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Pelvic Floor Support

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Abstract

Pelvic floor muscle can be weakened by pregnancy and birth trauma and this contributes to sagging of pelvic floor, and may lead to pelvic floor disorder (PFD). There are various forms of pelvic floor support available in modern medicine, each has its own therapeutic logic behind its use. The noninvasive mechanical device bowel aid provides conservative support to supplement current obstetric management to improve outcome of management of pregnancy related problem like hemorrhoid and anal fissure. With optimization of the conservative pelvic floor support during pregnancy, it is very promising to prevent PFD in later life of the women.

Keywords: pelvic floor, pelvic floor support, pelvic floor disorder, perineal support, pregnancy

1. Introduction

This chapter aims to review the role of the pelvic floor in the promotion of optimal urinary, reproductive, and defecatory function and examine various types of pelvic floor support available and used in medical practice. The healthy pelvic floor support is greatly affected by pregnancy and delivery. The healing of birth trauma is compromised by defecation, predisposing women to complications of organ prolapse, urinary incontinence, obstructive constipation, and sexual dysfunction due to stretch weakness of the supporting muscular and connective tissue structures. The importance of natural healthy pelvic floor support for normal functioning of urinary, reproductive, and intestinal systems is beyond doubt. The weakened and sagged pelvic floor will lead to pelvic floor disorder (PFD). PFD has wide spectrum of manifestations which include urinary and anal incontinence [1], pelvic organ prolapse (POP) [2], obstructed defecation, frequent UTI, constipation, sexual dysfunction, chronic pain syndromes, and associated problems like hemorrhoid [3–5]. PFD symptoms

are strongly associated with female gender [6]. It was estimated that one in every three women who delivered a baby experienced PFD and 50% over 50 years old will suffer POP [7]. A total of 46.2% of women would have some major PFD in their life [6]. Based on the logic, there are various type of artificial supports used in management of wide range of medical problems associated with pelvic floor muscle weakness. These artificial supports are not limited to reconstructive surgery of pelvic floor. Perineal support during vaginal delivery is a good example of pelvic floor support with therapeutic role. Evidences also show certain manual support and mechanical support on pelvic floor that have significant therapeutic role deserve more attention in medical world.

2. Pelvis, pelvic floor, pelvic floor support, and pelvic floor related disorder

2.1. Anatomy of pelvis

Pelvis is the lowest part of human trunk, below the abdomen. Pelvic bone is formed by a pair of hip bone and a sacrum. Each hip bone consists of three sections, ilium, ischium, and pubis. Anteriorly, the two hip bones are joined at pubic symphysis. Posteriorly, they are joined to sacral bone by sacroiliac joints. The cavity bounded by these bones is called pelvic cavity. Superiorly, the cavity opens to abdominal cavity. The combined cavity is referred to as abdominopelvic cavity. Pelvic organs refer to the bladder, prostate, and bowel in men (**Figure 1**), and bladder, bowel, and uterus in women (**Figure 2**). Because pelvic cavity is open to and below abdominal cavity, part of small intestine, which is an intra-abdominal organ, is also

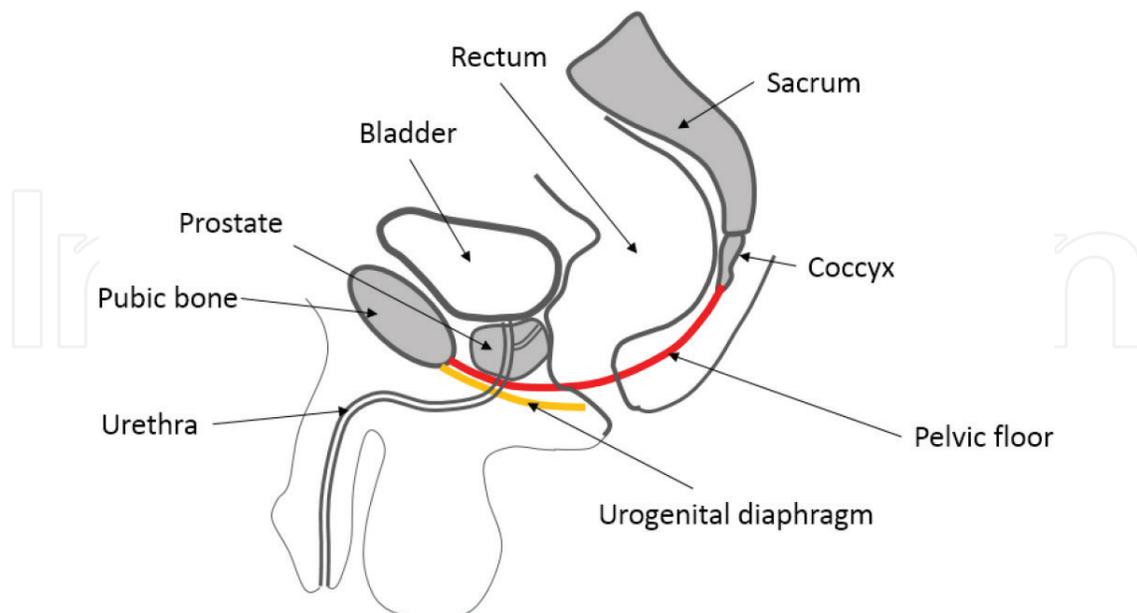


Figure 1. Pelvic anatomy in man (in standing position).

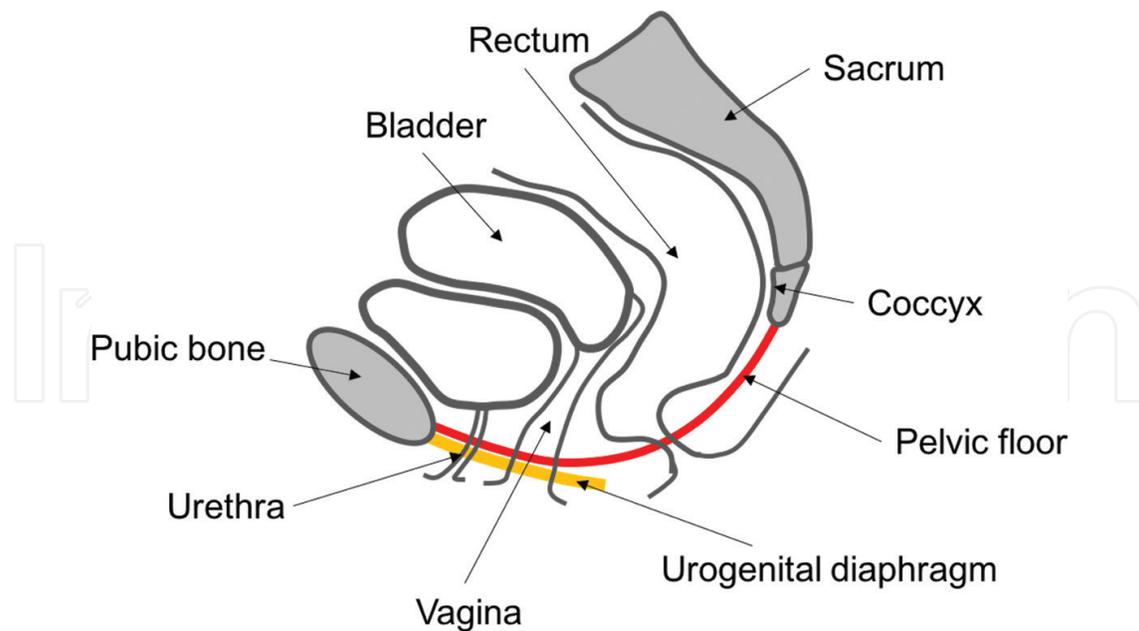


Figure 2. Pelvic anatomy in women (in standing position).

found in pelvic cavity. Inferiorly, pelvic cavity is closed with a diaphragm which is also called pelvic floor. In reality, it forms the floor of the big abdominopelvic cavity.

2.2. Anatomy of pelvic floor

Pelvic floor is also commonly referred as “hammock” which stretches from the front to the back. Superior to pelvic floor is pelvic cavity and inferior to it is perineum. Anterior part of the pelvic floor is naturally reinforced with support by perineal membrane and muscles in perineal pouch. The perineal membrane is a thick, triangular fascial sheet that fills the space between the arms of the pubic arch, and has a free posterior border. The posterior part of pelvic floor does not have the similar additional reinforcement.

Pelvic floor is a broad sling of muscles that stretch from pubic bone at the front of the body, to the base of spine at the back. These muscles support the pelvic organs and span the bottom of the pelvis. It is the lowest boundary of abdominopelvic cavity. Its largest component is formed by levator ani muscles: two levator ani muscles which attach peripherally to the pelvic walls and join each other at the midline by connective tissue raphe to form a funnel shape with diaphragm. Posterior aspect of the diaphragm is completed by coccygeus muscles. Anteriorly, there is a “U” shaped hiatus in the diaphragm named as levator hiatus. Through the hiatus, urinary, reproductive, and bowel system open exteriorly. This is the largest hiatus in human body and at the floor of the biggest cavity of human body. In healthy individual, the brim of hiatus is reinforced with thicker puborectalis which is a common sphincter muscle for three systems. With the grip of sphincter, the larger parts (bladder, uterus, and rectum) are well supported in their respective healthy position. Through this hiatus, baby is delivered and through the same hiatus sexual intercourse, urination, defecation, and all the pelvic organs prolapse take place (**Figure 3**).

