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Sebin Choi & Johnny Phuong Tran

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REVIEW

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A review of treatment options for chronic pelvic pain from endometriosis

Sebin Choi [a] and Johnny Phuong Tran [a,b]

[a]Albert Einstein College of Medicine, Bronx, NY, USA; [b]Division of Multidisciplinary Pain, Department of Anesthesiology, Montefiore Medical Center, Bronx, NY, USA

ABSTRACT

Chronic pelvic pain is a severe condition affecting patients with endometriosis. Treatment options range from physical therapy, medical management, to surgical resection. However, some patients continue to have severe pain after maximal management. We review current treatment options for endometriosis and discuss regional anesthesia techniques currently used for acute pain that may be used for chronic pelvic pain patients. A comprehensive literature search was conducted using PubMed, Cochrane Library, and Google Scholar databases through 2025. An algorithm on which procedure to choose was also created to guide treatment in hopes to bridge the gap for patients who are recalcitrant to current available therapies.

PLAIN LANGUAGE SUMMARY

Endometriosis is a condition that can cause pain in the abdomen, pelvis, and anal or genital areas called chronic pelvic pain. This can affect quality of life. There are several ways to treat this type of pain; however, current treatments don't always work well. Some patients also have tried many different types of treatment without success. This review looks at the current treatment options such as medicines, physical therapy, psychotherapy, surgery, and different types of injections that may be helpful for patients. The authors searched medical research studies to find ways to treat this type of pain.

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KEYWORDS
Chronic pain; neuromodulation; pain management; neuropathic pain; analgesia

1. Objectives

The purpose of this narrative review is to provide a framework on different non-surgical procedures for the treatment of chronic pelvic pain (CPP) secondary to endometriosis. In this review, we provide an overview of endometriosis with its symptomatology and mechanisms and discuss some of the current treatment options. We highlight which procedures may be an option for patients. The goal of this review is to enhance the care of chronic pelvic pain patients living with endometriosis.

2. Methods: literature review

A literature review was conducted using PubMed, Cochrane Library, and Google Scholar databases through 2025. Studies discussing interventional treatment options for chronic pelvic pain were identified. Search terms were tailored to the specific focus of each section. The search strategy incorporated key words related to endometriosis, chronic pelvic pain, pharmacologic treatment, non-pharmacologic treatment, surgical, and interventional therapies, and regional nerve blocks to capture a wide perspective of treatment options. Reports, including case reports, clinical trials, narrative reviews, meta-analysis, systematic reviews, and textbook chapters in any language were included. Reports were reviewed by the two coauthors to ensure relevancy to interventional chronic pelvic pain. We only included peer-reviewed publications. No formal bias analysis was performed given the narrative nature of this review.

3. Overview of endometriosis

Endometriosis is a chronic, estrogen-dependent inflammatory condition characterized by the growth of endometrial-like glands and stroma outside the uterine cavity [1]. These ectopic implants are most commonly located within the pelvis, usually on the ovaries, fallopian tubes, uterosacral ligaments, and pelvic peritoneum, but can also be found in more distant sites such as the diaphragm, pleura, and even the central nervous system in rare cases [2]. The ectopic tissue responds to cyclical hormonal signals, leading to recurrent bleeding, inflammation, fibrosis, and adhesions. These pathological processes are central to the chronic pain and infertility associated with the disease [3].

3.1. Epidemiology

The incidence of endometriosis is difficult to determine accurately due to diagnostic delays and variability in symptom expression, but it is estimated to affect approximately 6–10% of individuals assigned female at birth during their reproductive years [1]. Among patients with chronic pelvic pain, the prevalence increases to around 40–60%, and in those with infertility, up to 50% may have underlying endometriosis [4]. Despite its high prevalence, the delay in diagnosis can be as long as 8 to 12 years from symptom onset, with studies showing an average diagnostic delay of approximately 6.7 years. This delay is multifactorial and reflects both patient- and provider-level barriers. Patients may normalize or minimize their symptoms, especially

CONTACT Johnny Phuong Tran jotran@montefiore.org Division of Multidisciplinary Pain, Department of Anesthesiology, Montefiore Medical Center, 1250 Waters Place, Tower II, Bronx, NY 10461, USA

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Article highlights

- Chronic pelvic pain is a complex disease and endometriosis accounts for a large proportion of patients living with this disease.
- Current treatment options include pelvic floor physical therapy, medication management including hormonal therapies, and surgical resection of endometriosis lesions.
- There is a subset of patients who continue to have severe pain after exhausting all of the previous therapies; in these patients, injection treatment may be offered.
- Regional anesthesia has been used to treat acute postoperative abdominal and pelvic pain and may be used to treat chronic pelvic pain.
- Since endometrial lesions may involve the pelvic organs or pelvic nerves, sympathetic blocks may often be indicated.
- Given the myriad of injections available, we created an algorithm to decide which injection may be beneficial to the patients based on presenting symptoms.

dysmenorrhea or chronic pelvic pain, and may delay seeking care. At the same time, healthcare providers may attribute symptoms to more common gynecologic or gastrointestinal conditions, especially in adolescents and nulliparous individuals [5]. This lag in diagnosis not only prolongs suffering but may also allow for disease progression, increased pain sensitization, and worsening quality of life.

