Chapter 11
Pelvic Pain

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Introduction

Chronic pelvic pain is an increasingly important, multifactorial condition requiring a multidisciplinary approach to diagnosis and treatment. Terminology often varies across specialty, and practice guidance for the majority of etiologies of pelvic pain remains nebulous. Randomized controlled trials are emerging. A summary of treatments that are evidence-based, emerging, accepted, and disproven by etiology is provided in tabular form at the end of the chapter.

Epidemiology

Pelvic pain is a multifactorial condition that arises from disorders of the viscera, bony structures, soft tissues, nerves, and muscles of the pelvis, bounded anteriorly by the anterior abdominal wall, posteriorly by the buttocks, superiorly by the umbilicus, and inferiorly by the pelvic floor musculature.

The causes of pelvic pain—acute and chronic—span roughly 70 diagnoses and are listed in Tables 11.1 and 11.2. Patients frequently consult a series of providers across specialties and may be given multiple diagnoses resulting in multiple, sometimes conflicting treatment plans. Specialties commonly seen for pelvic pain include primary care, OB/GYN, gastroenterology, neurology, urology, psychology, physical therapy, and physical medicine and rehabilitation. The breadth of providers involved in treatment and the rarity of interdisciplinary centers may help explain a lack of uniform terminology addressing the many manifestations of pain in the pelvis.

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Table 11.1 Common acute pelvic pain causes

Gastrointestinal	Urologic	Gynecologic	Musculoskeletal
Acute appendicitis	Acute prostatitis	Ectopic pregnancy	Acute fracture
Bowel obstruction	Nephrolithiasis	Ovarian cyst rupture	Acute hip or gluteal tendinopathies
Hernia	Urinary tract infection	Ovarian torsion	Osteitis pubis
	Sexually transmitted infection	Endometriosis	
		Sexually transmitted infection	
		Pelvic inflammatory disease	
		Vaginal yeast and bacterial infection	

Acute pelvic pain is frequently dealt with in an emergent or urgent setting, as many causes of acute pelvic pain, including acute appendicitis, ectopic pregnancy, ovarian torsion, and ovarian cyst ruptures, can be life threatening. Other common causes of acute pelvic pain, particularly those managed by primary care providers and gynecologists, include urinary tract infections and endometriosis. The percentage of acute pelvic pain that cannot be given a diagnosis ranges between 8% and 37% across multiple studies [63]. Cases of acute pelvic pain that remain undiagnosed are unlikely to receive timely treatment and may become chronic.

Pelvic pain lasting greater than 6 months is considered chronic (CPP) and is likely of greater interest to the pain specialist. CPP is thought to arise from a variety of visceral, myofascial, and neuropathic etiologies. CPP is associated with significantly decreased quality of life and disproportionately affects women with a prevalence of up to 33% of women worldwide with an average symptom duration of 2.5 years. Approximately 2–16% of men under 50 are also affected worldwide [62].

CPP is often multifactorial and is accompanied by comorbidities that commonly attend chronic pain disorders including depression, sleep disturbance, and impaired social and sexual functioning. Physical, sexual, and emotional abuse may be one of many causes of CPP and may perversely discourage patients from seeking or accepting care.

Tables 11.1 and 11.2 list common causes of acute and chronic pelvic pain, respectively. They are not exhaustive.

Anatomy

Pelvic anatomy is complex and comprises a richly layered tapestry of the pelvic viscera, muscles, and nerves within a bony girdle. The pelvic girdle is composed of the two innominate bones that join anteriorly at the pubic symphysis joint and articulate posteriorly with the sacrum at the sacroiliac joints. The pelvic girdle's