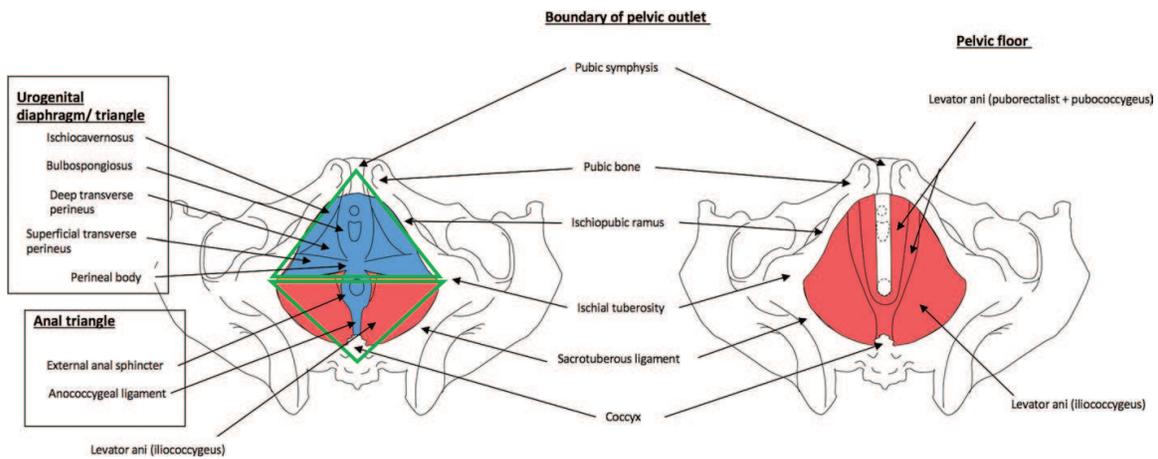


Figure 3. Pelvic floor inferior view: right showing pelvic floor (levator ani) and left showing urogenital diaphragm and part of pelvic floor.

2.3. Role of pelvic floor

A healthy pelvic floor support is essential for normal functioning of urinary and reproductive system as well as normal defecation function. When the support is weakened, the three systems will malfunction and give rise to wide range of problems of PFD, such as descending perineum syndrome, urinary incontinence, pelvic organs prolapse, constipation, etc.

The female pelvic floor serves multiple functions: pleasure and sexuality, parturition, urination and urinary continence, defecation and fecal continence, and keeping the pelvic organs in position.

The functions of pelvic floor:

- Provide direct support to pelvic organs and indirect support to intra-abdominal contents.
- Continence function of urinary system.
- Sexual performance during sexual intercourse.
- Process of defecation and continence function of anus.

2.4. Nerve supply to pelvic floor

Pudendal nerve is the main nerve supply. It carries sensation from the perineum as well as motor supply for the pelvic floor muscle. Pudendal nerve derives from nerve root S2–4 which forms two cords before uniting to form the pudendal nerve. It crosses over the lateral part of the sacrospinous ligament and reenters the pelvis running on lateral pelvic wall contained in sheath of obturator fascia called pudendal canal. In the canal, it divides into inferior rectal nerve and perineal nerve before comes out from the canal to continue with their separate routes. Inferior rectal nerve supplies lower segment of rectum, anal canal, anal sphincter, and sensory to adjacent skin. Perineal nerve supplies the genitalia of both male and female. Injury of the nerves would lead to sensory and motor dysfunction of the affected area. When pelvic floor sagged, pudendal nerve tends to be stretched because the part traveling horizontally

in the canal has very restricted mobility. Depending on the nature and severity of the nerve injury, the symptoms may include perineal pain to anal incontinence.

2.5. Comparison between male and female pelvis

Male and female pelvis differs in the following aspects (**Table 1**).

2.6. Pelvic floor support at different physiological circumstances

Pelvic floor support exposed to different severity of loading and challenges under different circumstances.

2.6.1. During defecation

Pelvic floor descends during defecation even in healthy individual [8]. Pelvic floor muscle relaxes which is part of normal reflex of defecation. With relaxation of puborectalis and descend of pelvic floor, anorectal angle opens and creates a natural smooth passage for feces to be easily pushed down by peristalsis and causes increase in intra-abdominal pressure by straining. Feces in rectum is guided by smooth curvature of sacrococcyx bone, beyond which the load is on anococcygeal part of pelvic floor. The load would be more in squatting position, because of additional load contributed by the mechanism of squatting explained above (**Figure 4**). Collectively, this challenges the pelvic floor support specifically on the posterior aspect and contributes to obstructed defecation [9].

2.6.2. During standing positions

Lumbar vertebra in lordosis during standing position because of this, pelvic floor is not directly under the load of abdominal contents (**Figure 5**)

	Male	Female
Pelvis	Smaller	Bigger (typically gynecoid pelvis)
Prostate	Present (prevent over push of feces during defecation)	Absent (most of the anterior anal fissure sufferer are women)
Vaginal (the only parous opening: remain opened) (urethra and anus are only potential opening: normally remain closed)	Absent	Present (important reason for pelvic organs prolapse. Various organs prolapse into vaginal canal: i. Cystocele: bladder ii. Urethrocele: urethra iii. Uterus prolapse: uterus iv. Rectocele: rectum v. Enterocele: small intestine)
Risk of birth trauma	No	Yes (exposed to more medical problem in pelvic area not limited to pelvic floor and anorectal disorders)

Table 1. Comparison between male and female pelvis.

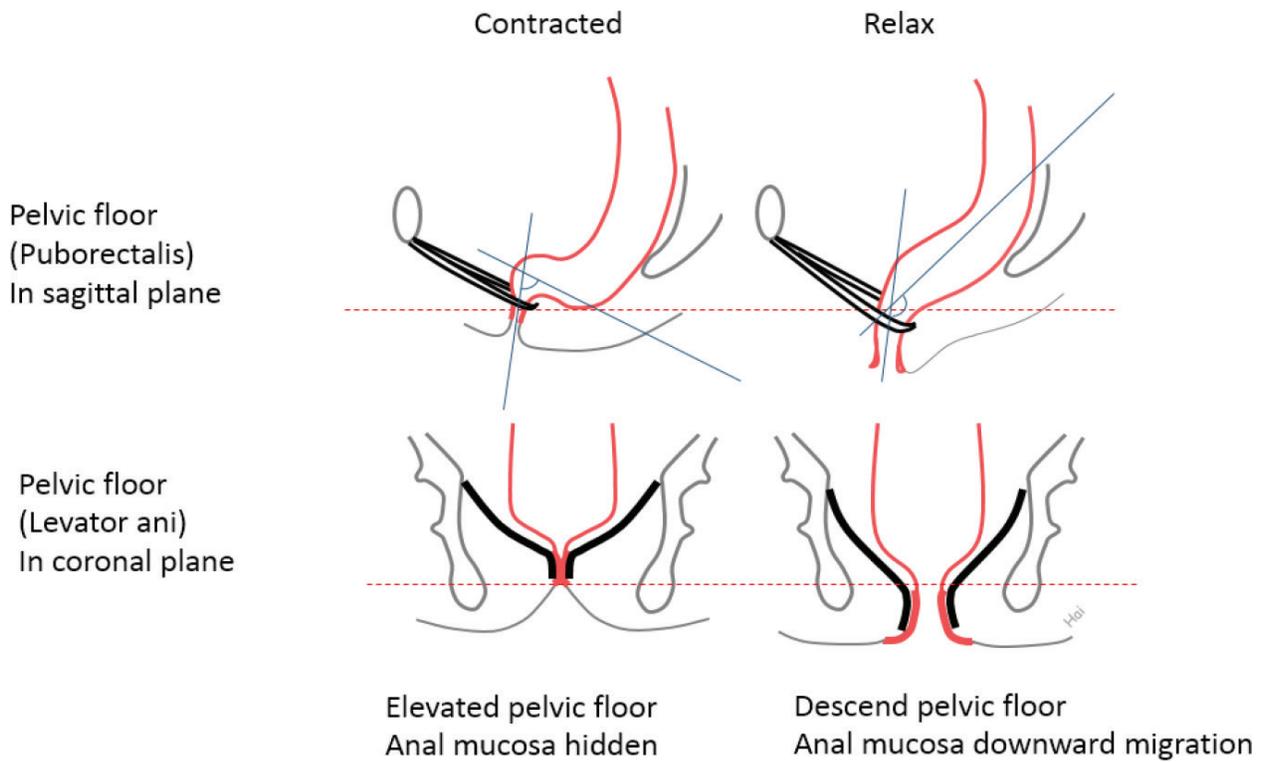


Figure 4. Condition of pelvic floor, anorectal angle, and anal mucosa in sagittal and coronal plane during contraction and relaxation.