3.2. Symptoms and diagnosis

Endometriosis is a heterogeneous disease and hallmark symptoms include dysmenorrhea, dyspareunia, dysuria, dyschezia, infertility and chronic pelvic pain [1]. The disease can significantly impair quality of life, limiting academic, occupational, and social functioning. The intensity of symptoms does not always correlate with the extent of disease; some patients with minimal disease experience severe pain, while others with advanced disease may remain asymptomatic [4].

Traditionally, the diagnosis of endometriosis has relied on direct visualization of lesions during laparoscopy, often with histologic confirmation of endometrial glands and stroma located outside the uterus [3,6]. While laparoscopy remains the diagnostic gold standard, there is growing recognition of the need for earlier, noninvasive diagnosis based on clinical presentation, imaging, and therapeutic response. This is due to the invasiveness and cost of surgery, as well as the risk of complications, making this approach less feasible as a first-line diagnostic strategy. Current guidelines from the American College of Obstetricians and Gynecologists (ACOG) and the European Society of Human Reproduction and Embryology (ESHRE) now support a clinical diagnosis based on symptomatology, imaging, and therapeutic response, rather than requiring surgery [7].

3.3. Development of chronic pelvic pain

Chronic pelvic pain (CPP) is a complex and multifactorial condition, defined as non-cyclic pain lasting at least six months that localizes to the pelvis, anterior abdominal wall, lower back, or buttocks, and is severe enough to cause functional disability or require medical care [8]. Among the various causes of CPP, endometriosis accounts for approximately 20–40% of cases, making it one of the most common gynecological contributors to chronic pelvic pain [8].

Endometriosis contributes to chronic pelvic pain through a variety of mechanisms, both peripheral and central. One pathway is through inflammatory sensitization. Ectopic endometrial lesions secrete pro-inflammatory cytokines, chemokines, and growth factors that activate surrounding immune cells and nociceptors [9]. This localized inflammation contributes to peripheral sensitization, which causes a heightened pain response at the site of lesions.

Another key mechanism is nerve infiltration. Endometriotic lesions, particularly those in deep infiltrating endometriosis, have been shown to contain nerve fibers and are capable of inducing neuroangiogenesis. These lesions can entrap or irritate surrounding pelvic nerves, leading to neuropathic pain [9,10]. In addition, patients with long-standing endometriosis may develop central sensitization, a condition where the central nervous system becomes hyper-responsive to pain signals [9]. One study found the prevalence of central sensitization among patients with endometriosis to be 41.4% [11].

Abdominal myofascial dysfunction and pelvic floor muscle spasm are also common in patients with endometriosis-related CPP [12]. Moreover, psychological factors such as anxiety, depression, and a history of trauma can amplify the pain experience and should not be overlooked in comprehensive management [13].

Understanding these multifactorial mechanisms is crucial for developing effective interventional and multidisciplinary treatment strategies, which may need to target not only the ectopic lesions themselves but also systemic inflammation, pelvic floor dysfunction, and altered central pain processing. This highlights the importance of a biopsychosocial approach to the evaluation and treatment of endometriosis-associated chronic pelvic pain.

4. Current treatment options

4.1. Pelvic floor physical therapy

Pelvic floor physical therapy (PFPT) is a conservative, noninvasive treatment modality that plays a crucial role in the management of chronic pelvic pain secondary to endometriosis. PFPT focuses on restoring normal function to the pelvic floor muscles, which can become hypertonic, dysfunctional, and a source of pain due to chronic inflammation and neural sensitization associated with endometriosis [12]. The therapy includes a combination of manual therapy, biofeedback, neuromuscular reeducation, myofascial release, trigger point therapy, and patient education on relaxation techniques to reduce muscle tension and improve pelvic function [14]. Research suggests that about 60% of patients report significant pain relief with dedicated pelvic floor therapy [15]. Meta-analyses show multimodal physical therapy, which include integrating manual techniques, education, and exercise, provides greater reductions in pain intensity compared to non-conservative treatments. This benefit is supported by high-certainty evidence in the short term and moderate-certainty evidence in the intermediate term (up to 36 weeks post-treatment), with

no significant adverse effects reported [16]. PFPT has also been shown to improve dyspareunia, reduce pain-related disability, and enhance overall quality of life in affected individuals [17].