Table 11.2 Common chronic pelvic pain causes

Gastrointestinal	Urologic	Gynecologic	Neurologic	Musculoskeletal	Psychological
IBS	Interstitial cystitis	Fibroids	Pudendal neuralgia	Overactive pelvic floor dysfunction (PFD) with myofascial pelvic pain (MFPP)	Anxiety
IBD	Chronic prostatitis	Ovarian cysts	Inferior clunealgia	Pubic symphysis pain, osteitis pubis	Depression
Hemorrhoids	Nephrolithiasis	Endometriosis	Border nerve syndrome (ilioinguinal, iliohypogastric, genitofemoral neuralgia)	Sacroiliac joint pain	Stress
Chronic appendicitis	Penile pain syndrome	Adhesions	Plexopathy	Hip disorders (labral tear, OA, FAI)	Sleep disturbance
Proctalgia fugax	Chronic epididymitis	Adenomyosis	Cauda equina syndrome	Piriformis syndrome	Physical abuse
Anal fissures	Orchialgia	Lichen planus/lichen sclerosus	Radiculopathy, including sacral radiculopathy associated with Tarlov cysts	Hip flexor tendinopathy	Sexual abuse
Meckel diverticulum		Vaginal mesh	Adhesive arachnoiditis	Greater trochanteric pain syndrome	Substance abuse
Diverticular disease		Vulvodynia		Ischiofemoral impingement syndrome	
Hernia		Pelvic congestion syndrome		Coccydynia	

stability derives from a combination of form closure (the shape, structure, and form of the joint that provides stability) and force closure (compressive and frictional forces at the pelvic joints provided by the associated ligaments and muscles of the gluteal region, hip girdle, and pelvic floor) [30]. The pelvic floor muscles form the inferior boundary of the pelvis and include the puborectalis, pubococcygeus, iliococcygeus, ischiococcygeus (often referred to as simply coccygeus), piriformis, and obturator internus. Above this lower boundary, the pelvis contains all reproductive organs, the lower urinary system, and the distal gastrointestinal tract. A list of pelvic nerves and the structures they innervate is provided in Table 11.3. Disturbances to any of the extensive pelvic structures can shift a precarious balance, leading to pain, paresthesias, weakness, bowel or bladder incontinence, and sexual dysfunction.

Table 11.3 Pelvic nerves and the structures they innervate

Nerve involvement and spatial distribution of symptoms		
Nerve	Location and distribution of sensory symptoms	Associated signs
Lumbosacral nerve roots	Gluteal area, lower extremities along distribution of affected nerve roots	Leg weakness, pain, paresthesias
Femoral	Groin and anterior thigh	Leg weakness, knee buckling
Sciatic	Posterior gluteal area, posterior thigh, posterior-lateral calf and top of foot	Leg weakness, gluteal cramping
Superior gluteal	Deep and superior gluteal area	Abductor muscle weakness
Inferior gluteal	Deep and inferior gluteal area	Hip extension weakness
Posterior femoral cutaneous	Inferior gluteal area and posterior thigh	May have ischial or labial/perineal pain due to involvement of inferior cluneal branches
Iliohypogastric	Anterior and lateral lower abdominal wall, lateral gluteal region	
Ilioinguinal	Groin and medial thigh	
Pudendal	Deep pelvis, anterior pelvis, genital area	Urinary and defecatory pain and dysfunction, dyspareunia
Pudendal branches	Anorectal region (inferior hemorrhoidal nerve), perineum (perineal branches), genitalia (dorsal nerve of clitoris or penis)	Urinary and defecatory pain and dysfunction, dyspareunia
Genitofemoral	Groin, scrotum and labia, and superior anterior thigh	Testicular pain
Lateral femoral cutaneous	Anterolateral thigh	
Superior cluneal nerves (dorsal rami of L1–L3)	Posterior superior iliac spine and iliac crest, mid-gluteal region	
Middle cluneal nerves (dorsal rami of S1–S3)	Lateral gluteal crease, posterior perineum, ischial region	
Inferior cluneal nerves (branches of the PFCN)	Coccyx and rectal area, perineum	
Ganglion impar	Medial gluteal region	

Diagnosis

The diagnosis of pelvic pain requires a thorough history, physical exam, and, when necessary, electrodiagnostic (EDx) testing, laparoscopy, and imaging modalities that may include ultrasound (US), magnetic resonance imaging (MRI), and computed tomography (CT).

A patient history should be collected in a manner that invites self-disclosure, as abuse in various forms—physical, sexual, and emotional—is strongly associated with pelvic pain [15]. An extensive review of systems questionnaire can help narrow an otherwise broad differential prior to exam, and it is especially important to ask about associated urinary, defecatory, and sexual dysfunction.

