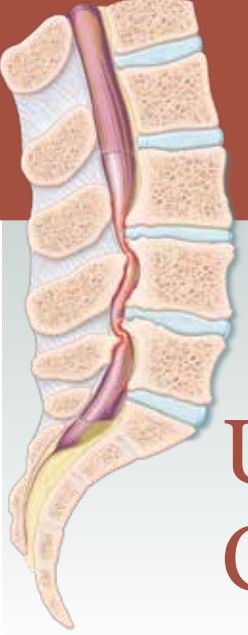

Understanding Myofascial Pain Syndrome: Causes, Diagnosis, and Treatment

ABSTRACT

Myofascial Pain Syndrome (MPS) is a chronic pain disorder characterized by localized pain originating from myofascial trigger points (MTrPs) within the skeletal muscle of the spine and should be included in the differential diagnosis for non-surgical back pain. The etiology of MPS is multifactorial, involving trauma, repetitive strain, and postural dysfunction, leading to the formation of hyperirritable nodules that cause both local and referred pain. Diagnosis is primarily clinical, relying on the identification of MTrPs through physical examination. Treatment approaches include pharmacological interventions, manual therapies, and needling techniques. Evidence for long-term efficacy remains limited. Future research is essential to establish reliable diagnostic criteria and effective treatment modalities for MPS.

KEYWORDS: Myofascial Pain Syndrome, Trigger Points, Diagnosis, Treatment, Chronic Pain, Musculoskeletal Disorders, Manual Therapy, Pharmacological Interventions.

CME Pre-test Quiz

Myofascial Pain Syndrome (MPS) is a chronic pain disorder characterized by regional pain originating from hyperirritable spots located within taut bands of skeletal muscle and the sheaths of connective tissue, known as fascia, that surround them. Unlike other forms of pain, MPS is associated with specific trigger points within muscle tissue known as myofascial trigger points (MTrPs). This condition is a significant and often overlooked cause of musculoskeletal pain, affecting a substantial portion of the population and presenting a complex challenge for both diagnosis and treatment.[1,2]

To review this condition, let's consider a typical patient who may present to a family physician's office.

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Patient Case: Brian

Brian is a 42-year-old male patient well known to his family physician. He has no chronic health conditions and is seen only occasionally for periodic health examinations and minor illnesses or injuries. Brian does not maintain a structured physical activity regimen but would classify himself as a "weekend warrior" with winter pursuits including hockey and a penchant for golf in the summer.

He presented to his family physician with a 5-day history of right sided low back and buttock pain, that started to bother him the day after a particularly strenuous round of golf when a cart was not available. It has gotten progressively worse with time. He described a deep aching pain in the right lower back with radiation of the pain along the lateral aspect of the right leg towards the ankle. Based on the history of progressive low back and leg pain as well as a right antalgic gait, his physician arranged an MRI scan that was carried out 21 days after the onset of the pain.

The MRI scan described degenerative disc changes at all levels of the lumbar spine, disc bulging at L3-4, L4-5, and a disc herniation at L5-S1 that may be compressing the traversing right S1 nerve root.

At day 25, Brian had a transforaminal epidural steroid injection for the right S1 nerve root and got a spine surgery referral. There was minimal improvement with the epidural injection. Brian was significantly limiting his activity during this period and was beginning to develop fear-avoidance behaviours.

Because of a cancellation, the spine surgeon was able to see Brian only two months after the triggering event. There had been little overall change in his symptoms during that time. The physical examination found normal neurology in the lower extremities and equivocal signs of sciatic tension. Based on current clinical practice guidelines which recommend education and rehabilitative therapies as the first line therapy for mechanical low back pain, with or without the presence of sciatica, Brian was referred to a community physiotherapist.