4.2. Psychotherapy

Psychotherapy, particularly cognitive behavioral therapy (CBT), plays an important role in the management of chronic pelvic pain associated with endometriosis. The American

Academy of Family Physicians recommends CBT as part of a multidisciplinary approach, noting its benefit in addressing central sensitization and common psychological comorbidities such as depression, anxiety, and social isolation [18]. CBT offers small to moderate improvements in chronic pain outcomes, and can be especially helpful in patients who experience significant emotional distress or persistent symptoms despite medical or surgical treatment. Sex therapy may also be useful in patients with associated sexual dysfunction, improving symptoms like genito-pelvic pain and supporting pain-free intercourse [18]. A recent systematic review has further supported the use of CBT, acceptance and commitment therapy (ACT), and mindfulness-based interventions in improving pain-related outcomes, psychological well-being, and overall functioning in women with endometriosis. These approaches aim to shift maladaptive pain beliefs, increase psychological flexibility, and support engagement in meaningful life activities. Mindfulness and ACT-based group programs, such as those evaluated in the MY-ENDO trial, have demonstrated improvements in quality of life and self-regulation, even when pain levels remain unchanged [19]. Although more work is needed to refine patient selection and delivery methods, early integration of psychotherapy into care plans may improve outcomes for many patients. Ongoing research is exploring the scalability of low-intensity and internet-based CBT programs to improve accessibility and long-term effectiveness [20].

4.3. Pharmacologic management

Pharmacologic management of chronic pelvic pain secondary to endometriosis spans several drug classes, aiming to reduce inflammation, control hormonal triggers, and alleviate musculoskeletal or neuropathic contributors to pain [21].

4.3.1. Nonsteroidal anti-inflammatory drugs

Nonsteroidal anti-inflammatory drugs (NSAIDs), such as ibuprofen and naproxen, are frequently first-line therapies. They target prostaglandin-mediated inflammation associated with endometriotic lesions and may provide short-term relief of dysmenorrhea and pelvic pain [22]. However, their utility may be limited by gastrointestinal side effects and antiplatelet properties, which should be considered when prescribing. Although analgesics are often the initial step in managing chronic pelvic pain, their effectiveness in endometriosis-related CPP remains inconsistent. Literature suggests that NSAIDs may not significantly alleviate symptoms for all patients, particularly those with moderate to severe pain. Interestingly, COX-2 overexpression has been identified more frequently in peritoneal-only endometriosis, and some studies propose that patients with this profile might experience improved symptom control with selective COX-2 inhibitors [23].

4.3.2. Muscle relaxers

Muscle relaxants are another therapeutic option, especially when pelvic floor muscle spasm contributes to pain. Oral agents like cyclobenzaprine, which has effects comparable to tricyclic antidepressants, can help reduce overall muscle tone and are often used at night due to their sedative properties [21]. For more localized treatment, intravaginal formulations of muscle relaxants, such as diazepam or baclofen, are available in suppository or compounded cream forms and have been reported to be well tolerated, with drowsiness being the most common side effect [24]. Topical lidocaine, applied internally, may also aid in reducing discomfort during penetrative intercourse or prior to pelvic floor physical therapy sessions involving internal manual techniques [21].

4.3.3. Hormonal therapies

Hormonal therapies are the cornerstone of long-term pharmacologic management in endometriosis-related CPP. Combined oral contraceptives (COCs) suppress ovulation and reduce endometrial proliferation, often resulting in significant pain relief, are used in mild cases. Continuous dosing regimens are preferred to avoid cyclic pain flares [25]. Other hormonal options progestins (oral, injectable, or intrauterine) reduce estrogen stimulation of ectopic endometrial tissue. Progestins, agents that contain only progesterone, are used as first-line treatments and are recommended by the American College of Obstetricians and Gynecologists and European Society of Human Reproduction and Embryology [26].

For more severe or refractory cases, gonadotropin-releasing hormone (GnRH) agonists and antagonists (e.g., leuprolide, elagolix respectively) induce a hypoestrogenic state, effectively shrinking endometrial implants. These are often prescribed in conjunction with "add-back therapy," which involves supplementing with additional pharmacologic agents to help preserve the therapeutic benefit of GnRH modulation while reducing or preventing estrogen-deficiency side effects such as bone demineralization and vasomotor symptoms. Newer oral agents like Elagolix, a GnRH antagonist, provide more flexible dosing and fewer long-term complications [27,28].

4.3.4. Opioids

A subset of patients with CPP from endometriosis are treated with opioids [29]. Women with endometriosis are nearly three times more likely to fill an opioid prescription compared to women without the condition, and are at increased risk for prolonged use, higher dosages, and concurrent benzodiazepine prescriptions [30]. Their risk of developing chronic opioid use is approximately four times higher [31]. Evidence supporting long-term opioid use for chronic pelvic pain is limited, and the potential harms may outweigh the benefits. These risks include immunosuppression, endocrine dysfunction such as hormonal deficiencies, and opioid-induced hyperalgesia [32].

The pharmacologic management of CPP in endometriosis underscores the need for individualized care. A combination of anti-inflammatory agents, hormonal suppression,

neuromuscular treatments, and cautious pain management remains the mainstay. For many patients, medications serve as a bridge or adjunct to physical therapy or procedural and/or surgical interventions when pain persists.

4.4. Surgical management

Surgical resection, typically via laparoscopy, remains the most definitive and invasive therapeutic option for patients with chronic pelvic pain secondary to endometriosis. It is often pursued when conservative measures fail or when disease burden is suspected to be severe but may also be used in cases of fertility preservation or planning [33].

