Fibromyalgia

Volume 18, Issue 8

Photobiomodulation for the Treatment of Fibromyalgia

In this case presentation and protocol review, the authors report on patient outcome after using low-level light therapy.

CITE THIS ARTICLE
Demchak T, Christian M, Fagg B. Photobiomodulation for the Treatment of Fibromyalgia. Pract Pain Manag. 2018;18(8).

Aug 10, 2021
Timothy J. Demchak, PhD, ATC, LAT, Professor of Applied Medicine and Rehabilitation
McCall Christian, DAT, ATC
Breanna Fagg, RN Candidate

This article is part of a series on the use of light therapy for pain management. See related pieces on AMPS, migraine, and trigeminal neuralgia.

Fibromyalgia Syndrome (FS) is a chronic pain syndrome, affecting approximately 5 million Americans (2 to 5% of adults and up to 6% of school-age children).[1] In the pediatric population, the typical diagnosis of Juvenile Primary Fibromyalgia Syndrome (JPFS) is usually confirmed around 12 years of age. Adults receive a diagnosis of FS by meeting the American College of Rheumatology (ACR) diagnostic criteria, which includes a combined widespread pain index and symptom severity score of 12 or greater, symptoms that have been consistently present for at least three months, and no other confirmed disorder that explains the pain.[1–3]

Fibromyalgia is thought to affect neural stimulation leading to a decrease in blood flow due to a vasoconstriction in blood vessels.[4] Recent evidence supports one of two theories to explain the etiology: damage to small sensory nerve fibers similar to Small Fiber Polyneuropathy or hyperexcitable C nociceptors.[5,6]

Patients with FS commonly experience diminished strength, decreased upper body flexibility, poor balance, loss of coordination, and reduced endurance [7] Usual treatment for this syndrome has included: pharmacological interventions, cognitive behavior therapy, myofascial release, TENS, and exercise.[8, 9]

Photobiomodulation for Fibromyalgia

The average medical cost to treat an adult fibromyalgia patient in the United States between 2002 and 2005 was $9573 ± $20,135 annually.[10] And yet, pharmacologics for individuals with FS appear to reduce pain at best by half, suggesting an urgent need to identify safe, affordable, effective, non-pharmacological treatments for the syndrome. One such example, photobiomodulation (PBM), reportedly decreases pain enough to support an increase in activity levels in fibromyalgia syndrome patients.[11–13] As such, PBM may be a viable alternative to be employed to improve symptom relief in patients with fibromyalgia.

To provide greater appreciation for PBM, the authors describe a successful at-home approach employing this management strategy to treat a patient diagnosed with fibromyalgia. In addition, the authors explain a possible physiological mechanism for the beneficial effect that photobiomodulation may have in fibromyalgia syndrome.

The Case

A 46-year-old Caucasian woman diagnosed with FS 14 years ago was referred to our rehabilitation clinic. The patient was screened during initial evaluation using the ACR's Preliminary Diagnostic Criteria to confirm her diagnosis.[1,14] She reported a widespread pain index (WPI) of 13 out of 19 possible locations including the: left shoulder girdle, left upper arm, left lower arm, left and right buttock, upper leg, lower leg, neck, chest, upper and lower back. The patient had a symptom and severity score of 9 out of 12.

The patient completed the Fibromyalgia Impact Questionnaire (FIQ) to establish baseline measures.[15,16] The FIQ provides for an assessment of how a patient's fibromyalgia pain has been affecting activities of daily living and the ability to complete tasks. These tasks may include: the ability to grocery shop, do laundry, prepare meals, wash dishes, vacuum, make beds, walk several blocks, visit with friends or relatives, complete yard work, drive a car, and climb stairs. Additionally, the FIQ includes a measurement of pain, fatigue, anxiety and depression using a visual analog scale (VAS).

The patient did not have any of the contraindications photobiomodulation therapy including active cancer, pacemaker, and being pregnant. The patient was presented with the option of treatment with PBM and discussed the positive research results to date, after which the patient agreed to try this new therapy.

