Laparoscopic surgery for pelvic support defects

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Reconstructive pelvic surgery for the treatment of vaginal prolapse continues to evolve as surgeons continue their quest for definitive surgical cure. Though there are three primary routes of access to reconstructive pelvic surgery (abdominal, vaginal and laparoscopic) it is the laparoscopic approach that appears to be the least utilized. This is in part due to the great degree of technical difficulty associated with laparoscopic suturing. This paper reviews the general principles and functional anatomy associated with normal vaginal support as well as the laparoscopic surgical approach to pelvic floor support defects.

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Introduction

The anatomy, pathophysiology, and treatment of pelvic organ prolapse has significantly evolved over the last decade with increasing understanding of anatomy and development of minimally invasive surgical procedures. Although support for the pelvic viscera, the vagina, and neighboring structures involves a complex interplay between muscles, fascia, nerve supply, and appropriate anatomic orientation, the endopelvic fascia and pelvic floor muscles provide most of the support function in the female pelvis. Laparoscopic reconstructive pelvic surgery requires a thorough knowledge of pelvic floor anatomy and its supportive components before repair of defective anatomy is attempted. This review examines contemporary concepts in pelvic support anatomy, describes the various laparoscopic surgical techniques currently available for reconstructive pelvic surgery, and summarizes currently published results of laparoscopic reconstructive pelvic surgery.

Anatomy of pelvic support

Female pelvic support is dependent upon a number of different entities including: bone, muscle, nerves and endopelvic fascia. Even though all of these entities play an important role in the support of the vagina, it is the integrity and the inherent support of the vagina itself that is usually the focus of surgical repair. This inherent support layer is called the endopelvic fascia.

Endopelvic fascia

To understand the pelvic support system of the female pelvic organs, it is useful to subdivide the support system into three axes: (1) the upper vertical axis, (2) the midhorizontal axis, and (3) the lower vertical axis. The endopelvic fascia, a network of connective tissue and smooth muscle, constitutes the physical matrix that envelopes the pelvic viscera and maintains the integrity of the axes supporting the bladder, urethra, uterus, vagina, and rectum in their respective anatomic relationships.

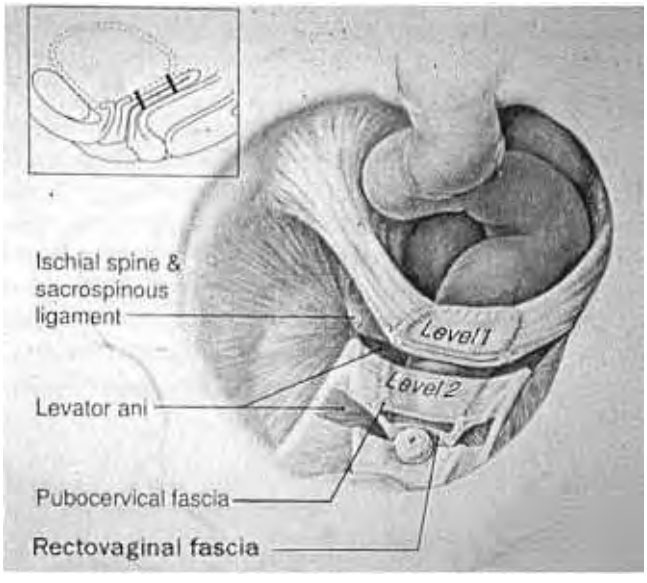
DeLancey [1] further described the three levels of support axes as follows: level 1, superior suspension of the vagina to the cardinal-uterosacral complex; level 2, lateral attachment of the upper two thirds of the vagina; and level 3, distal fusion of the vagina into the urogenital diaphragm and perineal body. In this support system, the endopelvic fascia system is thought to be continuous, extending from the origin of the cardinal-uterosacral complex to the urogenital diaphragm, providing structural support to the vagina and adjacent organs (Fig. 1).

Level 1: apical support

The cardinal-uterosacral complex provides apical support by suspending the uterus and upper one third of the vagina to the bony sacrum. This complex can be described as two separate entities: the cardinal ligament and the uterosacral ligament. The cardinal ligament is a fascial sheath of collagen that envelops the internal iliac vessels and then continues along the uterine artery, merging into the visceral capsule of the cervix, lower uterine segment and upper vagina. The uterosacral ligament is denser and more prominent than the cardinal ligament. Collagen fibers of the uterosacral ligament fuse distally with the visceral fascia over the cervix, lower uterine segment, and upper vagina, forming the pericervical ring; proximally these fibers end at the presacral fascia overlying the second, third, and fourth sacral vertebrae. This complex appears to be the most supportive structure of the uterus and upper third of the vagina. Disruption of the cardinal-uterosacral complex may result in uterine descensus or vaginal vault (apex) prolapse (Fig. 2). Likewise, the most common cause of vaginal vault prolapse is previous hysterectomy with failure to adequately reattach the cardinal-uterosacral complex to the pubocervical fascia and rectovaginal fascia at the vaginal cuff intraoperatively (Fig. 3).