It is estimated that approximately 8–20% of individuals with CPP secondary to endometriosis will undergo surgery at some point during their care [34]. In the United States alone, chronic pelvic pain is a leading reason for diagnostic and therapeutic laparoscopy, accounting for up to 40% of such procedures performed each year, making it one of the most common indications for gynecologic laparoscopy [35].

Success rates of surgery vary depending on the extent of disease, surgical expertise, and whether complete excision is achieved. In general, most patients report significant pain relief following laparoscopic excision of endometriosis lesions. Symptom recurrence following treatment is frequently reported, with 15–50% of patients experience a return of pain within two years of surgery [35]. Additionally, around a quarter of individuals may not experience meaningful pain relief after their first surgical procedure, and many go on to require additional interventions [36]. If patients elect for a hysterectomy for their chronic pelvic pain, 21–40% of women undergoing the procedure may continue to experience symptoms afterward, and about 5% may develop new pain following the procedure. Additionally, around 14% of patients report outcomes that are worse than anticipated, while nearly 26% experience a slower-than-expected recovery [37].

While laparoscopy is considered relatively safe, complications still exist, including risks such as bleeding, infection, injury to bowel or bladder, and anesthesia-related complications [38]. The risk increases with disease severity and extent of adhesions, like in cases of deeply infiltrating endometriosis involving structures such as the rectum, ureters, or bladder [39].

5. Non-surgical interventional management options

Given the myriad symptoms with which patients living with endometriosis can present, a tailored approach is often needed to effectively treat their pain. When conservative treatments such as PFPT, pharmacologic management, and surgery fail, different procedural interventional may be utilized. In this next section, we discuss various injections, the indications, and a brief description on the procedural technique and potential complications. Technical descriptions of procedural technique and approaches for each intervention are beyond the scope of this review article.

5.1. Trigger point injections

CPP may persist in patients with endometriosis despite surgical resection and hormonal therapy. Myofascial dysfunction or pain, presenting as either focal or widespread pelvic muscle pain, is a common symptom of CPP. It is characterized by tight or hypersensitive pelvic floor muscles or trigger points. Digital palpation via the transvaginal or transrectal approach may reproduce the pain. A cross-sectional study of women with endometriosis-associated CPP found all the women had pelvic floor muscle spasms which were self-identified as a major source of pain [40].

The pelvic floor muscles are a group of muscles at the bottom of the pelvis. The primary layers of the pelvic floor are the levator ani muscles and the coccygeus, as well as other smaller supporting muscles. The levator ani muscles are the largest and most important layer, consisting of the pubococcygeus, puborectalis, and iliococcygeus muscles. Trigger point injections can be performed in these muscles to reduce their hypertonicity. A retrospective chart review in 68 women who underwent pelvic floor trigger point injections found 65% had improvement in pain scores [41].

Knowledge of pelvic floor anatomy is necessary to perform pelvic floor muscle trigger point injections. Patients will need to be placed in a lithotomy position and focal trigger points should be identified with manual digital palpation. Trigger point injections mainly consist of a local anesthetic with or without steroid. Longer acting local anesthetics such as 10 mL of bupivacaine 0.25% combined with particulate steroid such as 1 mL of 40 mg/mL triamcinolone may be used to prolong the duration of analgesia. As a trigger point is identified, 1–2 cc of the local anesthetic mixture is slowly injected into the painful muscle using a small gauge spinal needle [42].

Botulinum toxin is a neurotoxin that blocks release of acetylcholine neurotransmitter from presynaptic nerve terminals resulting in muscle relaxation. Botulinum toxin has been used as part of injection therapy into pelvic floor muscles for pelvic pain with muscle spasms or muscular hypertonicity. One benefit of Botulinum toxin is the duration of the toxin offers several months of relief [43,44], which can be an option if trigger point injections are helpful in relieving pain but not offering long enough duration of relief.

5.2. Fascial plane blocks

Nerve blocks can offer relief by blocking nerve signals along the distribution of nerves within the pelvic region. Endometriosis may be widespread, and lesions may appear within the abdominal wall musculature, manifesting as abdominal wall pain [45–47]. Depending on the area of pain, different peripheral nerve or fascial plane blocks may be employed to provide analgesia.

If the region of pain is widespread in the abdominal wall, fascial plane blocks are preferred as they provide broader analgesic coverage covering multiple dermatomes. The fascial plane blocks are the transversus abdominis plane block, quadratus lumborum block, rectus sheath block, and erector spinae plane block. These fascial plane blocks are often employed by regional anesthesiologists in the perioperative setting to treat acute postoperative pain in patients undergoing abdominal surgeries [48,49]. However, they can also be used in the outpatient setting to treat chronic pain.

For each fascial plane block, the technique involves the use of either an echogenic peripheral nerve block needle or

a spinal needle. The injectate is anywhere from 20–40 mL of local anesthetic with or without steroid. Ultrasound guidance is recommended for improved success and to prevent complications such as injury to deeper structures.