Photobiomodulation Therapy Treatment Approach

A TQ-Solo device (Multi Radiance Medical, Solon, OH: 15W, SPL 905nm; IR 875nm; Red 670mn; variable frequency 1000-3000Hz; Beam spot size 4cm2, 15 mW/cm2; 4.7 J/cm2) was used to treat the patient. Each identified fibromyalgia painful point (n = 13) was treated with PBM for two minutes using the variable setting for total of 26 minutes; the variable setting was used to inhibit pain. The patient reported an immediate decrease in pain at each treated site. (Note: The TQ-Solo was chosen primarily because it was the only handheld device that was available to the patient for at-home use.)

Since the reduction in pain was deemed successful, the patient received education on the use of the TQ-Solo equipment in order to self-treat at home. She was advised to apply treatment to each painful site for 2 minutes once per day, as needed. The patient was instructed not to treat any site for more than 12 days in a row to avoid overtreatment, which could produce an exasperation of symptoms. The patient documented her pain levels using the Brief Pain Inventory (BPI) daily, tracked her physical activity, and completed the FIQ once per week to monitor the effectiveness of the treatments.[15] She was scheduled for a follow-up visit every two weeks. During the follow-up visits her BPI, FIQ, and physical activity logs were reviewed. The treatment protocol was adjusted based on her reported outcomes. For example, the patient noticed an increase in pain symptoms just prior to a storm system moving into the area where she lives.

Ongoing Management and Monitoring

After the first four days of consecutive at-home PBM treatment, the patient reported a reduction in pain from 8 out of 10 to 0 out of 10 (see Figure 1) and her WPI decreased from 13 out of 19 to 0 out of 19. Additionally, her FIQ score decreased from 75 out of 100 to 31 out of 100. The patient reported one caveat—an increase in pain when a storm system moved through the area at the end of the first week—for which the laser therapy had no effect. However, after the storm moved out of the area, the PBM treatments again were effective at reducing her pain and she returned to her prestorm physical activity levels. We instructed the patient to treat 4 to 6 of her typically worst painful sites prophylactically when she knew a storm was coming, which proved effective in reducing the pain flares that occurred during subsequent storms.

The patient reported improvement in her activity levels; in particular, she stated an ability to pick vegetables from her garden, swim in a lake, and walk five blocks with her daughter. Her level of activity continued to increase after her pain returned to zero. Three weeks after her initial PBM treatment she was able to take a week-long family vacation that included sitting in a car for 8 hours each way, hiking for 2 hours, and spending 4 hours in multi-level museum pain-free. The patient did not have an increase in pain during the family trip. She traveled with the TQ-Solo to address any pain that might arise with her increase in activity but she did not need to employ the device during the trip.

However, upon her return, she reported an injury to her shoulder, which was diagnosed as shoulder impingement due to poor posture during extended of inactivity. The patient received Graston Technique Therapy through our clinic to her shoulder as well as stretching and scapular stabilization exercises. The patient was instructed to complete a home exercise program consisting of stretching and scapular stabilizing exercises. Also, she was instructed to use the PBM to decrease the shoulder inflammation. The shoulder injury resolved within two weeks, restoring the patient to a pain-free status.

Table I. Previous Photobiomodulation Research Protocols for Treating Fibromyalgia and Results from the Literature.

Study	Laser Wavelength (nm) and Class	Treatment protocol	Treatment Dose (J)	Treatment Frequency	Changes in Pain Level (0 to 10 scale)	Changes in # tender points (0 to19)	Changes in FIQ Score
Gur et al [12]	904 nm Continuous Class 3b	3 min/ tender point	2 J/cm2 per tender point	10 treatments over 2 weeks	↓2 (3 to 1)	↓7 (13 to 6)	N/A
Armagan et al [11]	830 nm Continuous Class 3b	1 min/ tender point	2 J/ tender point	10 treatments over 2 weeks	N/A	↓2 (14 to 12)	↓7 (65 to 58)
Panton et al [13]	810 nm 980 nm Class 4	1 min/ tender point	600 J/pt; 4200 J/treatment	8 treatments over 4 weeks	↓1 (7 to 6)	↓3 (14 to 11)	↓7 (62 to 55)
Presented case study	SPL 905 nm; IR 875 nm & Red 670 nm Class 3b	3 min/ tender point	16 J/ tender point	as needed	↓8 (8 to 0)	↓13 (13 to 0)	↓44 (75 to 31)

