19. Pelvic Floor Disorders

Patrick Y.H. Lee and Guillaume Meurette

- Pelvic floor disorders are a continuum of a disease processes resulting from the loss of pelvic floor support.
- Although these diseases are commonly believed to afflict primarily women, the ease of examination of the pelvic floor in women makes the identification of pelvic floor disorders easier in women than in men.
- Anatomical differences in the size of the genital hiatus between the sexes also make women more prone to pelvic floor prolapse.
- Epidemiologic studies on pelvic floor prolapse suggest that it is a disease that will become more prevalent as the population ages.
- Despite the incomplete knowledge on the etiology of pelvic floor laxity and prolapse, surgical management is one of the most important modalities in the repair of the pelvic floor in women.
- Hence, successful repair of the pelvic floor requires a good understanding not only of the pelvic floor anatomy but also of the dynamic interaction between pelvic floor muscles and organs.
- The levator ani complex and the supporting or endopelvic fascia are the two most important dynamic structures of the pelvis (Fig. 19.1a, b).
- The endopelvic fascia is found between the visceral peritoneum and parietal fascia of the levator ani and is a fibroareolar tissue containing neurovascular bundles, smooth muscles, collagen, and elastin (Fig. 19.2).
- Equally important to the understanding of pelvic anatomy is an understanding of the dynamic changes of the pelvic organs. Kelvin and associates popularized the use of four-contrast study to outline the small bowel,

P.Y.H. Lee, MD (✉)
Pacific University Physician Assistant Program, Surgical Specialty Group PC, The Colon and Rectal Clinic, Oregon Health Sciences University, 511 SW 10th Ave. #714, Portland, OR 97205-2708, USA
e-mail: pylee1@comcast.net

G. Meurette, MD
Chirurgie Digestive et Endocrine, Institut des Maladies de l'appareil Digestif, Centre Hospitalo-Universitaire, Nantes, France

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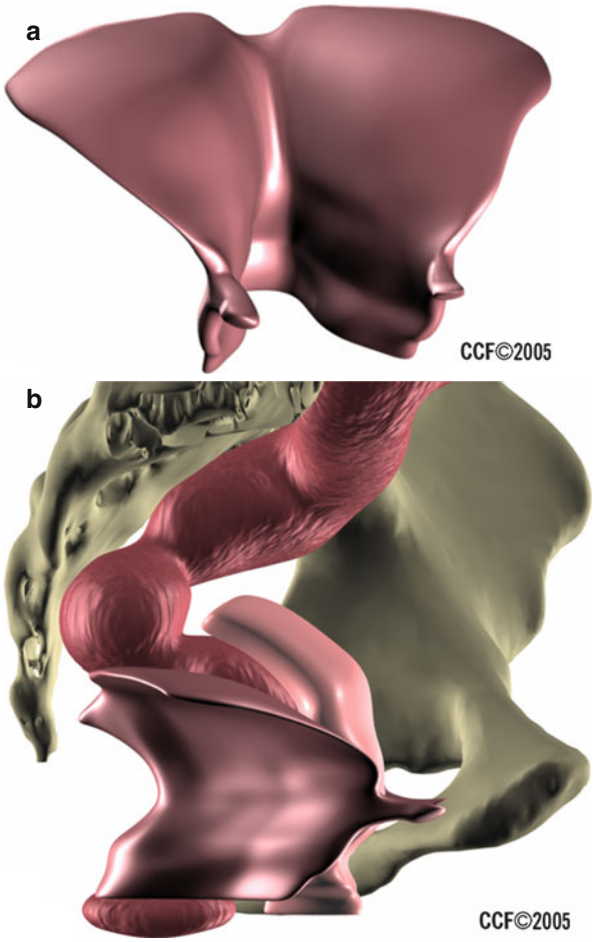

Fig. 19.1 (**a**, **b**) Digitally enhanced MRI reconstruction of the levator ani at rest in a 23-year-old nulliparous woman. The levator ani gives a biconcave shape posteriorly and the puborectalis show as a sling imbedded in the muscle of the pelvic floor (Reprinted with permission from Cleveland Clinic Center for Medical Art and Photography© 2004–2009 and Matthew Barber, MD)

bladder, vagina, and rectum. The dynamic evaluation of the pelvic floor before, during, and after evacuation of the contrasts in the rectum and bladder not only yields a tremendous amount of information about the function of the pelvic organs and the surrounding structures which support them, but it also complements physical examination for enterocele, one of the findings in advanced pelvic floor prolapse.