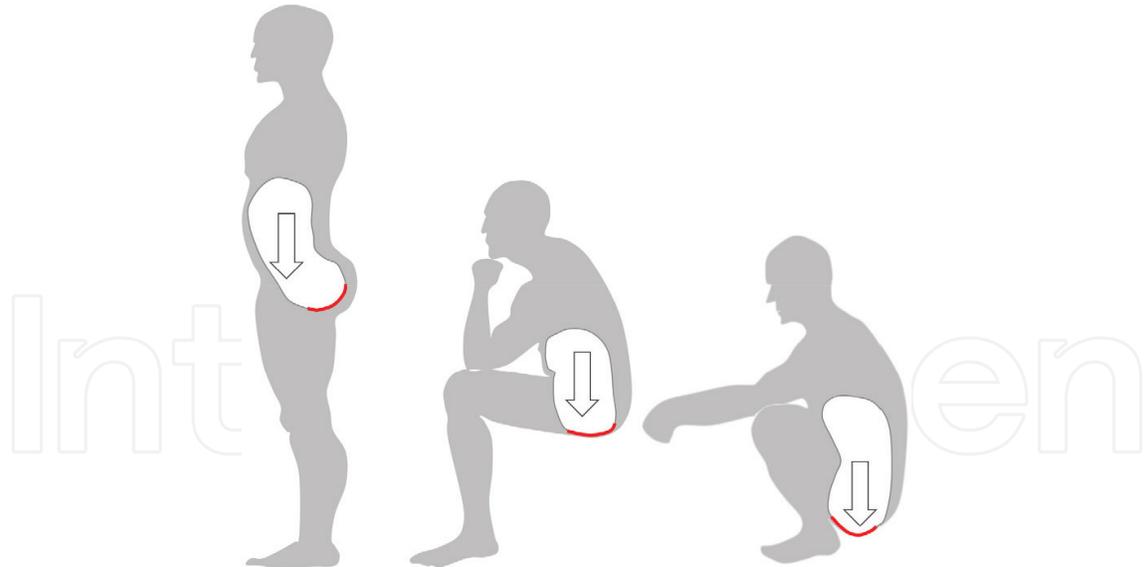


Figure 5. Condition of pelvic floor during standing, sitting, and squatting.

2.6.3. During sitting position

Forward flexion of spine in sitting position brings the pelvic floor directly under whole content of abdominopelvic cavity. This is the rational why one should not have habit sitting too long on toilet seat (e.g., reading in toilet) and most in squatting position (**Figure 5**).

2.6.4. During squatting position

In squatting position, abdominal cavity with the spine further flexed forward plus abdominal wall is compressed by two thighs. This increases intra-abdominal pressure forcing the contents downward. The pressure on rectal wall would help in process of bowel emptying but the force on pelvic floor would progressively sag pelvic floor and predispose to pelvic organs prolapse in later part of life (**Figure 5**).

2.6.5. Changes in perineum from standing to sitting and squatting position

In standing position, anus is hidden deep in intergluteal cleft, in between two thighs. As we flex the thighs to sit and to squat, anus is tugged anteriorly by continuity of skin with that of the two thighs. The gluteal maximus muscles or buttock displaced laterally to allow us to sit with ischial tuberosities directly under the skin and fat. As a result of these, the perianal skin is stretched anteriorly and laterally. Since skin is clearly tougher than the anal mucosa, the stretches pull and expose anal mucosa and cause downward migration of even normal hemorrhoidal bed. The exposure of hemorrhoidal bed predisposes for pathological hemorrhoid formation if there is chronic straining during defecation. This also contributes to the rationale of increase of hemorrhoid among those with weak and sagged pelvic floor.

2.6.6. During pregnancy

As a result of progesterone hormone, pelvic floor relaxes as part of nature preparation to enable vaginal delivery. With increase in intra-abdominal content and pressure, the relaxed pelvic floor sags. Sagged pelvic floor bends terminal rectal passage and contributes to obstructive defecation. Pregnancy increases incidence of constipation, urinary incontinence, perineum pain, hemorrhoid, and also anal fissure similar to that of pelvic floor disorders: pregnancy with relaxed and sagged pelvic floor, PFD with weakened and sagged pelvic floor [10, 11].

Progesterone also relaxes smooth muscle in the wall of blood vessel to increase intravascular capacity to accommodate 40–50% increase in blood volume. Due to the same, hemorrhoidal veins also engorge.

Progesterone is widely associated as a cause of constipation. It may or may not be due to its direct effect, but sagged pelvic floor due to progesterone also contributes to increased incidence of constipation among pregnant women. Collectively, these clearly explained increased incidence of constipation and hemorrhoid during pregnancy.

2.6.7. During straining in weight lifting and defecation

The main difference between straining during weight lifting and defecation is pelvic floor. Pelvic floor is relaxed and descended as part of normal physiology of reflex defecation. Straining during defecation, abdominal wall and diaphragm contracts increase intra-abdominal pressure with relaxed and descended pelvic floor and expose hemorrhoidal bed (**Table 2**). This plays an important role in pathogenesis of hemorrhoid.

	Straining during weight lifting	Straining during defecation
Diaphragm	Contract	Contract
Abdominal wall	Contract	Contract
Pelvic floor	Contract	Relax

Table 2. Pelvic floor changes during weight lifting and defecation.

During weight lifting, pelvic floor muscle contracts together with diaphragm and abdominal wall. Without anal mucosa migration, hemorrhoidal bed is compressed in anal canal, straining would not allow engorgement of hemorrhoidal vein except in those with preexisting third to fourth degree of hemorrhoid or weight lifting in extreme squatting position.

2.7. Factors contributing to weakening of pelvic floor support

- i. Gender
- ii. Aging
- iii. Pregnancy
- iv. Birth trauma
- v. Obesity
- vi. Constipation
- vii. Chronic cough
- viii. Position of defecation
- ix. Lack of sexual activity

2.7.1. Gender

Women suffer from pelvic floor related disorders much higher than men. The main reason is because of vaginal delivery. Even without delivery, women have a bigger hiatus with vaginal passage on their pelvic floor. Severe constipation and urinary incontinence are more common in elderly women, with rates of constipation two to three times higher than that of their male counterparts [12–15].

2.7.2. Aging

With muscle dystrophy due to aging and accumulative effect from chronic constipation, the pelvic floor support weaken and this may lead to increase in incidence of pelvic floor related disorders.

A population-based study reported that the cumulative incidence of chronic constipation (CC) is higher in the elderly compared to a younger population [12].

The proportion of women with one or more pelvic floor disorder dramatically increased from 6.3% (95% CI 5.0, 7.8) in women aged 20–29 to 31.6% (95% CI 28.3, 35.1) for women 50–59 years to 52.7% (95% CI 48.1, 57.2) for women aged 80 years and more [16].

2.7.3. *Pregnancy*

Pregnancy alone without birth trauma is an independent factor contributing to weaken pelvic floor [17]. Prevalence of urinary incontinence (UI) in women with vagina delivery increases by 100% (21% of vaginal delivery, compared to nulliparous, 10.1%) [18]. The same study also revealed that prevalence of UI among those who had caesarian section increases by 50% (15.9% of caesarian section, compared to nulliparous, 10.1%) This clearly implies half of the weakening of pelvic floor is not due to birth trauma but due to physiological changes in pregnancy which remain as residual damage and contribute to PFD as delayed complications. Physiological weakened pelvic floor with permanent damage manifests practically the same symptoms as found in PFD, such as constipation, UI, haemorrhoid, anal fissure, and perineal pain.

2.7.4. *Birth trauma*

Pelvic floor is traumatized due to overstretching by newborn with or without episiotomy wound. Objective evaluations of pelvic floor muscle strength revealed a significant decrease after vaginal delivery compared to nulliparous patients [19]. Risk of urinary incontinence significantly increases among those experiencing vaginal delivery [18]. First delivery is the most significant and its prevalence increases with parity [20]. It is undeniable fact that birth trauma is an important factor for pelvic floor damage. But if it is compared to bigger trauma to other part of body (e.g., extensive laparotomy wound), birth trauma alone is not sufficient to give rational explanation for the pathogenesis of chronic pelvic floor disorders and the reason why pelvic floor which is very rich in neurovascular supply is not having satisfactory recovery after birth trauma which is years apart.

2.7.5. *Obesity*

Overweight and obesity were the most common disorders affecting urogynecological patients (72.6% overall). In a Chinese population-based, cross-sectional study conducted by Zhu et al. [21] on a group of 5300 randomly selected female residents, obesity described by BMI is a strong risk factor for all types of urinary incontinence in women. The associations of BMI and waist circumference with urinary incontinence were also evaluated in the Nurses' Health Study. Waist circumference was associated with stress UI, suggesting that overweight and obesity results in higher risk of that pathology. Increased body weight is also a predictor of severity of future symptoms. Comparing women with BMI of 35 kg/m² or higher with lean women (BMI 21–22.9 kg/m²), the odds ratio (OR) for at least monthly incontinence was 2.11 (95% CI 1.84–2.42) [22].

2.7.6. *Constipation*

Pelvic floor muscle relaxes and descends during defecation; with straining, it descends further. Perineal descent was first described by Parks in 1966 [23]. Chronic repetitive straining for

constipation would accumulatively lead to descending perineum syndrome and pelvic organs prolapse [23]. Further descent would result in stretching of pudendal nerve and lead to incontinence. CT defecography showed pelvic floor not only descends but also the levator hiatus opens during defecation [24]. Great majority of constipation is obstructive in nature secondary to weakness in pelvic floor support, especially the posterior aspect and patients with pelvic floor disorders usually present with constipation [3, 9, 25]. Collectively, these evidences clearly show straining during defecation or constipation and damage of pelvic floor support forming a vicious cycle and leading to various pelvic floor and constipation related disorders (**Figure 6**).

2.7.7. Chronic cough

Cough causes impulsive, sudden increase in intra-abdominal pressure and challenges the continence function of pelvic floor muscle and results in stress urinary incontinence. Chronic cough accumulatively weakens pelvic floor support and leads to more PFD not limited to UI [26, 27].

2.7.8. Position of defecation

Refer to Section 2.6.1.