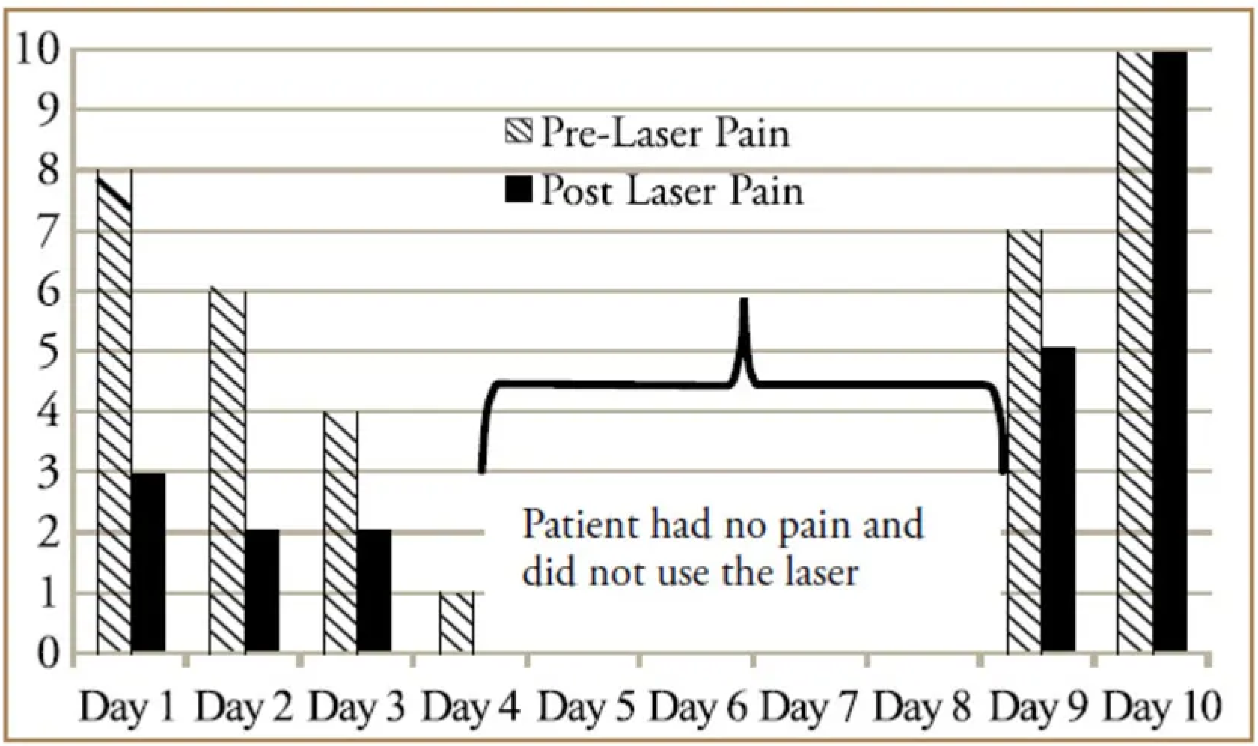


Figure 1. Case patient's reported pain level change on a 0 to 10 VAS scale during first 10 days of photobiomodulation treatment. On Days 4-8, the patient reported no pain and did not use the laser.

Considerations in Photobiomodulation for Fibromyalgia

This patient case offers documented success of at-home PBM treatment of fibromyalgia syndrome. The patient had a complete reduction in pain levels and an increased ability to perform activities of daily living following one week of therapy.

