

# Recognition and Management of Nonrelaxing Pelvic Floor Dysfunction

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## CME Activity

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## Abstract

Nonrelaxing pelvic floor dysfunction is not widely recognized. Unlike in pelvic floor disorders caused by relaxed muscles (eg, pelvic organ prolapse or urinary incontinence, both of which often are identified readily), women affected by nonrelaxing pelvic floor dysfunction may present with a broad range of nonspecific symptoms. These may include pain and problems with defecation, urination, and sexual function, which require relaxation and coordination of pelvic floor muscles and urinary and anal sphincters. These symptoms may adversely affect quality of life. Focus on the global symptom complex, rather than the individual symptoms, may help the clinician identify the condition. The primary care provider is in a position to intervene early, efficiently, and effectively by (1) recognizing the range of symptoms that might suggest nonrelaxing pelvic floor dysfunction, (2) educating patients, (3) performing selective tests when needed to confirm the diagnosis, and (4) providing early referral for physical therapy.

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Pelvic floor disorders are common among women.<sup>1</sup> Symptoms associated with pelvic floor muscle dysfunction include lower urinary tract symptoms, bowel symptoms, sexual dysfunction, prolapse symptoms, and pain.<sup>2</sup> Pelvic floor disorders caused by relaxed pelvic floor muscles, including pelvic organ prolapse and urinary incontinence, are often readily identified. However, symptoms of nonrelaxing pelvic floor muscles vary and often are not attributed to the pelvic floor, making these disorders less widely recognized.

Several terms such as *pelvic floor tension myalgia*, *piriformis syndrome*, and *levator ani syndrome*<sup>3</sup> have been used to describe this entity, but the term *nonrelaxing pelvic floor dysfunction* may be preferable because it will help the clinician identify a recognizable pattern of symptoms. Because it is difficult to precisely characterize which muscles are responsible for dysfunction, this general term is preferred over more specific descriptors that attribute the disorder, sometimes erroneously, to a specific muscle (eg, levator ani syndrome, coccygodynia, piriformis syndrome, puborectalis dyssynergia).

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**TABLE. Recognizing and Managing Nonrelaxing Pelvic Floor Dysfunction**

Inquire about symptoms of bowel, bladder, and sexual dysfunction and pain
Bowel function: bloating, constipation, difficulty evacuating stool, straining with bowel movement, splinting the posterior vagina, anal digitation, incomplete evacuation, sense of anal blockage during defecation
Urinary function: frequency, hesitancy, urgency, dysuria, bladder pain, urge incontinence
Sexual function: insertional or deep dyspareunia, pelvic ache after intercourse
Pain: low back pain radiating to thighs or groin, pelvic pain unrelated to intercourse, lower abdominal wall pain
Perform a focused physical examination
Vulvar, vaginal, and rectal examination
External palpation of the urogenital triangle
Internal palpation of deep pelvic floor muscles (may reveal tension and tenderness)
Consider diagnostic testing, as dictated by symptoms
Pelvic ultrasonography for pelvic pressure, pain, bloating
Anorectal manometry and rectal balloon expulsion for defecatory symptoms
Voiding diary, urinalysis, and possibly urodynamic study for voiding symptoms
Provide education about pelvic floor muscles and function
Refer for pelvic floor physical therapy (a cornerstone of management)
Refer to subspecialists (gastroenterology, gynecology, physical medicine, sexual medicine, and urology) when symptoms and examination findings are complex

The pelvic floor consists of bone, muscles, and connective tissue; together, these elements provide support to the pelvic organs, spine, and pelvic girdle and assist with urinary, defecatory, and sexual function. In particular, these functions require relaxation and coordination of pelvic floor muscles and urinary and anal sphincters. Hence, their impaired relaxation or paradoxical contraction can result in various symptoms such as impaired voiding or defecation, pelvic pain,<sup>4</sup> and sexual dysfunction.

Women with these disorders tend to have the dysfunctions diagnosed and managed by specialists who usually focus on symptoms pertaining to their expertise (eg, urologists for bladder problems, gastroenterologists for defecatory problems, physiatrists for low back or pelvic pain). This concise review is geared toward primary care providers because they are in a position to intervene early, efficiently, and effectively by (1) recognizing the range of symptoms that might suggest a nonrelaxing pelvic floor disorder, (2) educating patients, (3) performing selective tests when needed to confirm the diagnosis, and (4) referring the patient early for pelvic floor physical therapy. The Table provides an approach to recognizing and managing nonrelaxing pelvic floor dysfunction.