Etiology and Pathophysiology

The etiology of MPS can be multifactorial, involving direct or indirect trauma, spine pathology, cumulative and repetitive strain, postural dysfunction, and physical deconditioning. These factors contribute to the formation of MTrPs, which are palpable, hyperirritable nodules within a taut band of muscle that, when compressed, cause local and referred pain.[2]

MTrPs are classified as active or latent. Active MTrPs cause spontaneous pain and are always tender; they weaken and prevent

full lengthening of the muscle. On direct compression they can produce referred pain and mediate a local twitch response. Latent MTrPs are painful only when palpated but can also induce referred pain sensations and autonomic phenomena in their pain referral zone.[1,2]

The exact etiology of MTrPs is still not known but an energy crisis of muscle fibres is a commonly accepted theory.[3] Increased activity can cause overloading of the muscle fibers which leads to a cycle of increased tone, muscle hypoxia, and ischemia. Other hypotheses include increased focal inflammation related to neurogenic causes, local irritation, or limbic dysfunction.

Compared to non-trigger-point areas, MTrPs are associated with altered biochemical milieus, including increased availability of pro-inflammatory substances such as substance P, IL-1β, and tumor necrosis factor α (TNF-α). These substances activate muscle nociceptors and contribute to peripheral mechanisms by sensitizing nociceptive nerve endings. Studies have also reported that myofascial trigger points sensitize non-nociceptive large-diameter myelinated afferents nerve endings. This supports the presence of nociceptive and non-nociceptive pain sensitivity in the area of the MTrP and confirm that myofascial trigger points are a focus of peripheral sensitization able to sensitize both spinal and supraspinal neurons.[1]

Diagnosis

There are no accepted diagnostic criteria for MPS, so the diagnosis is primarily clinical, based on the identification of MTrPs on physical examination. The most accepted definition of a myofascial trigger point is a hyperirritable spot within a taut band of skeletal muscle, painful on compression, stretch, overload, or contraction of the tissue and frequently producing referred pain perceived a distant location.[2] There may be painful associated nodes or “ropes”, with palpable local twitch responses.

Other signs and symptoms associated with MPS include: (i.) focal regional pain, often described as burning, jumping, (ii.) stiffness and limited range of motion, (iii.) taut muscle bands, focal dysautonomia (sweating, chilling, pallor, edema) (iv.) focal tenderness. Myofascial Pain Syndrome is found with depression and dyssomnia.[2] There are no routine laboratory or imaging studies to confirm MPS, however, electromyography, infrared thermography, and ultrasound elastography has been suggested to assist in the diagnosis.

The diagnosis requires a detailed patient history to rule out other conditions and a thorough physical examination to identify