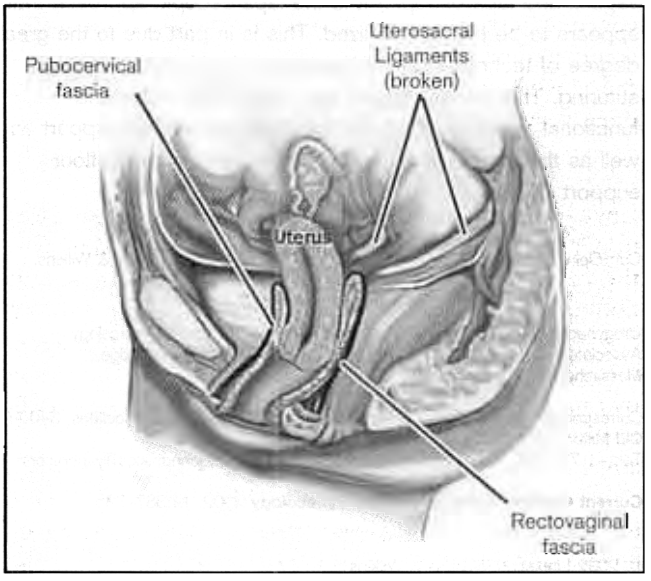
An enterocele is defined as a pelvic floor hernia where the parietal peritoneum comes into direct contact with the vaginal epithelium with no intervening fascia [2,3]. In normal pelvic supportive anatomy, the anterior pubocervical fascia, posterior rectovaginal fascia, cardinal-uterosacral ligaments and paracolpial fibers all converge, or fuse to form the pericervical ring. The integrity and continuity of these supportive tissues can be

Figure 1. Level 1 (apical suspension) and level 2 (lateral attachment)



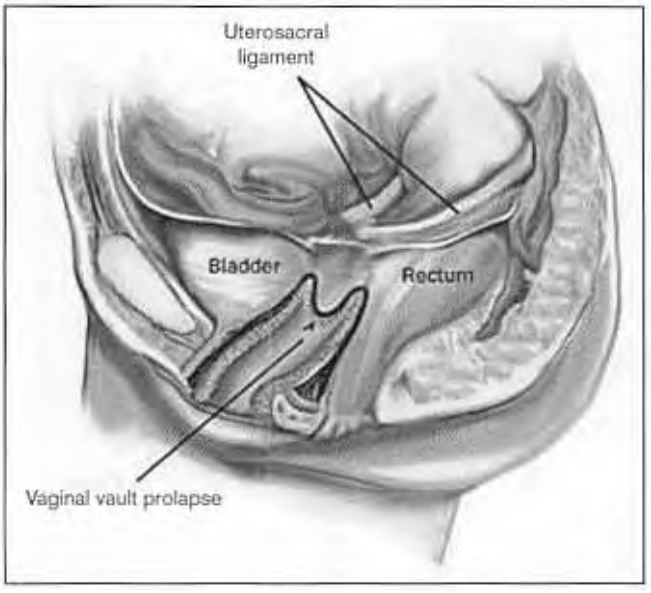
Level 1, paracolpium suspends the vagina apex from the lateral pelvic sidewall via the uterosacral-cardinal complex. Level 2, the anterior vaginal wall is attached laterally to arcus tendineus fascia pelvis and the posterior vaginal wall is attached laterally to the fascia overlying the levator ani muscle. Adapted with permission [1]. The copyright for this figure is retained by Miklos and Kohli.

Figure 2. Uterine prolapse



Uterine prolapse begins with breaking or cutting of uterosacral ligaments. The copyright for this figure is retained by Miklos and Kohli.

Figure 3. Vaginal vault prolapse



The apex of the vagina is prolapsed due to the lack of uterosacral ligaments attachment. The copyright for this figure is retained by Miklos and Kohli.

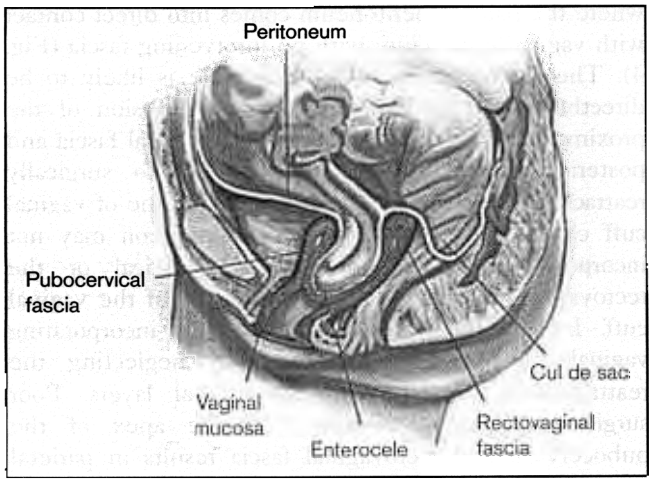
compromised in patients who have had a complete hysterectomy, as previously described [4–6]. An enterocele is likely to be directly related to a disruption of the fusion of the proximal margins of the pubocervical and rectovaginal fascia (Fig. 4). Although vaginal mucosa may cover this defect, it is not supportive, which greatly increases the likelihood that an enterocele will eventually develop within the vaginal cavity. Though it is possible to have an enterocele without concurrent vaginal vault prolapse, the two defects usually occur concomitantly. Although the depth and overall anatomic configuration of the cul-de-sac have been implicated in the development of the enterocele, they have never been proven to be the primary causes.