- Kelvin et al., using their four-contrast study to evaluate 74 women with pelvic floor prolapse, found 14 (19 %) to have enteroceles, 50 % of which were missed on physical exam.

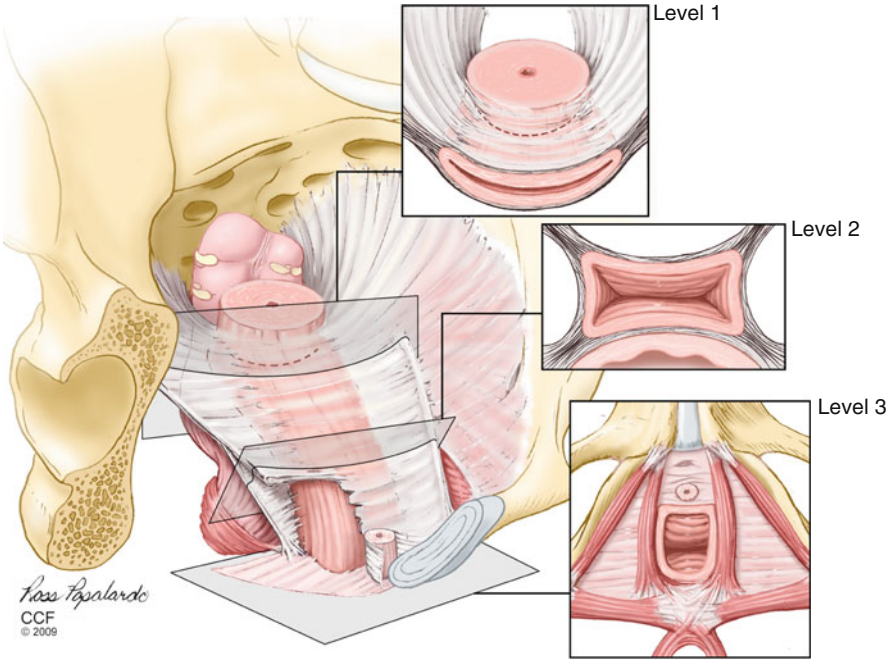

Fig. 19.2 Illustration of the endopelvic fascia as it fans out to cover the pelvic floor and provide support to the surrounding organs. The *levels 1*, *2*, and *3* depict the vaginal support (Reprinted with permission from Cleveland Clinic Center for Medical Art and Photography© 2004–2009 and Matthew Barber, MD)

- These dynamic studies also helped to identify other pelvic organ dysfunctions. In a study of 100 women referred for evaluation of pelvic floor prolapse, dynamic cystoproctography or cystodefecography found that of the 20 patients with anterior compartment systems (urinary), 45 % had middle compartment findings of vaginal vault prolapse; of posterior compartment findings, 90 % had rectocele, 40 % had enterocele, and 35 % had rectal intussusception.
- Similarly, of the 45 patients with symptoms of middle compartment defects (genital), 91 % had anterior compartment findings of cystocele and 56 % of hypermobile bladder neck; of posterior compartment findings, 82 % had findings of rectocele and 58 % of enterocele.
- Of the 17 patients with posterior compartment symptoms (anorectal), 71 % had cystocele, 65 % had hypermobile bladder neck, and 35 % had vaginal prolapse. Their study concluded that 95 % of the women with pelvic floor dysfunction had abnormalities of all three compartments.
- This study underscores the global nature of pelvic floor disorders and the need to understand the pelvic floor as a unit rather than as compartments.

Enterocele

- The loss of pelvic organ alignment as seen on cystodefecography of the bladder, vagina, uterus, and rectum is obvious, but the significance of an enterocele remains controversial.
- Kinzel described an enterocele as a "true" hernia because it contains a hernia sac (the pouch of Douglas), neck, and contents.
- Delancey postulates that enterocele sac develops as a result of the loss of suspension of the upper vagina and muscle integrity of the levator ani muscles that leads to the herniation of the cul-de-sac between the rectum and vagina.
- Enteroceles are often classified as congenital, pulsion, traction, and iatrogenic.
  - A congenital enterocele is a result of the failure of the fusion of the anterior and posterior peritoneum during fetal development, resulting in a deep pouch of Douglas.
  - Pulsion type is caused by chronic increase of abdominal pressure.
  - While traction type is caused by the loss of pelvic floor support and resulting in the pulling or traction of the pelvic organ on the surrounding structures out of the pelvis such as the vagina.
  - Iatrogenic is caused by surgical injury.
- The clinical presentations of an enterocele are dependent on the extent of the herniation and may present from no physical findings to bulging of the perineum or posterior vagina during strain.
- Clinical examination of the vagina or bidigital exam of the rectum and vagina during maximum strain can help detect the spreading of the rectovaginal plane between the fingers as the enterocele enters into the rectovaginal plane; however, physical examination is unreliable in detecting enterocele.
- Kelvin et al. reported their findings on 170 patients with symptoms of pelvic floor dysfunction who were evaluated by urogynecologist and found 47 patients (28 %) with an enterocele; only 24 (51 %) of these patients were found by physical exam.
- There are, however, controversies about the significance of enterocele containing small bowel versus sigmoid colon.
- Some contend that enteroceles containing sigmoid colon result in defecatory dysfunction, whereas enteroceles containing small bowel are more reflective of pelvic floor prolapse.
- MRI has been reported to be useful in the detection of enteroceles (Fig. 19.3).
- It is also helpful in evaluating not only the size of the levator hiatus in prolapse but also the changes in the anatomy of the levator ani muscle.

