Overview of pelvic floor failure and associated problems

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Abstract

Pelvic organ prolapse POP, including anterior and posterior vaginal prolapse, uterine prolapse, and enterocele, is a common group of clinical conditions affecting millions of women worldwide. The aim of this review is to highlight the clinical importance of prolapse, its pathophysiology, and different modalities for diagnosis and treatment. POP includes a range of disorders, from asymptomatic disturbed vaginal anatomy to complete vaginal eversion associated with considerable degrees of urinary, defecatory, and sexual dysfunction. The pathophysiology of prolapse is multifactorial however genetically susceptible women are more exposed to life events that result in the development of clinically significant prolapse. The evaluation of women with prolapse requires a comprehensive approach, with focusing on the function in all pelvic compartments based on a detailed patient history, physical examination, and investigations. Although prolapse is associated with many symptoms, few are specific for prolapse; it is often a challenge for the clinician to determine which symptoms are prolapse-specific and will therefore improve or resolve after prolapse treatment. Prolapse treatment is based on specific symptoms moreover its management options fall into two broad categories: nonsurgical, which includes pelvic floor muscle training and pessary use; and surgical, which can be reconstructive or obliterative. Associated symptoms require additional management. All women with prolapse can be treated and their symptoms improved, even if not completely resolved.

Introduction

Pelvic organ prolapse (POP) is a bulge or protrusion of pelvic organs and their associated vaginal segments into or through the vagina.[1] It commonly affects older women. A North American analysis revealed that a woman up to the age of 80 years has an 11% risk of needing surgery for pelvic floor weakness. Furthermore, if she has an operation, she has a 29% risk of requiring further surgery.[2] It has been thought that over the next 30 years, the demand for treatment of POP will increase 45%, matching with an increase in the number of women above 50 years old.[3] It is estimated that up to half of the normal female population will develop uterovaginal prolapse during their lifetime. Twenty percent of these women will be symptomatic and need treatment.[4]

As this problem grows significantly, it becomes important to focus on understanding of the pathophysiology and risk factors associated with pelvic organ prolapse to try to prevent its occurrence. Furthermore, more efforts are needed to understand factors that result in long-lasting, effective repair of pelvic organ prolapse for those patients undergoing surgical management. Despite extensive experience, the optimal surgical approach to apical and other compartment prolapse remains a matter of debate.[5]

Data from the Women's Health Initiative revealed anterior pelvic organ prolapse in 34.3%, posterior wall prolapse in 18.6%, and uterine prolapse in 14.3% of women in the study.[6]

In this study, a significant risk factor associated with prolapse was vaginal delivery. After adjusting for age, ethnicity, and body mass index, women with at least one vaginal delivery were twice as likely as nulliparous women to have pelvic organ prolapse. Causes of POP are most likely multifactorial, however; factors other than vaginal delivery also are associated with the development of these disorders. Gurel et al., found that the incidence of prolapse doubled with each decade of life between the ages of 20 and 59 years.[7]

In another study, each year of increasing age was associated with a 12% increase in the risk of developing prolapse.[8] Other associated risk factors for the development of POP include history of hysterectomy,[7] obesity,[9] history of previous prolapse operations, and race.[10]

Pathophysiology

The main cause of pelvic organ prolapse is the attenuation of the supportive structures, whether by actual tears or "breaks" or by neuromuscular dysfunction or both. The vagina is supported by the enveloping endopelvic connective tissue and its condensations at the vaginal apex, which form the cardinal uterosacral ligament complex. The endopelvic connective tissue is the first line of support. The second line is the pelvic diaphragm, composed of the levator ani and coccygeus muscles. These muscles provide a supportive diaphragm through which the urethra, vagina, and rectum pass.