Level 2: lateral support

Level 2 provides horizontal support to the bladder, upper two thirds of the vagina, and rectum. Additionally, the vaginal wall itself has inherent support because of its fibromuscular composition, which is often referred to as fascia. Anterior support of the vaginal wall is provided by the pubocervical fascia, and posterior support is provided by the rectovaginal fascia. The pubocervical fascia, found between the bladder and the vaginal epithelium, attaches laterally to the arcus tendinous fascia pelvis, also referred to as the white line (Fig. 5). The white line is a linear thickening of the parietal fascia overlying the levator ani muscles and can be traced along its course, starting at its origin at the ischial spine, along the pelvic sidewall (obturator internus muscle) to its insertion into the pubic bone. A breech in the integrity of the pubocervical fascia or a defect in its lateral attachment at the white line can result in an anterior vaginal wall prolapse known as a cystocele, urethrocele or a cystourethrocele (Fig. 6)

Posteriorly, the rectovaginal septum, found between the vaginal epithelium and the rectum, attaches laterally to the fascia over the levator ani muscles. The rectovaginal septum lies between the vaginal epithelium and rectum, suspended superiorly by the cardinal-uterosacral com-

Figure 4. Enterocele



Enterocele is defined as peritoneum in direct contact with vaginal epithelium with no intervening fascia. Note the difference between vault prolapse in Fig. 3 and enterocele here. The copyright for this figure is retained by Miklos and Kohli.

Figure 5. Space of Retzius: normal anatomy

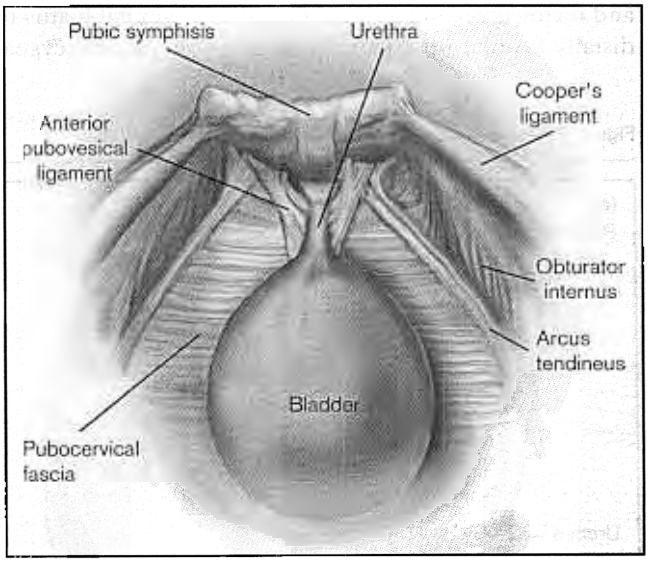


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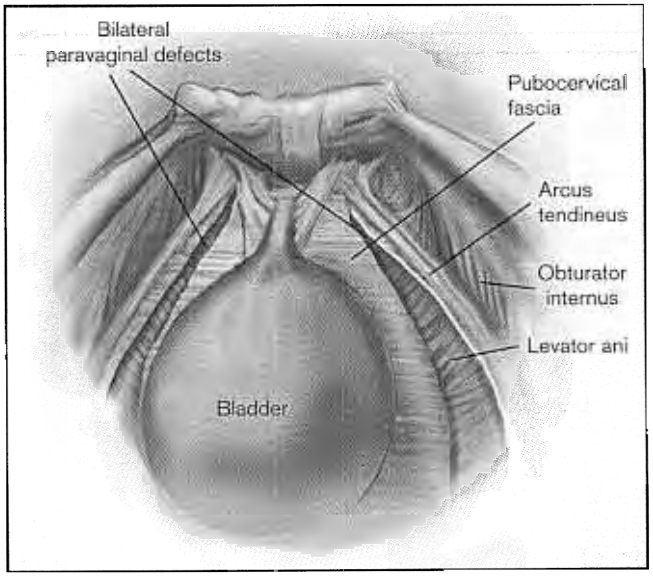
Figure 6. Paravaginal defects



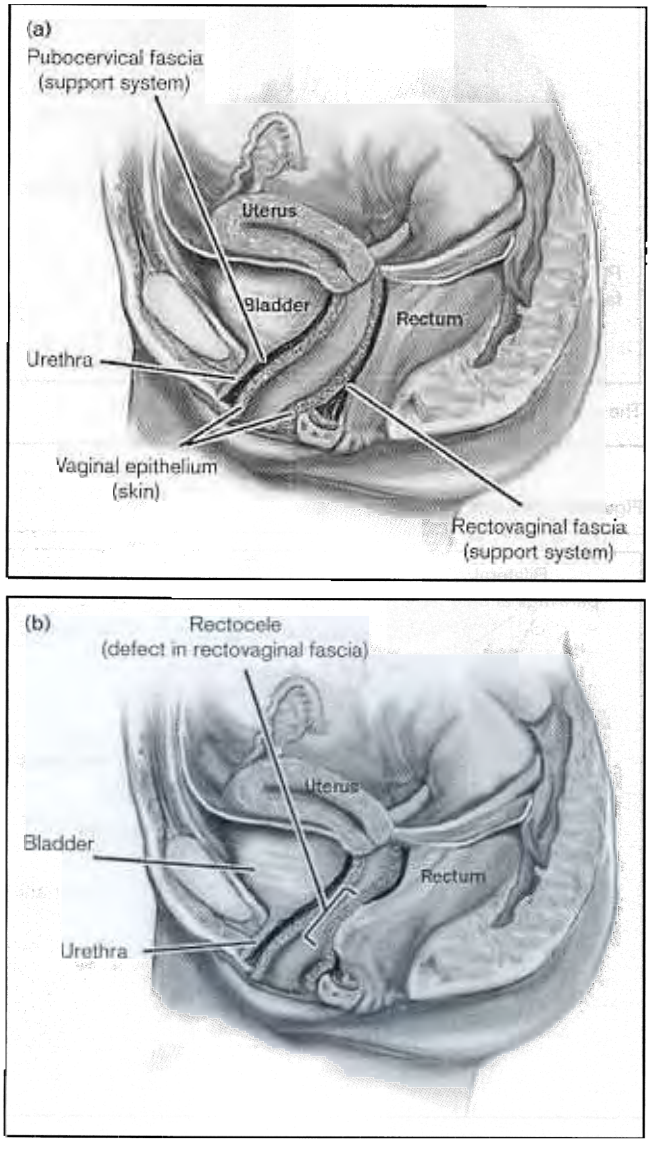
Lateral vaginal wall defects result in cystourethrocele as seen from the space of Retzius. The copyright for this figure is retained by Miklos and Kohli.