#### SCOPE OF THE PROBLEM

The prevalence of nonrelaxing pelvic floor disorders is unknown. The age- and sex-adjusted incidence rate of clinically diagnosed defecatory disorders in Olmsted County, Minnesota, is 16 per 100,000 per-

son-years.<sup>5</sup> The prevalence of lower urinary tract symptoms in women is as high as 76%, according to a recent, large, population-based study.<sup>6</sup> The lifetime prevalence of sexual pain disorders ranges from 17% to 19% in population-based survey studies.<sup>7</sup> It is important to recognize that women with pelvic floor disorders may have multiple concerns related to bowel, bladder, or sexual dysfunction and pain. A recent, small study showed that 82% of patients with defecatory disorders also had at least 2 urinary symptoms, and 57% had 4 or more symptoms of voiding dysfunction.<sup>8</sup> Lower urinary tract symptoms, defecatory disorders, chronic pelvic pain, and sexual dysfunction can impair quality of life.<sup>6,9-11</sup> However, the effect of overlapping or coexisting symptoms (eg, bowel and bladder disorders) on quality of life is unknown.

#### SYMPTOMS

Symptoms of nonrelaxing pelvic floor dysfunction are associated with voiding dysfunction, anorectal dysfunction, sexual dysfunction, and pain. Symptoms tend to develop slowly and insidiously; for some patients, they may begin in childhood (eg, defecatory disorders). Difficulty evacuating stool or straining with bowel movements, a sense of incomplete evacuation, bloating, and constipation are bowel symptoms characteristic of nonrelaxing pelvic floor dysfunction. Urinary symptoms include frequency, hesitancy, urgency, dysuria, bladder pain, and sometimes urge incontinence. Insertional or deep dyspareunia, a pelvic ache after intercourse,

low back pain radiating to the thighs or groin, and pelvic pain unrelated to intercourse are also common. It is important to inquire about the range of symptoms that may suggest nonrelaxing or hypertonic pelvic floor dysfunction in women who present with bowel, bladder, or sexual concerns.

### POTENTIAL MECHANISMS

The most commonly implicated mechanism for these symptoms is dysfunctional voiding or defecation, which either was never learned correctly or was acquired in adulthood through voluntary holding of urine or stool. This voluntary holding might be attributable to habit, lifestyle, occupation, or constant recruitment of muscles used to avoid bowel or bladder incontinence.<sup>12,13</sup> Conditions that result in dyspareunia (eg, atrophic vaginitis, vulvodynia) may trigger involuntary muscle contraction of the pelvic floor. This pattern is reinforced over time, particularly if intercourse is continued despite pain, and can potentially lead to persistent contraction of the pelvic floor and symptoms of nonrelaxing pelvic floor dysfunction.

Injury to the pelvic floor from surgery or trauma can result in painful, hypertonic muscles. Pelvic surgical procedures such as mesh placement or permanent sutures in the muscles, as well as obstetric injury, have been reported to result in muscular pain and hypertonicity of the pelvic floor.<sup>12,14</sup>

Visceral pain syndromes associated with chronic pelvic pain include irritable bowel syndrome, endometriosis, and interstitial cystitis or painful bladder syndrome. These may be associated with nonrelaxing pelvic floor muscles through central and peripheral sensitization and lowering of nociceptive thresholds, resulting in neuropathic up-regulation, hypersensitivity, and allodynia. Pain may be referred from visceral organs to muscles and vice versa.<sup>15</sup>

Several recent studies have demonstrated neural “cross-talk” between pelvic organs, which, while necessary for normal physiologic regulation of bowel, bladder, and sexual function, may explain why shared painful symptoms of the rectum, bladder, and pelvic and adnexal structures might develop.<sup>16-18</sup> The underlying mechanism for this phenomenon is poorly understood, but it may be mediated by the peripheral and central nervous systems.<sup>19</sup>

Postural or gait abnormalities, skeletal asymmetry, and prolonged sitting may trigger symptoms in some individuals. Because the lower extremity, hip, abdomen, pelvis, and spine are a connected kinetic chain, any dysfunction along this chain may cause overcompensation and dysfunction of other associated muscles.<sup>20,21</sup> A recent, small, blinded, prospective study of women with chronic pelvic pain showed a higher frequency of abnormal pelvic mus-

culoskeletal findings (eg, asymmetric iliac crests) in those with pelvic pain compared with controls.<sup>21</sup>