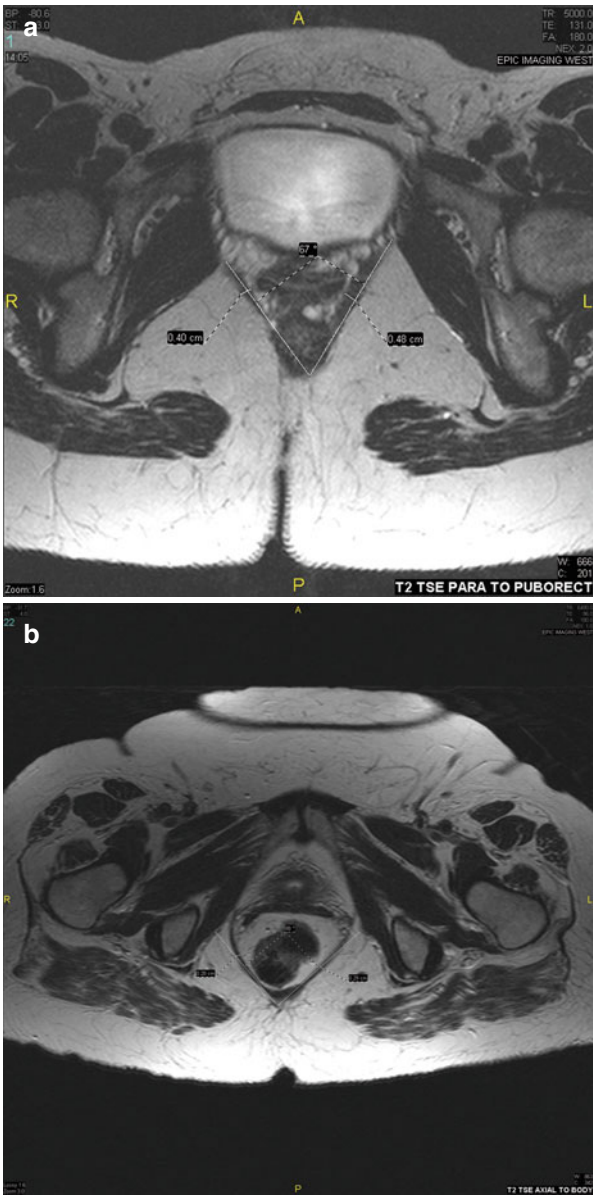

Fig. 19.3 MRI of the levator hiatus, normal on the *top* (**a**) and enlarged on the *bottom* (**b**). The angle between the *two lines* drawn along the puborectalis muscle and bisecting in the posterior midline of the levator ani defines the levator hiatus angle. This angle can also be measured by endorectal ultrasound and is found to correlate with findings of enterocele and pelvic floor prolapse findings on MRI and cystodefecography