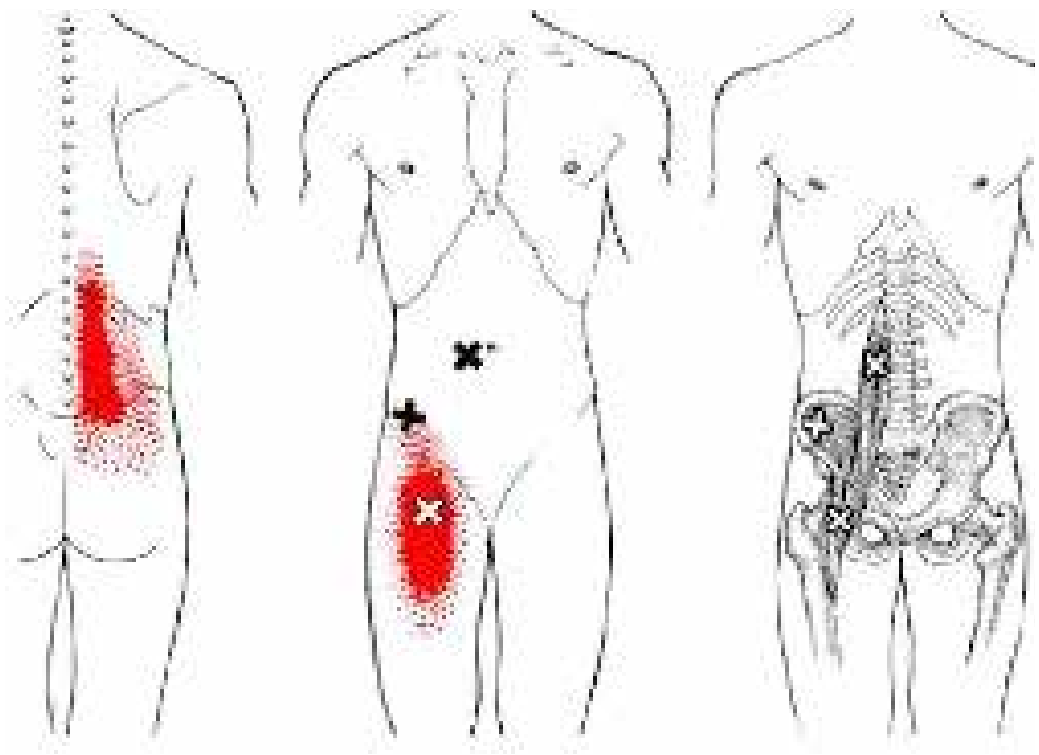

Figure 1: Iliopsoas

the characteristic taut bands and trigger points. True sciatic tension pain (sciatica) is not a feature of MPS. Reproduction of the patient's pain on palpation of the MTrP confirms the diagnosis.[2]

Examples of Myofascial Trigger Points affecting the lower limbs include:

Figure 1: Iliopsoas

Figure 2: Iliotibial Band

In these illustrations from Travell and Simon's classic reference, Myofascial Pain and Dysfunction: The Trigger Point Manual, the X shows the typical location of the palpable myofascial trigger points, with the zone and intensity of the referred pain pattern illustrated by the shaded regions.[4]