plex and laterally attached to the fascia of iliococcygeal muscle and distally fused to the perineal body. This intact rectovaginal septum is the support system of the posterior vaginal wall and helps maintain the rectum in its posterior position. A breech in the integrity of the rectovaginal septum or a defect in its lateral attachment to the iliococcygeal muscles often results in development of a rectocele (Fig. 7).

Level 3: distal support

The vagina and its support structures of pubocervical and rectovaginal septum traverse the urogenital hiatus to distally fuse into the parietal fascia of the pubococcygeal and puborectal muscles and the perineal membrane. The rectovaginal septum fuses to the perineal body and the pubocervical fascia fuses to the perineal membrane of the urogenital triangle, which subsequently fuses to the pubic bone.

Figure 7. Rectovaginal fascia



(a) Normal anatomy. (b) Rectocele caused by a defect in the rectovaginal fascia. The copyright for this figure is retained by Miklos and Kohli.

Level 1 support: laparoscopic approach to enterocele repair and vaginal vault suspension

The foundation for the surgical correction of enterocele and vaginal vault prolapse is based upon sound anatomical principles already discussed. Irrespective of the surgical approach utilized the surgeon must determine and repair the specific apical defect or defects present.

Site-specific enterocele repair and vaginal vault suspension

As previously mentioned, level 1 support involves the long paracolpial fibers which suspend the proximal vagina and cervicovaginal junction. The cardinal and uterosacral ligaments previously described merge with these fibers and attach to the pericervical ring. This network of connective tissue fibers and smooth muscle serves to prevent vaginal eversion. A disruption of the integrity of these fibers, as opposed to stretching, results in apical vaginal vault eversion (Fig. 3). The most common cause of this condition is hysterectomy with failure to adequately reattach the cardinal-uterosacral complex to the pubocervical fascia and rectovaginal fascia at the vaginal cuff.

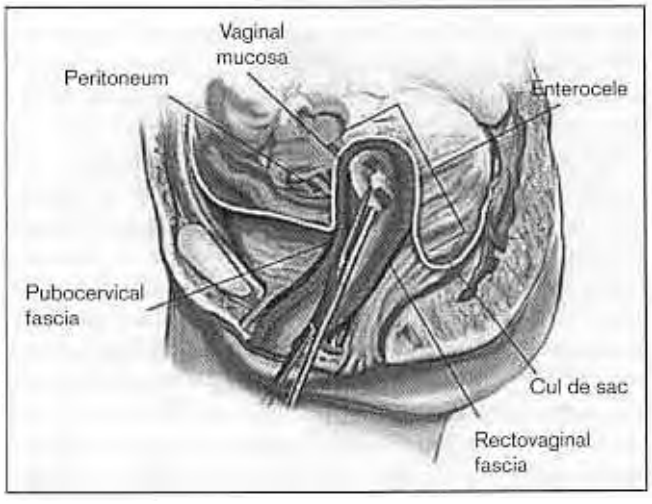
Enterocele repair begins first by anatomically defining the fascia defect present that resulted in the herniation of peritoneum and bowel through the apex of the vagina. An enterocele is defined as a pelvic hernia where the parietal peritoneum comes into direct contact with vaginal epithelium with no intervening fascia (Fig. 4). The development of an enterocele is likely to be directly related to a disruption of the fusion of the proximal margins of the anterior pubocervical fascia and posterior rectovaginal fascia or failure to surgically reattach these two fascial margins at the time of vaginal cuff closure. It is possible that the surgeon may not incorporate the apex of the pubocervical or the rectovaginal fascia at the time of closure of the vaginal cuff. Instead the surgeon may be only incorporating vaginal mucosa and unintentionally neglecting the reattachment of the supportive fascial layers. Poor surgical closure or disruption at the apex of the pubocervical and rectovaginal fascia results in parietal peritoneum in direct contact with vaginal epithelium. Chronic rises of intraabdominal pressure will ultimately exploit this vaginal weakness with stretching of the peritoneum and vaginal mucosa and clinically evident symptomatic enterocele.