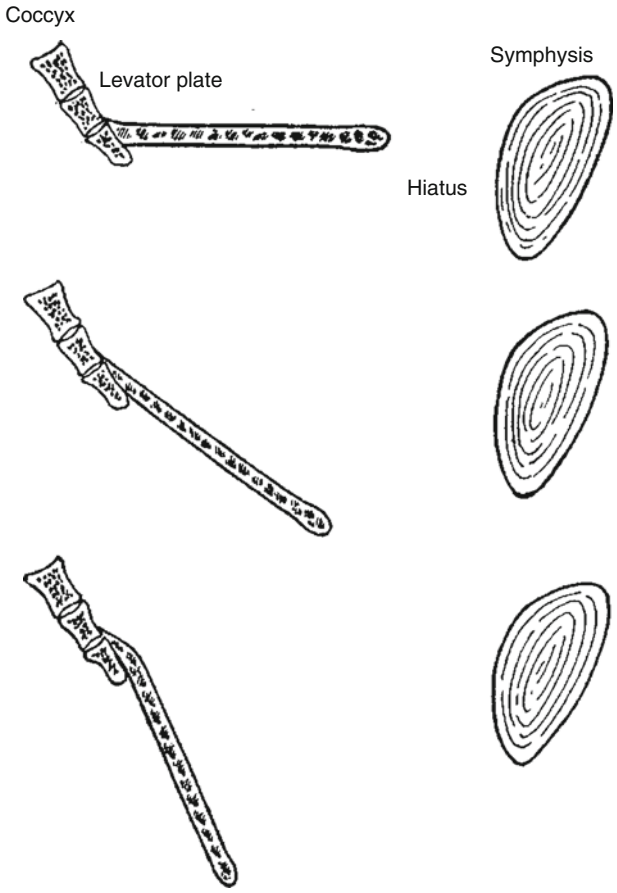

Fig. 19.4 Illustration of the incline of the levator plate and enlargement of the levator hiatus resulting in pelvic organ prolapse (With permission from Berglas B, Rubin IC. Study of the supportive structures of the uterus by levator myography. Surg Gynecol Obstet 1953;97:677–92)

- Singh et al. used a three-dimensional MRI reconstruction to assess the size of the levator hiatus and morphology of the levator ani muscle.
- They found that increasing stage of prolapse correlated with increasing size of the levator hiatus, but not with the morphology of the levator ani (Fig. 19.4).
- They proposed that patients who have pelvic organ prolapse with normal levator ani morphology may only need fascial repair compared to those who show morphologic changes of muscle injury.
- Currently, the MRI remains the best imaging technique in looking at the anatomy of the pelvic floor, while cystodefecography provides for dynamic images of the pelvic organs during defecation and urination.
- The increasing use of open-configuration MRI to allow the patient to assume a sitting position has shown this to be equivalent to the supine

MRI in the evaluation of pelvic floor laxity. In the future, the open-configuration MRI may offer superior imaging findings compared to cystodefecography.

- The MRI and cystodefecography studies have helped confirm what is already clinically known about the enlargement of the levator hiatus in pelvic organ prolapse. What is not known is at what point in the levator hiatus enlargement does pelvic organ dysfunction or prolapse occur, and why.
- The true incidence or prevalence of colorectal diseases associated with pelvic floor disorder is unknown.
- This is in part due to our failure to recognize the early signs of pelvic floor laxity and in part due to the poor correlation between the degree of pelvic organ prolapse and symptoms.
- In an attempt to identify patients with pelvic organ prolapse by history, Barber et al. found that when patients with high probability of prolapse were asked, "Do you usually have a bulge or something falling out that you can see or feel in your vagina?" an affirmative answer had a 96 % sensitivity (95 % CI 92–100) and 79 % specificity (95 % CI 77–92) for stage III and IV vaginal prolapse defined by the Pelvic Organ Prolapse Quantification (POP-Q).
- Interestingly, the degree of colorectal symptoms associated with vagina and bladder prolapse seems to be higher in early stages than in late.
- The progression of enlargement of the levator hiatus appears to be in a ventral-caudal direction.
- This view is supported not only by cystodefecography and MRI studies but also by numerous clinical studies showing the higher incidence of urinary and vaginal prolapse over rectal prolapse in women with pelvic floor prolapse.
- Furthermore, patients with rectal prolapse have on average of 1.5–3.3 operations related to bladder and vaginal prolapse prior to their presentation with anorectal symptoms. Peters et al. studied 55 women with rectal prolapse; 95 % had other pelvic floor defects. The five most common complaints were vaginal prolapse/pressure (92 %), rectal prolapse/pressure (69 %), constipation (71 %), fecal incontinence (40 %), and obstructive defecation (38 %). Their study underscores the importance of colorectal evaluation in patients with vaginal prolapse/pressure.
- Although there are no longitudinal studies to validate the progression of pelvic floor prolapse resulting in rectal symptoms, the clinical studies along with the cystodefecography and MRI support the postulate that as the rectum descends and loses its anatomical alignment in the pelvis, a spectrum of colorectal symptoms will emerge.
- In the early phase, the symptoms of worsening "hemorrhoids" and mucous discharge may be related to rectal mucosal prolapse.
- As the rectum descends further from the pelvic floor, symptoms of incomplete evacuation of stool and needing to splint or use fingers to extract the stool are often associated with rectocele and internal rectal prolapse.