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Muscle

The striated muscle of the pelvic floor, in common with other striated muscles throughout the body, undergoes a gradual denervation with age.[11]

This denervation will lead to a gradual weakening of the muscle with time. While some of the aging effect can be compensated for by muscle training, the impact of denervation will be to diminish the number of neurones which can stimulate muscle fibres to contract. Pelvic floor muscle denervation is increased by repeated vaginal delivery, particularly in case of prolonged second stage of labour.[12]

Fascia

Recently, our understanding of the frequency of fascial tears has improved with intraoperative dissection. Careful examination of prolapse segments as well as careful dissection of the fibromuscular layer from the overlying vaginal epithelium frequently identifies specific tears in this fibromuscular layer. It has become clear that fascial tears tend to begin as apical transverse defects, or separation of the fibromuscular layer from the vaginal apex or cervix, with the highest degree of frequency. Recent studies reveal that the highest incidence of fascial separation occurs as superior transverse fascial defects posteriorly. This will typically lead to the formation of what is commonly thought of as an enterocele.[13]

Restoration of attachment of this layer to the vaginal apex will also reduce an obvious rectocele very often. Thus, restoration of intact attachment of the fibromuscular layer to the vaginal cuff can be an important part of the correction of any posterior vaginal prolapse. Along the anterior vaginal wall, superior transverse fibromuscular layer separation is also very common in the development of a cysto-

cele, and may be more clinically significant than paravaginal separation.[14]

Classification

Prolapse is normally divided into anterior, uterine/vault and posterior compartments. Although anterior vaginal wall prolapse is still commonly called a cystocoele and posterior prolapse a rectocoele or enterocoele the difficulty in providing reproducible descriptions for the purpose of research has led to the development of scoring systems. The most frequently used validated method in current literature is a system called the Pelvic Organ Prolapse Quantification (POPQ).[15] The system is shown diagrammatically in Figure 1.

The POPQ is a valid system for staging for vaginal prolapse. This staging system separately addresses the vaginal compartments (anterior, posterior, apical) and defines the extent of prolapse in relation to the hymen. Stage 0 indicates no prolapse, stage 1 implies that the most distal portion of the prolapsed organ is 0.1 cm above the hymenal ring, stage 2 defines prolapse within 1 cm of the hymen (proximal or distal), stage 3 denotes prolapse 0.1 cm distal to the hymen, and stage 4 implies complete vaginal eversion.[15]

According to a dynamic pelvic magnetic resonance imaging (MRI) for patients with uterine prolapse, Prolapse is classified in reference to the puborectalis hiatus (sling), which is formed by the puborectalis muscle (the most inferior part of levator ani) and includes the urethra, vagina, and rectum. The degree of prolapse is based on 2-cm increments: mild uterine prolapse is between 0 and 2 cm below the hiatus, moderate prolapse is 2-4 cm, and severe prolapse is 0.4 cm below the hiatus.[16]

Clinical presentation

POP and symptoms of pelvic organ dysfunction are both common in the general population and may occur concurrently, but independently. It is important to understand the correlation between patients' symptoms and clinical staging of POP. Many studies have reported little or no agreement between POP severity and symptoms of bladder and bowel dysfunction.[17-19]

The most reliable symptom, which has previously shown to be well related to the severity of prolapse, was *to see or to feel a bulge in the vagina*.[20-21]

Mechanical symptoms

Three studies showed quite consistent rates of mechanical symptoms of around 8% among older women.[22-24] Mechanical symptoms are often presented when the prominent edge of the prolapse is at or outside the hymen.[25]

Prolapse classically produces a sensation of fullness in the vagina or a visible or palpable lump at the introitus. This sensation is always related to posture. If the symptoms do not resolve when lying down an alternative aetiology should be considered. Low backache is a common symptom but is also commonly experienced by women who do not have prolapse. Vaginal atrophy, if present, will exacerbate many prolapse symptoms and should be treated as a first priority with topical oestrogens unless clinically contraindicated.