Laparoscopic uterosacral-ligament vault suspension and enterocele repair

The technique of laparoscopic uterosacral-ligament vaginal vault suspension and enterocele repair begins with identification of the vaginal vault apex, the proximal uterosacral ligaments and the course of the pelvic ureter. The identification of the vaginal vault and the delineation of the rectovaginal and pubocervical fascia are facilitated by the use of a vaginal probe (Fig. 8). Using the vaginal probe, traction is placed cephalad and ventrally, causing the uterosacral ligaments to stretch so they can be identified and traced backward to their most proximal point of origin, lateral to the sacrum. At this level, the uterosacral ligament is usually about 2–3 cm below the pelvic ureter. The peritoneum overlying the vaginal apex is incised to expose the pubocervical fascia anteriorly and the rectovaginal fascia posteriorly. If the enterocele sac is large, it may be excised and the apical edges of the pubocervical and rectovaginal fascia should be exposed (Fig. 9).

A full-thickness purchase of the uterosacral ligament at its proximal portion is secured with nonabsorbable sutures. These sutures are then placed full thickness, excluding the vaginal mucosa, through the ipsilateral rectovaginal fascia and then corresponding pubocervical fascia in the region of the lateral vaginal fornix. Extracorporeal knot tying secures the uterosacral ligament to the apex of the newly formed vaginal cuff, which consists of pubocervical and rectovaginal fascia. Suture tying not only elevates and secures the apex of the vagina to the uterosacral ligament (vault suspension), but it also allows for coaptation of the rectovaginal and pubocervical fascia at the apex (enterocele repair) (Figs 10, 11).

Figure 8. Reducing the enterocele

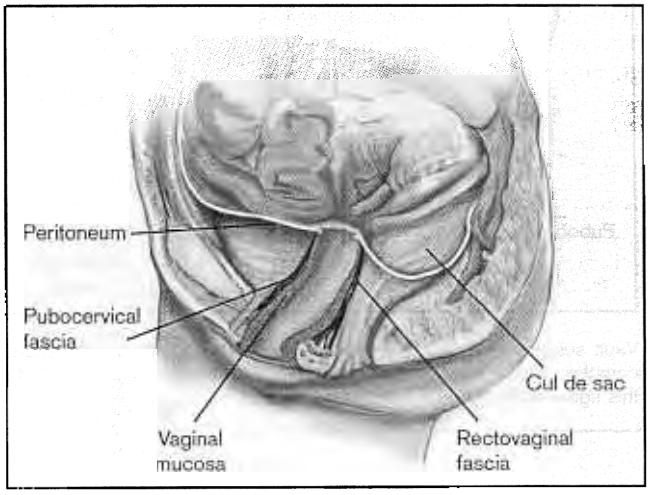


Identifying pubocervical and rectovaginal fascia utilizing a vaginal probe. The copyright for this figure is retained by Miklos and Kohli.

Laparoscopic sacral colpopexy

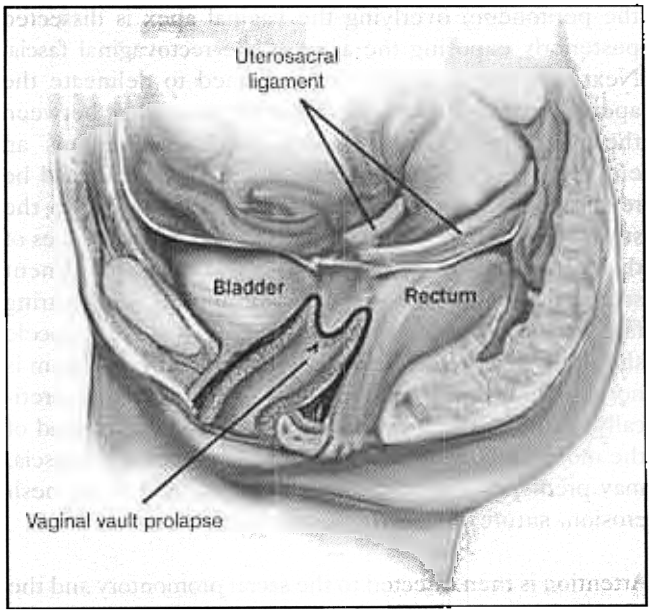
Abdominal sacral colpopexy remains one of the most successful operations for the treatment of vaginal vault prolapse with excellent results on long-term follow-up. If the surgeon utilizes laparoscopy as a means of surgical access and performs the sacral colpopexy in the same

Figure 9. Excision of enterocele sac



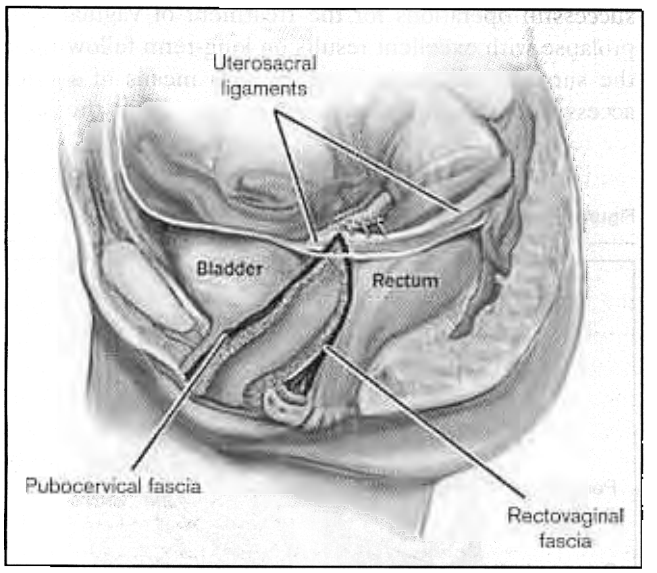
Please note it is the apex of the vagina which has been excised. The copyright for this figure is retained by Miklos and Kohli.