Several previous studies have offered support in the application of laser light therapy as an effective treatment for pain in patients with fibromyalgia; however, none of the earlier reports indicated complete remediation of pain.[11–13]Additionally, the changes achieved in past reports were modest in comparison to the significant pain resolution achieved in this patient (see Table I for a summary of previous research outcomes). The overall decrease in pain reported in the three studies ranged from 1 to 2 points, the number of tender points decreased from between 1 and 7, and the drop in FIQ score was 7 points.[11–13]

Outcomes of Pain Reduction Using PBM

There are several differences in comparing previous studies and the current case that may explain the improvement in outcomes of pain reduction using PBM to treat this FS patient. Notable differences include:

- the selection of wavelengths used to treat the sites of pain
- the treatment dose
- treatment protocol
- frequency of treatments
- selection of a different combination among these factors (see Table I).

Differences in Light Therapy Wavelength and Frequency Protocols

Studies by Gur et al,[12] and Armagan et al,[11] used single wavelength laser diodes (904 nm and 830 nm respectfully) and the Panton et al,[13] study used a dual wavelength emitter (810 nm and 980 nm).[11–13] Our team used a laser emitter employing three wavelengths: 905 nm, 875 nm, and 670 nm (red light). The 905 nm and 875 nm wavelengths are relatively close to the wavelengths used in the other studies, however, our emitter also utilized red light (670 nm), which does not penetrate as deeply as other wavelengths and is used primarily to treat superficial tissue, therefore affecting superficial nociceptors. One theory of the mechanism of fibromyalgia pain is in a hypersensitivity of type C nociceptors, six of which may explain the large decrease in pain experienced in this clinical case.

PBM outcomes followed a bi-phasic dose curve.[17] Lower levels of PBM are known to have a stimulatory effect and at larger doses, will deliver an inhibitory effect. There is an optimal dose for stimulation and another optimal dose for inhibition.[17] Both Armagan et al,[11] and Gur et al,[12] reported small changes in pain tender points and FIQ with a 2 J/cm2 dose per tender point, which may not have introduced enough energy to achieve the change that we were able to produce in our patient. On the contrary, Panton et al,[12] used a treatment protocol with 600 J per point and 4200 J per treatment yielding similar results to Gur et al,[12] for changes in pain and to

Armagan et al,[11] for decreases in FIQ score. This finding may have occurred due to the use of too much energy, resulting in a lower reduction in pain.

In comparison, our team treated each point of pain with low-dose energy (42 J), which achieved a larger decrease in patient-reported pain. As such, while counter-intuitive, it seems that a lower dose, laser application may be sufficient to achieve complete pain reduction.

The frequency of treatments and the selection of points to be treated may have also played a role in the very favorable outcome for our patient. While Panton et al, treated the same seven points regardless of their tenderness levels at a frequency of two days/week for four weeks,[12] this may have led to treatment of unnecessary areas or that non-treatment of tender points that may have benefited from a PBM treatment were missed. The other aforementioned studies applied PBM only to selected tender points once daily for a total of 10 times over two weeks whereas our patient was able to self-treat each tender point daily on an as needed basis. Since her pain fully resolved after four weeks, it appears there may be a cumulative effect, which was not seen in the other studies.[11, 12]

Light Therapy for Fibromyalgia: Physiological Mechanism

There are several possible mechanisms that may offer insight regarding the successful use of photobiomodulation to decrease pain associated with fibromyalgia syndrome. First, the process in which PBM blocks C-fiber depolarization; Serra et al, reported that the superficial C-fiber nociceptors are hyperexcited or may be damaged in FS patients. PBM inhibits C-fiber depolarization,18 which may help decrease the excitability of the fibers at normal resting levels. It is known that individuals with fibromyalgia have a decrease in microcirculation at their tender point areas. Therefore, there may be a decrease in oxygen, such that pain arises due to hypoxia.[4] PBM stimulates the local release of nitric oxide, which is a vasodilator, thus, restoring balance in blood flow by increasing oxygen to the area.[19] Therefore, another possible mechanism may arise from stimulating vasodilatation to produce a local release of nitric oxide.