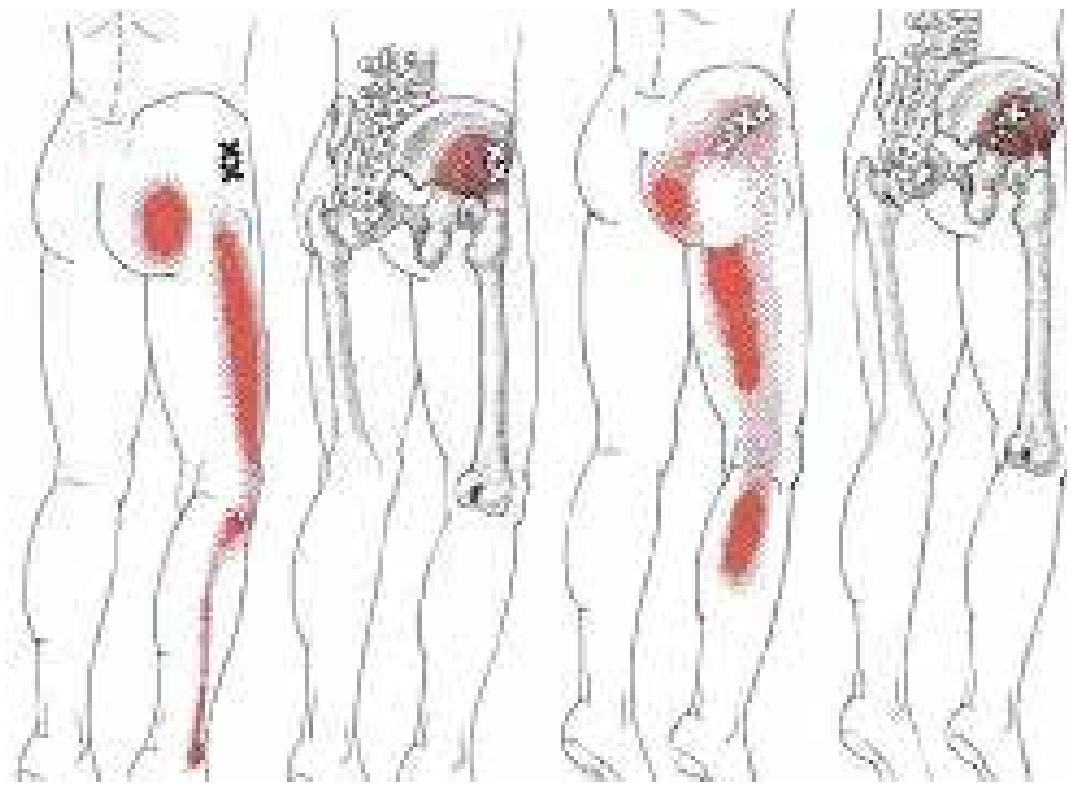

Figure 2: Iliotibial Band

Epidemiology and Evidence for Treatment of MPS

Evaluation of the evidence for treatment efficacy of MPS is difficult because there is no accepted diagnostic criteria for this condition. This is reflected by the wide range in prevalence estimates for MPS, from 30.0% to 93.0%.[5] A recent systematic review has concluded that further research is required to determine the reliability of a MTrPs diagnosis since any investigation of back pain may not be specifically studying MPS.[6] Further, many of the recommended treatment options for Myofascial Pain Syndrome are consistent with evidence-based guideline management for non-specific back pain.

Despite the inherent difficulty of ensuring that any research is studying the correct diagnosis, several systematic reviews have attempted to assess the efficacy of specific treatment modalities. What is clear from this literature is that high-quality evidence is required. This includes studies looking at long term outcomes rather than immediate response, larger subject numbers to enable sufficient power, precise subgroup

identification and reduced study design bias even in randomized controlled studies.

There is no Clinical Practice Guidelines for MPS and there is no consistent and high-quality evidence to support a long-term benefit from any specific interventions for MTrPs.[7]

The lack of evidence does not mean there is evidence that nothing works. Patients with MPS still require treatment guided by the clinician's best judgement, tailoring the available information regarding specific modalities individualized to their patient's needs through an empathetic and shared decision-making process.

Treatment Approaches

Treatment of MPS focuses on inactivating MTrPs and addressing underlying etiological factors. The mainstay treatments include exercise, pharmacological interventions, needling techniques and manual therapies.

Exercise and Physical Therapy: Regular physical activity and targeted exercises help improve muscle strength, flexibility, and overall functional status in patients with MPS. Physical therapy may include stretching, strengthening exercises, and ergonomic education that attempt to prevent recurrence of MTrPs.[1,2]

Pharmacological Treatments

1. **Non-Steroidal Anti-inflammatory Drugs (NSAIDs):** While the role of NSAIDs in MPS treatment is unclear, their analgesic properties can provide relief in acute musculoskeletal disorders. Long-term use should be avoided due to potential gastrointestinal, renal, and antiplatelet side effects.[8]
2. **Muscle Relaxants:** Agents like tizanidine and cyclobenzaprine have shown efficacy in reducing pain intensity and muscle spasticity in MPS. However, their use should be balanced against potential central nervous system side effects.[8]
3. **Antidepressants:** Tricyclic antidepressants like amitriptyline and serotonin-norepinephrine reuptake inhibitors (SNRIs) like duloxetine are beneficial in managing chronic pain conditions, including MPS. These medications modulate neurotransmitter systems involved in pain processing and can also help address comorbid mood disorders.[8]
4. **Anticonvulsants:** Gabapentin and pregabalin can occasionally be considered for their analgesic and neuromodulating effects.[8]