2.7.9. Lack of sexual activity

Sexual activity is an exercise for pelvic floor muscle just like Kegel's exercise for pelvic floor muscle. Refer Section 2.8.4.

2.8. Medical problems associated with weakened pelvic floor support

- i. PFD— anterior, middle, and posterior
- ii. Descending perineal syndrome
- iii. Constipation and constipation related anorectal disorders (e.g., hemorrhoid and anal fissure)

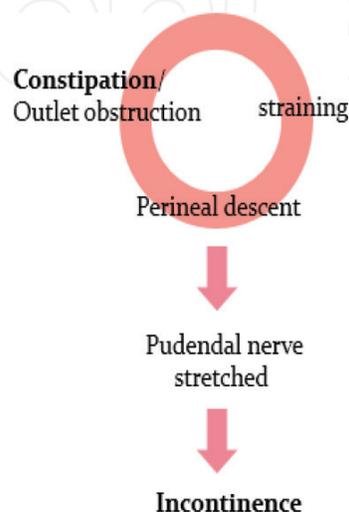


Figure 6. Constipation leading to descending perineum syndrome and incontinence.

iv. Sexual dysfunction

v. Urinary incontinence

vi. Pudendal nerve stretching

vii. Pelvic organ prolapse

viii. Fecal incontinence

Academically, they are considered different from one another, but actually they are just different descriptions of the partially or fully the same problem from various different prospective.

2.8.1. PFD

Theoretically, pelvic floor is also divided into three compartments:

- Anterior compartment (bladder and urethra)
- Middle compartment (vagina and uterus)
- Posterior compartment (anus and rectum)

Since pelvic floor support is essentially for normal functioning of all the three compartments, weakness of the pelvic floor would lead to malfunction and manifest with symptoms from urinary system, reproductive, and also anorectal system [28].

Manifestations or symptoms of PFD:

- Constipation and related problems
- Urinary incontinence
- Recurrent urinary tract infection
- Perineal pain
- Pelvic organ prolapse
- Fecal incontinence
- Sexual dysfunction

Patient may present with symptom of one compartment but study show 95% of PFD patients had abnormalities in all three compartments [28].

2.8.2. Descending perineum syndrome

Descending perineum syndrome (also known as levator plate sagging) refers to a condition where the **perineum** "balloons" several centimeters below the bony outlet of pelvis during strain, although this descent may happen without straining. The syndrome was first described in 1966 by Parks et al. [23]. Study shows descend of pelvic floor by merely 1.5 cm would increase frequency of all the functional troubles related to the perineum including constipation [29].

2.8.3. Constipation and related problems

Urinary incontinence (UI) is undoubtedly the most popular presentation of PFD but constipation is actually the earliest and the commonest manifestation of PFD. Constipation is the manifestation of posterior compartment in pelvic floor disorders. Even though posterior pelvic floor is complete compared to anterior part with levator hiatus, posterior pelvic floor does not have secondary support like urogenital diaphragm which provides additional support to pelvic floor muscle.

During defecation, feces guided by sacrococcyx bone beyond which it pushed down pelvic floor and bend terminal passage of defecation contribute to obstructive defecation. Outlet obstruction, secondary to pelvic floor dysfunction, accounts for 50% or more cases of constipation in adults [25]. This explains why constipation is commonest manifestation of PFD [3]. In another study in 786 women with urinary symptoms and/or genital prolapse, bowel dysfunction correlates exclusively with posterior aspects of the pelvic floor support [9].

Anal fissure may be the associated problem. Anal mucosa tears occur when the anal mucosa is overstretched by hard stool or even forceful diarrhea [30].

2.8.4. Sexual dysfunction

A strong pelvic floor is associated with higher rates of sexual activity as well as higher sexual function scores [31]. In sexually active women, poorer sexual functioning was associated with more symptom distress and with pelvic floor surgery [32].

2.8.5. Urinary incontinence

Urinary incontinence (UI) is involuntary leakage of urine. It is the manifestation of anterior compartment in PFD. Worldwide over 200 million people have an incontinence problem, which is encountered often in healthy persons, especially in women. Its prevalence is between 15 and 50% [33–35].

Theoretically, UI are divided into three types:

1. Stress UI
2. Urge UI or overactive bladder
3. Mixed type

Practically, they may not be clearly differentiated. Stress UI constitutes most of the UI. Stress urinary incontinence refers to situation of leakage when there is extra pressure on bladder on coughing or sneezing. It occurs due to weakness of pelvic floor support at the bladder neck area.

Urge UI or overactive bladder, as the name indicates, is due to overactivity of the urinary bladder. Practically, it can be quite difficult to put blame on the weak sphincteric action as in

stress UI or overactive bladder or in urge UI. One thing that is clear is with healthier strong pelvic floor muscle it helps to reduce the incidence of mixed UI [36].

2.8.6. Recurrent urinary tract infection (UTI)

Like PFD, risk of recurrent UTI is associated with women, age, and constipation. With weakened pelvic floor support, residual urine occurs. Constipation is also another problem associated with PFD. Constipation increases chances of *Escherichia coli* contamination of the urinary system and logically contributes to increase incidence of UTI in those with PFD [37].

2.8.7. Pudendal nerve stretching, perineal pain

Interstitial cystitis (IC) or bladder pain syndrome (BPS) is a chronic bladder health issue. It is referred to as a feeling of pain and pressure in the bladder area or pelvic area. Along with this pain are lower urinary tract symptoms which have lasted for more than 6 weeks, without having an infection or other clear causes [38]. The exact cause is still considered unclear in medical world but obviously pudendal nerve would be stretched as PFD or perineum descend leading to pain and incontinence depending on the severity [23].

2.8.8. Pelvic organ prolapse

In PFD, the pelvic floor not only descends, the sphincteric grip of puborectalis (thicken muscle which forms the brim of levator hiatus) also relaxes and results in descend from their original position and prolapse of the pelvic organs through the common levator hiatus and to exterior usually to vagina orifice.

These organs are the uterus, vagina, bowel, and bladder.

Symptoms may include:

- a sensation of a bulge or something coming down or out of the vagina, which sometimes needs to be pushed back,
- discomfort during sex,
- problems passing urine—such as slow stream, a feeling of not emptying the bladder fully, needing to urinate more often, and leaking a small amount of urine when you cough, sneeze, or exercise (stress incontinence).

2.8.9. Fecal incontinence

Fecal incontinence could happen due to traumatized anal sphincter as in third degree perineal tear or due to damage of its nerve supply as in descending perineal syndrome. There is a 20–40% association between pelvic floor prolapse and fecal incontinence [4, 39, 40]. With weakened pelvic floor, descended anococcygeal part of pelvic floor constitutes to constipation in PFD. The constipation may in turn contribute to fecal overflow incontinence,

which is a very common type of fecal incontinence. When pelvic floor descends further, it may cause stretching and damage nervous supply of the anal sphincter and lead to anal incontinence [23].

2.9. Measurement of pelvic floor strength

Pelvic floor strength can be measured subjectively and objectively using different approaches.

2.9.1. Manual muscle testing

It is a subjective measurement [41]. Laycock developed the Modified Oxford Grading System to evaluate the strength of the pelvic floor muscles by using vaginal palpation [42]. It consists of a six-point scale: 0 = no contraction, 1 = flicker, 2 = weak, 3 = moderate, 4 = good (with lift), and 5 = strong. This measurement scale is widely used by physiotherapists since it can be used with vaginal palpation in the clinical evaluation. For its correct use, manual skill of the physiotherapist is considered essential. All assessments should be carried out by the same physiotherapist. It is an easy method to use and does not require expensive equipment [43]. Inter-rater reliability for vaginal palpation was high ($\kappa = 0.33$, 95% confidence interval 0.09–0.57) [44].

2.9.2. Perineometer

Perineometer or vaginal manometer is an objective measurement of pelvic floor strength. It is a pressure device inserted into vagina and connected to a pressure manometer [45].

2.9.3. Anal manometry

Similar to vaginal manometry or perineometer, manometry is performed to quantify muscle tone and contractility of pelvic muscles using a pressure sensor inserted through the anal sphincter [46].

2.9.4. Electromyography (EMG)

Electromyography is performed using an internal vaginal or rectal sensor and surface patch electrodes to evaluate accessory muscle activity. Two EMG surface electrodes are placed on the rectus abdominal muscle, two fingerbreadths apart and medial to the anterior superior iliac spine (ASIS), and one ground electrode is placed on the hipbone. With the internal sensor inserted, the patient is asked to repetitively contract and relax the pelvic floor muscles. Measurements are recorded and analyzed in four phases: (1) *initial baseline phase*: 60-second evaluation with the patient at rest to determine the initial resting baseline EMG; (2) *rapid contraction phase*: recording of electrical activity while performing five phasic rapid contractions; (3) *tonic contraction and endurance phase*: recording of electrical activity of pelvic floor and abdominal wall muscles following a total of five contractions of 10 seconds each, with a resting interval time of 10 seconds; (4) *late baseline phase*: 60-second evaluation with the patient at rest to determine the final resting baseline EMG activity [46].

These tests include anal (or vaginal) manometry and electromyography (EMG). Manometry is performed to quantify muscle tone and contractility of pelvic muscles using a pressure sensor inserted through the anal sphincter. On verbal command, the patient is asked to voluntarily contract and relax the anal sphincter muscles. The series of contractions and relaxations are repeated and the results are recorded over a specific time interval. Baseline manometric results can identify altered pelvic muscle function and categorize the pelvic floor syndrome into two broad categories: hypotonic and hypertonic.

