



## Review

## The female pelvic floor through midlife and aging

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## ABSTRACT

Female pelvic floor is a complex functional unit involved in multiple functions that extend beyond the sole support of pelvic organs. Pelvic floor dysfunction globally affects micturition, defecation and sexual activity. Evolutionary modifications such as adaptation to upright standing, walking and the need to deliver fetuses with larger head diameters made the fascial and muscle support of the pelvic floor vulnerable, therefore predisposing women to pelvic organ prolapse and incontinence. Different than in males, the female pelvic floor undergoes a number of adaptive changes related to life and endocrine events. Most of the clinical manifestations of these changes become apparent after menopause and throughout aging in women. This review article summarizes the key aspects of the pathophysiology and the clinics of the modifications of the pelvic floor in women through midlife and beyond. A particular focus is given to the relationship between urinary and bowel dysfunction.

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## 1. Introduction

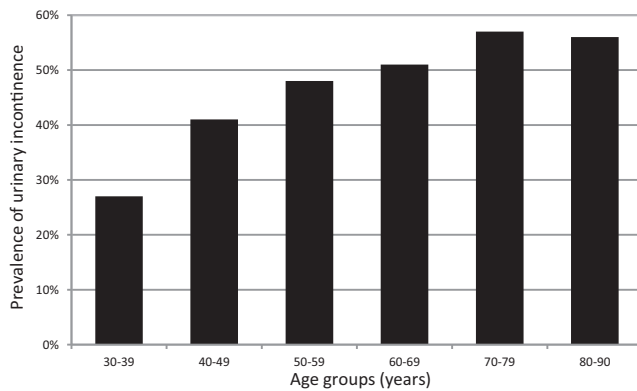
The pelvic floor is a functional unit involved in multiple functions that extend beyond the support of pelvic organs. Pelvic floor dysfunction globally affects micturition, defecation and sexual activity. Female pelvic organ prolapse (POP), sexual dysfunction, urinary incontinence (UI), chronic obstructive defecation syndrome (OFD), constipation are just a few of the many facets of pelvic floor

dysfunction, and their incidence increases dramatically with age and menopause.

## 1.1. POP: definition, signs and symptoms

Following the definition of a joint report by the two leading urogynecological societies [1], POP is defined as “any descent of one or more of the anterior vaginal wall, posterior vaginal wall, the uterus (cervix) or the apex of the vagina (vaginal vault or cuff scar after hysterectomy)”. Typical symptoms of POP are vaginal bulging, pelvic pressure, vaginal bleeding, discharge and infection, low backache. Prolapse of organs toward the vagina (bladder,

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**Fig. 1.** Prevalence of urinary incontinence by decade of life.

Adapted from Melville JL, Katon W [3].

urethra, small intestine, colon or rectum) sometimes makes it necessary to digitally replace the prolapse or to otherwise apply manual pressure, e.g. to the vagina or perineum (splinting), or rectally (digitation) to assist bladder voiding or defecation. Clinical POP can be identified in 31.8% of postmenopausal women. Annual incidences of cystocele, rectocele, and uterine prolapse have been estimated as 9.3, 5.7, and 1.5 cases per 100 women-years, respectively [2].

### 1.2. UI: definition, signs and symptoms

According to the definition of the International Continence Society (ICS), UI 'is the complaint of any involuntary leakage of urine'. This definition, however, requires further characterization as type, frequency and severity, precipitating factors, social impact, effect on hygiene and quality of life, the management of the leakage and whether or not the individual seeks or desires help because of UI. This assessment is needed to establish the most appropriate clinical approach. Prevalence and severity of urinary incontinence increases with age [3,4] (Fig. 1). 31.7% of US Women over the age of 80 have clinically significant UI, compared with women aged 40–59 years, showing a prevalence of 17.2% [5].