Fig. 19.5 Extreme form of multiorgan prolapse with rectum, uterus, vagina, and bladder prolapsed out of the levator hiatus

- In the advanced phase of rectal prolapse, symptoms of tissue protrusion out of the anus or vagina, along with pressure and pain in the local and regional areas of the pelvis, may represent the rectal and vaginal prolapse with enterocele.
- In the extreme form of pelvic floor prolapse, the rectum, vagina, uterus, and bladder are prolapsed out, as shown in Fig. 19.5. Sullivan et al. described this condition as the tetralogy of Fallot.
- The continuum of pelvic floor laxity leading to anorectal symptoms makes it difficult to evaluate the effectiveness of medical versus surgical management, but medical management becomes less effective than surgery when the patient's complaints and physical findings of rectal and other pelvic organ prolapse become evident.

Rectocele

- The presence of rectocele and multi-pelvic organ prolapse is specific to pelvic floor disorders and manifests as complaints of rectal pressure, defecation difficulty, incomplete emptying, fecal seepage, low back and pelvic pain, "hemorrhoids," and tissue "falling out" of the rectum and vagina.
- The evaluation and determination of when a rectocele becomes significant for surgical intervention are hampered by the lack of a unified agreement on the pathogenesis and diagnostic evaluation of rectoceles.

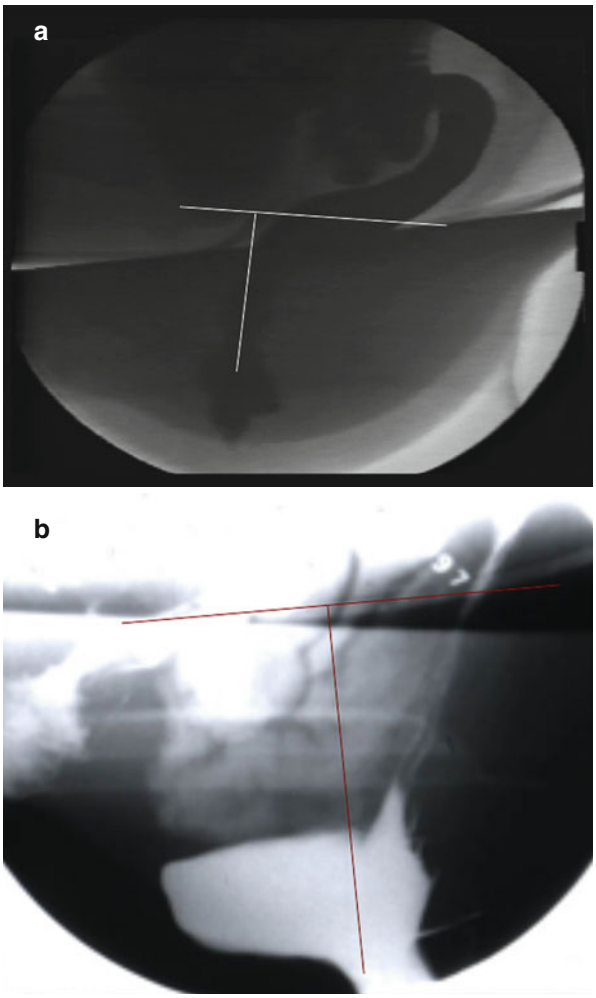

Fig. 19.6 Cystodefecographies show the widening of the distance between the pubis and anal opening in patients on the *top* (**a**) compared to the normal on the *bottom* (**b**). Measurement of the distance can be made by drawing a perpendicular line from the pubococcygeal line to the anal opening during the defecation phase

- They are usually described as herniation or defect of the rectovaginal septum, but clinical findings of perineal laxity and cystodefecography findings of increased length between the pubis and anus during strain, as shown in Fig. 19.6a, b suggest that rectoceles also have a component of rectal descent in addition to rectovaginal defect.
- The evidence of rectal descent is even more compelling in men with rectocele.
- Chen et al. evaluated 234 men with defecation complaints and found 40 men (17 %) with rectocele; 40 % had prostatectomies. Rectoceles were

anterior in 48 % and posterior in 52 %, nonrelaxing or partially relaxing puborectalis muscle 66 %, perineal descent 65 %, intussusception 23 %, and sigmoidocele 15 %.