2.10. Current management options for pelvic floor disorders and the associated medical problems

Depending on severity and the compartment of pelvic floor involved. PFD manifests with various symptoms and this may fall under the care of different specialists: urologist, gynecologist or coloproctologist.

2.10.1. Conservative approach

Conservative options for pelvic floor disorders are practically the same, they are as follows:

1. Increase water and fiber intake to ease defecation.
2. Regular bowel habit.
3. Pelvic floor exercise—pelvic floor exercises are recommended for problems from urology, sexual, gynecology, and also anorectal disorder for both genders.
4. Weight reduction.

Conservative approaches are generally targeted at their common etiological factors which are to strengthen pelvic floor and to ease defecation. Even though the concepts behind the conservative approaches are very logical, there is still lots of room to be explored before go to the next level of management. Beyond common conservative options, treatment for PFD is mainly to target at the manifestation. Medication has very limited role except for symptom relieving and management of associated problem like urinary tract infection. Antibiotic for UTI would eliminate the bacteria causing the infection but residual urine due to sagged bladder would predispose to similar infection again. Constipation associated with PFD is obstructive in nature mainly due to sagging of posterior part of pelvic floor. Laxative just improves the peristalsis in reflex of defecation but the rectal passage remains bent. Hemorrhoid may not be typically pelvic floor disorders but it is strongly associated with PFD. Medication for haemorrhoid normally targets on the pathological site to help in tissue recovery and relieve symptoms, however if the reason for frequent straining uncorrected, the recurrence would be eminent.

2.10.2. Surgical approach

The individual problems of the three pelvic organs are actually just part of the manifestation of weakness of pelvic floor support. Practically, all surgical options are confined to a system or a compartment out of the three compartments of pelvic floor and mainly target

at the manifestation level. This should be the reason why prognosis of surgical treatment of the problems in pelvic floor area is generally poor and also associated with higher risk of complication.

Sling surgery for UI in anterior pelvic floor to reconstruct the bladder neck support effectively corrects the UI but the associated posterior pelvic floor sagging is uncorrected. The associated obstructed defecation due to sagged posterior pelvic floor exposes the patient to frequent straining during defecation and overloading the surgical site and cause complication.

Hemorrhoid and anal fissure are indirectly related to sagged pelvic floor. Hemorrhoid surgery just removes the diseased part but not the disease mechanism. Lateral sphincterotomy for anal fissure may eliminate the ability of anal spasm and help constipation. With sagged pelvic floor and the obstructed defecation, straining and overstretching of anal mucosa will still happen and lead to recurrence of hemorrhoid and anal fissure, respectively.

In relation to surgically reconstructed support, sling surgery and mesh implantation are recommended as gold standard surgery to be effective in treating urinary incontinence and POP symptoms. But, these surgeries are facing largest medical complications in medical world. There are hundreds of thousands of such procedures performed in the USA so far and thousands of them end up in complications and lawsuits [47, 48]. This has raised the concern for public about the safety of surgical procedures in treating POP.

Why for sling surgery, an evidence based intervention can end up in such a big catastrophic complication? Mesh or sling is a synthetic non-stretchable material that holds up the urethra or pelvic organ to correct the UI or POP symptoms. During defecation while the rest of pelvic floor is descended during defecation, the surgical site is loaded more than what it can hold. In early postoperative period, prognosis is usually good, but as time passed with aging and straining due to constipation, the rest of pelvic floor descends to overload the surgical site. The synthetic material does not fail to support but only the supported sites gradually erode and migrate and cause excruciating pain when the synthetic material touches the nerve plexus. This has led to world's largest medical complications, involving billion dollar lawsuit. The worse is yet to come, as urogynecologists are yet to find a reliable solution.

2.11. Various type of artificial pelvic floor supports and their roles, limitation, and evidence

There are various forms of pelvic floor supports available in modern medicine. Individually, they are widely accepted and used in clinical practice but probably they have never been grouped together for their common synthetic therapeutic purpose for natural pelvic floor support.

2.11.1. Exercise

In 1948, Dr. Arnold Kegel, an American gynecologist, published an article describing a non-surgical method of toning the pelvic floor in order to help women control incontinence following childbirth. He explained that by exercising the pubococcygeus muscles (PC muscles)

of the pelvic floor, women can reduce their likelihood of experiencing bladder problems after pregnancy and birth.

Today, pelvic floor exercises are regarded as the first line of treatment for stress incontinence, as recommended by the National Institute for Health and Care Excellence (NICE). While people usually associate Kegel's with women, men can also benefit from these exercises. Another great thing about Kegel's is that they can improve sexual gratification for both men and women. Studies also found pelvic floor exercises benefit constipation [49], sexual dysfunction in both sexes (including erectile dysfunction) [50].

Vaginal cone and ball are also used to improve pelvic floor exercise performance [51]. Pelvic floor exercises can also be done with passive stimulation directly onto pelvic floor or indirectly through stimulation of sacral nerve (sacral neuromodulation) or peripheral nerve stimulation of posterior tibial nerve. The stimulation can be done with electrical stimulation (e.g., transcutaneous electrical nerve stimulation (TENS)), electromagnetic wave, or acupuncture needle stimulation. Pelvic floor is supplied by sacral nerves. Sacral nerve stimulation as in sacral neuromodulation and peripheral nerve stimulation of posterior tibial nerve share the same nerve roots that supply pelvic floor and are found to have therapeutic benefit to various pelvic floor disorder and constipation.

2.11.2. *Manual*

i. Perineal support during labor

Perineal support is an important step routinely practiced during final stage of vaginal delivery to minimize pelvic floor damage by vaginal delivery. Clinical intervention program focusing on a manual protecting the perineum, the incidence of anal sphincter ruptures has been successfully reduced from 4.1% to 2.3% [52].

ii. Manual pelvic floor support or massage during defecation

Manual perineal or pelvic floor splinting or support was found to significantly improve constipation among women with defecatory dysfunctions [53].

2.11.3. *Mechanical*

Bowel aid is a generic name coined by the authors, refer to aids to facilitate defecation. Bowel aid is a special toilet seat with additional supporting means (HPS = Hai's Perianal support).

It is based on the rationale that majority of constipation or straining during defecation is obstructive type due to sagging of pelvic floor, especially the posterior aspect. Also, repeated downward stretching of pelvic floor accumulatively leads to weakening of pelvic floor support as in PFD. And constipation and PFD in turn lead to multiple disorders in pelvic floor region.

Feces in its terminal passage in rectum are guided by strong sacrococcyx curvature. Beyond the tip of coccyx, feces push down anococcygeal part of pelvic floor and contribute to obstructive defecation.

HPS just provides an external posterior perianal support to counter the pressure by the incoming feces and descend of pelvic floor. It is easier to understand by just comparing to perineal support during delivery (**Table 3**).

This conservative approach has being clinically proven to have multiple therapeutic potential. It is proven to successfully manage 100% of subject with chronic idiopathic posterior anal fissure without any side effects, in a controlled study compared with lateral sphincterotomy in the controlled arm which was found to associate with anal incontinence in 17% of the subjects [54].

Posterior anal fissure accounts for more than 90% of anal fissure, very promising to be resolved with the HPS bowel aid [54]. For anterior anal fissure, based on the similar concept, anterior perianal support manually is recommended.

Overstretching of anal mucosa is the cause of the ulcer initiation beyond doubt. Repeated stretching with normal defecation, worse with overstretching as in chronic constipation would interrupt normal healing of the ulcer leading to chronic anal fissure. HPS bowel aid by just providing counter pressure adjacent to the fissure prevents repeated stretching, allowing the fissure to heal naturally without interruption.

In another study, HPS bowel aid alone significantly managed hemorrhoid in pregnancy, without reproductive risk as in oral or topical medication [55].

The same HPS bowel aid also reported to successfully manage pain complication associated with sling surgery for urinary incontinence [56].

Mechanisms of actions of HPS bowel aid:

- Prevent downward descend of pelvic floor—smoothen defecation process, prevent anal mucosa migration attributed to perineal descend, and minimize straining.

	Perineal support	Perianal support
Type of support	Manual	Mechanical or manual
Time of application	Labor	Defecation
Area to support	Posterior to vaginal opening	Posterior to anus
Facilitate passage of	Baby	Feces
Passing through	Levator hiatus via vagina	Levator hiatus via anal canal
Benefit: to protect	Protect vaginal and pelvic floor	Protect anus and pelvic floor
Frequency needed	Few times in a life time	Daily to few times a week
Likely location of tear if the support is not applied	6 o'clock position of vagina	6 o'clock position of anus

Table 3. Comparison between perineal support and perianal support.

- Enhance reflex of defecation by mechanically exaggerating stimuli of feces onto pressure receptor in rectal wall (**Figure 7**).
- Prevent backward overstretching of anal mucosa which is responsible for majority of anal fissure.
- As a supplementary pelvic floor support to prevent premature loading or overloading of surgical site as in episiotomy and sling surgery, respectively.

2.11.4. Surgical

There are many surgical procedures developed for various circumstances and disorders in pelvic floor area. The basic intention of the procedure mainly to repair, to reposition the prolapse organs, or reconstruct the weakened support. The following are some of the commonly performed surgical procedures in pelvic floor area:

1. Episiotomy wound repair

It is surgical cut made at perineum to widen vagina passage during last stage of childbirth. The purpose of episiotomy is to facilitate easier, faster delivery of the baby and also prevent irregular tear and rupture of tissue and allow better repair of perineum and better healing. Quality of healing of pelvic floor muscle plays an important role in determining the risk of pelvic floor disorders in later life.

