

Review

Understanding Pelvic Organ Prolapse: A Comprehensive Review of Etiology, Epidemiology, Comorbidities, and Evaluation

Ali Ersin Zumrutbas 

Uroden Urology Center, Denizli 20040, Türkiye; alizumrut@yahoo.com

Abstract: Pelvic organ prolapse (POP) is a prevalent condition characterized by the descent of one or more pelvic organs, such as the bladder, uterus, or rectum, into the vaginal canal due to weakened pelvic floor support. This comprehensive review elucidates the multifactorial etiology of POP, which includes genetic predisposition, hormonal changes, obstetric factors, lifestyle influences, and age-related pelvic floor decline. Epidemiological data underscore its rising prevalence, particularly among older women, highlighting disparities across populations and risk factors such as parity and socioeconomic status. POP frequently coexists with significant comorbidities like urinary incontinence, sexual dysfunction, and pelvic pain, which exacerbate its impact on quality of life. Accurate evaluation through patient history, physical examinations, and imaging modalities like ultrasound and MRI is critical for diagnosis and management. The review emphasizes advancements in POP evaluation methods, including the POP-Q system, and explores the interplay of anatomical, functional, and psychosocial factors affecting patient outcomes. Key findings reveal that a tailored and holistic approach to treatment, addressing both anatomical correction and associated symptoms, significantly improves patient outcomes. Surgical interventions can alleviate related comorbidities, including urinary and bowel dysfunctions, as well as enhance body image and sexual function. However, the long-term success of such treatments necessitates continued research into preventive strategies and innovative therapeutic approaches. In conclusion, understanding the complexities of POP's etiology, epidemiology, and management is vital for mitigating its burden and improving the health and well-being of affected individuals. This review highlights the need for integrated care strategies and further studies to advance diagnostic and therapeutic paradigms.



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1. Introduction

Pelvic organ prolapse (POP) is a common disorder affecting millions of women worldwide, significantly impacting their quality of life. It involves the descent of pelvic organs, including the bladder, uterus, or rectum, into the vaginal canal due to weakened pelvic floor support. Despite its prevalence, the etiology of POP remains multifactorial, involving a complex interplay of genetic, anatomical, hormonal, and lifestyle factors. Epidemiological studies have shed light on the prevalence and risk factors associated with POP, while comorbidities such as urinary incontinence, sexual dysfunction, and pelvic pain further exacerbate the burden of this condition.

Managing POP is financially burdensome, with nearly \$300 million spent annually on outpatient care for pelvic floor disorders in the U.S. between 2005 and 2006. Recent studies indicate that the financial burden of managing pelvic organ prolapse (POP) in the United States has increased substantially. Between 2016 and 2018, the estimated national

cost for POP surgeries was approximately \$1.523 billion per year. Notably, 82.5% of these surgeries occurred in ambulatory settings, accounting for 78% of the total national costs associated with POP surgery during this period. By 2023, the annual national cost associated with POP surgeries had escalated to over \$4.5 billion. This significant increase underscores the growing economic impact of POP management. POP remains a prevalent condition among older women, which is anticipated to rise with the aging population. These findings highlight the escalating economic burden of POP in the U.S., emphasizing the need for effective prevention and management strategies to address this growing healthcare challenge [1–3].

Accurate evaluation and diagnosis of POP are essential for tailoring appropriate treatment strategies and improving patient outcomes. This review aims to provide a comprehensive overview of the etiology, epidemiology, comorbidities, and evaluation methods of POP, highlighting recent advancements in our understanding of this multifaceted condition.

2. Etiology of Pelvic Organ Prolapse

Before directly diving into the etiology, terminology and basic anatomy of the pelvic organs should be summarized. Pelvic organ prolapse (POP) involves the herniation of pelvic organs beyond the vaginal walls. Specific types include anterior compartment prolapse, which involves the bladder (cystocele); posterior compartment prolapse, which involves the rectum (rectocele); enterocele, which involves the intestines; apical compartment prolapse, which involves the vaginal apex that is often associated with enterocele; and uterine procidentia, which involves all three compartments. The terms “anterior vaginal wall prolapse” and “posterior vaginal wall prolapse” are preferred over “cystocele” and “rectocele” because vaginal anatomy does not always accurately indicate the location of the associated organs in POP. Moreover, dividing the vagina into separate compartments is somewhat arbitrary because the vagina is a continuous organ, and prolapse in one area is often associated with prolapse in another. For example, about half of anterior prolapse cases are related to apical descent [4].