Figure 10. Enterocele repair



Enterocele repair is accomplished by the reapproximation of the anterior pubocervical and posterior rectovaginal fascia. Failure to suspend the apex of the vagina will result in a persistent apical vault prolapse as seen here. The copyright for this figure is retained by Miklos and Kohli.

Figure 11. Vault suspension



Vault suspension is achieved by incorporating the uterosacral-cardinal complex with the newly constructed apex of the vagina. The copyright for this figure is retained by Miklos and Kohli.

manner as in the open abdominal approach, operative cure rate should theoretically be equivalent.

Port placement is based on the surgeon's preference, skill and acquired technique. Once the operative ports have been placed the vagina is elevated with a probe and the peritoneum overlying the vaginal apex is dissected posteriorly exposing the apex of the rectovaginal fascia. Next, anterior dissection is performed to delineate the apex of the pubocervical fascia. A separation between the rectovaginal and pubocervical fascia confirms an enterocele. If a small enterocele is present it should be repaired in a site-specific fashion by imbricating the stretched vaginal epithelium between the apical edges of the pubocervical and rectovaginal fascia. Permanent suture can be utilized in a continuous purse-string fashion or in interrupted fashion. A large enterocele should be resected so the excessive vaginal epithelium is not utilized as a point of mesh attachment. Theoretically, suturing the mesh to the enterocele sac, instead of the more supportive pubocervical and rectovaginal fascia, may predispose the patient to an increased risk of mesh erosion, suture pullout or surgical failure.

Attention is then directed to the sacral promontory and the presacral space. The peritoneum overlying the sacral promontory is incised longitudinally and this peritoneal incision is extended to the cul-de-sac. A laparoscopic dissector is used to expose the anterior ligament of the sacral promontory through blunt dissection. Hemostasis is achieved using either coagulation or surgical clips. A 10–12 cm × 2.5 cm polypropylene mesh graft is introduced through a 10 or 12 cm port. The vaginal apex is now directed anterior and cephalad exposing the rectovaginal fascia for application of the surgical graft. The mesh is then sutured to the rectovaginal fascia with three pairs of number 0 nonabsorbable sutures beginning distally and working towards the rectovaginal fascia apex. A second piece of mesh approximately 4 cm × 2.5 cm is then sutured in a similar fashion to the pubocervical fascia. The surgeon should attempt to take stitches through the entire thickness of the vaginal wall, excluding the vaginal epithelium. These two meshes are then sewn together and the excess anterior mesh is trimmed as needed. The surgeon sutures the free end of the Y-shaped mesh to the anterior longitudinal ligament of the sacrum using two pairs of number 0 nonabsorbable suture. The mesh should be attached with minimal tension on the vagina. In an attempt to decrease surgical time some surgeons have utilized titanium bone tacks and hernia staplers for the mesh attachment to the anterior longitudinal ligament of the sacrum. After reducing intraabdominal pressure and inspecting the presacral space for hemostasis, the peritoneum is reapproximated with 2-0 polyglactin suture.

Level 1 support procedures: clinical results

Richardson [3] first described this anatomic defect for enterocele in 1995 in his landmark paper 'The anatomic defects in rectocele and enterocele'. Since that time, others have described laparoscopic surgical techniques which employ Richardson's anatomic theories in the treatment of enterocele and vaginal apex prolapse [7–9]. Recently Carter *et al.* [10••] reported on eight patients who underwent the Richardson-Saye laparoscopic vaginal vault suspension and enterocele repair technique with excellent results.

There are no other reports in the literature that evaluate clinical results of the laparoscopic uterosacral ligaments suspensions or traditional types of enterocele repairs such as the Halban and Moskowitz procedures. However, some have described their surgical technique or complications. Lyons [11] reviewed the technique and complications in 276 patients who had either a Moskowitz or Halban procedure. The worst complications encountered in this series were port site infections. Koninckx *et al.* [12] emphasized using the carbon dioxide laser for vaporization of the enterocele sac, followed by uterosacral ligament shortening and suspension of the posterior vaginal wall. A modified Moschowitz procedure with approximation of the posterior vaginal fascia to the anterior wall of the rectum has also been described laparoscopically. Despite the paucity of data regarding long-term cure rates, the uterosacral ligament suspension and site specific enterocele repair remains a mainstay in many surgeons' armamentaria.

In 1994 Nezhat *et al.* [13] were the first to report a series of 15 patients who underwent laparoscopic sacral colpopexy. They reported an apical vault cure rate of 100% on follow-up ranging from 3 to 40 months. In 1995, Lyons and Winer [14] reported four laparoscopic sacrospinous fixation and 10 laparoscopic sacral colpopexies. Ross [8] subsequently reported on 19 patients who underwent laparoscopic sacral colpopexy, Burch colposuspension and modified culdeplasty in 1997. The author reported seven complications including three cystotomies, two urinary tract infections, one seroma, and one inferior epigastric laceration. Despite two patients being lost to follow-up, he reported a cure rate of 100% (thirteen out of thirteen) for vaginal apex prolapse at 1 year [8].