A full review of physical exam techniques and imaging indications for evaluating pelvic pain is beyond the scope of this chapter. A thorough yet targeted physical examination may involve abdominal, neurological, musculoskeletal, lumbosacral, pelvic girdle, external pelvic floor, and internal pelvic floor (per vaginam in females, per rectum in both genders) evaluations, as suggested by the patient's chief complaint and history [11]. Where the physical exam is non-diagnostic, additional studies may be more illustrative.

US and MRI may be effectively used for evaluation of varied diseases of the pelvic organs, including endometriosis, adenomyosis, fibroids, pelvic congestion syndrome, cysts, and foreign bodies [59]. US for CPP evaluation is typically performed through the transabdominal or through the more sensitive transvaginal approach. The main advantages of US over MRI include decreased cost and compatibility with pacemakers and other implanted metals. Chronic pelvic infections such as pelvic inflammatory disease (PID), tubo-ovarian abscess (TOA), peritonitis, oophoritis, and endometritis, however, are more readily distinguished on MRI. Suspected neuropathy can potentially be evaluated by MR neurography (MRN) as an asymmetric hyperintensity on T2-weighted fat-saturated images and diffusion tensor imaging (DTI). CT may be used to evaluate the pelvis for fractures, arthritis, heterotopic ossification, and other space-occupying lesions. CT, with or without contrast, is also commonly used to evaluate the various gastrointestinal and pelvic organ causes of CPP.

Electrodiagnostic studies (EDx) consist of nerve conduction studies and electromyography and may be employed to diagnose disorders of the lumbosacral nerve roots and of the nerves arising from the lumbosacral plexus to further elucidate the cause of neuropathic pelvic pain. EDx may be helpful in identifying lumbosacral radiculopathy, lumbosacral plexopathy, and peripheral neuropathies of the pelvis and lower extremities. Of the peripheral nerves implicated in chronic pelvic pain, only the pudendal motor nerve is routinely tested on nerve conduction studies (typically via an intrarectal St. Mark's electrode), and axonal neuropathy can be evaluated with EMG testing of the external anal sphincter (EAS). Pudendal nerve conduction studies and EMG have not been shown to be sensitive or specific, however, and are therefore considered unreliable indicators of pudendal neuropathy [60, 64, 67].

Laparoscopy may be used for direct visualization of the peritoneum and the pelvic organ surfaces. The most common findings on laparoscopy performed on women with pelvic pain are adhesions and endometriosis. CPP is the indication for between

15% and 40% of all laparoscopies performed in the United States [53]. And while up to 40% of patients undergoing laparoscopy for evaluation of symptoms have negative results, laparoscopy has multiple distinct advantages over MRI, specifically biopsy capability and pain mapping [51].

Pain Etiologies

CPP includes a broad category of symptoms and pain etiologies, most commonly myofascial/musculoskeletal pelvic pain, neurogenic pelvic pain, chronic prostatitis, interstitial cystitis, endometriosis, and vulvodynia. It may prove difficult to discretely identify primary and secondary pain generators in CPP. Differentiating these etiologies on history is complicated by overlap in visceral innervation across the rectum, sigmoid colon, lower ileum, bladder, uterus, cervix, and adnexa. A thorough but non-exhaustive list of treatments is summarized in the following tables.

Musculoskeletal (MSK) pelvic pain is a widely encompassing category of diagnoses that commonly follow joint and musculotendinous stress from overuse, trauma, or hormonal changes. Myofascial pelvic pain (MFPP) is pain arising from the pelvic floor muscles (PFMs) and pelvic fascia and commonly arises from a background of pre-existing pelvic girdle derangements, visceral organ pathology, or prior pelvic surgeries or trauma (including childbirth). MFPP is typically a sequela of overactive pelvic floor dysfunction (PFD), which has associations with the aforementioned MFPP etiologies but also has been linked to chronic anxiety and may also be a manifestation of central sensitization. MFPP is diagnosed on vaginal/rectal examination as tender, taut bands of muscle or as trigger points with reproducible radiation patterns. Mainstay treatments include pelvic floor physical therapy, supportive therapy, analgesics, muscle relaxants per os and per vaginam, trigger point anesthetic injections, dry needling, chemodenervation, and neuromodulation therapy. Additional studies hope to provide further guidance on evidence-based treatment for MFPP.