- Their findings support the view that rectoceles rarely occur in isolation. Furthermore, rectoceles are not all equal in their effect on defecation dysfunction.
- Pucciani et al. described two types of rectocele in women, type I (distension) and type II (displacement), and found that type II was associated with higher incidence of vaginal prolapse, more frequent manual evacuation, lower anal pressure, and greater mucosal intussusception than type I.
- The displacement type of rectocele is likely a result of the descent of the rectum. Brubaker described the displacement of the rectum as the "rectal width" and correlated this to stool entrapment. The loss of rectal alignment in the pelvis means that intraabdominal pressure is ineffectively transferred during defecation, leading to obstructive defecation complaints. Halligan et al. showed that patients who were able to expel a 10 cc pressure transduced balloon had higher intrarectal pressure than those who did not (median 208 versus 143 cmH_2O). Evacuation ability of the rectal balloon correlated with defecography findings of prolonged and incomplete evacuation.
- Interestingly, they found eight patients who had prolonged evacuation time, low intrarectal pressure, and very little change in pelvic floor descent, and concluded that these patients lacked the ability to generate intraabdominal pressure. It is unclear if these eight patients had extreme pelvic descent such that they could not have any further excursion of their pelvic floor during the evacuation phase of their defecography.
- Karlbom et al. showed that successful improvement of rectal emptying after rectocele repair is associated with elevation of the pelvic floor.
- Surgical repairs of rectoceles are generally divided into transanal and transvaginal approaches.
- Transabdominal approaches for rectocele are usually done in conjunction with other more severe pelvic organ prolapse findings.
- The most common transanal approach to rectocele repair is the modified Delorme procedure popularized by Sullivan et al. in which the anterior rectal wall was plicated after the mucosa was lifted up from the muscularis propria.
- The recognition that up to 70 % of rectal mucosal intussusceptions or internal rectal mucosal prolapses were associated with rectocele led to the return of Delorme's original description of the repair, which involved the circumferential stripping of the rectal mucosa and plication of the rectal musculature.
- The technique is described in the ASCRS textbook.
- Long-term outcomes of transanal rectocele repair are associated with 50 % recurrence at 5.5 years. It is unclear if recurrence means return of symptoms of obstructive defecation or anatomical recurrence of rectocele, or both.

- Other techniques using a stapler to obliterate the rectocele and reduce intussusception, such as the single-stapled transanal prolapsectomy with perineal levatorplasty (STAPL) and double-stapled transanal rectal resection (STARR), had 76 and 88 % improvement of obstructive defecation symptoms at 20 months, respectively.
- Again, the lack of postsurgical defecography or MRI studies makes it difficult to explain why reduction of the rectocele results in improvement of symptoms.
- Van Laarhoven et al. showed that there is no correlation between patients' symptoms and size of rectocele reduction, suggesting that other factors may be at play for patients' improved symptoms.
- Transvaginal techniques of rectocele repair or posterior colporrhaphy are primarily performed by gynecologists using one of the four techniques:
  1. Levator ani (puborectalis) or rectovaginal muscularis reapproximation
  2. Site-specific repair of the rectovaginal septum
  3. Reapproximation of the rectovaginal septum to the levator ani fascia
  4. Posterior repair of the rectovaginal defect with grafts or mesh
- All these techniques involve an incision in the posterior wall of the vagina and separating the plane between the rectum and vaginal wall.
- Once the exposure is complete, then various techniques of reinforcement of the septum are performed. In general, the approximation of the levator ani results in up to 50 % incidence of dyspareunia.
- This technique has been mostly abandoned and replaced with rectovaginal septal repair by reapproximating it either longitudinally or transversally, with or without grafts or mesh.
- The concept of site-specific repair of the rectovaginal septum is best described by Richardson, who described "breaks" in the rectovaginal septum resulting in rectocele formation. Depending on the location and extent of the breaks, various types of rectocele emerge, and with higher "breaks," enteroceles may enter into the rectovaginal plane. The use of biologic grafts and synthetic mesh in rectocele repair is reserved for large rectoceles (with >4 cm depth), presence of vaginal prolapse, poor native tissue, and associated vagina and bladder prolapse. In general, the use of grafts or mesh in the repair of rectocele is safe, but its superiority and efficacy over established repair remains inconclusive.
- The best study on the benefits of transvaginal repair of rectocele was done by Mellgren et al. who reported on 25 patients prospectively for a mean period of 1 year.
- Constipation was present in 88 % preoperatively and relieved in 84 % postoperatively.
- Paraiso et al. reported their randomized trial evaluating three surgical techniques of posterior colporrhaphy (rectovaginal muscularis reapproximation, site-specific repair, and site-specific repair with a xenograft) and found all three methods had similar improvement in symptoms, quality of

life, and sexual function. Interestingly, they found a 46 % anatomical failure rate with the xenograft, but without any difference in outcome compared to the other two techniques.