5.2.1. Transversus abdominis plane block

The transversus abdominis plane (TAP) block targets the anterolateral abdominal wall. This block targets the intercostal nerves from T6-T11, the subcostal nerve (T12), and the ilioinguinal and iliohypogastric nerves (L1-L2) [50]. These nerves lie in the layer between the transversus abdominis and internal oblique muscles.

Techniques for TAP blocks are varied. Ultrasound is typically used to identify the layers of the abdominal wall, but the primary target for deposition of local anesthetic, the layer between the transversus abdominis muscle and the internal oblique muscle, remains the same for each approach. The subcostal TAP block is performed in the lower margin of the rib cage and covers the upper abdominal wall. The lateral TAP is performed along the midaxillary line between the subcostal margin and the iliac crest and covers the anterior abdominal wall from midclavicular line to midline. The posterior TAP is similar to the lateral TAP except that the deposition of injectate is placed along the most posterior end of the transversus abdominis plane, covering the anterolateral abdominal wall [50].

TAP blocks are regularly used in the perioperative setting for abdominal surgeries but have also recently been used on an outpatient basis for chronic abdominal pain. A retrospective review of 95 patients over 5 years showed 50% improvement in pain scores with an average duration of pain relief of 108 days [51].

5.2.2. Quadratus lumborum block

The quadratus lumborum (QL) blocks have the same indications as the TAP blocks. The QL block targets the thoracolumbar nerves from T7-L1 to cover anterolateral abdominal wall. There are three techniques for the QL block: QL1 (lateral QL), QL2 (posterior QL), and QL3 (anterior QL) [52]. In the QL1 block, local anesthetic is deposited on the lateral edge of the QL muscle. In the QL2 block, it is deposited superficial to the QL muscle, and in the QL3 block, local anesthetic is deposited deep to the QL muscle and superficial to the psoas muscle. There is no evidence to support one approach to the QL block over another and the technique should be at the provider's expertise level with each block.

In each approach, local anesthetic is deposited into the thoracolumbar fascia. The thoracolumbar fascia extends posterior from the quadratus lumborum muscle to the lumbar paravertebral area and contains sympathetic fibers. As such, in addition to the somatic coverage similar to the TAP block, the QL blocks also provide visceral pain coverage [53].

QL blocks have been shown to provide excellent postoperative analgesia for patients undergoing pelvic surgeries [54,55]. Given the distribution area of these blocks, they may be a potential therapy for CPP patients on an outpatient basis as well. A study found QL blocks, combined with ilioinguinal and iliohypogastric blocks, was able to offer significant and long-lasting pain relief in patients with CPP from endometriosis who have failed surgery and oral medications [56]. The benefit of the QL over the TAP is the addition of visceral coverage and the expanded dermatomal coverage area.

5.2.3. Rectus sheath block

The rectus sheath block targets the anterior cutaneous branches of spinal nerves T7-L1. This block provides coverage to the umbilicus and anteromedial abdomen from the xyphoid process to the pubic symphysis. This block involves depositing local anesthetic between the rectus abdominis muscle and the posterior rectus sheath [57]. While this block mostly covers midline abdominal wall pain, it can be an option for patients who experience pain at this location.

5.2.4. Erector spinae plane block

The erector spinae plane (ESP) block is a newer fascial plane block in which local anesthetic is deposited in the plane between the erector spinae muscles and the transverse process. It was first described in 2016 and used to treat severe neuropathic pain of the thoracic region secondary to metastatic cancer to the ribs and malunion of multiple rib fractures [58]. Since then, the ESP block has been utilized along the cervical and lumbar spine as well to provide coverage to these areas [59]. The mechanism through which the ESP block provides analgesia has not been elucidated. However, cadaveric studies have revealed radiocontrast spread into the neuroforamina and epidural space as well as the paravertebral space [60,61].

This block has been used to treat severe acute exacerbations of pelvic pain secondary to endometriosis [62]. When performed at the lower thoracic levels, the analgesic coverage extends posteriorly to anteriorly and can provide somatic analgesia to the abdominal wall and pelvic region.

The ESP block has been used extensively to treat patients with various chronic pain syndromes ranging from lower extremity complex regional pain syndrome, low back pain, and even cancer pain [63–65].

5.3. Paravertebral block

Paravertebral blocks (PVB) provide somatic and sympathetic nerve block by inhibiting the somatic and sympathetic nerves in the paravertebral space. Local anesthetic is deposited along the thoracic vertebra where the spinal nerves exit the intervertebral foramen [66]. The paravertebral block is more commonly performed in the thoracic spine, but it can also be performed in the lumbar spine in combination with a lower thoracic paravertebral block to treat pelvic pain. Ultrasound guidance is recommended for PVB due to the high risk of pneumothorax in the thoracic spine and deeper structures within the lumbar spine. The paravertebral space is identified by locating the transverse process at the respective spinal level. The paravertebral space is bordered anterolaterally by the pleura (or in the lumbar spine, the psoas muscle), medially by the vertebral body, and posteriorly by the transverse process. Injectate consists of 5 mL of local anesthetic at each spinal level with spread into the intercostal and epidural space to provide analgesia [67].