Other common forms of MSK pelvic pain include sacroiliac joint (SIJ) pain, pubic symphysis pain, pelvic insufficiency fractures and bone stress injuries, hip disorders, piriformis syndrome, greater trochanteric pain syndrome, hip flexor tendinopathy, ischiofemoral impingement syndrome, coccydynia, and pelvic floor dysfunction. Treatment mainstays of these complaints may include activity modification, rehabilitation, medical management, injections, and surgery when indicated.

Neurogenic pelvic pain or pelvic neuralgias may present as neatly or poorly demarcated sensory changes, lower limb weakness, sexual dysfunction, and bowel or bladder dysfunction/incontinence. The most common clinical finding, however, is pain in the absence of any sensory disturbance due to the overlap in the cutaneous distributions of these nerves. Common diagnoses under this category include lumbosacral radiculopathy, lumbosacral plexopathy, cauda equina syndrome, the frequently overlooked sacral Tarlov cysts (which can cause sacral radiculopathies), and disorders of cutaneous nerves, including the iliohypogastric, ilioinguinal, geni-

tofemoral, pudendal, posterior femoral cutaneous, and cluneal nerves. A variety of neuropathic pain medications and interventions tabulated below are accepted treatment mainstays; evidence is strongest for pudendal nerve interventions, specifically nerve block and radiofrequency treatment [35, 60, 89, 91].

Urologic- and gynecologic-origin pelvic pain commonly arise from infectious, inflammatory, or malignant causes. Pain generators may be vulvar, vaginal, cervical, uterine, ovarian, adnexal, urethral, ureteral, prostatic, vesicular, or renal. Urologic and gynecologic pain may have severe implications for future reproductive success, and delay in diagnosis and treatment may result in infertility. Additionally, as urologic and gynecologic malignancies are commonly advanced by time of presentation, prompt evaluation, diagnosis, and treatment decision-making are vital. In this chapter, focus is placed on treatment of vulvodynia, endometriosis, chronic prostatitis/chronic pelvic pain syndrome, and interstitial cystitis.

Vulvodynia manifests as burning, itching pain that primarily affects the labia and vestibule on application of pressure or with vaginal penetration. Vulvodynia affects up to 20% of women across their lifetimes, most commonly young women, and the associated dyspareunia and sexual dysfunction commonly lead to psychological distress and depressive symptoms [34, 47]. Conservative treatment is inconsistently supported by the literature, but there is growing consensus for the use of pelvic physical therapy to relieve associated overactive PFD which may be contributing significantly to the symptom profile. While surgery has shown greater effectiveness than non-PT conservative care in the reduction of pain across longitudinal follow-ups (regardless of surgical technique used), vestibulectomy generally remains a last resort following unsuccessful conservative management [12, 13, 57, 61, 110, 111].

Endometriosis is the manifestation of endometrial tissue outside of the uterus and affects approximately 10% of all women and a significantly higher proportion of women with fertility issues [33]. Endometriosis may present acutely but commonly persists beyond the acute phase in an inflammatory and estrogen-dependent cyclic pattern of dysmenorrhea, dyspareunia, and dyschezia. Non-steroidal anti-inflammatory drugs (NSAIDs) constitute first-line therapy, though the use of combined oral contraceptive pills (COCPs) has risen with increasing evidence of their effectiveness [18, 45, 102, 108]. Laparoscopic surgery to remove endometrial implants and lyse adhesions can be effective in symptom alleviation [19]. Hysterectomy is considered a last resort, and symptoms of endometriosis can frustratingly persist following surgery, perhaps because of associated overactive PFD and MFPP that developed over the course of the disease process [7].

