



## Mini-review: Modern Concept of Pelvic Organ Prolapse

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### Abstract

Symptomatic pelvic organ prolapse (POP) has been increasing in recent years for both developed and developing countries. By 2050, as the adult population grows, the number of women with symptomatic POP will increase by 46%. Due to the increasing number of complications after surgery among women with POP, the current understanding of treatment has become extremely important for researchers and practitioners. There are many novel conservative and surgical treatment approaches under investigation. However, some primary surgical treatments show an approximate 30–50% risk of repeated pelvic floor reconstruction. Therefore, the review aims to summarize several conservative treatment options and identify critical areas of need for future research.

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## Introduction

The female pelvic floor is a complex functional and anatomic system [1]. It is composed of an active muscular component and a passive support system and topographically divided into three main functional and anatomic compartments: The anterior (supporting the bladder and urethra), the middle (the vagina and uterus), and the posterior (anorectal) compartment. The definition of "POP" describes a condition in which the supporting function of the pelvic walls is lost, followed by the prolapse of the pelvic organs into the vagina [1], [2], [3]. The proportion of women with one or complex dysfunction of the pelvic floor is 6.3% at the age of 20–29, 31.6% at the age of 50–59, and 52.7% in women over 60 [4]. Most patients with POP are asymptomatic [5]. According to the current population studies, about 20% of women will undergo surgery for stress urinary incontinence and POP at some point in their lives [4], [6]. Earlier studies showed that among women who underwent surgery for POP, between 30% and 50% had a need for reoperation. More recent studies show reductions in reoperation rates from about 6% to 30%, with most estimates falling within the lower end of this range [7], [8]. By 2050, as the adult population grows, the number of women with symptomatic POP will increase

by 46% (4.9 million) [9], which will lead to an increase in the demand for adequate treatment and, accordingly, an increase in the costs of this pathology [10]. According to the well-known POP Quantification (POP-Q) system in combination with the Valsalva probe, POP divided into stages (Table 1) [11].

All points (anterior vaginal wall [Aa, Ba], superior vaginal wall [C, D], and posterior vaginal wall [Ap, Bp]) should be measured on maximal straining (except total vaginal length).

The etiology of POP is multifactorial. The main risk factors described in the literature include: Family form of POP [12], chronic constipation [13], an increase in body mass index in the first trimester of pregnancy [14], high parity of childbirth, mode of delivery, prolonged second stage of labor [15], use of obstetric forceps, damage to the anal sphincter, levator ani muscle injury [16], [17], as well as childbirth with a large fetus [18], [19]. Significant risk factors for the second trimester of pregnancy are the caudal position of the anterior vaginal wall (point Ba) at 21 weeks of gestation, greater distance from the urethra to the anus (Gh + Pb), increased levator muscle extensibility (measurement of the levator area at rest and straining with using transperineal ultrasound) at 21 weeks of gestation, and episiotomy during labor [10], [18].

**Table 1: Stages of POP according to POP-Q system (adapted by Haylen et al. [2])**

Stage	Characterization
0	No prolapse is demonstrated (points Aa, Ba, C, D Ap, and Bp are all $\leq -3$ cm).
1	The most distal portion of the prolapse is more than 1 cm above the level of the hymen (points Aa, Ba, C, D, Ap, and Bp are all $< -1$ cm).
2	The most distal portion of the prolapse is situated between 1 cm above the hymen and 1 cm below the hymen (any of the points Aa, Ba, C, D, Ap, and Bp has a value between $-1$ cm and $+1$ cm).
3	The most distal portion of the prolapse is more than 1 cm beyond the plane of the hymen, but not completely everted meaning no value is $\geq TVL-2$ cm (any of the points Aa, Ba, C, D, Ap, Bp is $\geq +2$ and $< /OAMJMS\_10F-8804 tvl-3$ cm)
4	Complete eversion or eversion to within 2 cm of the total vaginal length of the lower genital tract is demonstrated (any of the Points Ba, C, D, or Bp is $\geq TVL-2$ cm).