Consistent with clinical experience, a meta-analysis showed a significant association between sexual abuse and a lifetime diagnosis of functional gastrointestinal disorders, nonspecific chronic pain, and chronic pelvic pain.<sup>22</sup> The prevalence of abuse is higher in patients treated at tertiary care centers and in those with severe or multiple symptoms compared with those with milder and more limited symptoms. Moreover, a history of abuse is linked with poorer health status, increased physician visits, and disability.<sup>23</sup> Because a history of abuse is common in the general population, and even more so in women with multiple concerns related to the pelvic floor,<sup>24,25</sup> it is important to inquire about a history of abuse in women with nonrelaxing pelvic floor dysfunction.

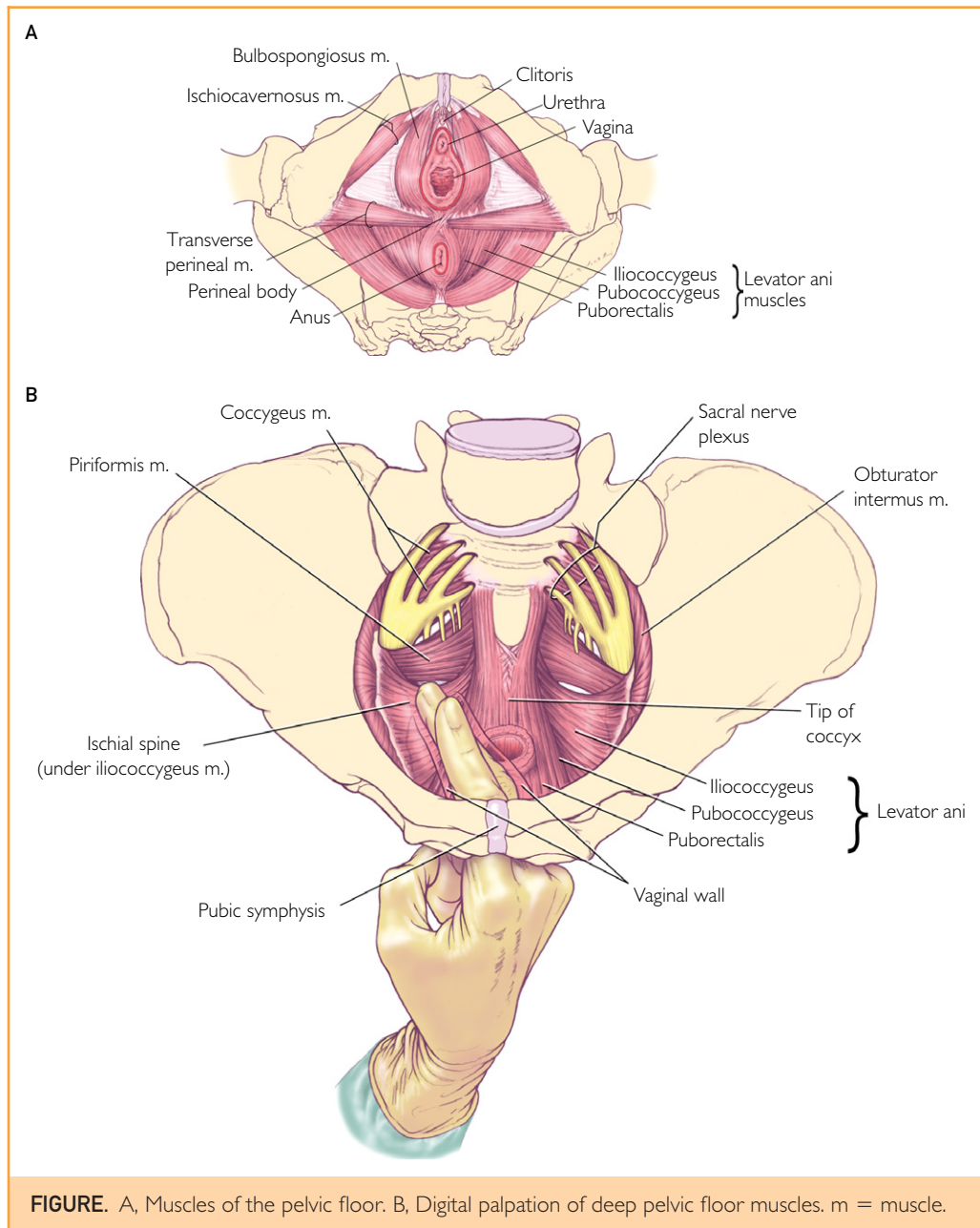
Often, the specific cause or inciting event that leads to nonrelaxing pelvic floor dysfunction is never identified. A series of events or combination of factors may contribute to development of the problem. Perpetuating factors include those that commonly complicate chronic pain such as sleep disturbance, depression, and anxiety.<sup>12</sup>