Chronic prostatitis/chronic pelvic pain syndrome (CP/CPPS) affects approximately 5% of men during their lifetime and is responsible for nearly 25% of all urology visits [10, 66]. CP/CPPS may be divided into three categories: chronic bacterial prostatitis (distinguished by confirmed infection), chronic non-bacterial prostatitis (characterized by inflammation without infection), and prostadynia (absence of both infection and inflammation), with the third type being by far the most common. The etiology of CP/CPPS is unknown though some studies suggest an underlying autoimmune process, and there is growing recognition that the prostate may not be responsible for the pain in a majority of men with this condition; CP/CPPS symptoms are often associated with PFD/MFPP and pelvic PT is often an

effective treatment option [37]. Therefore, current recommendations suggest that the term "chronic prostatitis" (CP) not be used at all, in favor of the broader but more accurate "chronic pelvic pain syndrome" (CPPS). CP is associated with reduced sunlight exposure, stress, BPH, and UTIs. Approaches to treatment should begin with treating any potentially underlying infection; alpha-blockers are the most evidence-based treatment available as a next step.

Interstitial cystitis (IC)—also known as bladder pain syndrome (BPS)—is a nebulous disease and is commonly a diagnosis of exclusion that may in fact be several illnesses not yet differentiated. IC results in inflammation of the bladder wall for unknown reasons and affects women more commonly than men in a 9:1 ratio. The symptoms of IC considerably overlap those of a UTI and include urinary urgency, urinary frequency, dysuria, and suprapubic pain associated with bladder filling. Terminology for subcategories of IC continues to evolve, and some providers consider Hunner lesion IC and non-Hunner lesion IC as distinct diseases. Similar to CP/CPPS, there is increasingly consensus and evidence that non-Hunner lesion IC is a manifestation of PFD/MFPP, and pelvic floor PT has been shown to be effective in randomized controlled trials [38]. Pentosan polysulfate and adalimumab constitute evidence-based medications, and a variety of urological interventions including bladder distention and instillations of various medications have proven effective [16, 21, 22, 28, 31, 49, 79–82]. Fulguration of Hunner lesions is an accepted form of treatment but lacks randomized controlled trials [31, 48, 100]. Treatments and their level of evidence are provided in the treatment tables at the end of this chapter.

Iatrogenic pelvic pain is most commonly caused by synthetic material surgically implanted in the pelvis including mesh and slings or may arise directly as a result of surgical manipulation. More than 10% of women by age 80 will undergo surgical management for stress incontinence or pelvic organ prolapse, and those requiring surgical revision for implanted mesh range from 7% to 18% [72, 86]. Complications of surgical mesh include erosion or exposure, contracture, infection, nerve entrapment, obstruction, and fistula formation. Changes to mesh may arise as a result of chronic inflammation, and some studies have shown that synthetic mesh causes greater inflammatory reactions than does organic mesh [119]. Retrieval of surgical mesh, however, introduces additional complications, including risk of anatomical defects, residual pain, and prolapse or hernia recurrence [65].

Treatment

Just as the causes of pelvic pain are often multifactorial, so are the recommended treatments multifaceted in approach. Given the breadth of providers seen by the average pelvic pain patient, patients frequently attempt multiple treatment modalities seeking relief. These treatments include medications, ultrasound, biofeedback, chiropractic, acupuncture, dry needling, physical therapy, psychological therapy, injections, interventional procedures, and surgery. While providers may vary in their approach to treating pelvic pain, most will agree that more research is needed

Table 11.4 Evidence-based treatments

	Medications	Surgery	Interventions/injections	Physical therapy	Supportive
Chronic prostatitis/ chronic pelvic pain syndrome (CP/CPPS)	Levofloxacin [114], terazosin [23, 24], tamsulosin [84], alfuzosin [76]				Aerobic exercise [43]
Endometriosis	Hormonal therapy [20, 45, 102, 108]	Laparoscopic endometrectomy, lysis of adhesions, hysterectomy [7]	Superior hypogastric plexus block [31]		
Interstitial cystitis	Pentosan polysulfate (PPS) [79, 80, 82], adalimumab [16]		Bladder distention [31], intravesical instillation of hyaluronic acid/ chondroitin, of DMSO, and of lidocaine [21, 22, 81]	Pelvic floor physical therapy [14, 55]	
Neurogenic			Pudendal nerve block [35, 60, 89, 91]		
Pelvic floor dysfunction/ myofascial pelvic pain (PFD/MFPP)_				Pelvic floor physical therapy [14, 55]	
Vulvodynia					