The pelvic support structure consists of muscles (pubococcygeus, puborectalis, and iliococcygeus) and connective tissue (uterosacral and cardinal ligaments) that stabilize pelvic organs. DeLancey described a system of three integrated levels of vaginal support that are connected through a continuous endopelvic fascia network [5]. Level 1 includes the uterosacral/cardinal ligament complex, level 2 includes paravaginal attachments to the levator ani muscle and arcus tendineus fascia pelvis, and level 3 includes perineal body, membrane, and muscles supporting the lower third of the vagina. POP can occur when there is disruption or dysfunction of one or some of these structures.

The etiology of pelvic organ prolapse is multifactorial, with a complex interplay of genetic, hormonal, obstetric, lifestyle, and age-related factors contributing to its development. Genetic predisposition plays a significant role in the etiology of pelvic organ prolapse, as studies have shown a strong familial tendency for the condition [6]. Women with a first-degree relative (mother, sister, or daughter) who has pelvic organ prolapse have a two- to threefold increased risk of developing the condition themselves. Hormonal factors, particularly the decline in estrogen levels during the menopausal transition, also contribute to the development of pelvic organ prolapse. Estrogen is crucial for maintaining the strength and integrity of the pelvic floor tissues, and its deficiency can lead to tissue weakening and prolapse [7].

Obstetric factors, such as vaginal childbirth, are widely recognized as significant risk factors for POP. The process of childbirth can cause damage to the pelvic floor muscles, nerves, and connective tissues, leading to long-term weakening and increased susceptibility to prolapse. On magnetic resonance imaging, up to 20% of primiparous women have defects

in the levator ani, which are not seen in nulliparous women [8]. Additionally, factors like large birth weight, prolonged labor, and instrumental deliveries (e.g., forceps or vacuum extraction) further exacerbate the risk of POP [4].

The association between hysterectomy and subsequent POP has always been controversial and influenced by factors such as age, existing prolapse at hysterectomy, and surgical approach, including apical support [4]. A retrospective cohort study of nearly 100,000 women indicated that performing hysterectomy during initial POP surgery reduces the risk of future repeat POP surgery by approximately 30% [9]. Conversely, hysteropexy at prolapse repair does not significantly affect the short-term (<3 years) risk of recurrent prolapse. Additionally, retropubic urethropexy or needle suspension may alter the anterior vaginal wall's force distribution, potentially leading to support defects in the apex and posterior vaginal wall, such as enterocele or rectocele.

Lifestyle factors, such as obesity, chronic constipation, and heavy lifting, can also contribute to the development of pelvic organ prolapse. Excess weight places additional strain on the pelvic floor, while chronic constipation and heavy lifting can increase intra-abdominal pressure, leading to the weakening of the pelvic structures. Finally, age-related changes, including the natural decline in muscle tone and connective tissue strength, play a significant role in the etiology of pelvic organ prolapse. As women age, the pelvic floor muscles and connective tissues gradually lose their elasticity and ability to support the pelvic organs, leading to an increased risk of prolapse. Collagen metabolism is significantly altered in women with prolapse. An alteration in the ratio of collagen types I and III could lead to pelvic floor dysfunction [10,11]. Additionally, connective tissue disorders have been linked to the development of POP. Amongst those, patients with Ehlers–Danlos or Marfan syndrome are at enhanced risk of POP [12].

