

Definitions and Pathophysiology of Overactive Pelvic Floor
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Definition of “overactive pelvic floor muscles”

According to the 2005 report from the Pelvic Floor Clinical Assessment Group of the International Continence Society (ICS):

“A condition in which the pelvic floor muscles do not relax, or may even contract when relaxation is functionally needed, for example during micturition or defecation”.

Pelvic Floor Muscle Function

The pelvic floor muscles work as a functional unit and normally contract simultaneously as a mass contraction.

Pelvic floor muscle types:

- 70% type I (slow twitch) – emphasize the postural and supportive roles of the pelvic floor muscles.
- 30% type II (fast twitch) - in higher proportion around the urethra and the anus, necessary for closure of these pelvic openings

Pelvic Floor Muscle Anatomy

- Superficial layer of the pelvic floor: superficial transverse perineal, bulbospongiosus, and ischioavernosus muscles.
- Intermediate layer of the pelvic floor: perineal membrane, or the urogenital diaphragm.
- Deepest muscular layer of the pelvic floor: the pelvic diaphragm, is composed of the ischiococcygeus (coccygeus) muscle and the levator ani muscle group.
- The endopelvic fascia provides muscle anchorage to the bony pelvis thus proper functioning of muscles, most notably of the levator ani, is highly dependent on the integrity ligamentous and fascial components.

Innervation of pelvic floor muscles

The somatic efferent (motor) nerve fibers:

- from the second to fourth sacral nerves (S2-S4). Separate branches from the sacral plexus supply the levator ani (S3-S4) and coccygeus muscles (S3-S4) directly, and also form the pudendal nerve (S2-S4).

The autonomic nervous system efferent (visceromotor) innervations (sympathetic and parasympathetic) to the pelvic floor:

- Sympathetic innervations to the pelvic floor arise from the thoracolumbar region (T10-L2).
- Parasympathetic innervations to the pelvic floor originate from the sacral spinal segments (S2-S4).

‘Tonic’ and ‘phasic’ pelvic floor muscle activity

- The striated urethral and anal sphincters and the levator ani (although not at all sites) demonstrate constant baseline activity, commonly referred to as ‘tonic’ activity
- The pelvic floor muscles also exhibit ‘phasic’ activity with stronger activation due to voluntary contraction or reflex activation, for example, in response to postural disturbances or increases in intra-abdominal pressure

Pathophysiology

- OPF implies a physical state of heightened activity within the pelvic floor muscles

- Co-morbid conditions involving different body systems can be present with symptomatic manifestations involving urinary, anorectal and/or sexual dysfunction, genital/pelvic pain and psycho-emotional distress
- Individuals with OPF: commonly found to present with pelvic floor muscle hypertonicity from other sources, most notably myofascial trigger points.
- Recognizing the various potential sources of pelvic floor muscle hypertonicity is particularly important for identifying the specific pelvic floor impairments affecting individuals with OAPF, and designing tailored treatment interventions
- Important concept: ‘Unnecessary’ muscle tension: a type of muscular activity that is unintentional and is the source of what is often referred to clinically as ‘muscle tension’. This is amenable to voluntary control with training (e.g., through biofeedback assistance) and may arise from psychological distress or anxiety, overload from sustained contraction or repetitive activity, and/or inefficient use of muscles.

Etiologies of OPF

Chronic pelvic pain

OPF has been found to be a physical hallmark of several different conditions involving CPP, an “idiopathic pain disorder” (IPD) which has two primary pathways of vulnerability, both mediated by genetic and environmental/social factors, that underlie its development:

- Pain amplification
- Psychological distress.

Noxious stimuli occurring over a prolonged period of time cause up-regulation of nociceptive system function, which leads to dysregulations in both the peripheral and central mechanisms of sensory and pain processing.

Mechanisms responsible for the up-regulation of nociceptive nervous system components:

1. Peripheral sensitization:
 - Sensitization of peripheral nociceptors
 - Activation of ‘silent’ nociceptive afferents
 - Conversion of myelinated afferents, such that they adopt the properties of nociceptive fibers
2. Central sensitization:
 - Up-regulation (sensitization) of the dorsal horn of the spinal cord.

Consequences of nociceptive system up-regulation:

 - ‘hyperalgesia’
 - ‘allodynia’
 - Neuropathic reflexes:
 - “neurogenic inflammation”.
 - “viscero-visceral hyperalgesia”.

Psychological distress

- Psychological distress, is thought to play a role in triggering and/or perpetuating CPP, and consequently OPF.
 - Fear-avoidance model (FAM) of chronic pain: a conceptual model that explains how negative pain-related cognitions and maladaptive behavioural responses contribute to the development and maintenance of chronic pain. The fear of pain, combined with pain-related anxiety and hypervigilance to pain, leads to defensive behaviours, notably muscular reactivity/contraction, in the presence of a painful stimulus or in the anticipation of pain.

Psychosocial and psychosexual disturbances

- A history of traumatic experience may lead to OPF, especially if the events occur repeatedly or if the person ‘re-lives’ the experiences through, for example, flashbacks or nightmares.
- The pelvic floor muscles are reactive to threatening images alone. These muscles demonstrate reactivity to experienced sexual trauma or abuse.