Table 11.5 Emerging treatments

	Medications	Surgery	Interventions/injections	Physical therapy	Supportive
Chronic prostatitis/ chronic pelvic pain syndrome (CP/CPPS)	Pentosan polysulfate (PPS) [79, 80]		Extracorporeal shockwave therapy [46], transrectal thermotherapy [106]	Pelvic floor physical therapy [112]	Traditional Chinese medicine (TCM) [116], curcumin/calendula suppository [77]
Endometriosis					
Interstitial cystitis			Intravesical botox [54, 113], intravesical instillation of heparin [42, 52, 71, 87]		Mindfulness-based stress reduction [56]
Neurogenic			Caudal ESIs [3], ganglion impar block, radiofrequency ablation (continuous vs pulsed) [35], sacral neuromodulation [73, 74, 92, 99], genitofemoral nerve block, ilioinguinal nerve block, iliohypogastric nerve block [4]		
Pelvic floor dysfunction/ myofascial pelvic pain (PFD/MFPP)_			Trigger point injections [6], botulinum toxin injections [1, 2, 78, 94, 97]	Pelvic biofeedback [88, 95, 103]	
Vulvodynia				Pelvic floor physical therapy [44], pelvic biofeedback [27, 93, 82, 29, 75]	Psychological therapy [44], acupuncture [104]

Table 11.6 Accepted treatments

	Medications	Surgery	Interventions/ injections	Physical therapy	Supportive
Chronic prostatitis/chronic pelvic pain syndrome (CP/CPPS)	Rofecoxib [85], finasteride [83]	Prostatectomy [105]			Acupuncture [25, 40, 66, 101]
Endometriosis	NSAIDs [18]	Hysterectomy, lysis of adhesions [96]		Pelvic floor physical therapy [14, 55]	Exercise [115], acupuncture [117], psychological therapy [118]
Interstitial cystitis		Bladder diversion, bladder augmentation [87], fulguration of ulcers or trigonitis [26, 48, 100]			TENS [41, 109]
Neurogenic	Gabapentinoids [5, 70], TCAs [32], capsaicin [69]	Neurectomy (for ilioinguinal/ genitofemoral nerves) [58]		Pelvic floor physical therapy [14, 55]	Exercise [14, 55], acupuncture [32]
Pelvic floor dysfunction/ myofascial pelvic pain (PFD/MFPP)_	Amitriptyline, gabapentin [36]				Exercise [14, 55], acupuncture [40]
Vulvodynia	Gabapentin [8, 17], TCAs [107], topical lidocaine [34, 39]	Vestibulectomy [12, 13, 57, 61, 110, 111]			

Table 11.7 Disproven treatments

	Medications	Surgery	Intervention/ injections	Physical therapy	Supportive
Chronic prostatitis/chronic pelvic pain syndrome (CP/CPPS)	Steroids [9]		Transurethral needle ablation [68]		
Endometriosis					
Interstitial cystitis	Tiaprofenic acid				
Neurogenic					
Pelvic floor dysfunction/ myofascial pelvic pain (PFD/MFPP)	Vaginal valium [50]				
Vulvodynia			Botulinum toxin injections [90]		

to scientifically support treatments for their various indications. Summarized in Tables 11.4, 11.5, 11.6 and 11.7 below are existing treatments by categories of evidence-based treatments, emerging treatments, accepted but as-yet unproven treatments, and disproven treatments. Evidence-based treatments are those supported by at least one large randomized controlled trial (RCT) or multiple smaller RCTs. Emerging treatments are supported by a single small RCT or evidence of lower level. Accepted treatments are mainstays of current practice without evidence or with evidence of passable quality. Disproven treatments are treatments with evidence of harm or of ineffectiveness.

Conclusion

Pelvic pain is a disabling condition that is very common and multifactorial in etiology. Continued research is necessary to find treatments which are truly effective for pelvic pain, but emerging treatments such as pelvic physical therapy and procedural interventions hold great promise.

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