Lower urinary tract symptoms

POP is often associated with incontinence and voiding problems.[26-28] Severe stages of anterior wall prolapse correlate with voiding problems with the need to manually reduce the prolapse to urinate.[29,30]

A more vague feeling of bladder-emptying problems may be reported by 30-50% of patients without specific relation to the prolapsed compartment. Some recent studies showed that 13-83% of patients with POP also complained of stress incontinence, and 21-73% of urge incontinence.[26,28] In population studies, 15-20% of women in this age group complain of incontinence.[31]

POP is usually associated with incontinence regardless the presence of a strict relation to the prolapsed compartment or not. There is a tendency for urge incontinence (UI) to improve with more severe POP stages, while voiding problems are aggravated. Repair of prolapse can improve or cure both voiding problems and stress and urge incontinence in more than half of the cases.[30,32]

It is highly recommended to perform urodynamics, Q-tip test, fluoroscopy, ultrasonograhy, and reduction of the prolapse with pessary and speculum tests in order to evaluate coexisting or occult incontinence in women with prolapse.[33-36]

Masked incontinence may be revealed, after correction of urethral kinking and compression by reduction of the prolapse, and is reported in 15-22% of patients.[37,38] In many studies, the consequence of a *demasking* test was taken, and the *expected* incontinence operated in the same session with POP surgery without validating the efficacy of the test. Weil *et al*., showed that the pessary test was falsely positive in 72% and falsely negative in 10% of 40 patients. Urodynamic tests with and without prolapse reduction cannot determine the outcome of overactive detrusor function. Also the efficacy of the anti-incontinence surgery, done simultaneous by vaginal repair, cannot be predicted by these tests.[32,39]

Bowel symptoms

Posterior vaginal wall prolapse may be presented with a range of bowel symptoms.

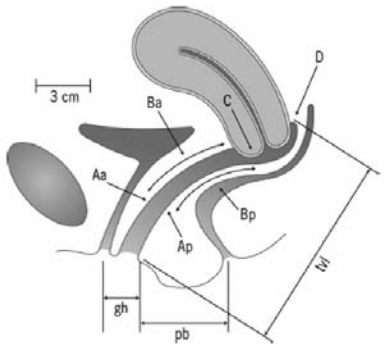

Figure 1. Pelvic Organ Prolapse Quantification system. (Abbreviations: Aa, anterior wall; Ap, posterior wall; Ba, anterior wall; Bp, posterior wall; C, cervix or cuff; D,posterior fornix; gh, genital hiatus; pb, perineal body; tvl, total vaginal length). Modified from Bump RC, Mattiasson A, Bo K, *et al.*[15]

Constipation is a common symptom in women and may contribute to obstructed defecation. The presence of posterior vaginal wall prolapse may not be the cause of the obstructed defaecation but more a symptom of it. Posterior vaginal wall prolapse does not normally result in ano-rectal incontinence.[40]

Sexual dysfunction

Treatment of POP and UI usually concentrate more on anatomy and cure of UI than sexual dysfunction. Many studies are retrospective[41-42] and based mainly on dyspareunia and *general sexual wellbeing* as the key aspects of female sexual function. Dyspareunia is a multifactorial and common symptom among older women, often due to vaginal dryness, atrophy, low oestrogen levels, and old age.[41-43]

The frequency of sexual activity did not differ in a group with UI or POP compared to controls. Decreased sexual satisfaction because of urine leakage during intercourse, embarrassment, dyspareunia, and vaginal dryness were significantly more common in the group with UI or POP compared to controls.[44] In another study, it has been shown that most sexual problems were in the group with UI and were associated with decreased libido, vaginal dryness and dyspareunia, while POP was not associated with sexual problems in this stud.[45]

The relation of sexual function to cure of UI and objective vaginal dimensions before and after treatment for POP is weak.[20,42] Deterioration of emotional status of sexual life in spite of physical improvement after POP and UI surgery was found in a study using PISQ-12, which is a specific questionnaire in both a long- and a short-form with 12 questions covers broader aspects of female sex life, and has been validated for use in patients with pelvic floor dysfunction.[46]

The sexual outcome was not related to age,

type of surgery, oestrogen status, and cure or not of incontinence symptoms. Other studies showed that vaginal surgeries, especially posterior colporrhaphy, vaginal atrophy, old age and partner's medical and sexual problems, are considered risk factors for sexual dysfunction and dyspareunia in women.[39,41,42]

Sexual complaints in women can be related to many physical problems: e.g. urine leakage during intercourse, dyspareunia from the feeling of a narrow or short vagina, vaginal dryness, scar tissue and mucosal bridges from prior vaginal tears or surgery, and/or due to emotional impact of menopause, pelvic floor dysfunction, and partner relationship and function. Clinicians need more information in order to assess these factors to be able to counsel patients and adjust surgical techniques.