Use of synthetic mesh for the treatment of vaginal vault prolapse has been performed since 1991 at The University of Auvergne, Clermont-Ferrand. More than 250 cases have been treated with an apical vault cure rate of approximately 92% [15••]. Complications are rare with the most common being mesh extrusion (2%) and only in patients who underwent concomitant hysterectomy. Patients who had uterine suspensions or who have not had a concomitant hysterectomy have not experienced this complication (A. Wattiez, personal communication at the International Society of Gynecologic Endoscopy, Berlin 2002).

Level 2 support: laparoscopic approach to cystocele repair

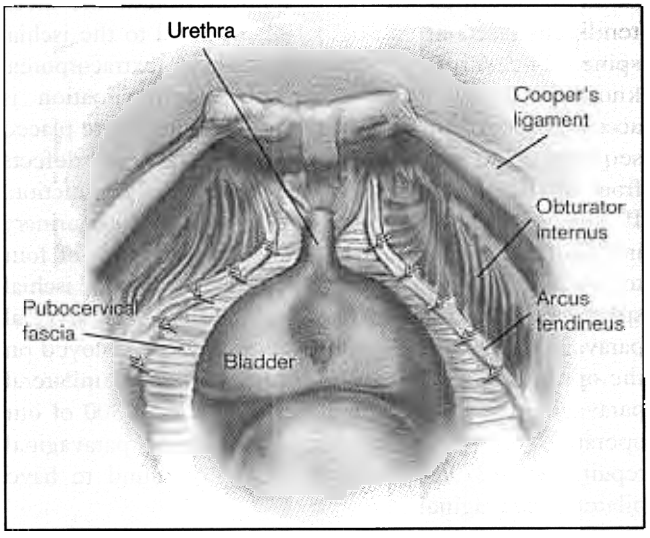
As previously described, the pubocervical fascia of the anterior vaginal wall provides primary support for the bladder and urethra. The pubocervical fascia is apically suspended by the uterosacral-cardinal ligament complex, laterally attached at the fascia overlying the obturator internus via the arcus tendineous fascia pelvis, and distally fused to the pubic bone and urogenital diaphragm. A breech or break in the integrity of the pubocervical fascia may result in a cystocele. Fascial breaks can be defined by the location of the break: transverse defects occur as a horizontal defect at the pericervical ring, lateral or paravaginal defects (Fig. 6) occur at the insertion of the white line on the lateral pelvic sidewall, and midline defects occur along the longitudinal axis of the anterior vaginal wall.

Successful surgical correction of the cystocele depends on the type of defect found in the pubocervical fascia. Clinical preoperative assessment in the office is important in determining the correct surgical approach. On examination of the anterior vagina, anterolateral support should be confirmed. If one or both anterolateral sulci are absent and vaginal rugation is present, then a detachment of the pubocervical fascia from the fascial white line – a paravaginal defect – should be suspected. Cystocele due to lateral defects can be treated in a site-specific fashion by performing a paravaginal repair (Fig. 12). The paravaginal repair has been described via open abdominal, transvaginal and laparoscopic approaches [16]. The authors believe that the abdominal and laparoscopic approaches are the preferred method for the following reasons: (1) transvaginal paravaginal repairs requires extensive dissection and theoretically could lead to an increase in local neuropathy; (2) abdominal/laparoscopic approaches allow for an unobstructed view of the white line and pubocervical fascial break, while the transvaginal approach reduces visualization and may impede the optimal site specific repair; (3) extensive lateral dissection for the transvaginal approach requires the surgeon to completely take down any remaining good lateral attachment, allowing for paravaginal access to the white line, and (4) the laparoscopic/abdominal approach, compared with the transvaginal approach, does not require splitting of the vaginal mucosa from the underlying fibromuscular 'fascia' and thus provides more secure suture attachment on the vagina.

Laparoscopic paravaginal repair: technique

Port placement is a matter of surgeon's preference. We routinely perform open laparoscopy at the inferior margin of the umbilicus and place three ancillary ports under direct vision. The bladder is filled in a retrograde manner with 200–300 ml of normal saline, allowing for identification of the superior border of the bladder edge. Entrance into the space of Retzius is accomplished by a transperitoneal approach using a harmonic scalpel. The incision is made approximately 3 cm above the bladder

Figure 12. Paravaginal repair



The reapproximation of the pubocervical fascia to the obturator internus at the arcus tendineus fascia pelvis. The copyright for this figure is retained by Miklos and Kohli.

reflection, beginning along the medial border of right obliterated umbilical ligament. Immediate identification of loose areolar tissue at the point of incision confirms a proper place of dissection.