### ASSESSMENT OF THE PELVIC FLOOR

The pelvic floor is a dome-shaped muscle complex with contraction occurring in 3 planes.<sup>26</sup> Its complex actions include tightening, lifting, squeezing, and relaxing. Pelvic floor muscles support organs within the pelvis and lower abdomen, maintain continence, allow for bladder and bowel emptying, and contribute to sexual arousal and orgasmic function. Although there is no single standard for assessing the function of the pelvic floor, a focused approach to the physical examination, including an assessment of the patient’s ability to contract and relax the pelvic floor muscles, is useful.

Assessment begins with visual inspection of the vulva, perineum, and anus. The patient is asked to perform a pelvic floor contraction (ie, to contract the muscles she uses to stop urinating). When effective, contraction results in an upward lift of the perineum. Many women need specific instruction to perform a pelvic floor contraction. Some women may inappropriately strain instead of contracting the pelvic floor muscles, resulting in descent of the perineum.<sup>27,28</sup>

Cotton swab testing for vulvodynia can be performed, if indicated, to localize painful sites on the vulva. When pain is present, it may be quantified as mild, moderate, or severe.<sup>29</sup> A speculum examination of the vagina allows inspection of the mucosa for conditions such as atrophy or inflammation and visualization of the cervix.



Digital palpation of the pelvic floor muscles is used to assess contraction and relaxation and to evaluate pain. External palpation of the urogenital triangle (Figure) includes the ischiocavernosus, bulbospongiosus, and transverse perineal muscles and the perineal body. Assessment of muscle tension and tenderness of the urogenital triangle is especially important in women with dyspareunia. The deeper muscles include the pubococcygeus, puborectalis, and iliococcygeus, known together as the levator ani, and the obturator internus on the lateral pelvic wall (Figure). Pelvic floor muscles are

assessed for tenderness, tone, contraction, and relaxation through vaginal and rectal digital palpation.<sup>30</sup> The strength of a pelvic floor contraction can be classified subjectively as absent, weak, normal, or strong after asking the woman to squeeze around the palpating finger. Relaxation is assessed after attempted voluntary contraction.<sup>28,31</sup> A rectal examination is important, not only to assess the anal sphincter but also to evaluate the coccygeus, levator ani muscles, sacrococcygeal ligaments, and attachments to the sacrum and coccyx.<sup>3</sup>

A careful clinical examination is very useful and sometimes sufficient for identifying nonrelaxing pelvic floor dysfunction. Appropriate testing should be performed as indicated to exclude other conditions that cause chronic pelvic pain (eg, colorectal, gynecologic, neurologic, or urologic conditions).<sup>32</sup> When symptoms or examination findings are complex, further objective assessment is needed, and referral to a subspecialist should be considered. Diagnostic evaluation might include anorectal manometry with balloon expulsion, anal endosonography, defecography, urodynamic testing, cystoscopy, electromyography, ultrasonography, and static or dynamic magnetic resonance imaging.<sup>2,33,34</sup> Anorectal manometry and rectal balloon expulsion studies can help confirm the diagnosis of defecatory disorders by documenting inadequate intra-abdominal pressure during straining, incomplete evacuation of the rectum, and inadequate relaxation of anal canal pressures.<sup>13</sup>

## EDUCATION

Providing education about the anatomy and function of the pelvic floor is important and should be a routine part of women's health care, particularly around the times of childbirth and menopause, when changes in the pelvic floor are common. Women are frequently unfamiliar with pelvic floor muscles and their function. A recent study showed that 45% of adult women in Austria were unable to perform a voluntary contraction of the pelvic floor muscles during a routine gynecologic examination.<sup>35</sup> Pelvic floor strengthening exercises (Kegel exercises) originally were developed to treat urinary incontinence<sup>36</sup> and are commonly taught today, but it is important to remember that the pelvic floor has many other functions beyond maintaining urinary continence. Thus, instruction on relaxation and integrated function of the pelvic floor muscles is equally important. Having a model or diagram of the pelvic floor in the office and a hand mirror for education about anatomy may be particularly useful.