3. Epidemiology of Pelvic Organ Prolapse

POP is a prevalent condition, particularly among older women, with estimates of lifetime risk ranging from 30% to 50%, and the prevalence of symptomatic prolapse ranges from 3% to 12%. The prevalence of POP varies across populations and is influenced by factors such as age, parity, ethnicity, and socioeconomic status. Epidemiological studies have highlighted disparities in POP prevalence among different racial and ethnic groups, with higher rates observed among Caucasian and Hispanic women compared to African American women [13].

Determining the exact prevalence of pelvic organ prolapse (POP) is challenging due to several factors: varying diagnostic systems, differences in studies reporting symptomatic versus asymptomatic cases, and the unknown number of women who do not seek medical attention for POP. The distinction between symptomatic and asymptomatic POP is important because treatment is generally only necessary for those with symptoms. Moreover, symptoms do not necessarily correlate with the location or the severity of the prolapse, and prolapse often does not become symptomatic until it reaches the hymenal ring [14]. Stage 1 prolapse of the anterior and posterior vaginal wall is so common that it might be considered to be part of the normal spectrum [15]. Therefore, there is limited high-quality data on the prevalence of symptomatic POP [13].

Age is a significant risk factor for POP, with prevalence increasing with advancing age, peaking in the postmenopausal years. Socioeconomic factors such as lower education and income levels have also been linked to a higher prevalence of POP, reflecting disparities in access to healthcare and preventive services. In a cross-sectional study by the US National Health and Nutrition Examination Survey (NHANES), 1961 women aged 20 to 80 years were interviewed. Symptomatic prolapse was defined as a positive response to the question about experiencing a bulging sensation in the vaginal area, resulting in a reported

2.9 percent prevalence [16]. This question, derived from the Pelvic Floor Distress Inventory, has higher specificity than sensitivity for POP. Other population-based surveys found that 6 to 8 percent of women reported POP symptoms without physical examinations, likely underreporting the true prevalence [17,18]. In a multicenter observational study of 1004 patients, only 24% of patients had no prolapse, with 38%, 35%, and 2% of the patients having stage 1, stage 2, and stage 3 POP, respectively [19]. Anterior compartment prolapse is the most frequent location of prolapse (34%), and apical prolapse is always underdiagnosed. It is almost always present when there is significant anterior and posterior vaginal wall prolapse. The Women's Health Initiative study, using a non-validated physical examination, found prolapse rates of 41 percent in women with a uterus and 38 percent post-hysterectomy. As indicated above, anterior vaginal wall defects were more common than posterior or apical defects in that study [20].

4. Comorbidities Associated with Pelvic Organ Prolapse

POP is often accompanied by various comorbidities that further exacerbate its impact on quality of life and functional status. Urinary incontinence is one of the most common comorbidities, with studies reporting a high prevalence of both stress and urge urinary incontinence among women with POP. The coexistence of urinary incontinence and POP underscores the shared pathophysiology and risk factors between these conditions, highlighting the importance of comprehensive evaluation and management. Studies have reported that 40–55% of women with stress urinary incontinence and 20% of women with overactive bladder have anterior wall prolapse [21,22].

Loss of support of the anterior vaginal wall or vaginal apex can impact bladder and urethral function, often leading to stress urinary incontinence (SUI) in women with stage I or II prolapse [23]. As prolapse progresses, SUI symptoms may improve, but voiding difficulties can increase. Advanced prolapse may obstruct the urethra, causing a slow urine stream, positional changes to urinate, a feeling of incomplete emptying, and in rare cases, complete urinary retention. A study showed that 5–12% of women with stage II and 23–36% of those with stage III or IV anterior prolapse reported urinary splinting [24]. Post-surgical correction of prolapse can lead to SUI in 13–65% of previously continent women, and prolapse elevation during vaginal examination may reveal occult SUI. Women with pelvic organ prolapse (POP) are also at a two- to fivefold higher risk of overactive bladder symptoms compared to the general population [25]. Moreover, up to 69% of women experience improvement in OAB symptoms after POP surgery.

