur in 2.1% to 13% of cases,[19–27] a significant number of which require reoperation for mesh removal. Analysis of the first 100 Prolift vaginal mesh procedures revealed a 17.5% erosion rate, which fell to 2.7% with limitation of the number and extent of colpotomies and avoidance of concomitant hysterectomy and perineal incisions.[28] Creation of vaginal flaps that are thicker with an attached fibromuscularis thus may reduce the mesh erosion rate. Efficacy and safety trials are paramount prior to widespread adoption. Emerging techniques must be compared with gold-standard procedures in well-designed, long-term trials for anatomic and functional outcomes.

For women with potential or occult stress incontinence in association with advanced prolapse, Meschia et al[29] reported that placement of a TVT results in a significantly higher objective postoperative continence rate compared with suburethral plication (92% vs 56%; $P < .01$). For this reason, placement of a TVT or perhaps a transobturator sling is recommended for all women with potential stress incontinence, except perhaps for very elderly patients and those with significant voiding dysfunction.

Paravaginal defect repair using the transvaginal approach results in excellent anatomic cure of anterior vaginal wall prolapse.[13] However, it has been used infrequently as an isolated procedure for treatment of stress urinary incontinence. Evidence suggests that it has less than satisfactory results when used in this capacity. Mallipeddi et al[30] reported that 57% of subjects with anterior vaginal wall prolapse and stress incontinence treated with a vaginal paravaginal repair and bladder neck plication had persistent urinary incontinence after an average of 1.6 years of follow-up. Thus, while the vaginal paravaginal repair is safe and relatively effective for correction of anterior vaginal wall prolapse, it has limited applicability in the surgical correction of stress incontinence.

Risk factors for repair failure

Risk factors for failure of anterior vaginal wall prolapse repair have not been specifically studied. Vaginal prolapse recurs with increasing age and length of follow-up, but the actual frequency is unknown. Recurrence of anterior prolapse is more likely with more severe initial prolapse[31] and probably with transvaginal, as opposed to abdominal, repairs.[32] Recurrence may represent a failure to identify and repair all support defects, or weakening, stretching, or breaking of patients' tissues, as occurs with advancing age and after menopause. Sacrospinous ligament suspension of the vaginal apex, with exaggerated retrosuspension of the vagina, may predispose patients to recurrence of anterior vaginal wall prolapse. Other factors that may increase the chances of recurrence are genetic predisposition, subsequent pregnancy, heavy lifting, chronic pulmonary disease, smoking, and obesity.

COMPLICATIONS

Intraoperative complications are uncommon with anterior vaginal wall prolapse repair. Excessive blood loss may occur, requiring blood transfusion, or a hematoma may develop in the anterior vagina; this is probably more common after vaginal paravaginal repair than after anterior colporrhaphy.[33] The lumen of the bladder or urethra may be entered in the course of dissection. Accidental cystotomy should be repaired in layers at the time of the injury. After repair of cystotomy, the bladder is generally drained for 7 to 14 days to allow adequate healing. Ureteral damage or obstruction occurs rarely (0% to 2% incidence),[34] usually with very large cystoceles or with apical prolapse.

Other rare complications include intravesical or urethral suture placement (and associated urologic problems) and fistula, either urethrovaginal or vesicovaginal. If permanent sutures or mesh material are used in the repair, erosion, draining sinuses, or chronic areas of vaginal granulation tissue can result. The incidence of these complications is unknown but may be as high as 13%.[21]

Urinary tract infections occur commonly, especially with concurrent catheter use, but other infections (eg, pelvic or vaginal abscesses) are less common.

Voiding difficulty can occur after anterior vaginal wall prolapse repair. In our hands, the average time to adequate voiding after cystocele repair with suburethral plication is 9 days.[35] This problem may occur more often in women with subclinical preoperative voiding dysfunction. The treatment is bladder drainage or intermittent self-catheterization until spontaneous voiding resumes, usually within 6 weeks.

Sexual function may be positively or negatively affected by vaginal operations for anterior vaginal wall prolapse. The current popularity of synthetic or allograft mesh to augment vaginal prolapse repairs could improve sexual function if cure rates improve or could worsen function if vaginal stiffness, mesh erosions, or draining sinuses result. More data with careful follow-up after surgery are needed.