## THERAPY

Pelvic floor rehabilitation with neuromuscular education is the cornerstone of therapy for women with nonrelaxing pelvic floor dysfunction. Therapy is ideally provided by a physical therapist with training in pelvic floor dysfunction. The specific therapy used is guided by symptoms and usually includes strategies to optimize lumbopelvic and spinal function and to improve bowel, bladder, and sexual function. Manual techniques may include trigger point massage, myofascial release, strain-counterstrain, and joint mobilization, among others.<sup>31,37</sup> In addition, exercises to strengthen

and stabilize the core muscles usually are included with pelvic floor physical therapy. A resource to help clinicians identify physical therapists who specialize in pelvic floor dysfunction may be found at the American Physical Therapy Association's Web site ([www.womenshealthapta.org/plp/](http://www.womenshealthapta.org/plp/)).<sup>38</sup>

Physical therapy techniques for alleviating dyspareunia associated with hypertonicity of the pelvic floor have been described.<sup>39</sup> In a systematic review of existing manual physical therapy techniques for musculoskeletal pelvic pain,<sup>40</sup> 59% to 80% of patients were reported to have marked or complete relief. However, most studies included in the review were case series; controlled clinical trials still are necessary.

Biofeedback is a neuromuscular training approach in which patients learn how to appropriately contract or relax muscles; efforts are aided by visual or auditory feedback of muscle activity. Controlled clinical trials demonstrate that biofeedback therapy to improve anal and pelvic floor relaxation improves symptoms in defecatory disorders. Surface electromyography–assisted biofeedback to enhance anal contraction is superior to Kegel exercises alone in patients with fecal incontinence that is unresponsive to other conservative measures. Retraining to increase (or decrease) rectal sensation is possible in patients with sensory disorders.<sup>13</sup>

Women with deep dyspareunia associated with nonrelaxing pelvic floor dysfunction generally should be counseled to avoid penetrative sexual activity until pelvic floor muscles are rehabilitated. Referral to a sex therapist is also important, particularly if the dyspareunia is long-standing, associated with personal or relational distress, or unresponsive to initial physical therapy of the pelvic floor. If a woman has experienced physical, sexual, or emotional abuse, her treatment plan needs to take into consideration the nature of the abuse and the status of her recovery. Members of her treatment team need to be aware of the abuse history and may need to modify their treatment approaches accordingly.

Neuropathic pain modulators, including amitriptyline, nortriptyline, gabapentin, and pregabalin, are frequently used for managing other conditions of chronic pain, but tricyclic antidepressants may aggravate bowel and bladder symptoms and should not be the first-line therapy for nonrelaxing pelvic floor dysfunction. Other methods to treat refractory nonrelaxing pelvic floor dysfunction may include trigger point injections using a local anesthetic and corticosteroid; botulinum toxin type A trigger point injections; acupuncture; and neuromodulation with sacral, pudendal, and posterior tibial nerve stimulation. These treatments are associated with varying degrees of success.<sup>41</sup>

## CONCLUSION

Women with nonrelaxing pelvic floor muscle dysfunction tend to present with a recognizable pattern of symptoms that include one or several of the following: irritative voiding symptoms, chronic constipation with difficulty evacuating stool, dyspareunia, chronic pelvic pain, and low back pain. Primary care providers should be able to identify women with this constellation of symptoms, perform a focused physical examination and selected tests to exclude other causes of chronic pain, and provide early referral to a physical therapist skilled in the treatment of pelvic floor dysfunction. Further evaluation and referral for multidisciplinary care should be considered for women whose symptoms and functional limitations do not respond to pelvic floor physical therapy, biofeedback, or other bowel- or bladder-retraining modalities. Depending on the patient's predominant symptoms, referral to specialists in gastroenterology, gynecology, physical medicine and rehabilitation, sexual medicine, or urology may be appropriate.