Abnormal behavior/pattern of pelvic floor muscle use

- Dysfunctional voiding and/or defecation can result from improper learning of these control mechanisms.

Direct trauma or pathology

- Both obstetric injury and pelvic surgical procedures, have been reported to result in painful and hypertonic pelvic floor muscles.
- This may be the consequence of inflammation and pain resulting from the trauma.
- Resulting anatomical disruptions within the pelvic floor, including tissue adhesions and imbalances between the right and left pelvic floor may lead to OPF.

Postural abnormalities

Any ongoing postural abnormality in the region of the spine, pelvis and/or lower extremities can contribute to the development of pelvic pain and/or OPF.

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Gastrointestinal co-morbidities and OPF
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Defecation:

- Synchronization of the autonomic and somatic neural functions of the pelvic floor muscles is essential in order to allow normal defecation
- Neural control:
 - The foregut is innervated by the vagal system

- the hindgut by the sacral parasympathetic nerves
- the levator ani by sacral nerves
- the internal anal sphincter by nerves originating from L4 level
- the external anal sphincter by the pudendal nerve. Only the latter is volitional.

Defecation disorders are a common cause and effect of overactive pelvic floor and may be acquired in early childhood.

- Toilet training is the beginning of the cognitive control of continence.
- If the need to defecate is not properly perceived, recognized or accepted, continence may be affected.
- Children may learn to use a withholding mechanism and abstain from defecation, leading to inappropriate activation of the neuronal circuitry linking the rectal nerves to the sacral plexus, the spine and the brain, resulting in future abnormal behavior.
- 50% of constipated children contract the external anal sphincter during defecation.
- 95% of children with idiopathic constipation have impaired rectal sensation and weakening of rectal contraction during distension, which contributes to impaired rectal evacuation.
- One-third of children with idiopathic constipation continued to report severe complaints of constipation beyond puberty.

Constipation, pain and associated pelvic floor complaints

- In half of children with acute abdominal pain constipation is considered to be the cause of the pain (13).
- Prolonged contraction of muscles activate locally the free ends of afferent nerves fibers of the group III (thin myelinated fibers) and group IV (non-myelinated fibers), which transmit pain.
- 'Cross talk' between pelvic organs and pelvic muscular layers can enhance dysfunction and pain. Many patients have more than one underlying cause for their pain.
- Persistent levator ani contraction, which perpetuates the dysfunction, can be the result of:
 1. skeletal imbalance
 2. poor learned defecation habits
 3. a chronic visceral injury such as the neuroinflammation seen in irritable bowel syndrome (IBS) or interstitial cystitis
 4. a guarding reflex
- Constipated children frequently complain about urinary dysfunction, such as urinary tract infection (UTI) in 11% of the cases and urinary incontinence in 63% of the cases.
- The association of urinary dysfunction with constipation is supported by the observation that resolution of fecal retention leads to the disappearance of daytime urinary incontinence in 89% of the cases and of UTI in 100% of the children. (14).

Gastroenterological functional symptoms and sexual abuse

- There is a significant association between early sexual abuse, and gastroenterological functional symptoms (15).
- Patients with a history of sexual abuse were more likely to complain of both constipation and diarrhea.
- Anismus, a condition characterized by anal muscle contraction, was more frequent in sexual abuse survivors, suggesting a perturbation of pelvic floor function (16).
- In studies on sexually abused children, gastrointestinal disorders met the diagnostic criteria for somatization disorder, presenting with hypervigilance, anxiety and psychiatric disorders.

- These patients have poor quality of life due to health-related issues, utilize the health care system more often and report more pain (17).

Typical GI complaints in OPF patients

1. Constipation :with obstructive defecation, a sensation of incomplete rectal evacuation or anal blockage and a change of behavior with excessive straining to defecate and/or rectal digitation
2. Pain: during or after rectal evacuation, caused by tension of the hypertonic pelvic muscles. Cramping pain may be related to dyssynergic defecation and excessive abdominal straining.

Rome III classification of functional anorectal and pelvic pain:

- Chronic proctalgia
 - Levator ani syndrome
 - Unspecified functional anorectal pain
- Proctalgia fugax.

Pain can be also evoked by other pathologies, which should be excluded by a thorough examination, such as:

- Strained hypertonic pelvic floor muscles related to anal fissure.
- Prolapse of internal hemorrhoids
- Rectal mucosal prolapse with a recto-anal intussusception
- Overt rectal prolapse

Clinical examination

- Inspection of the perineum during contraction and relaxation
- Digital anal examination, to assess relaxation or contraction of the perineal muscles.
- Evaluation of tenderness on pelvic floor muscle palpation

Pelvic floor investigations

- Anorectal manometry and Rectal balloon evacuation test (BET)
- Imaging
 3. X-ray defecography
 4. Trans-perineal ultrasound
 5. MR defecography

Treatment

- Patient education and reassurance
- Nutritional management, treatment for constipation
- Biofeedback
- Electrical Stimulation
- Botulinum A Toxin
- Local analgesic treatment
- Oral Medications for chronic pain
- Sacral Nerve Neuromodulation (SNM)

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