2. Obliterative surgery

Obliterative surgery narrows or closes off the vagina to provide support and prevent prolapse of the pelvic organs through vagina orifice. Sexual intercourse is not possible after this procedure.

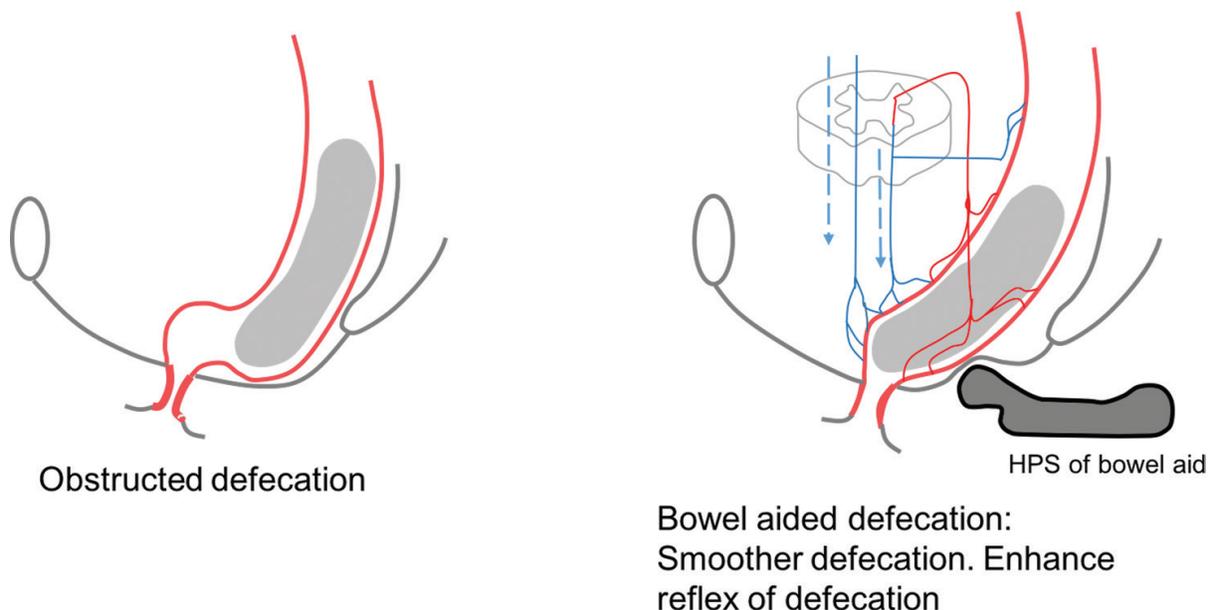


Figure 7. Bowel aided defecation: smoother defecation and enhanced reflex of defecation.

3. Reconstructive surgery for POP

Pelvic organ prolapse is a common disorder that affects urinary, bowel, and sexual functions in women. The lifetime risk of surgery for pelvic organ prolapse and urinary incontinence is estimated to be 11%, with a 29% rate of reoperation [57].

Reconstruction of pelvic floor may be just by repairing weakened tissue or with graft. The graft use can be autologous (fascia) or synthetic (mesh or sling).

Followings are types of the reconstructive surgery for POP:

- i. Fixation or suspension using patient's own tissues (uterosacral *ligament* suspension and sacrospinous fixation)—this procedure is performed through the vagina and may involve less recovery time than those performed through the abdomen.
- ii. Anterior and posterior *colporrhaphy*—repair of anterior and posterior part of lax vaginal walls for situations like cystocele and rectocele, respectively.
- iii. *Sacrocolpopexy* and *sacrohysteropexy*—the tethering of a prolapsed uterus or vagina to its proper anatomical position within the pelvis, typically with a support made of synthetic surgical mesh.
- iv. Levatorplasty is a reconstructive surgery to strengthen the general pelvic floor support. In the procedure, both sites of the pelvic floor muscles (levator ani) are stitched together to elevate and strengthen levator plate.

Surgery using vaginally placed mesh—mesh placed through the vagina has a significant risk of complications, including mesh erosion, pain, and infection. Because of these risks, vaginally placed mesh for pelvic organ prolapse usually is reserved for women in whom previous surgery has not worked, who have a medical condition that makes abdominal surgery risky, or whose own tissues are too weak to repair without mesh.

4. Sling surgery for urinary incontinence

The two most common types of bladder slings are the TOT sling (transobturator tape sling) and the TVT sling (tension-free vaginal tape sling). Both based on the same basic principle is to provide synthetic support to the urethra, lacking of which is the cause of urinary incontinence. In TOT, the sling is placed through the two obturator foramen. In TVT, the sling is placed behind pubic bone. These sling surgeries have almost wiped out every other surgical incontinence procedures and became gold standard for UI. One may be better than the other but both associated with serious complications.

Except for levatorplasty, generally surgery in pelvic floor area has separate specific reason. Sling surgery aims to reconstruct the support of the urethra specifically to correct UI. Cystocele and rectocele is corrected with anterior and posterior colporrhaphy, respectively. Hemorrhoidectomy and lateral internal sphincterotomy may not be typically referred to as pelvic floor surgery, but problems it meant for are closely associated with pelvic floor disorders. Hemorrhoidectomy removed hemorrhoid. Lateral sphincterotomy means specific for chronic anal fissure.

On the other hand, therapeutic benefits of levatorplasty for descending perineal syndrome are more general. Perineal descent of more than 1.5 cm significantly increases the frequency of all the functional troubles related to the perineum. Retroanal levatorplasty levator plate myorrhaphy is a reconstructive surgery done at pelvic floor posterior anus but benefits all the symptoms [58]. It facilitates easier defecation as well as manage anal incontinence. The benefits not only confine to posterior compartment symptoms but also to that of anterior and middle compartment pelvic floor disorders (stress urinary incontinence, frequency, urgency, dysuria, anal incontinence, dyschesia, dyspareunia, perineodynia, and prolapse).

2.11.5. Others: pessary

A vaginal pessary is a removable device placed into the vagina. It is designed to support areas of pelvic organ prolapse. A variety of pessaries are available, including the ring, inflatable, doughnut, and Gellhorn. Pessaries are conservative alternative to surgical repair for pelvic organ prolapse (POP) as well as stress urinary incontinence. Difficulty with self-removal and insertion may be limiting more widespread use of currently available pessaries.

2.12. Issue related to pelvic floor support

Three issues related to pelvic floor support are discussed:

- i. Episiotomy – to cut or not to cut
- ii. Interstitial cystitis
- iii. Hemorrhoid during pregnancy
- iv. Mesh surgery complication

2.12.1. Episiotomy: “to cut or not to cut”

Episiotomy is an incision on the female perineum that is performed just prior to crowning of the fetal head to increase the diameter of pelvic outlet, thus expediting delivery of the fetus [59]. It is one of the most common surgical procedures experienced by women [60]. Historically, episiotomy was introduced as a strategy to prevent fetal trauma and maternal perineal injury and its routine use gained popularity as it was endorsed by prominent obstetricians in the early 1900s [61, 62]. Early advocates of routine episiotomy argued that it protects the mother’s perineum, resulting in better postpartum pelvic organ support [63, 64]. Recent evidence shows routine practice of episiotomy was not found to be protective against urinary incontinence, fecal incontinence, prolapse, or decreased pelvic floor muscle strength [65]. Researchers tried to look into every aspects not limited to position of episiotomy, suturing method, suture material, postpartum care and pelvic floor exercise. Till recently, there is yet to have any conclusion and the role of episiotomy remains debatable and requires further investigation.

2.12.2. Interstitial cystitis (IC)

Interstitial cystitis (IC) or painful bladder syndrome (PBS) affects more than 1 million persons in the USA [38]. This condition often affects women of child-bearing age. Its symptoms include suprapubic pelvic and/or genital area pain, dyspareunia, urinary urgency and frequency, and nocturia. The disease is still poorly understood in modern medicine and the cause is unknown. The diagnosis is mainly by history and questionnaire. There is no specific reliable test to confirm the diagnosis. It is important to exclude other organic causes before coming to the diagnosis. Treatment options include oral medications, intravesical instillations, and dietary changes and supplements. Pentosan polysulfate sodium is the only oral therapy and dimethyl sulfoxide is the only intravesical therapy with U.S. Food and Drug Administration approval for the treatment of interstitial cystitis/painful bladder syndrome. During pregnancy, medication should be avoided. To date the disease is poorly understood naturally, the prognosis is still poor, modern medicine is still in the dark and evidence shows no single treatment option with A level evidence (*consistent, good-quality patient-oriented evidence*) available in the market [38].

2.12.3. Hemorrhoid during pregnancy

Pregnancy and vaginal delivery predisposes women to develop hemorrhoids because of hormonal changes and increased intra-abdominal pressure. It has been estimated that 25–35% of pregnant women are affected by this condition [11, 66]. In certain populations, up to 85% of pregnancies are affected by hemorrhoids in the third trimester [67].