Furthermore, comparative studies were carried out among different populations, as a result of which the genetic determinism of POP was proved. Four variants of genes significantly associated with POP have been identified (rs2228480 in the ESR1 gene, rs12589592 in the FBLN5 gene, rs484389 in the PGR gene, and rs1800012 in the COL1A1 gene) [19]. Success in repairing a stretch or tear in connective tissue is less likely to be achieved where collagen deficiency is most evident [20], [21], [22], similar to that observed in sports injuries. It has been proven that women with symptomatic POP are diagnosed with a greater degree of POP compared to an asymptomatic disease [23], which proves the presence of a persistent connection between the stage and the clinic of this disease (Table 2) [24], [25].

**Table 2: Description of symptoms**

Local vaginal symptoms	Discomfort in the vagina Vaginal "bulge" or "something coming down" Worse at the end of the day, better lying down Queefing (a little bit of air can get pushed into the vagina and pushed out during sexual intercourse or physical activity)
Urinary tract symptoms	Stress incontinence (less likely with advanced prolapse) Urgency and urgency incontinence the need for a manual procedure for emptying, for changing the position of the body to urinating Voiding difficulties – urinary retention
Bowel symptoms	Constipation, straining to defecate Anal incontinence (fecal/flatal) Painful defecation Feeling of incomplete bowel evacuation
Sexual symptoms	Decreased libido Dyspareunia Embarrassment due to altered body image

### Diagnostic tools for the detection of POP

There is no universally accepted criterion for diagnosis of pelvic floor disorders, including POP-Q. The true influence of symptoms associated with POP on quality of life may be underestimated because of women social stigmatization and mentality [26], [27]. Therefore, development of standardized criteria, including the use of a specific prolapse grading system that correlates with symptom burden scores, is becoming of paramount importance. Moreover, choosing the multidisciplinary approach is a key issue in correct interpretation and further treatment of POP [28].

Different imaging techniques should be employed for correct diagnosis of POP. In accordance with the latest International Urogynecological

Association/International Continence Society recommendations, among the studies used in clinical practice, X-ray methods, ultrasound diagnostics, and magnetic resonance imaging (MRI) have become the most widely used [2], [12]. At present, an alternative method for assessing POP is dynamic MRI of the pelvic floor, especially with lesions of the posterior vaginal wall. Due to its multifunctionality and high contrast of soft tissues, MRI allows a complex morphological and functional assessment of all three compartments simultaneously, without the use of ionizing radiation. It allows real-time assessment of functional diseases with dynamic acquisitions, similar to conventional defecation proctography [12], [29], [30], [31]. As a result of comparative studies, it has been proved that there is no difference in the detection of clinically significant pathologies associated with pelvic floor abnormalities when performing magnetic resonance defecography in a sitting position (open magnet) or in a supine position (closed magnet) [32], [33], [34]. Adequate pelvic tension during tension (clear movement of the abdominal wall and small intestine is visible) and evacuation of the rectal gel during bowel movements are critical for the examination to be considered diagnostic [28], [35].

There are many promising genetic markers underlying the heritability of POP needed further evaluation in large cohort prospective studies [19], [36], [37], [38]. Accumulating knowledge on the genetic aspects of POP gives hope to developing precise diagnostic algorithms based on the genetic features to achieve better preventative and treatment strategies for patients.

## Management of POP

### Non-surgical treatment

As world practice shows, despite all the variety of existing methods for correcting POP, the effectiveness of these measures remains unsatisfactory. Today, it is advisable to divide all types of treatment into non-invasive (exercises to strengthen the pelvic floor muscles and pessaries), minimally invasive (laser technologies), and invasive (surgical). A terminology report on the conservative management of pelvic floor dysfunction in women has been developed, including over 200 separate definitions. It is based on clinical evidence, identifying the most common symptoms, signs, assessments, diagnoses, and treatments [39]. Clarity and ease of use were key goals to make it readily interpretable by practitioners from all the different groups of specialists involved in pelvic floor dysfunction in women [40]. Ongoing review is not only expected but also required to ensure that the document is constantly updated and is as widely accepted as possible [2]. However, the therapeutic potential of conservative methods

is effective only in prevention, as well as in the initial stages of prolapse [41]. Evidence for lifestyle changes is mixed, and there is a limited amount of research on specific interventions. Nevertheless, according to some authors, maintaining a healthy body mass index and smoking cessation significantly improve the condition of organs and tissues of the pelvic floor [42]. An exercise program aimed at improving the strength and function of the pelvic floor muscles in combination with physical therapy is the first line of therapy for symptomatic POP Stages 1–3 [39]. The essence of these exercises is to create negative intra-abdominal pressure. The use of physiotherapy, in turn, increases the effectiveness of these exercises [43]. If symptoms of pelvic floor muscle failure, urinary incontinence, or fecal incontinence are detected in the postpartum period, early referral to a physiotherapy program for at least 3 months is recommended [39].