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## REFERENCES

- Nygaard I, Barber MD, Burgio KL, et al; Pelvic Floor Disorders Network. Prevalence of symptomatic pelvic floor disorders in US women. *JAMA*. 2008;300(11):1311-1316.
- Haylen BT, de Ridder D, Freeman RM, et al; International Urogynecological Association; International Continence Society. An International Urogynecological Association (IUGA)/International Continence Society (ICS) joint report on the terminology for female pelvic floor dysfunction. *Neurourol Urodyn*. 2010;29(1):4-20.
- Sinaki M, Merritt JL, Stillwell GK. Tension myalgia of the pelvic floor. *Mayo Clin Proc*. 1977;52(11):717-722.
- Bharucha AE, Trabuco E. Functional and chronic anorectal and pelvic pain disorders. *Gastroenterol Clin North Am*. 2008;37(3):685-696.
- Eaton J, Thapa P, Zinsmeister A, Choung RS, Bharucha A, Locke G. The incidence rate of clinically diagnosed dyssynergic defecation in the community [abstract]. *Am J Gastroenterol*. 2009;104(suppl 3):S487. Abstract 1305.
- Coyne KS, Sexton CC, Thompson CL, et al. The prevalence of lower urinary tract symptoms (LUTS) in the USA, the UK and Sweden: results from the Epidemiology of LUTS (EpiLUTS) study. *BJU Int*. 2009;104(3):352-360.
- Paik A, Laumann EO. Prevalence of women's sexual problems in the USA. In: Goldstein I, Meston CM, Davis SR, Traish AM, eds. *Women's Sexual Function and Dysfunction: Study, Diagnosis and Treatment*. New York, NY: Taylor & Francis; 2006:23-33.
- Klinge CJ, Lightner DJ, Fletcher JG, Gebhart JB, Bharucha AE. Dysfunctional urinary voiding in women with functional defecatory disorders. *Neurogastroenterol Motil*. 2010;22(10):1094-e284.
- Bharucha AE, Zinsmeister AR, Locke GR, et al. Prevalence and burden of fecal incontinence: a population-based study in women. *Gastroenterology*. 2005;129(1):42-49.
- Laumann EO, Paik A, Rosen RC. Sexual dysfunction in the United States: prevalence and predictors [published correction appears in *JAMA*. 1999;281:1174]. *JAMA*. 1999;281(6):537-544.
- Tripoli TM, Sato H, Sartori MG, de Araujo FF, Girão MJ, Schor E. Evaluation of quality of life and sexual satisfaction in women suffering from chronic pelvic pain with or without endometriosis. *J Sex Med*. 2011;8(2):497-503.
- Butrick CW. Pathophysiology of pelvic floor hypertonic disorders. *Obstet Gynecol Clin North Am*. 2009;36(3):699-705.
- Whitehead WE, Bharucha AE. Diagnosis and treatment of pelvic floor disorders: what's new and what to do. *Gastroenterology*. 2010;138(4):1231-1235, 1235.e1-e4.
- Hurtado EA, Appell RA. Management of complications arising from transvaginal mesh kit procedures: a tertiary referral center's experience. *Int Urogynecol J Pelvic Floor Dysfunct*. 2009;20(1):11-17.
- Doggweiler-Wiygul R. Urologic myofascial pain syndromes. *Curr Pain Headache Rep*. 2004;8(6):445-451.
- Peng HY, Huang PC, Liao JM, et al. Estrous cycle variation of TRPV1-mediated cross-organ sensitization between uterus and NMDA-dependent pelvic-urethra reflex activity. *Am J Physiol Endocrinol Metab*. 2008;295(3):E559-E568.
- Rudick CN, Chen MC, Mongiu AK, Klumpp DJ. Organ cross talk modulates pelvic pain. *Am J Physiol Regul Integr Comp Physiol*. 2007;293(3):R1191-R1198.
- Ustinova EE, Gutkin DW, Pezzone MA. Sensitization of pelvic nerve afferents and mast cell infiltration in the urinary bladder following chronic colonic irritation is mediated by neuropeptides. *Am J Physiol Renal Physiol*. 2007;292(1):F123-F130.
- Winnard KP, Dmitrieva N, Berkley KJ. Cross-organ interactions between reproductive, gastrointestinal, and urinary tracts: modulation by estrous stage and involvement of the hypogastric nerve. *Am J Physiol Regul Integr Comp Physiol*. 2006;291(6):R1592-R1601.
- Akuthota V, Nadler SF. Core strengthening. *Arch Phys Med Rehabil*. 2004;85(3, suppl 1):S86-S92.
- Tu FF, Holt J, Gonzales J, Fitzgerald CM. Physical therapy evaluation of patients with chronic pelvic pain: a controlled study. *Am J Obstet Gynecol*. 2008;198(3):272.e1-e7.
- Paras ML, Murad MH, Chen LP, et al. Sexual abuse and lifetime diagnosis of somatic disorders: a systematic review and meta-analysis. *JAMA*. 2009;302(5):550-561.
- Drossman DA. Abuse, trauma, and GI illness: is there a link? *Am J Gastroenterol*. 2011;106(1):14-25.
- Beck JJ, Elzevier HW, Pelger RC, Putter H, Voorham-van der Zalm PJ. Multiple pelvic floor complaints are correlated with sexual abuse history. *J Sex Med*. 2009;6(1):193-198.
- Felitti VJ, Anda RF, Nordenberg D, et al. Relationship of childhood abuse and household dysfunction to many of the