The PVB has been used to treat perioperative pelvic pain from inguinal or incisional hernia surgeries [68,69]. This block

has been studies in abdominal surgeries including laparotomy incisions showing improve pain scores [70,71] and may also be an option for patients on an outpatient basis.

5.4. Peripheral nerve blocks

If the region of pain is more localized to the inguinal or genital region, blockade of distinct peripheral nerves can be more readily employed. These peripheral nerve blocks include the ilioinguinal, iliohypogastric, genitofemoral, and pudendal nerve blocks.

5.4.1. Ilioinguinal and Iliohypogastric Block

The ilioinguinal and iliohypogastric nerves branch from the primary ventral ramus of the L1 spinal nerve of the lumbar plexus. These nerves lie in the plane between the internal oblique and transversus abdominis muscles [72]. The distribution of these two nerves is the area overlying the pelvis and the upper medial thigh and groin.

Although frequently used to treat pain from inguinal hernia surgery, this block has been used to treat acute and chronic postoperative pelvic pain after Cesarean sections [73]. This has also been shown to improve CPP from endometriosis in patients when combined with QL blocks [56]. Performing this block is similar to the TAP block in that the nerves lie in the same fascial plane. However, the injection is performed lower in the abdomen by identifying the anterior superior iliac spine and orienting the probe superomedial toward the umbilicus.

5.4.2. Genitofemoral nerve block

The genitofemoral nerve arises from the L1 and L2 spinal nerves and divides into the genital and femoral branches. The genital branch enters the inguinal canal sensation to the mons pubis and labia majora in females. The femoral branch provides sensation to the upper medial thigh near the femoral triangle [74]. The most common approach is to target the genital branch of the genitofemoral nerve at the inguinal canal. Ultrasound guidance is used to identify the femoral artery at the level of the inguinal ligament and moved proximally along the artery until it becomes the external iliac artery. At this level, the inguinal canal can be visualized and contains the round ligament. The genital branch may be visualized superficial to the external iliac artery and deep to the rectus abdominis muscle, and local anesthetic with or without steroid is deposited around the nerve.

5.4.3. Pudendal nerve block

The pudendal nerve originates from the S2-S4 nerve roots of the sacral plexus. It exits the pelvis through the greater sciatic foramen and passes through the gluteal area before entering the perineum via the lesser sciatic foramen. It innervates the perineum, genitalia, anus, and lower rectum [75]. There are many approaches to the pudendal nerve block, including transvaginal or transperineal approaches [76]. However, for patients with CPP, a posterior transgluteal approach using ultrasound or fluoroscopy may be more comfortable and avoid manipulation of sensitive anatomy. In both the ultrasound or fluoroscopy approach, the ischial spine is identified. At this level, the pudendal nerve lies near the internal pudendal artery along the ischial spine. Once identified, 5 mL of local anesthetic with or without steroid is deposited. There have been multiple published reports for the use of the pudendal nerve block for patients with CPP with good results [77,78]. Radiofrequency ablation of the pudendal nerve has also been used to treat refractory cases of pelvic pain [79].

5.5. Sympathetic plexus blocks

The sympathetic nervous system is of tantamount importance in pain signaling from internal organs. There is a longstanding history of utilizing sympathetic nerve blocks for treatment of visceral pain secondary to internal organ pathology. One classic example is the use of the celiac plexus block to treat malignant pain from pancreatic adenocarcinoma [80].

5.5.1. Superior hypogastric plexus

The superior hypogastric plexus (SHP) is a network of nerves located in the retroperitoneum anterior to the vertebral bodies of L5 and S1. It plays a crucial role in the autonomic innervation of the bladder and reproductive organs [81]. A block of the superior hypogastric plexus will provide visceral analgesia from these structures that are often affected by lesions from endometriosis.

The SHP block was initially used to treat pelvic pain due to malignancy in patients who had failed opioid therapy [82]. Given the success of this block in pelvic cancer pain patients, it has since been used to successfully treat other etiologies of CPP including endometriosis [83].

Because the SHP is a deep retroperitoneal structure, fluoroscopy is used to perform the injection. A spinal needle needs to be advanced to the anterior border of the lower portion of the L5 vertebral body. Contrast is injected prior to deposition of any local anesthetic or steroid to confirm positioning.

5.5.2. Inferior hypogastric plexus

The inferior hypogastric plexus (IHP) is more caudal to the superior hypogastric plexus and is located anterior to the sacrum at the level of S2-S4. Similar to the superior hypogastric plexus, the inferior hypogastric plexus also innervates the pelvic organs as well as the vagina, rectum, and perineum.

Like the SHP block, the IHP block was initially used to successfully treat cancer-related pelvic and perineal pain [84]. A randomized controlled trial found that the IHP block had an almost 75% success rate in reducing pain in patients with idiopathic CPP compared to acupuncture [85].