Vaginal pessaries or rings are occlusive agents and can be used for any stage of prolapse. At present, a wide range of these products is offered, depending on the shapes and characteristics of the material being manufactured [44]. The main disadvantage of this method is its palliative needs, therefore, it is advisable to use them in women with pronounced prolapse of the vaginal walls, but having contraindications for surgical intervention [41], [45]. It is extremely important to consult with an experienced specialist when choosing a pessary to minimize the feeling of discomfort and prevent the development of inflammatory processes on the vaginal mucosa [40].

Due to the development of laser technologies in medicine, the relevance of using various techniques in the field of gynecology has also increased. Laser technologies release energy, which penetrates superficially into the tissues of the vagina, altering the structures of the vaginal epithelium and connective tissue. The impact occurs by triggering collagen synthesis. At the end of the treatment course, patients notice the “tightness” of the walls of the vagina. Nowadays, there is no any single large-scale multicenter study on the effectiveness of laser exposure in POP. However, the pathogenetic effect of this technology is not excluded, which may be effective under certain conditions [46].

### **Surgical treatment**

Surgery remains the main treatment for dysfunction associated with POP. Treatment is considered successful when surgery is directed at well-defined triggers of the pathological process. All methods of surgical treatment are divided into organ preserving, organ losing ones using native tissues, as well as using mesh prostheses [47].

Colporrhaphy grafting with own tissues is the most frequently performed surgical treatment in the treatment of anteroposterior prolapse. The essence

of the method consists in the reconstruction of the ligaments and fascia of the pelvic floor with surgical sutures [48]. When performing plastic surgery of the posterior vaginal wall, most specialists prefer the transvaginal approach. The presence of a defect after an old perineal rupture is an indication for perineorrhaphy (attachment of the pelvic floor wall to the rectovaginal septum) [41], [49].

According to some authors, the treatment of anterior compartment prolapse secondary to a lateral wall defect with an abdominal approach (open or laparoscopic) has shown sufficient anatomical success [39]. However, in terms of the duration of the operation, the frequency of complications and relapses, this method is still inferior to the anterior colporrhaphy and remains the least preferred among practicing doctors. The feasibility of organ carrying methods (extirpation and supravaginal amputation of the uterus) for uterovaginal prolapse has been discussed [50], since the main pathophysiology is associated with connective tissue, and not with a potentially healthy uterus. Removal of the organ does not in itself solve this problem, and the recurrence rate of prolapse ranges from 10% to 40%, since after removal of the uterus, an additional defect forms in the pelvic support apparatus [51]. The current review of all evidence suggests that, in the absence of indications for uterine preservation, vaginal hysterectomy with simultaneous apical fixation is the most appropriate treatment for uterovaginal prolapse [52]. Abdominal hysteropexy can be performed by anchoring the uterus to a fixation point within the pelvis. Most often, the cervix is fixed to the anterior longitudinal ligament of the sacrum using a mesh [49]. The efficacy rates 1 year after surgery for laparoscopic sacrohysteropexy turned out to be equivalent to those of vaginal hysteropexy [52]. Techniques have been developed to reduce the recurrence of vaginal dome prolapse after hysterectomy. Fixation of the vaginal vault to the sacrouterine ligament, as well as sacrospinal fixation [41], [53] as options for plastic surgery with one's own tissues, is often used as a method of treating apical prolapse. The results of the effectiveness of these interventions 2 years after the operation are 64.5% and 63.1%, respectively [7]. However, the implementation of these methods is technically difficult due to the anatomical relationship of the ligaments and ureters. Foreign experts use indigo carmine for intraoperative prophylaxis of ureteral kinking. In the group of elderly sexually inactive patients in whom comorbidities are relative and absolute contraindications for extensive reconstructive surgery of the genitals, an alternative is obliteration procedures, which consist in partial or complete closure of the vagina [54]. The advantage of these methods of treatment is the short duration of the operation, the low rate of intra- and post-operative complications, and in most cases 100% efficiency [55]. The main disadvantage is the impossibility of sexual intercourse and difficult access to the uterine cavity when it is necessary to carry out diagnostic procedures [56].