- leading causes of death in adults: the Adverse Childhood Experiences (ACE) Study. *Am J Prev Med*. 1998;14(4):245-258.
26. Frawley H. Pelvic floor muscle strength testing. *Aust J Physiother*. 2006;52(4):307.
  27. Bø K, Sherburn M. Evaluation of female pelvic-floor muscle function and strength. *Phys Ther*. 2005;85(3):269-282.
  28. Messelink B, Benson T, Berghmans B, et al. Standardization of terminology of pelvic floor muscle function and dysfunction: report from the pelvic floor clinical assessment group of the International Continence Society. *NeuroUrol Urodyn*. 2005;24(4):374-380.
  29. Haefner HK, Collins ME, Davis GD, et al. The vulvodynia guideline. *J Low Genit Tract Dis*. 2005;9(1):40-51.
  30. Prather H, Dugan S, Fitzgerald C, Hunt D. Review of anatomy, evaluation, and treatment of musculoskeletal pelvic floor pain in women. *PM R*. 2009;1(4):346-358.
  31. Rosenbaum TY, Owens A. The role of pelvic floor physical therapy in the treatment of pelvic and genital pain-related sexual dysfunction (CME). *J Sex Med*. 2008;5(3):513-523.
  32. Fall M, Baranowski AP, Elnail S, et al; European Association of Urology. EAU guidelines on chronic pelvic pain. *Eur Urol*. 2010;57(1):35-48.
  33. Bharucha AE, Wald A, Enck P, Rao S. Functional anorectal disorders. *Gastroenterology*. 2006;130(5):1510-1518.
  34. Woodfield CA, Krishnamoorthy S, Hampton BS, Brody JM. Imaging pelvic floor disorders: trend toward comprehensive MRI. *AJR Am J Roentgenol*. 2010;194(6):1640-1649.
  35. Talasz H, Himmer-Perschak G, Marth E, Fischer-Colbrie J, Hoefner E, Lechleitner M. Evaluation of pelvic floor muscle function in a random group of adult women in Austria. *Int Urogynecol J Pelvic Floor Dysfunct*. 2008;19(1):131-135.
  36. Kegel AH. Stress incontinence of urine in women; physiologic treatment. *J Int Coll Surg*. 1956;25(4, pt 1):487-499.
  37. Weiss JM. Pelvic floor myofascial trigger points: manual therapy for interstitial cystitis and the urgency-frequency syndrome. *J Urol*. 2001;166(6):2226-2231.
  38. Section on Women's Health. American Physical Therapy Association. [www.womenshealthapta.org/plp/](http://www.womenshealthapta.org/plp/). Accessed December 5, 2011.
  39. FitzGerald MP, Kotarinos R. Rehabilitation of the short pelvic floor. II: treatment of the patient with the short pelvic floor. *Int Urogynecol J Pelvic Floor Dysfunct*. 2003;14(4):269-275.
  40. Tu FF, As-Sanie S, Steege JF. Musculoskeletal causes of chronic pelvic pain: a systematic review of existing therapies: part II. *Obstet Gynecol Surv*. 2005;60(7):474-483.
  41. Wehbe SA, Fariello JY, Whitmore K. Minimally invasive therapies for chronic pelvic pain syndrome. *Curr Urol Rep*. 2010;11(4):276-285.