Physical assessment

It is useful to divide the pelvis into compartments, each of which may exhibit specific defects. The apical compartment of the vagina can be assessed by the use of a Graves speculum or Baden retractor. The anterior and posterior compartments are best examined with the use of Sims' speculum. The speculum is placed posteriorly to retract the posterior wall downward when examining the anterior compartment and placed anteriorly to retract the anterior wall upward when examining the posterior compartment. A rectovaginal examination is helpful in evaluating the posterior compartment to differentiate between a posterior vaginal wall defect and a dissecting apical enterocele or a combination of both. During the evaluation of each compartment, the patient is encouraged to perform Valsalva so the full extent of the prolapse can be assessed. If the findings determined with Valsalva are not correlated with the patient's description of her symptoms, it may be helpful to perform a standing straining examination with the bladder empty.[47]

Imaging

Imaging studies including ultrasonography, computed tomography (CT) scan, and MRI are useful in the determination of POP. The CT scan and sector, real-time, or three-dimensional ultrasonography have been employed to provide anatomic details of the pelvic floor support. MRI is an emerging technique for the study of pelvic floor dysfunction and holds promise due to its excellent ability to differentiate soft tissues.[48]

However, their use is currently limited to research rather than clinical practice due to the cost and lack of standardized criteria for the diagnosis of POP. It is also important to take into account the quality of life in women with pelvic floor disorders when planning treatment and evaluating the efficacy of a particular therapy.[21,49]

Cystography

Lateral cystography provides a static view of the bladder and bladder outlet in relation to the pubic bony structures. Early investigators used a bead chain cystourethrogram to aid with the analysis of the posterior urethrovesical angle.[50]

Ultrasound

Sonography is considered a convenient, inexpensive, and radiation-free technique. The integrity of the anal sphincter muscles can be assessed with a high-frequency (7 MHz) transducer that produces a panoramic image.[51] The internal sphincter defects generally appear as an echogenic discontinuity in the hypoechoic muscle between the vagina and rectum. On the other hand, external sphincteric injuries appear as hypoechoic lesions in a normally echogenic structure.[51] Sonographic findings predict intraoperative diagnosis with a 95% accuracy.[52,53] The recent advent of 3D sonography may further increase our understanding of anal sphincteric dysfunction.[54]

Computed tomography

Computerized axial tomography (CT) has not been shown to be particularly useful in the evaluation of pelvic organ prolapse. This radiological method has the disadvantage of imaging structures, which lie in the axial plane via an axial imaging technique.[55]

Magnetic resonance imaging

The fast-scanning MRI technique has a great value in describing and quantifying anatomical changes that may cause pelvic floor relaxation. MRI can be used to evaluate the female pelvis without ionizing radiation. Organ descent may be simultaneously assessed in all three pelvic compartments.[56]

Additionally, MRI has been shown to have a useful role in measuring levator muscle thickness,[57] urethral length, and the thickness and integrity of periurethral muscle ring.[58] The addition of 3D imaging has the advantage of quantification of muscle volume, which may give a more accurate representation of the relationships among pelvic floor structures, thereby potentially improving surgical planning.[57]

Treatment

Nonsurgical therapy

Nonsurgical therapy of pelvic organ prolapse includes conservative behavioral management and the use of mechanical devices. A nonsurgical treatment approach usually is considered in women with mild to moderate prolapse, those who desire preservation of future childbearing, those in whom surgery may not be an option, or those who do not desire surgical intervention.

Conservative management

Conservative management approaches include alteration of lifestyle or physical activities such as pelvic floor muscle training (PFMT). These lines of treatment are used mainly in cases of mild to moderate prolapse; however, their actual role in managing prolapse and associated symptoms is uncertain.[59,60] Lifestyle intervention includes carrying out activities that reduce weight and avoiding of those activities that increase intra-abdominal pressure. Pelvic floor muscle exercises may decrease the progression of mild prolapse and related symptoms;[61,62] however, a lower response rate has been observed when prolapse extends beyond the vaginal introitus.[63] The efficacy of biofeedback therapy in the treatment of impaired defecation associated with a rectocele has been determined.[64]

Mechanical devices

The use of mechanical devices such as pessaries is usually considered in women who cannot undergo surgery for medical reasons, desire to avoid surgery, or have a significant degree of prolapse that makes other nonsurgical approaches unfeasible. Indications extended to include pregnancy-related prolapse as well as prolapse and incontinence in elderly women. Reports have shown that age older than 65 years, the presence of severe medical comorbidity,[65] and sexual activity[66] were associated with successful pessary user.