Due to its location, fluoroscopy is necessary to perform the block. Transacral approaches, passing a needle through the sacral foramen, have been described as well as transdiscal approaches [86].

5.5.3. Ganglion of Impar

The Ganglion of Impar (GOI), also known as the Ganglion of Walther, is the final sympathetic pelvic ganglion and is located anterior to the sacrococcygeal ligament. Blockade of the GOI can provide analgesia to the anus, rectum, perineum, and genitalia. It has successfully been used to treat perineal and

pelvic pain secondary to malignancy [87]. It has also been used to treat nonmalignant CPP and perineal pain [88]. Like both the SHP and IHP, performance of this block requires fluoroscopy due to its location.

5.6. Neuromodulation

Some patients may fail to improve after conservative management and even fascial plane or peripheral nerve blocks. For this population of patients with CPP, neuromodulation may be an option, especially for patients who continue to have CPP after surgery to resect their endometriosis.

Broadly, neuromodulation in the context of pain involves using electrical energy near the spinal cord to treat pain. Electrical stimulation, accomplished via the implantation of leads in either the epidural space or near the dorsal root ganglion, activates large A-beta fibers which then inhibits the transmission of nociceptive fibers, providing analgesia [89]. For CPP, spinal cord stimulation (SCS), dorsal root ganglion (DRG) stimulation, and sacral stimulation have all been utilized, but there is not a consensus on which form of neuromodulation is best [90].

Specifically for endometriosis, one study of ten patients with severe CPP secondary to endometriosis underwent bilateral L1 and S2 DRG stimulation with significant improvements in quality of life and pain scores as well as reduced narcotic consumption [91].

Given the technical complexity and the reality of having a permanent implant surgically placed, neuromodulation should be reserved for refractory cases in patients recalcitrant to any other form of therapy.

6. Decision tree and block selection

When deciding on which injection to offer the patient, it is first important to assess for the region of pain. For example, abdominal wall blocks may not improve perineal or vaginal pain, and sympathetic plexus blocks may not improve somatic pain stemming from the abdominal wall. Given the number of injections discussed, we created an algorithm to help guide practitioners on which injections may be most beneficial for the patient depending on their presenting symptoms. Figure 1 illustrates an algorithm to decide on an intervention for endometriosis pain.

It is also important to obtain a good history and physical and ascertain the descriptors of the pain. Somatic pain is more sharp whereas visceral pain is dull and achy in nature [92]. Injections