### 1.3. Chronic constipation: definition, signs and symptoms

Chronic constipation is a common and troublesome disorder that significantly impairs quality of life [6]. Slow transit constipation, dyssynergic defecation and irritable bowel syndrome are considered primitive causes of chronic constipation: dyssynergic defecation is associated with pelvic floor dysfunction and particularly with paradoxical contraction or insufficient relaxation of the levator ani and other muscles. Secondary reasons include inappropriate diet, low physical activity, constipating drugs or metabolic, endocrine, neurological, psychiatric or connective diseases, and are frequent in older adults [7]. Anatomical disruption of the entire pelvic floor (POP) or limited to the bowel (e.g. rectocele, intussusception, internal or external rectal prolapse) and reduced rectal sensation are also common in aging individuals [8]. Such conditions include also the consequences or complications of surgical procedure on the pelvis and the perineum [9].

The most frequently referred symptoms are infrequent defecation, hard or lumpy stools, straining at defecation, sensation of incomplete defecation or ano-rectal obstruction, and need for manual maneuvers to facilitate bowel movements [10]. These symptoms have been the basis for conceiving the Rome III diagnostic criteria for functional constipation (Table 1).

Prevalence of chronic constipation is approximately 16% in adults overall and 33% in adults older than 60 years and it is more

**Table 1**

Rome III criteria for functional constipation.

#### Diagnostic criteria<sup>a</sup>

1. Must include two or more of the following:
  - (a) Straining during at least 25% of defecations
  - (b) Lumpy or hard stools in at least 25% of defecations
  - (c) Sensation of incomplete evacuation for at least 25% of defecations
  - (d) Sensation of anorectal obstruction/blockage for at least 25% of defecations
  - (e) Manual maneuvers to facilitate at least 25% of defecations (e.g., digital evacuation, support of the pelvic floor)
  - (f) Fewer than three defecations per week
2. Loose stools are rarely present without the use of laxatives
3. Insufficient criteria for irritable bowel syndrome

<sup>a</sup> Criteria fulfilled for the last 3 months with symptom onset at least 6 months prior to diagnosis.

common in women (F:M = 1.5:1) and increases with age [8]. However, about 50% of community-dwelling elderly report constipation with an estimated prevalence up to 74% in nursing homes [11,12].

### 1.4. Sexual disorders and pelvic floor dysfunction

Any of the above-mentioned conditions or the associated symptoms has potentially devastating effects on sexual function [1,13]. This can be due to dyspareunia or chronic pelvic pain, to the modified self-image associated to the change in the appearance of the genitalia, or to the loss of urine, gas or feces associated with attempted coital activity [14].

### 1.5. Function and dysfunction of the pelvic floor

Pelvic floor laxity depends on muscle injury and progressive pelvic floor weakening. These result from connective tissue degradation [15], pelvic denervation [16] and devascularization and anatomic modifications [17], all determining a decline in mechanical strength and dyssynergic pelvic floor function, predisposing to prolapse [18].

Pelvic floor consists of several muscles, all fundamental for the support and function of female pelvic structures. The levator ani constitutes the floor of the pelvis; it is composed of three different parts: the pubo-coccygeus, pubo-rectalis and ileo-coccygeus muscles (Fig. 2). The pubo-coccygeus is the main part of the levator ani and it extends from the pubis toward the coccyx. The two parts (right and left) of the pubo-rectalis, behind the ano-rectal junction, arrange a muscular sling. The ileo-coccygeus is the smallest part of the levator ani.

In women with normal pelvic statics, smooth muscle fibers in the anterior vaginal wall are organized in tight bundles orientated in circular and longitudinal order [19]. In comparison, in women with POP the vaginal muscularis presents a decline of overall smooth muscle amount, fewer, smaller and disorganized bundles [19]. Levator ani injury has an established role in the pathophysiology of prolapse but does not explain all pelvic organ prolapses. 30% of women with prolapse show no sign of muscle injury on magnetic resonance imaging, underlining the fact that the disease process involves other factors as well. In this chain of events, failure of one of the functional and structural elements of the pelvic floor complex, e.g. the levator ani, results in increased mechanical load on other components (connective tissue and smooth muscle), which will eventually fail, as well [20,21]. On the other side, connective tissue abnormalities and smooth muscle alterations may represent the leading event in the development of prolapse [22].

Pelvic connective tissues are structured into a fascial sheet which covers the pelvic floor muscles and forms ligaments, connecting pelvic organs to the bony pelvis [23]. During evolution human female pelvis has undergone significant enlargement and

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