Needling Therapies

1. **Dry Needling and Trigger Point Injections:** Dry needling involves inserting a solid filiform needle into a trigger

point without introducing any substance, while trigger point injections typically involve injecting a local anesthetic. Both techniques can be effective in inactivating the trigger point and alleviating pain. These injections mechanically disrupt the trigger point and terminate the dysfunctional activity of involved motor endplates.[1] Two older meta-analyses demonstrated that both lidocaine injections and dry needing seem to be similarly effective for neck/shoulder myofascial pain.[1,8] Over the past decade, several more systematic reviews have been completed, reviewing over a dozen primary RCTs that suggest dry needling holds the most promise. One conducted by Dach et al., included a review of 2 meta-analyses and 4 additional individual randomized controlled trials assessing dry needling compared to control treatments. They found (i.) immediate post-intervention improvement in pain intensity and disability (ii.) more varied responses with follow-up, and (iii.) combining other treatment modalities with dry needling is more effective than dry needling alone.[9]

2. **Botulinum Toxin A (BoNT-A) Injections:** BoNT-A injections have shown significant efficacy in reducing pain intensity, duration, and the number of trigger points in patients with myofascial pain of the upper back. They are used more cautiously in lower quadrant myofascial pain due to the risk of causing weakness to muscular control of weight bearing joints.[8,10] Ahmed et al. conducted a systematic review of 33 studies comparing local anesthetic to Botulinum Toxin for MPS. They concluded BoNT-A was inconsistently more effective than local anesthetic but that further high-quality studies were required.[11]
3. **Steroid injections:** Steroid injections into MTrPs are controversial and without clear rationale because little evidence exists to support an underlying inflammatory pathophysiology.[8] They may also have a potential myotoxic effect.[4]
4. **Opioids:** Opioids are not normally indicated in the treatment for MPS. Although limited studies demonstrate that weak opioids are moderately effective in the treatment of myofascial pain, most studies do not support their use. The use of opioids for the management of acute pain may be counterproductive to recovery.[8]

Manual Therapies

Manual therapy, including deep-pressure massage, stretch therapy, superficial heat, and myofascial release, is widely used for MPS. These techniques help inactivate MTrPs and alleviate pain, although controlled studies proving long-term effectiveness are lacking.[8]

Other Modalities

1. **Ultrasound and Laser Therapy:** These techniques have mixed results in treating MPS. While some studies show potential benefits, others do not find significant efficacy compared to placebo.[8]
2. **Transcutaneous Electrical Nerve Stimulation (TENS):** TENS can be used as an adjunct therapy but is not superior to trigger point injections or medication.[8]
3. **Magnetic Stimulation (MS):** MS has shown promise in improving pain and range of motion in MPS patients, but more evidence is needed to support its widespread use.[8]

Comparison with Fibromyalgia

While MPS and fibromyalgia are distinct conditions, they often coexist and share certain similarities. Fibromyalgia is characterized by widespread pain, fatigue, and tenderness at specific points on the body, without the presence of taut bands or trigger points seen in MPS. Both conditions lack specific biomarkers and involve negative laboratory findings, making differential diagnosis challenging. However, fibromyalgia involves more diffuse pain and is associated with central sensitization, whereas MPS is more localized and involves peripheral mechanisms.[12] Unlike MPS, accepted diagnostic criteria for Fibromyalgia exist.[13]

Other Differential Diagnoses

Other differential diagnoses for MPS include:

- Nonspecific Mechanical Back Pain with or without central pain sensitization. The pain can be more diffuse without specific MTrPs.
- Polymyalgia Rheumatica. Myalgia is usually more symmetric in older individuals with an elevated ESR.
- Radiculopathy. The pain is leg or arm dominant and follows a dermatomal distribution. There may be nerve root tension signs and findings.

The referral of pain from a trigger point into the extremity is often confused with radiculopathy, particularly with the high prevalence of false positive MRI findings. The clinician should complete a detailed history and physical exam to differentiate MPS from radiculopathy.

Patient case: Follow up

Brian's physiotherapist noted the presence of myofascial trig-

ger points in the right piriformis, obturator internus and gluteal muscles. Manual stimulation of the piriformis trigger point reproduced his leg symptoms. He was managed with a combination of manual therapy and trigger point self-management education, including reassurance and encouragement to gradually resume activity and exercise. On follow up with his family physician, 56 days after the pain started, his symptoms had resolved.