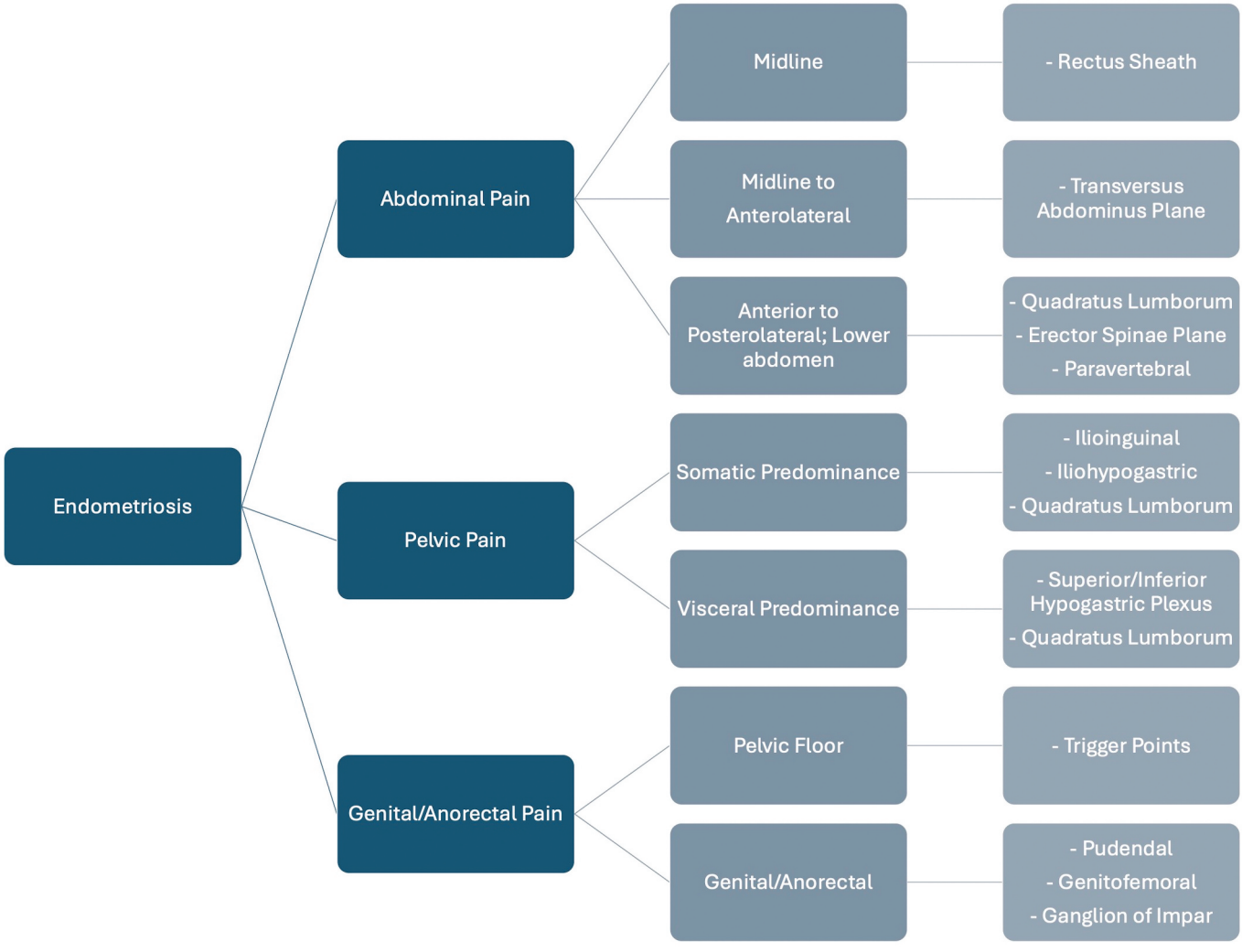


Figure 1. An algorithm for interventional procedures for endometriosis pain.

Table 1. Somatic versus visceral coverage for each intervention and procedural modality.

Injection	Somatic vs visceral	Ultrasound or fluoroscopy
Trigger Points	Somatic	Manual or Ultrasound
Rectus Sheath	Somatic	Ultrasound
Transversus Abdominis Plane	Somatic	Ultrasound
Erector Spinae Plane	Somatic	Ultrasound
Ilioinguinal/Iliohypogastric	Somatic	Ultrasound
Quadratus Lumborum	Both	Ultrasound
Paravertebral	Both	Ultrasound
Superior & Inferior Hypogastric Plexus	Visceral	Fluoroscopy
Ganglion of Impar	Visceral	Fluoroscopy
Genitofemoral	Somatic	Ultrasound or Fluoroscopy
Pudendal	Both	Ultrasound or Fluoroscopy

which block the sympathetic nerve system and provide visceral coverage may offer more benefit for patients whose pain is more diffuse and vague in nature. Table 1 shows which blocks offer somatic and/or visceral coverage as well as whether ultrasound or fluoroscopy are needed to perform the injection.

Deciding on which block to offer would also be up to the physician's own comfort and skill level. One advantage of the fascial plane and peripheral nerve blocks is that these can be done without fluoroscopy guidance using just an ultrasound machine which is more mobile than a C-arm. The learning curve for these interventions is also less steep than the learning curve for the sympathetic plexus blocks or neuromodulation that require fluoroscopy. Overall, this may allow for more physicians to learn these interventions and more patients to receive these therapies.

7. Conclusions

CPP is prevalent, and patients with endometriosis account for a large percentage of patients with CPP [93,94]. The management of CPP is multimodal and includes PFPT, medical management such as hormonal therapy, and in severe cases, surgery. Despite decades of research and advancements, many women who undergo these treatments may continue to experience severe CPP [35]. For these patients, we must begin to think outside of the box. One such opportunity is bringing the arsenal of regional anesthesia outside of the realm of perioperative pain and bridging the toolbox to the chronic pain world, as is being done with the fascial plane and peripheral nerve blocks. These interventions, while relatively newer, have been shown to be effective in treating various etiologies of chronic abdominal and pelvic pain and not just for acute postoperative pain. In addition, the ease of these interventions using ultrasound rather than fluoroscopy may make them available for more patients with less of a learning curve for physicians.

8. Limitations

Due to the nature of this being a narrative review, the primary limitation is the lack of a standardized systematic review. Included articles were selected based on a search of keywords relevant to the topic. There is also limited data available on non-surgical interventional therapies or nerve blocks for CPP and endometriosis and many are based on case reports. In addition, some studies may not exclusively involve endometriosis patients but rather CPP patients in general. The aim of this article is to provide a broad overview on the current treatment options for CPP with a focus on interventional treatment options such as injections but given the breadth of the field of CPP and endometriosis, this review could only provide a brief overview of each treatment option.

9. Future perspectives

Despite a vast array of options for treating CPP from endometriosis, many women still suffer from pain. This necessitates the use of current techniques such as regional anesthesia which are not being traditionally used for CPP. As more patients are offered these interventions, more focused studies can be performed to examine whether they are beneficial beyond the scope of perioperative pain. In addition, physicians should be aware of the wide array of options currently available. Our algorithm will hopefully guide physicians on which interventions may be a possibility for their patients in hopes that more CPP patients can achieve better pain relief.

Author contributions

All authors: research, writing – editing and review.

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ORCID

Sebin Choi http://orcid.org/0000-0002-8249-0351
Johnny Phuong Tran http://orcid.org/0009-0005-9269-1316

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