There are no randomized controlled trials of pessary use in women with POP.[67] Moreover, there are no consensus guidelines on the care of pessaries (i.e., intervals between changes), the role of local estrogens, or the type of pessary indicated for specific types of POP.[67]

Effective outcomes have been reported for stage II or greater prolapse using the Gelhorn and ring diaphragm pessary.[65] After 2 to 6 months, 77% to 92% of women with a successful pessary fitting were satisfied.

Possible complications associated with pessary use include vaginal discharge and infection. Failure to retain the pessary may occur or on the other side, the pessary may be too large, which could result in excoriation or irritation. With reduction of vaginal prolapse, de novo or increased stress incontinence may occur,[68] and in rare cases, more severe complications, including vesicovaginal fistula, small bowel entrapment, and hydronephrosis have been described.[69,70]

Surgical management

The primary aim of surgery is to relieve or improve prolapse symptoms and, if possible, symptoms associated with the lower urinary and gastrointestinal tracts. In some women, this means an attempt to restore normal vaginal anatomy and maintain or improve sexual function. In others, an obliterative approach is more appropriate and still yields the desired result of symptom relief.

Approach

Prolapse surgery approaches include vaginal, abdominal, and laparoscopic routes or a combination of approaches.[71-73] Depending on the degree and location of prolapse, surgery usually involves a combination of repairs addressing the anterior vaginal wall, vaginal apex, posterior vaginal wall, and perineum; concomitant surgery may be needed for the bladder neck or anal sphincters. Procedures for posterior vaginal prolapse most commonly use a transvaginal approach, or less commonly, a transanal approach. Apical and anterior vaginal prolapse can be approached by either vaginal or abdominal routes. It is beneficial to compare the vaginal approach with the abdominal approach (*i.e.*, laparotomy), from the perspective of complications and short-term effects on recovery. The vaginal approach has fewer wound complications, less postoperative pain, shorter hospital stay, and less cost than abdominal surgery.[71,72]

Anterior vaginal repair

Anterior vaginal prolapse has traditionally been repaired with anterior colporrhaphy, where the vaginal epithelium is separated from the underlying fibromuscular connective tissue, followed by midline placation of the vaginal muscularis with a series of interrupted stitches, usually of absorbable suture, excision of excess epithelium, and closure.[14]

Variations in this technique include placing graft material on top of or instead of the midline plication. There are two randomized trials showed that a considerable improvement in success was noticed, adding 12-18% to the *cure* rates after 1 year, when polyglactin mesh (Vicryl; Ethicon, Somerville, NJ, USA) was placed over the midline plication compared with standard repair.[74,75]

Posterior vaginal repair

The basic technique used for treatment of posterior vaginal wall prolapse is posterior colporrhaphy. This technique involves separation of the vaginal epithelium from the underlying fibromuscular connective tissue (which includes the rectovaginal septum, followed by midline plication with interrupted stitches, excision of excess epithelium, and closure. Variations also include placing graft material on top of or instead of the midline plication. Other procedures can be combined with posterior colporrhaphy, such as levator ani plication and perineorrhaphy, however the indications for these additions are controversial.[76]

Dyspareunia is reported as a complication of this procedure due to levator ani plication if a band or narrowing is formed inside the vagina.[54] Narrowing can also occur with marked perineorrhaphy or combinations of procedures that change normal vaginal contours. Dyspareunia is more liable to occur when Burch is performed with posterior repair, when the altered vaginal contour and posterior transverse ridge is overlaid with the plication of the posterior repair. After posterior repair, there should be a careful attention to ensure adequate introital caliber. Despite the previous precaution, 38% of women after Burch and posterior repair had persistent dyspareunia 1 year or more after surgery.[39]