REFERENCES

1. Bump RC, Mattiasson A, Bø K, et al. The standardization of terminology of female pelvic organ prolapse and pelvic floor dysfunction. Am J Obstet Gynecol 1996; 175:10–17.
2. Weber AM, Walters MD. Anterior vaginal prolapse: review of anatomy and techniques of surgical repair. Obstet Gynecol 1997; 89:311–318.
3. DeLancey JOL. Anatomic aspects of vaginal eversion after hysterectomy. Am J Obstet Gynecol 1992; 166:1717–1728.
4. Nichols DH, Randall CL. Vaginal Surgery. 4th ed. Baltimore: Williams & Wilkins; 1996.
5. White GR. A radical cure by suturing lateral sulci of vagina to white line of pelvic fascia. JAMA 1909; 21:1707–1710.
6. White GR. An anatomical operation for the cure of cystocele. Am J Obstet Dis Women Child 1912; 65:286–290.
7. Richardson AC, Lyon JB, Williams NL. A new look at pelvic relaxation. Am J Obstet Gynecol 1976; 126:568–573.
8. DeLancey JO. Fascial and muscular abnormalities in women with urethral hypermobility and anterior vaginal wall prolapse. Am J Obstet Gynecol 2002; 187:93–98.
9. Aronson MP, Bates SM, Jacoby AF, et al. Periurethral and paravaginal anatomy: an endovaginal magnetic resonance imaging study. Am J Obstet Gynecol 1995; 173:1702–1708.
10. Barber MD, Cundiff GW, Weidner AC, et al. Accuracy of clinical assessment of paravaginal defects in women with anterior vaginal wall prolapse. Am J Obstet Gynecol 1999; 181:87–90.
11. Whiteside JL, Barber MD, Paraiso MF, et al. Clinical evaluation of anterior vaginal wall support defect: interexaminer and intraexaminer reliability. Am J Obstet Gynecol 2004; 191:100–104.
12. Tulikangas PK, Lukban JC, Walters MD. Anterior enterocele: a report of three cases. Int Urogynecol J 2004; 15:350–352.
13. Shull BL, Benn SJ, Kuehl TJ. Surgical management of prolapse of the anterior vaginal segment: an analysis of support defects, operative morbidity, and anatomic outcome. Am J Obstet Gynecol 1994; 171:1429–1439.
14. Rane A, Davila GW. A transobturator system for the vaginal repair of cystocele [abstract]. Obstet Gynecol 2005; 105(4 Suppl):120S–121S.
15. Weber AM, Walters MD, Piedmonte MA, et al. Anterior colporrhaphy: a randomized trial of three surgical techniques. Am J Obstet Gynecol 2001; 185:1299–1306.
16. Sand PK, Koduri S, Lobel RW, et al. Prospective randomized trial of polyglactin 910 mesh to prevent recurrence of cystoceles and rectoceles. Am J Obstet Gynecol 2001; 184:1357–1362.
17. Gandhi S, Kwon C, Goldberg RP, et al. A randomized controlled trial of fascia lata for the prevention of recurrent anterior vaginal wall prolapse [abstract]. Neurourol Urodynam 2004; 23:558.
18. Goldberg RP, Koduri S, Lobel RW, et al. Protective effect of suburethral slings on postoperative cystocele recurrence after reconstructive pelvic operation. Am J Obstet Gynecol 2001; 185:1307–1312.
19. Julian TM. The efficacy of Marlex mesh in the repair of severe, recurrent vaginal prolapse of the anterior midvaginal wall. Am J Obstet Gynecol 1996; 175:1472–1475.
20. Nicita G. A new operation for genitourinary prolapse. J Urol 1998; 160:741–745.
21. Flood CG, Drutz HP, Waja L. Anterior colporrhaphy reinforced with Marlex mesh for the treatment of cystoceles. Int Urogynecol J 1998; 9:200–204.
22. Mage P. Interposition of a synthetic mesh by vaginal approach in the cure of genital prolapse [in French]. Gynecol Obstet Biol Reprod (Paris) 1999; 28:825.
23. Migliari R, Usai E. Treatment results using a mixed fiber mesh in patients with grade IV cystocele. J Urol 1999; 161:1255–1258.
24. Migliari R, De Angelis M, Madeddu G, et al. Tension-free vaginal mesh repair for anterior vaginal wall prolapse. Eur Urol 2000; 38:151–155.
25. Hardiman P, Oyawoye S, Browning J. Cystocele repair using polypropylene mesh [abstract]. Br J Obstet Gynaecol 2000; 107:825.
26. Salvatore S, Soligo M, Meschia M, et al. Prosthetic surgery for genital prolapse: functional outcome [abstract]. Neurourol Urodynam 2002; 21:296–297.
27. de Tayrac R, Gerviase A, Chauveaud A, et al. Tension-free polypropylene mesh for vaginal repair of anterior vaginal wall prolapse. J Reprod Med 2005; 50:75–80.
28. Berrocal J, Clavé H, Cosson M, et al. Conceptual advances in the surgical management of genital prolapse. J Gynecol Obstet Biol Reprod 2004; 33:577–587.
29. Meschia M, Pifarotti P, Spennacchio M, et al. A randomized comparison of tension-free vaginal tape and endopelvic fascia plication in women with genital prolapse and occult stress urinary incontinence. Am J Obstet Gynecol 2004; 190:609–613.
30. Mallipeddi PK, Steele AC, Kohli N, et al. Anatomic and functional outcome of vaginal paravaginal repair in the correction of anterior vaginal prolapse. Int Urogynecol J 2001; 12:83–88.
31. Whiteside JL, Weber AM, Meyn LA, et al. Risk factors for prolapse recurrence after vaginal repair. Am J Obstet Gynecol 2004; 191:1533–1538.
32. Maher CF, Qatawneh AM, Dwyer PL, et al. Abdominal sacral colpopexy or vaginal sacrospinous colpopexy vaginal vault prolapse: a prospective randomized study. Am J Obstet Gynecol 2004; 190:20–26.
33. Young SB, Daman JJ, Bony LG. Vaginal paravaginal repair: one-year outcomes. Am J Obstet Gynecol 2001; 185:1360–1366.
34. Kwon CH, Goldberg RP, Koduri S, et al. The use of intraoperative cystoscopy in major vaginal and urogynecologic surgeries. Am J Obstet Gynecol 2002; 187:1466–1472.
35. Kobak WH, Walters MD, Piedmonte MR. Determinants of voiding after three types of incontinence surgery. Obstet Gynecol 2001; 97:86–91.