Piriformis Syndrome as an Example of Myofascial Pain

Piriformis syndrome (PS) is a frequently cited example of myofascial pain syndrome, where pain is presumed to originate from the piriformis muscle. This muscle, located deep in the buttocks near the top of the hip joint, is significant due to its proximity to the sciatic nerve. PS manifests primarily through pain in the buttocks, hips, and lower limbs and has been estimated to constitute 5-6% of patients diagnosed with sciatica.[14]

Etiology and Pathophysiology

The primary cause of PS is prolonged or excessive contraction of the piriformis muscle. This contraction can lead to the compression or irritation of the sciatic nerve as it passes through the greater sciatic foramen a. Figure 3 shows several anatomic varia-

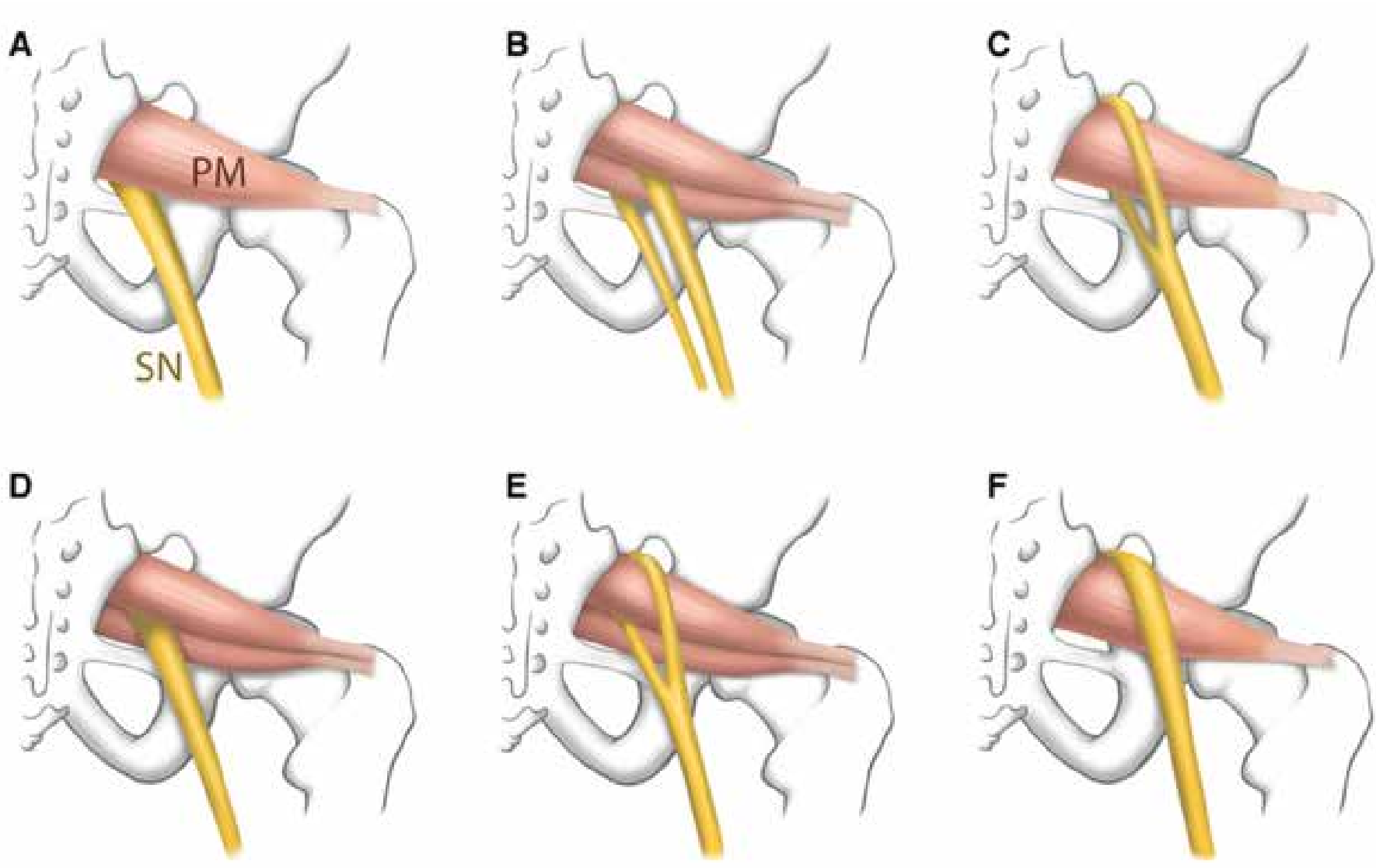

Figure 3:

tions of the relationship between the Piriformis Muscle (PM) and the Sciatic Nerve (SN), and how the nerve can be compromised. The syndrome can be attributed to both somatic and neuropathic components. The somatic aspect is directly related to myofascial pain syndrome in the piriformis muscle, characterized by the presence of trigger points—hyperirritable spots within the muscle that elicit pain.[14]