Vaginal apical repair

Apical vaginal prolapse includes uterine prolapse with or without enterocele and vaginal vault prolapse, typically with enterocele. Uterine prolapse may be presented in some cases with marked elongation of the cervix. The standard management for symptomatic uterine prolapse is hysterectomy with additional procedures to suspend the vaginal apex, correct enterocele when indicated, repair associated anterior and posterior vaginal prolapse, and perform antiincontinence procedures as required. It is particularly important to perform a specific vaginal vault suspension procedure in addition to hysterectomy because when hysterectomy is performed for prolapse, hysterectomy alone (or hysterectomy with colporrhaphy) is inadequate.

Enterocele repair

Enterocele repair is usually performed in association of concomitant prolapse procedures, in which case the approach is based on the combination of procedures required. Whether by vaginal, abdominal, or laparoscopic access, enterocele repair is basically done by sharply dissecting the peritoneal sac from the rectum and bladder. A purse-string suture is performed to close the peritoneum as high as possible. In addition to obliterating the enterocele sac, it is recommended to approximate the anterior to the posterior fibromuscular connective tissue of the vagina. Suspension of the vaginal apex is essential, except in rare cases when the enterocele occurs in the presence of adequate apical support.[77]

Post-hysterectomy (apical) vaginal prolapse

Post-hysterectomy (apical) vaginal prolapse is defined as descent of the vaginal cuff scar below a point that is 2 cm less than the total vaginal length above the plane of the hymen.[78] The vaginal cuff scar corresponds to point C on the POPQ grid.[15]

A number of definitions have been used in studies carried out prior to the introduction of standard terminology by the International Continence Society.[1] A retrospective follow up of 448 women undergoing hysterectomy, using the definition described by Baden *et al.*,[79] showed the condition to follow 11.6% of hysterectomies performed for prolapse and 1.8% of those performed for other indications.[80]

Although several surgical procedures have been described, randomised controlled studies specifically addressing post-hysterectomy vaginal vault prolapse are limited and most reports are based on case series.

Prevention at the time of hysterectomy

A small-randomised trial compared vaginal Moschowitz-type operation, McCall's culdoplasty and peritoneal closure of the cul-de-sac as preventive measures against the development of enterocele. It included 100 women and showed that McCall's culdoplasty was more effective than vaginal Moschowitz or simple closure of the peritoneum in preventing enterocele at 3 years' follow-up.[81]

The technique involves approximating the uterosacral ligaments using continuous sutures, so as to obliterate the peritoneum of the posterior cul-de-sac as high as possible.[82] A similar approach has been described for abdominal hysterectomy.[83,84]

Attaching the uterosacral and cardinal ligaments to the vaginal cuff and high circumferential obliteration of the pouch of Douglas has been suggested to prevent vault prolapse and enterocele formation.[85] No cases of vault prolapse or enterocele were recorded among 112 patients over a follow-up period extending from 7 to 42 months.

Prophylactic sacrospinous fixation has been suggested at the time of vaginal hysterectomy for marked uterovaginal prolapse,[81] when the vault (point C on the POPQ system) could be pulled to the introitus at the end of anterior vaginal wall closure, which is a selected subgroup of those undergoing vaginal hysterectomy. A retrospective study reported the outcome in 48 patients at a mean follow-up of 2 years.[81]

Surgical repair of post-hysterectomy (apical) vaginal prolapse

Abdominal sacrocolpopexy is an effective operation for post-hysterectomy vaginal vault prolapse. In comparison, sacrospinous fixation may have a higher failure rate but has lower postoperative morbidity. Only one prospective randomised controlled study compared abdominal sacrocolpopexy and unilateral sacrospinous

fixation for post-hysterectomy vaginal vault prolapse. This study was relatively small, including 89 women, and the follow-up duration ranged from 6 to 60 months. Additional prolapse and continence surgery was performed as required. Abdominal sacrocolpopexy was associated with significantly longer operating time, slower return to normal activity and higher cost. There was no significant difference in terms of objective and subjective success, urinary, bowel or sexual dysfunction or quality of life.[86]

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