Therefore, it is necessary to exclude the presence of gynecological cancers before performing the procedure, however, routine hysterectomy is not recommended due to the increased incidence in older patients [57].

For the 1<sup>st</sup> time in 1997, P. Petros put forward the idea of using synthetic implants for a posterior intravaginal sling [58]. The essence of this method is to form “neofascia” in the necessary compartments using endoprotheses. Over the years, the technology has gone through a series of modifications (Elevate, Calistar, Perigee, Surelift, etc.), gaining the advantage of replacing the pubocervical and rectovaginal fascia [59]. By 2010, a third of all POP operations in the United States used mesh prostheses [60], [61]. However, a Cochrane systematic review of apical prolapse surgery did not show a significant advantage between prolapse treatment with native tissues and meshes, and patients with reconstructed meshes had a high risk of complications, including mesh erosion in 18% of cases [62]. In 2011, the United States Food and Drug Administration issued an advisory message warning professionals of an increase in mesh-related complications in urogynecologic procedures. The use of volumetric mesh prostheses entailed the development of implant-associated complications (erosion of the vaginal mucosa, vaginal synechiae, wrinkling of the mesh, *de novo* dyspareunia, and chronic pelvic pain) from 4.8% to 10% of cases [63]. It is believed that the possible causes of these complications are unjustified use of mesh implants in unexpressed stages of POP, insufficient qualification of the surgeon, peculiarities of the technical performance of the operation (superficial location of the polypropylene implant, excessive tension of the mesh, inadequate expansion followed by “wrinkling,” excision of excess vaginal mucosa, and fixation of the edge of the prosthesis in the projection of the limits of the fascial defect without peritonization [64], [65]. Cost analysis also showed that vaginal mesh correction was not cost effective compared to native tissue [66].

Numerous studies have shown that laparoscopic promontofixation, in which the vaginal dome or cervix is attached to the sacral promontory with a synthetic prosthesis, is the “gold standard” treatment for Stages 3–4 POP. The effectiveness of the intervention ranges from 78% to 100% if performed correctly, and the recurrence rate of stump prolapse ranges from 0% to 10% [67], [68]. However, this method is technically difficult, which requires a high competence of the surgeon and sufficient equipment of the operating departments.

Hybrid pelvic floor reconstruction implies a comprehensive approach to the treatment of POP, in particular the anterior-apical support level (DeLacey level I). The essence of the intervention is to use the maximum required amount of mesh prosthesis, carried out through the sacrospinous ligaments with simultaneous correction of the pubocervical fascia. The

advantage of hybrid pelvic floor reconstruction is the subfascial suture method (according to Halstead), which reduces the risk of erosion of the vaginal mucosa [69]. Speaking about the effectiveness of the method, it should be noted that after a 2-year observation, the authors note high objective (91.7%) and subjective (95.8%) effectiveness [70]. Given the relative novelty of the method, research is required on the long-term results of objective and subjective data.

## Conclusion

Thus, POP is common and at the same time highly variable in terms of anatomical and functional defects. Considering the growth of the older population, it is quite obvious that the burden of this pathological process will only increase. There are many novel conservative and surgical treatment approaches under investigation. The choice of a multidisciplinary approach, as well as patient focus in the diagnosis and treatment of prolapse, as well as associated pelvic organ dysfunctions, is an important link in the effectiveness of the treatment of these women. New techniques of minimally invasive surgical treatments are also required further research. Assuming that genetic biomarkers can be both diagnostic and prognostic to assist in the prediction of response to a certain therapy, prognostic risk groups stratification along with specific biomarkers identification will ensure low recurrence.

## Authors' Contributions

Conceptualization, S.S.; methodology, S.S., B.A., and S.L.; resources, B.A.; data curation, S.S. and B.A.; writing – original draft preparation, B.A.; writing – review and editing, B.A.; supervision, S.S; and project administration, S.S.

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