Hemorrhoid and constipation are among the most common morbidities that can seriously affect the quality of life of pregnant women. At present, there are no reproductive safety data available for any of the compounds commonly used for hemorrhoids. Hemorrhoids in pregnancy should be treated by increasing fiber content in the diet, administering stool softeners, increasing liquid intake, and training in toilet habits. If these do not work, patients should receive topical treatment. Situation can be so serious that certain percentage of cases will require a surgical evaluation during pregnancy or after delivery. In short, hemorrhoid and constipation are very common problems among pregnant women and the world is yet to have a satisfactory solution.

2.12.4. Mesh surgery complication: largest medical complication in history

Since the 1950s, surgical mesh has been used to patch the wall in abdominal hernias repair. In the 1990s, gynecologists began using surgical mesh to patch the floor in surgical treatment of stress urinary incontinence (SUI) and vaginal repair of POP. The use of mesh in SUI repair, referred to as slings or tape became popular, in 1998, based on the work by Ulmsten and colleagues which proved to cure up to 84% of stress urinary incontinence after up to 2 years of follow up [68]. With these, the devices were approved through the FDA's 510(k) process, which allowed them to go to market without clinical testing.

The evidence only proved the effectiveness and safety of the product up to 2 years of implantation but the device is meant to last lifelong in the women body. The reconstructive surgery only corrects the part responsible for UI and POP while the obstructive constipation associated

with posterior compartment on pelvic floor disorders was not attended effectively. The reconstructed pelvic floor continues to expose to increasing challenge due to chronic straining during defecation and aging. It is not logical to expect the same result and prognosis after decades.

From 2005 to 2008, American FDA receives over 1000 reports of transvaginal mesh injuries [69].

2008: FDA issues its first vaginal mesh safety alert, advising doctors of the reports of complications associated with the implants, though the agency states that complications are “rare.”

July 2011: FDA issues warning about high rates of transvaginal mesh complications in treating POP. The agency reports a fivefold increase in vaginal mesh injuries from various models of the devices.

September 2011: The Obstetrics and Gynecology Devices advisory panel to the FDA recommends that transvaginal mesh be reclassified to a high risk device. Manufacturers will have to undergo rigorous testing and get premarket approval studies for new transvaginal mesh devices.

2014: FDA required manufacturer of transvaginal mesh for POP to provide clinical data for premarket approval (PMA).

2016: FDA reclassifies transvaginal mesh products to treat POP *only* as Class III “High Risk Devices.”

As of 17 January 2017, more than 100,000 lawsuits had been filed in the federal court system claiming complications from vaginal mesh and bladder sling medical devices.

July 2018: Deadline for transvaginal mesh manufacturers to submit a PMA application for their devices.

Mesh and sling surgery remain the useful solution for UI and POP which affect up to one third of women population. Their prevalence actively increases with aging of global population [70].

2.13. Common problem in management of PFD

2.13.1. Managing in different disciplines

There is still plenty of room for improvement in management of diseases or disorders in pelvic or perineum area. The diseases are named after the manifestation rather than the cause and their managements are focused on the manifestation rather than the cause. In managing uterus prolapse, hysterectomy only removes the uterus not the cause of uterus prolapse. UI is due to weakness of pelvic floor support system at urethra site. Sling surgery effectively substitutes the weakness of the urethra support. If chronic factor that continues to challenge the pelvic floor support system is not managed properly, failure of the surgery and complication logically will happen. Hemorrhoidectomy removed the disease site (pathologically dilated vein) but if the disease causes (chronic straining for defecation) remain, recurrence of hemorrhoid is bound to happen.

Normal healthy pelvic floor support is essential for normal functioning of urinary, sexual and reproductive, and anorectal system. When the support weakens, it manifests like urinary incontinence, sexual dysfunction, pelvic organs prolapse, constipation, and associated problem. These clearly imply that so-called diseases are actually manifestations that arise from a common cause or factor. The causes of the pelvic floor damage are multifactorial, thus we should focus on the factors that are common, and any changes implemented that may positively influence the outcome of the management.

Weakness of pelvic floor is common among all these PFD manifestation and PFD is closely related with constipation. Majority of constipation is obstructive type due to sagged pelvic floor. PFD commonly presents with constipation. Chronic straining due to constipation would accumulatively damage the pelvic floor causing more descend in the pelvic floor. This in turn worsens the severity of associated obstructed defecation. They form a vicious cycle to worsen the situations.

2.13.2. Holistic understanding of the problem

When pelvic floor related problems are viewed holistically removing the boundary of urology, gynecology, and coloproctology, the common factor in their etiopathology is the vicious cycle (sagged pelvic floor—constipation—straining). For better understanding and better management, the diseases should be named by the cause not manifestation. Defecatory perineal disorders (DPD) refer to disorders of perineal region due to weakness of pelvic floor support and chronic straining during defecation. With this understanding, so-called diseases like urinary incontinence, pelvic organs prolapse, and hemorrhoid are actually just manifestations of the disease called DPD. The terminology of DPD may be used for the first time in second Eurasia Colorectal Technology Association Scientific Meeting 2011 in Italy, but the basic concept can be traced back to 1966 by Parks who was the first to describe descending perineal syndrome. Henry et al. explored the idea that constant straining and the resulting perineal descent stretched the pudendal nerve and lead to incontinence [71]. Study shows descend of pelvic floor by merely 1.5 cm that would increase frequency of all the functional troubles related to the perineum including constipation [72].

Birth trauma is widely blamed in etiopathogenesis of PFD. The rationale should be based on the reason why birth trauma heals with so much of complication despite pelvic floor and perineum is very rich in blood and nerve supply. With DFD, understanding the birth trauma is just a popular triggering factor that causes the injury. Defecation loads the newly repair episiotomy wound or birth trauma before healing takes place and compromised natural healing leading to clinical and subclinical wound dehiscence. With the defect, the pelvic descends and contributes to obstructive defecation (a posterior compartment problem of PFD). Chronic straining due to the obstructive defecation, pelvic floor descend further gradually stretches levator hiatus and loosens the sphincter function and gradually leads to urinary incontinence and pelvic organs prolapse (anterior and middle compartmental problem of PFD).

To explain DFD in women with only lower segment cesarean section (LSCS), no vaginal delivery, the significant percentage of damage of pelvic floor actually started during pregnancy by normal physiological changes (raised progesterone hormone and increase intra-abdominal pressure) that sag the pelvic floor and constitute to obstructed defecation. Repeated straining during defecation prevents proper remodeling and results in residual defect and ends up in the same vicious cycle that may be with lesser severity. For those nulliparous, DPD can be contributed by constipation of other causes. As a result of chronic straining for constipation of whatever causes, the pelvic floor sags and enters into the same vicious cycle with relatively lesser severity (**Figure 8**). Muscular dystrophy due to aging and menopause which is independent factor contributes to worsen DPD.

2.14. General prevention and management of DPD

Break the vicious cycle.

1. Prevent constipation

Conservative measures like cultivate regular bowel habit, increase water and fiber intake should be regularly practiced. Use of laxative to treat constipation should be avoided.

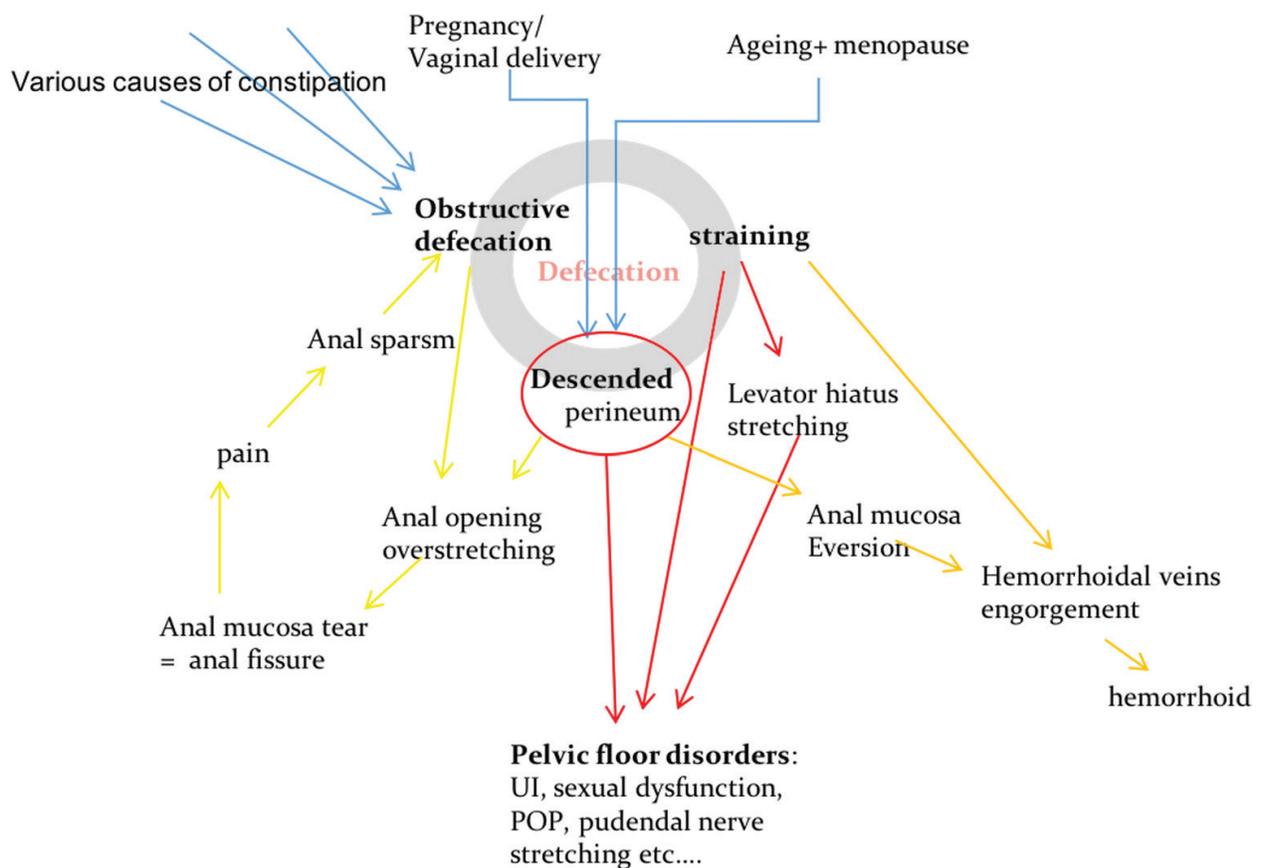


Figure 8. Flow chart shows the interrelation of contributing factor to defecatory perineal disorders DPD and how the manifestation is caused.