The results achieved in the patient case study suggest that PBM may effectively decrease the pain commonly arising in joints from fibromyalgia, and in turn, to restore the ability to carry out desirable activities of daily living. Clinically, it is important to caution patients to increase their physical activity slowly. As noted, our patient increased her activity level so quickly, after being inactive for 14 years, which resulted in an avoidable physical injury.

While we cannot conclude that home PBM treatment will be effective in addressing the pain and inactivity experienced by every patient with fibromyalgia based on this single case example, the results support the value of a larger randomized control study that includes a “sham” treatment to rule out a placebo effect and to determine if home PBM treatments using the protocol outlined by our team presents a viable and cost-effective non-pharmacological option for patients suffering from fibromyalgia syndrome.

REFERENCES

Notes: This article was originally published November 6, 2018 and most recently updated August 10, 2021.

Injections & Blocks

Volume 18, Issue 8

Slipping Rib Syndrome: A Case Report

Using an intercostal nerve block to aid diagnosis.

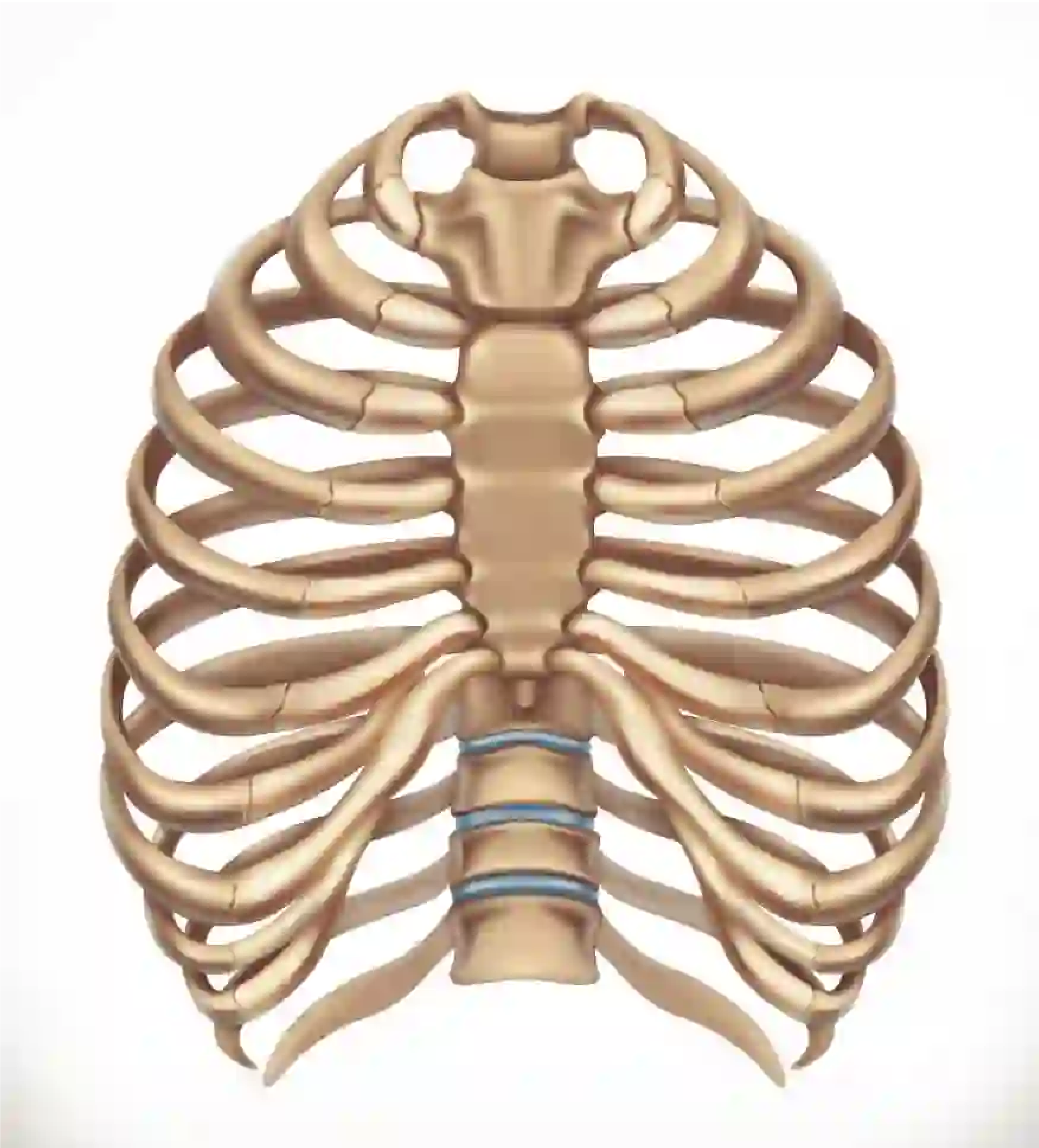
CITE THIS ARTICLE
Kaiser A, Farah F, Acquadro M. Slipping Rib Syndrome: A Case Report. Pract Pain Manag. 2018;18(8).