After the space of Retzius has been entered and the pubic ramus visualized, the bladder is drained in order to prevent injury during dissection. Separation of the loose areolar and fatty layers using blunt dissection develops the retropubic space, and dissection is continued until the retropubic anatomy is clearly visualized. The pubic symphysis and bladder neck are noted in the midline ad the obturator neurovascular bundle, Cooper's ligament and the arcus tendinous fascia pelvis are identified bilaterally along the pelvic sidewall (Fig. 5). The anterior vaginal wall and its point of lateral attachment from its origin at the pubic symphysis to its insertion at the ischial spine are identified. If paravaginal wall defects are present, then the lateral margins of the pubocervical fascia will be detached from the pelvic sidewall at the arcus tendinous fascia pelvis. To facilitate identification, it is often necessary to elevate the vagina with a finger in the vagina while gently dissecting the bladder and the paraurethral and paravesical fat medially. Often, the broken edge of the pubocervical fascia has fallen inferior to the bladder and its elevation is the optimal method to discern the discrete fascial break. Once appropriately dissected, the lateral margins of the detached pubocervical fascia and the broken edge of the white line can usually be clearly visualized, confirming the paravaginal defect.

The first suture is placed near the apex of the vagina though the paravesical portion of the pubocervical fascia. The needle is then passed through the ipsilateral obturator internus muscle and fascia around the arcus tendineus fascia at its origin 1–2 cm distal to the ischial spine. The suture is secured using an extracorporeal knot-tying technique. Good tissue approximation is accomplished without a suture bridge. Sutures are placed sequentially along the margins of the paravaginal defects from the ischial spine toward the urethrovesical junction. If the patient does not demonstrate stress urinary incontinence or urethral hypermobility, a series of four to five sutures are placed ipsilaterally between the ischial spine and the midurethra. If the patient has bilateral paravaginal defects, the same technique is employed on the opposite side (Fig. 12). In our experience, unilateral paravaginal defects are rare. After reviewing 300 of our operative reports for patients undergoing paravaginal repair, 93% (279/300) of patients were found to have bilateral paravaginal defects.

If patients have stress urinary incontinence a retropubic urethropexy procedure can be performed concomitantly. Incontinence and its laparoscopic treatment are beyond the scope of this paper. However, this information was recently reviewed and described by the authors [17].

Level 2 support procedures: clinical results

Clinical results are lacking with respect to the laparoscopic approach to paravaginal repair. However, many surgeons, including the authors, believe that laparoscopy is only a mode of surgical access. The technique of reconstructive surgery, if performed identically to the open approach, should have cure rates equal to that of abdominal procedures previously studied.

There are limited data reviewing the complication rate of lower urinary tract injuries. Data on open Burch procedures alone, using two sutures bilaterally, report injury to the lower urinary tract to be approximately 10%. Speights *et al.* [18] demonstrated a 2.3% bladder injury rate with no ureteral injury when performing a laparoscopic paravaginal repair with or without a Burch using four to five sutures bilaterally (total eight to ten sutures). The authors attribute the lower complication rate to the experience of the surgeons and the visualization afforded by laparoscopy.

Level 2 and 3 support: laparoscopic approach to rectocele repair

Laparoscopic repair of a rectocele is infrequently performed as most gynecologic surgeons find the vaginal approach to be preferred. However, in some cases including high rectocele or placement of mesh/graft from the perineal body to the uterosacral ligaments, the laparoscopic technique may have additional advantages. The technique employees open laparoscopy and placement of ports as previously described. The rectovaginal septum is opened using electrocautery, harmonic scalpel, or laser. Blunt dissection with dissectors, hydrodissection or sharp dissection may be used to open the rectovaginal space distally to the perineal body. This dissection should follow surgical planes and is often bloodless. The perineal body is sutured to the rectovaginal septum using delayed absorbable suture. The rectovaginal fascial defects are closed with number 0 nonabsorbable suture. If the rectovaginal fascia is detached from the iliococcygeus fascia, it is reattached with number 0 nonabsorbable suture. The medial aspect of the levator ani muscles may also be plicated, but care should be taken to avoid a posterior vaginal ridge [19].

Level 3 support procedures: clinical results

There are few data regarding the use of laparoscopic reconstructive techniques for the treatment of rectocele. Laparoscopic rectocele repair using a polyglactin mesh was first described by Lyons and Winer [20] with an 80% cure rate in 20 women followed at 3-month intervals for 1 year. No long-term complications were noted [20]. Although associated with high success rates, the

procedure is technically challenging and deviates from the traditional vaginal approach to rectocele adopted by most gynecologic surgeons.

Conclusion

Laparoscopy should only be considered a mode of surgical access, which should not significantly change the technique of operative reconstructive surgery. Laparoscopy benefits the surgeon by improving visualization, decreasing blood loss and magnifying the pelvic floor defects which need to be repaired. Other advantages, including less postoperative pain, shorter hospital stays, shorter recovery time and earlier return to a better quality of life, have also been described in the literature. Disadvantages often cited in the literature include increased operative time and associated increased costs. The authors' personal experience is that operative time is similar and in many times reduced especially for patients with a high body mass index. However, complex operative laparoscopy is associated with a steep and lengthy learning curve after which operative time can be significantly reduced based on the surgeon's experience and laparoscopy skills as well as the quality of the operative team.

A thorough knowledge of pelvic floor anatomy is essential before undertaking any type of reconstructive pelvic surgery, and advanced knowledge of laparoscopic surgery and suturing are essential to perform the surgical procedures discussed in this review. Despite the paucity of literature, laparoscopic pelvic reconstructive surgery will continue to be driven by patient demands as well as surgeon preference. With increasing experience, greater data should support its continued use and favorable long-term outcomes.

References and recommended reading

Papers of particular interest, published within the annual period of review, have been highlighted as:

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