2. Protect and enhance pelvic floor support holistically

- i. Kegel's pelvic floor exercise
- ii. Manual support or splint
- iii. Mechanical support—bowel aid
- iv. Surgical reconstruction—it has no role in pregnant women. For gynecological cases, surgical option should also be kept as last option. Even if surgical option is indicated, it should always be supplemented with other synthetic support like manual and mechanical wherever possible.

3. Special recommendations:

i. Pelvic floor care during pregnancy

Evidence has showed pelvic floor damage responsible for PFD in later life that contributed significantly by even normal physiological changes of pregnancy which cause sagged pelvic floor and constipation. So, preventive measures should be started early during pregnancy to support the pelvic floor and eliminate constipation by optimizing the conservative option discussed above.

Since pregnancy increases the incidence of all major manifestations of PFD and anorectal disorders, usage of drug should be avoided. Even though drugs may be used in desperate situation in management of hemorrhoid during pregnancy but actually there is no preparation available in market with reproductive safety proven. So in this situation, conservative method as mentioned above should be optimized. Instead of using drug to treat the engorged hemorrhoidal bed, it is better to correct the obstructed defecation that associated with constipation during pregnancy.

ii. Management of hemorrhoid and constipation

Since reproductive risk is an important issue, conservative treatment with supplementary pelvic floor support with bowel aided defecation should be recommended in the management of hemorrhoid and constipation besides pelvic floor protection.

iii. Episiotomy wound care

Even after a perfect method of repair and with the best suture material, the pelvic floor muscle has to be protected. It is not sufficient by just abstaining from sex because pelvic floor is challenged most during defecation, especially during constipation. Support of pelvic floor, manual or with bowel aid should be strongly recommended right from first defecation after episiotomy wound repair (**Figure 9**).

iv. Post-op care of mesh or sling surgery

Mesh or sling serves the purpose well to reconstruct the defective support but when it is repeatedly overloaded during defecation, the surgical site would ultimately fail. Supplementation with all the measure recommended for prevention of DPD would enhance therapeutic outcome. Bowel aid would protect the surgical site during defecation like how a walking aid or crutches protect surgical site after orthopedic surgery of lower limb (**Figure 10**).

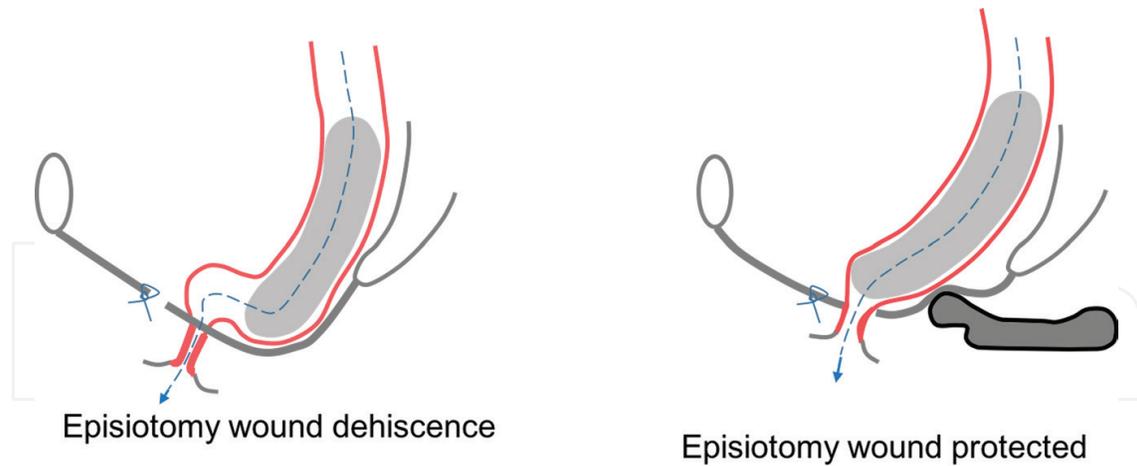


Figure 9. Episiotomy wound is protected with pelvic floor support.

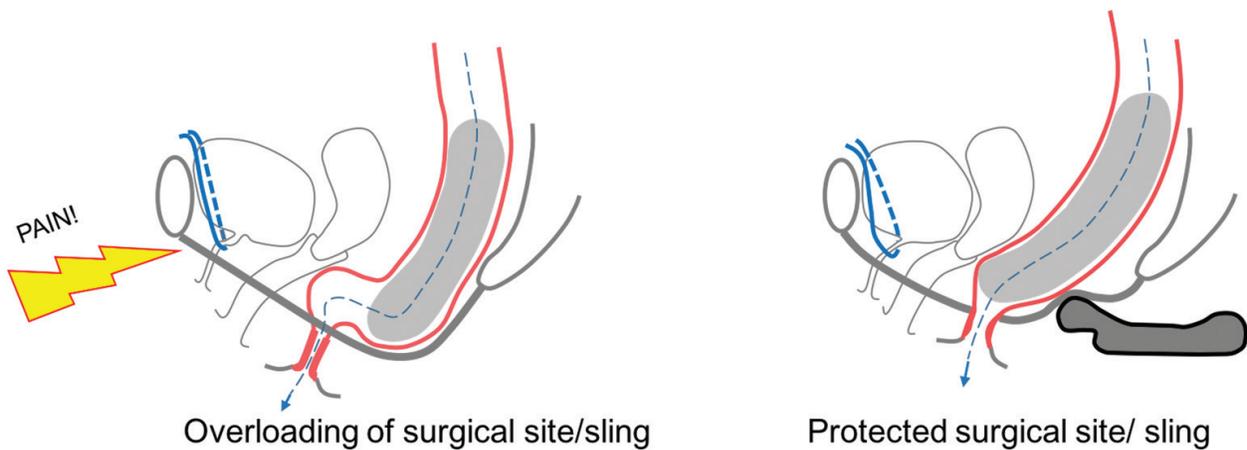


Figure 10. Protected surgical site/sling with pelvic floor support.

v. Interstitial cystitis (IC)/painful bladder syndrome (PBS)

Evidence shows muscle pain (myalgia and fibromyalgia) and constipation are associated with IC/PBS [73]. Conservative management above includes bowel aided defecation which targets on mechanisms to protect pelvic floor muscle and ease defecation which should serve some therapeutic benefit to the IC/PBS. Bowel aid has helped patient with sling surgery complication pain by protecting the surgical site from being stretched, it should serve the purpose on IC/PBS by preventing pudendal nerve stretching which is one of the mechanisms of the perineum pain in IC/PBS. After all, it is just a conservative option without any predicted risk or any reported complication since it was first used for anorectal condition in 2006.

3. Conclusions

Defecatory perineal disorders (DPD) include conventionally understood PFD and constipation related disorders in normal individuals and also similar problems in pregnant women.

With this understanding, the complicated multidisciplinary problems became simple: the disease is DPD and the main etiopathological mechanism is a vicious cycle (constipation—straining—descend perineum); and lack of healthy pelvic floor support is the main component of the vicious cycle. So, it is clear that the focus should be on how to improve, supplement, or protect the pelvic floor support. In evidenced-based medicine, there is actually wide range of synthetic pelvic support available, ranging from exercise, manual, and mechanical to surgical reconstructed supports. Mesh surgery for UI and POP is facing largest complication in history. They are actually base on a similar, logical concept too. The associated complication with the surgery should not be interpreted as failure. Collective scientific evidences actually clearly imply that the surgical support alone may not be sufficient. With chronic straining for defecation and aging, the surgical site is subjected to increasing load. Optimal supplementation with other options, for instance, pelvic floor supports would improve prognosis of the management. Conservative options like Kegel's exercise, manual, and mechanical support should be better explored before considering surgical option. For those indicated for surgery should be properly educated about manual and supplementary pelvic floor support with bowel aid, to prevent overloading of surgical site. For better outcome, the conservative approaches, including bowel aid defecation should be emphasized and implemented early enough to minimize harmful effects of physiology of pregnancy on pelvic floor and to facilitate optimal recovery from birth trauma. Bowel aid defecation during pregnancy and during postpartum period can be compared to preventive role of walking aid in prevention knee damage and supplementary role in postoperative period in management of orthopedic problems of lower limbs.

In short, with better understanding (with DPD concept) and more holistic approach (optimal pelvic floor supports), it is very promising to witness better prognosis in prevention and management of otherwise complicated pelvic floor and constipation associated perineal disorders. This approach is free of reproductive risk, thus suitable even for the relatively helpless situation of antenatal period.

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