Nov 26, 2018
Alexander J. Kaiser, MD, Anesthesiologist and Pain Specialist, Department of Anesthesiology, Critical Care, and Pain Medicine
Fadi Farah, MD, Assistant Professor, Anesthesia and Pain Medicine
Martin A. Acquadro, MD, DMD, FACP, FACPM, Anesthesiologist and Pain Specialist, Department of Anesthesiology, Critical Care, and Pain Medicine

---

Slipping rib syndrome has been described for almost a century after first being detailed by Cyriax in 1919.[1] Since then, a body of study and evidence has been accumulated regarding the pathophysiology of the syndrome. Mechanistically, it arises from the subluxation of the eighth, ninth, and tenth ribs from sudden hypermobility, usually sustained in some manner of trauma. Since these ribs do not articulate with the sternum, but rather, have loose fibrous connections to one another, they are susceptible to becoming “free floating” once these connections are disrupted and may impinge on the intercostal nerves and surrounding abdominal wall tissues and fascia. Due to this mechanism, a common physical exam finding is a positive “hooking maneuver” (see Figure 1), where pulling the lower ribs at the subcostal margin outward and upward will mimic the patient’s pain.

Despite being well described in the literature, slipping rib syndrome remains an elusive diagnosis with the combination of its relative obscurity, ambiguous presentation, and subtlety on even modern imaging techniques.[2]To this effect, there are numerous case reports and a series of patients who have gone undiagnosed with prolonged and meandering clinical courses. Here, the authors present a case of slipping rib syndrome that went undiagnosed for 18 months; after an extensive workup in the pain clinic, using confirmation with diagnostic and therapeutic intercostal T9-T11 nerve block under fluoroscopy, a diagnosis was made.



Slipping rib syndrome remains an elusive diagnosis with the combination of its relative obscurity, ambiguous presentation, and subtlety on even modern imaging techniques.

The Case

A 23-year-old previously healthy male student presented to the pain clinic after referral from his primary care provider. Eighteen months prior, the patient had been moving a large object when he felt a “crack and pop” resulting in immediate severe pain. Since then, the patient had experienced intermittent pain in his left upper quadrant (LUQ), with a sensation he described as “popping,” especially with certain abdominal movements, such as stretching his left flank. He had already undergone extensive workup in the prior 18 months.