- No cystodefecography studies were performed before or after the repairs to document the effects of the surgical intervention, which makes it difficult to explain the unexpected outcomes of any pelvic floor repair.
- Progression of pelvic floor laxity leads to complex, multi-pelvic organ prolapse similar to what Sullivan et al. described as the tetralogy of Fallot.
- Central to the successful restoration of the pelvic organs to their anatomic position is stabilization of the perineal body and reinforcement of the rectovaginal septum or posterior vaginal fascia.
- In men, this septum or fascia is known as Denonvilliers' fascia.
- In 1933, Sears published anatomic findings of the rectovaginal septum and described it as a double-layer sheet of fascia arising from the levator ani and uterosacral ligament. One of the layers (lateral) forms the urogenital diaphragm, and the other (medial) fuses to the fibers of the posterior vagina and perineal body (Fig. 19.7).
- Milley and Nichols provided further evidence of the relationship between the rectovaginal septum and perineal body in 143 specimens, whose ages ranged from 8 weeks fetus to 100 years.
- Lane in 1962 was the first to use mesh in the pelvis to reinforce the rectovaginal septum in the repair of vaginal vault prolapsed. Although there has been a plethora of mesh development, Lane's technique of the transabdominal sacrocolpopexy has undergone very little modification.
- Nygaard et al. summarized the published data on abdominal sacrocolpopexy from 1966 to 2004 and reported that the range of success rates for apical prolapse was 78–100 %, organ prolapse 58–100 %, reoperation for prolapse median 4.4 % (range 0–18.2 %), and mesh erosion 3.4 %.
- They concluded that sacrocolpopexy with mesh is an effective technique for vaginal apical prolapse, but reported an increase in constipation complaints from 29 to 52 %.
- Pilsgaard and Mouritsen reported their experience with 35 patients who underwent sacrocolpopexy with mesh with a mean follow-up period of 2 years (6 months to 4.5 years) and reported a 30 % increase in the symptoms of defecation difficulty. The exact etiology of the increased defecation dysfunction or constipation is unclear.
- Addison et al. reported on three cases of sacrocolpopexy with mesh failure and suggested mesh avulsion from the apex of the vagina or herniation below the mesh repair as a cause of recurrent symptoms of prolapse. They advocated placement of the mesh throughout the length of the vagina.
- Sullivan et al. in 2001 published the largest long-term result on pelvic floor prolapse repair with their technique called total pelvic mesh repair (TPMR).