Nocturia, the frequent need to urinate during the night, is a common symptom among women with pelvic organ prolapse (POP). The relationship between these conditions is complex, as the structural changes in the pelvic floor caused by prolapse can lead to bladder dysfunction, including overactive bladder and nocturia. Surgical interventions for POP, such as sacrospinous ligament fixation, have been shown to impact co-existing symptoms like nocturia. Studies have demonstrated that restoring pelvic floor integrity through reconstructive surgery can alleviate not only prolapse symptoms but also improve bladder function, including reducing the frequency of nocturnal voiding [26,27]. This highlights the interconnectedness of pelvic floor dysfunction and bladder symptoms in women with POP and suggests that surgical repair may offer significant relief for both issues.

Failure to recognize POP at the time of UI treatment may greatly increase the need for subsequent surgery for POP. Management strategies may also differ among different specialties. Gynecologists are more likely to perform concomitant POP surgery at the time of SUI surgery (55.7% vs. 29.1%), and patients who underwent surgery by a urologist are more likely to undergo a repeat surgery for POP (26.0% vs. 12.2%) [28].

Pelvic organ prolapse (POP) can result in anorectal dysfunction, including fecal incontinence, obstructive defecation, and pelvic pain, due to disruption of pelvic floor support structures. POP-induced anorectal dysfunction is primarily attributed to pathophysiologic mechanisms such as compromised support of the uterosacral and rectovaginal ligaments, leading to rectal intussusception, altered anorectal angulation, and impaired closure of the anal sphincter [29,30]. Surgical repair of POP, particularly transvaginal mesh-augmented apical suspension, has shown promise in restoring ligamentous support, alleviating fecal incontinence, and improving defecatory function by normalizing pelvic floor anatomy and biomechanics [29,31]. Additionally, posterior ligament repair, targeting the uterosacral ligaments, has been identified as a critical intervention for correcting rectal prolapse and relieving chronic pelvic pain [32,33]. Overall, POP repair offers significant potential for addressing these debilitating conditions by re-establishing the integrity of the pelvic support system, thus restoring function and improving quality of life [33].

Sexual dysfunction is another prevalent comorbidity in women with POP, encompassing symptoms such as decreased libido, dyspareunia, and orgasmic dysfunction. Pelvic pain, including dyspareunia, pelvic pressure, and discomfort, is frequently reported by women with POP and can significantly impact sexual function and overall quality of life. Numerous studies of varying quality have explored the impact of pelvic organ prolapse (POP) on sexual function, often yielding contradictory results due to the complex interplay of personal and environmental factors influencing human sexual function. The presence of lower urinary tract disorders, especially urinary incontinence, commonly associated with POP, further complicates this analysis. The literature does not consistently demonstrate a negative impact of pelvic floor disorders on sexual function, and when a negative association is identified, it remains unclear whether POP or urinary incontinence is more detrimental [34].

Research findings are mixed, with some studies indicating that POP is more likely to lead to sexual inactivity compared to urinary incontinence, while others report a more pronounced reduction in libido in women with urinary incontinence than in those with POP [35,36]. A 2015 study of 343 women awaiting surgery for either POP or SUI found no significant difference in the overall impact on sexual function between the two disorders. However, intercourse avoidance was more prevalent among women with POP compared to those with SUI and their partners [37]. Sexual function in women with POP is strongly correlated with self-perceived body image. POP is associated with negative emotions such as depression, perceived loss of attractiveness, and low self-confidence. A prospective study of 384 women with POP found no correlation between the stage or type of POP and sexual function scores, but poorer sexual function scores were linked to worse body image perceptions and more bothersome POP symptoms. Improvements in sexual function post-POP treatment may result from enhanced body image perception [38]. Despite most partners being supportive and not complaining, women with POP often lack confidence in their partner's sexual experience. A 2019 prospective cohort study showed significant improvements in sexual satisfaction among male partners and in sexual function scores of women following robotic-assisted laparoscopic sacrocolpopexy surgery [39].

Other comorbidities associated with POP include bowel dysfunction, such as fecal incontinence and constipation, as well as psychological distress and impaired body image. The multidimensional nature of POP underscores the importance of a holistic approach to management, addressing not only anatomical defects but also associated symptoms and comorbidities.