He initially presented to his primary care physician (PCP), who referred him to outpatient physical therapy as well as prescribed several over-the-counter remedies, including hot and cold therapy and NSAIDs. The patient sought chiropractic treatment on his own which did not provide relief. He was then referred to a rheumatologist as well as a general surgeon. Multiple rheumatoid panels provided no evidence and he was referred to a general surgeon. The patient underwent a PO and IV contrast abdominal and pelvis CT, that showed a question of Spigelian hernia. As the symptoms continued with no relief, the patient underwent exploratory laparoscopy, which failed to identify any defect; the abdominal anatomy was normal. The patient was then referred to psychiatry but refused to follow through and was finally referred to the authors’ pain clinic by his PCP.

Figure 1: Illustration of the "hooking maneuver."

Figure 2. Fluoroscopic image shows placement of intercostal block needles prior to injection.

At the clinic, the patient presents as a tall, thin, white young male, pleasant and eager to find results, with no obvious defect or deformity on initial inspection. On physical exam, he had a grossly tender LUQ on palpation and positive “hooking maneuver.” Initially, the patient was prescribed low dose gabapentin 300 mg PO QHS and gained some relief, but gabapentin was discontinued due to daytime somnolence and inability to focus on his schooling, even after reduction in dosage. He also had a trial of duloxetine 20 mg PO BID but reported gastrointestinal (GI) upset and intolerance. Failing medical management, the discussion of intervention with diagnostic and therapeutic block was approached with the patient, who agreed to proceed.

The patient underwent diagnostic and therapeutic intercostal T9-T11 nerve block in the clinic. No bony deformity (see Figure 2) was appreciated under fluoroscopy and the block was performed with combination 20 mg of Depomedrol diluted in 1.5 ml of 0.25% bupivacaine injected at each level. While monitored post-procedure, the patient reported immediate relief. On follow-up in the clinic, the patient reported over two weeks of approximately 80% relief before his pain gradually returned.

Given these positive findings, the authors identified slipping rib syndrome as the likely source of his pain and referred him to a thoracic surgeon. Upon review of the case and our findings, the surgeon agreed and the patient underwent surgical rib resection. During surgical exploration, the patient was found to have 9th and 10th costal cartilages that did not fuse with the costal margin and insinuated into the external oblique muscles. Summarily, these cartilages were resected with the anterior portion of the ribs. In the immediate postoperative period the patient reported being "sore," but stated his pain was "nothing compared to before" and that his previous pain had resolved. On follow-up (3 months post surgery), the patient reported complete resolution of his pain.

Discussion

Patients with slipping rib syndrome often have an ambiguous presentation with an extensive list of differentials, including muscular strains, costochondritis, nerve entrapment, somatic dysfunction, bony fracture, GI disorders, hernias, and hepatosplenic conditions. Review of the literature shows frequent mention of poor awareness, misdiagnosis, and extensive unnecessary workup and clinical courses before proper diagnosis and treatment is made.[2,3] For example, the clinical course of the patient presented herein spanned a year and a half of symptoms with evaluations by multiple specialists prior to referral to a pain clinic, and included dozens of clinic visits, a CT scan, and a diagnostic laparoscopy.

The importance of early detection and diagnosis cannot be understated. Proper evaluation should include a thorough history, as many times an initial direct or indirect traumatic event may be identified. The "hooking maneuver" reproducing the patient's pain can also aid in diagnosis and is helpful to add to the common repertoire of physical exam findings used daily in the pain clinic. Diagnostic and therapeutic nerve blocks may be easily and safely performed in a clinic and have been recommended in the literature,[4,5] as they may completely resolve slipping rib syndrome pain, even after only one block. Such blocks may also be crucial in confirming pathophysiology and involved anatomy of a patient's pain, thereby aiding in clinical decision-making and possible surgical planning.

Risks for intercostal nerve block include local bruising, infection, pneumothorax, nerve damage, intravascular injection, and bleeding. The proper diagnosis and treatment, and if not referral, for patients with slipping rib syndrome provides a unique and important opportunity for pain clinics to aid the modern multidisciplinary approach to pain management.

REFERENCES

Notes: This article was originally published November 7, 2018 and most recently updated November 26, 2018.