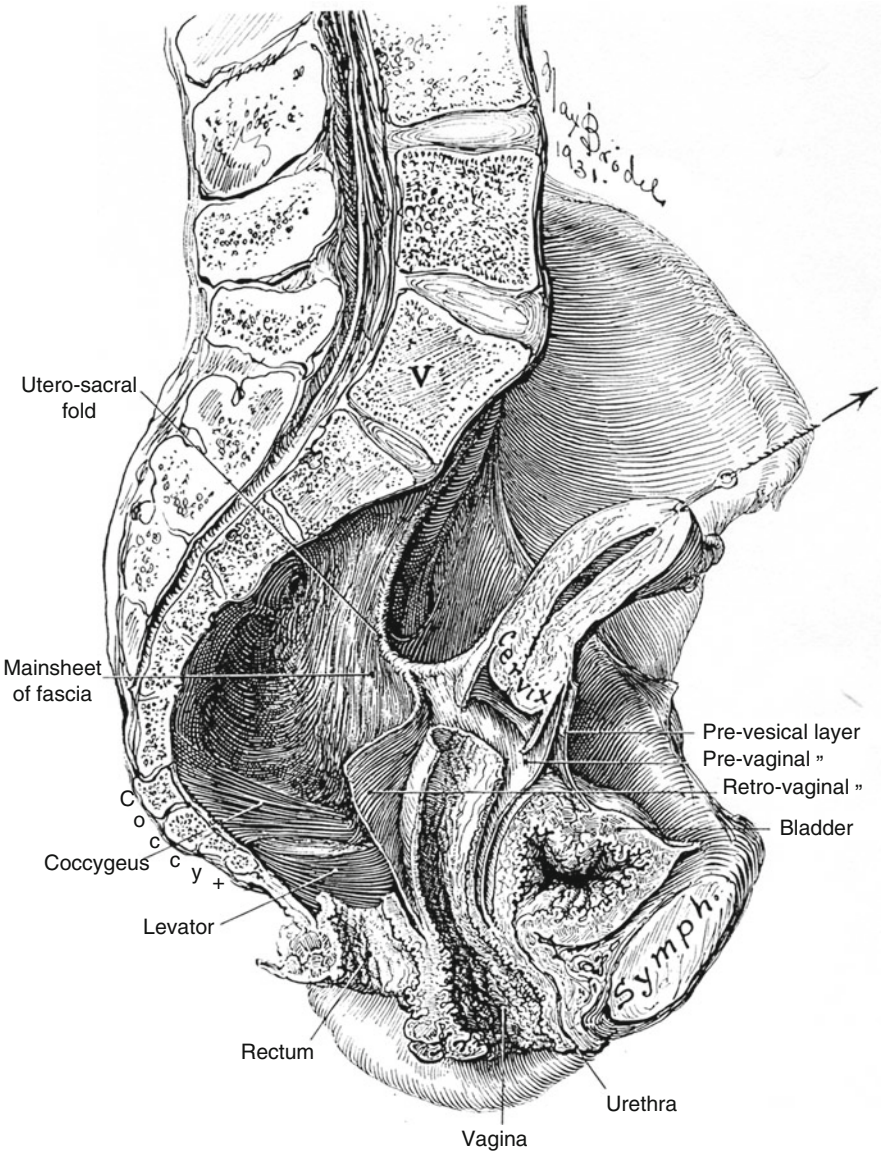

Fig. 19.7 The endopelvic layer arising from the pelvic sidewall and fanning out between the rectum and vagina to form the rectovaginal septum and anchoring to the perineal body (With permission from Sears NP. The fascia surrounding the vagina, its origin and arrangement. Am J Obstet Gynecol 1933;25:484–92)

Fig. 19.8 In the total pelvic mesh repair (TPMR), a Cobb-Ragde needle (V. Mueller, Deerfield, IL) is placed in back of the rectovaginal sulcus and pushed through into the introitus to secure the perineal body. A polypropylene suture is placed through the eye of the Cobb-Ragde needle and pulled into the pelvis to secure the mesh between the sacrum and the perineal body. Two additional strips of mesh are then placed on each side of the sacroperineal mesh, tunneled deep to the peritoneum, and secured lateral to the vagina and bladder to Cooper's ligament in the space of Retzius

  - Over a 10-year period, 236 women had TPMR, and 205 were available for a median follow-up of 5.3 years. They reported resolution of defecation difficulty in 76 % and of fecal incontinence in 85 %, and patient satisfaction of 74 % at 6 years or greater. Their procedure incorporates the current understanding of perineal stabilization and reinforcement of the rectovaginal septum by placing a mesh for the full length of the vagina and anchoring it to the perineal body. The procedure is outlined in Fig. 19.8). This study highlights the importance of perineal body stabilization and rectovaginal septum reinforcement with mesh in the support of pelvic floor prolapse.
- The use of mesh slings have proliferated beyond the initial use for urinary incontinence and have been advocated for the treatment of fecal incontinence and rectal prolapse.
- Although mesh placement, regardless of whether it is a transabdominal, transvaginal, or transperineal approach, seems to offer a better outcome than non-mesh repairs, there are no conclusive evidence to suggest that patients with early symptoms and findings of pelvic floor laxity will require more advance repairs with mesh than those patients reported by Sullivan et al., Cundiff et al., and others.

- The current techniques of local repair of the bladder, vagina, and rectum may be adequate, provided that clinical and radiologic findings show them to be truly isolated pelvic organ prolapse, but as discussed earlier such isolated prolapse is uncommon, and the failure to recognize and repair multiorgan prolapse is a primary source of patient dissatisfaction.
- Unlike diseases, which are surgically addressed with one technique such as appendicitis, the pathogenesis of pelvic floor prolapse is chronic and results in progressive constellation of symptoms and findings.
- The global transformation of the pelvic floor may result in surgical treatments that are successful for a limited period of time and fail not because of the technique but because of the progression of the pelvic floor prolapse.
- The exact etiology of pelvic floor prolapse remains unknown, and it is for this reason that dynamic imaging with cystodefecography, MRI, and other modalities are so important in documenting the disease process of pelvic floor disorders.
- Undoubtedly there will be new technologies and techniques that will evolve to replace the old, but as Moschcowitz most elegantly put it in his axiom, or generally accepted truth, about treatments of rectal prolapse, "the more remedies there are suggested for the cure of a malady, the less the likelihood of the efficacy of any particular one."
- A corollary to this axiom would be, "the more remedies there are for a disease, the more reflective of our lack of understanding of its pathogenesis."