5. Evaluation of Pelvic Organ Prolapse

Accurate evaluation and diagnosis of POP are essential for guiding appropriate treatment decisions and optimizing patient outcomes. The evaluation of POP typically involves a comprehensive assessment of symptoms, pelvic anatomy, and functional status. Patient history should include a detailed inquiry into symptoms such as vaginal bulge, pelvic pressure, urinary incontinence, bowel dysfunction, and sexual dysfunction. Physical examination plays a central role in the evaluation of POP, including speculum examination to assess vaginal anatomy and the extent of prolapse, as well as pelvic floor muscle strength and integrity.

Various classification systems have been developed to standardize the assessment of pelvic organ support and facilitate communication among healthcare providers. The POP-Q (Pelvic Organ Prolapse Quantification) system is a precise, site-specific method for staging pelvic organ prolapse (POP) in women, creating a “topographic” map of the vagina. Endorsed by major organizations like ICS, AUGS, SGS, and the American College of Obstetricians and Gynecologists, it shows high reliability and is widely used in the medical literature. Intraoperative measurements correlate well with preoperative findings, showing slightly more prolapse under anesthesia [40,41]. The Simplified POP-Q (S-POP-Q), developed by the International Urogynecology Association, offers an easier classification for clinical practice, staging prolapse for various vaginal sections using a half speculum [42]. The Baden–Walker Halfway Scoring System, another method, lacks the precision and reproducibility of the POP-Q system. It grades prolapse from 0 (normal) to 4 (maximum descent) but is less precise and reproducible.

Imaging studies such as pelvic ultrasound, magnetic resonance imaging (MRI), and defecography may be utilized to evaluate pelvic floor anatomy and assess for associated abnormalities. Renal ultrasonography might be used to evaluate the upper urinary tract because high-grade POP may cause kinking of the ureters and hydronephrosis. Perineal ultrasound can identify levator ani defects and prolapse of the bladder, rectum, or intestines into the vagina. It is emerging as an important predictor of both prolapse development and repair outcomes [43]. Although not used as an initial test, translabial ultrasound can be useful for evaluating patients who previously had mesh surgery. Dynamic Magnetic Resonance Imaging (dMRI) has been investigated for identifying site-specific pelvic support defects and differentiating between rectocele and enterocele. Though useful, standardized criteria for its use in diagnosing POP are lacking, and it is primarily a research tool [44].

Urinary tract evaluation is also important in patients with POP and should be guided by symptoms such as incontinence or urinary retention. Women with POP often have stress urinary incontinence (SUI), but many remain continent despite significant prolapse. Preoperative evaluation for occult SUI is crucial, involving prolapse reduction and observing for leakage with a cough or Valsalva. Postoperative development of SUI is common due to the unkinking of the urethra after prolapse repair. Urodynamic testing can help identify concomitant lower urinary tract dysfunction and guide treatment planning in women with POP and urinary incontinence. The selection of evaluation modalities should be tailored to individual patient characteristics and clinical presentation, with the goal of providing personalized and comprehensive care [45].

Women with POP may require evaluation for anal incontinence or obstructive symptoms like constipation and incomplete emptying. Defecography can demonstrate enteroceles not detected on POP-Q.

6. Conclusions

Pelvic organ prolapse is a prevalent and multifaceted condition with significant implications for women’s health and quality of life. The etiology of POP involves a complex

interplay of genetic, anatomical, hormonal, and lifestyle factors, highlighting the importance of comprehensive risk factor assessment and preventive strategies. Epidemiological studies have provided valuable insights into the prevalence and distribution of POP across populations, guiding targeted interventions to reduce its burden. Comorbidities such as urinary incontinence, sexual dysfunction, and pelvic pain frequently coexist with POP, underscoring the need for a holistic approach to management. Accurate evaluation and diagnosis of POP are essential for tailoring individualized treatment strategies and optimizing outcomes for affected individuals. Continued research efforts aimed at elucidating the pathophysiology of POP and identifying novel therapeutic targets are crucial for advancing our understanding and management of this complex condition.

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