Trigger points in the piriformis muscle can cause referred pain to the adjacent muscles such as the small external rotators of the hip and the hamstring muscles as well as activating additional points. The neuropathic pain component involves the compression of the sciatic nerve leading to a classic pattern of radiating pain.[4] Figure 4.

Clinical Presentation

Patients with PS typically present with a range of symptoms, including gluteal pain, observed in approximately 97.9% of cases. Other symptoms include pain and paresthesias in the back, groin, perineum, buttocks, hip, back of the thigh (81.9% of cases), calf (59% of cases), foot, rectum (during defecation), and the coccyx area. Neurological deficits are extremely rare.[14]

Three specific conditions may contribute to the clinical presentation of PS:

1. Myofascial referred pain from trigger points in the piriformis muscle.
2. Entrapment of the sciatic nerve within the greater sciatic foramen.
3. Dysfunction of the sacroiliac joint, which can exacerbate symptoms.

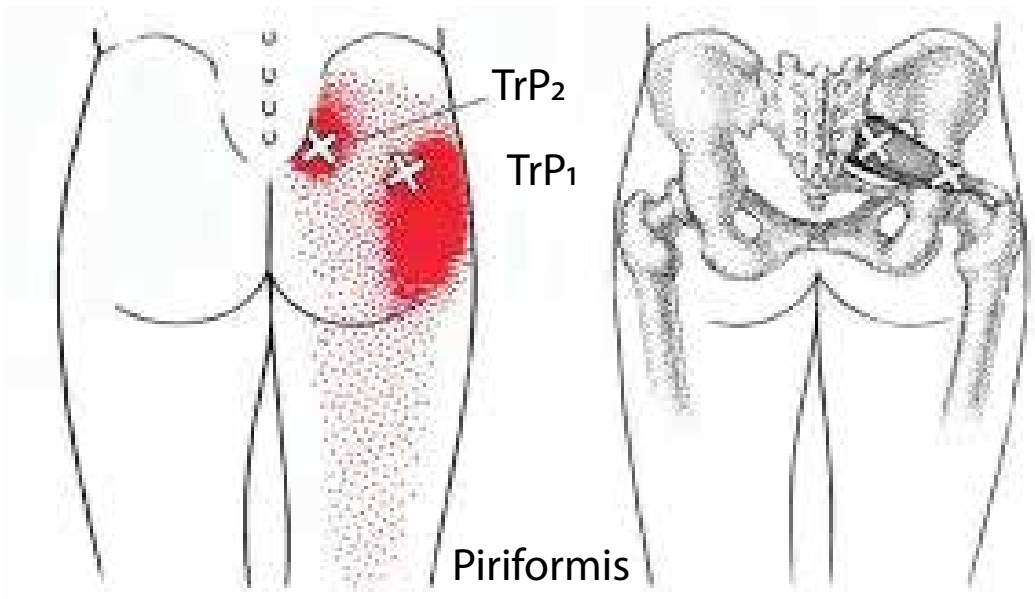

Figure 4:

Diagnosis and Management of Piriformis Syndrome

Diagnosing PS can be challenging due to the overlap of symptoms with other conditions such as lumbar disc herniation or sacroiliac joint dysfunction. Specific tests like the FADIR maneuver (Flexion, ADduction, Internal Rotation) can help. Imaging techniques and electromyography may rule out other potential causes of the symptoms.[14]

The management of PS includes physical therapy aimed at stretching and strengthening the piriformis muscle and other muscles in the hip area. Lifestyle modifications, such as avoiding activities that exacerbate symp-

SUMMARY OF KEY POINTS

1. Myofascial Pain Syndrome (MPS) is characterized by the presence of hyperirritable nodules, or myofascial trigger points, within taut bands of skeletal muscle, leading to localized and referred pain.
2. MPS can be caused by factors such as trauma, repetitive strain, poor posture, and muscle deconditioning, with theories suggesting muscle fiber energy crises or neurogenic inflammation as the main contributors.
3. The diagnosis of MPS is primarily clinical, relying on physical examination including palpable nodules, local twitch responses, and reproduction of the patient's pain with trigger point palpation. There are no standard imaging or lab tests.
4. Treatment includes a combination of exercise, manual therapy, pharmacological interventions, trigger point injections and dry needling. Dry needling has shown the most promise.
5. There is no established Clinical Practice Guideline for MPS, and high-quality evidence supporting the long-term efficacy of current treatments is lacking. Further research into pathophysiology and treatment strategies is needed.

toms, and pharmacological treatments, including non-steroidal anti-inflammatory drugs (NSAIDs) and muscle relaxants are commonly recommended.[14]

For patients who do not respond adequately to these measures, piriformis muscle injections may be considered.[14]

Myofascial Pain Syndrome: Challenges and Future Directions

Despite the variety of treatment options, managing Myofascial Pain Syndrome remains a challenge. Major problems include establishing accepted and reliable diagnostic criteria and establishing consensus on the most effec-

CLINICAL PEARLS

Trigger points are active or latent—active points cause spontaneous pain and limit muscle function, while latent points are asymptomatic until palpated.

MPS involves localized pain and trigger points; fibromyalgia presents with widespread pain and central sensitization. Conditions may coexist but require different management strategies.

A multimodal approach, combining dry needling with other physical therapies, yields better outcomes compared to single-modality treatments.

Opioids have limited evidence of efficacy and the potential to delay recovery. Use non-opioid and non-invasive interventions.

CME

Post-test Quiz

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tive treatment modalities. While needling therapies and manual treatments are widely employed, their long-term efficacy and the optimal combination of treatments require further investigation.[1,2]

Emerging therapies like BoNT-A injections and newer modalities such as ultrasound and laser therapy show promise but need more robust clinical trials to establish their effectiveness. Until comprehensive studies lead to understand the pathophysiology of MPS, there can be no targeted therapies.[1,2,4]

Conclusion

Myofascial pain syndrome is a complex, chronic pain condition that significantly impacts patients' quality of life. Understanding its pathophysiological mechanisms, including the role of myofascial trigger points and the self-sustaining cycle of muscle contraction and pain, is crucial for effective diagnosis and management. An examination that includes identification of MTrPs allows directed treatment options.

A multifaceted treatment approach, combining pharmacological and non-pharmacological therapies, can address both the symptoms and underlying causes. Ongoing research aims to identify the underlying mechanisms of MPS, to establish accepted and reliable diagnostic criteria, and to develop effective treatment strategies.

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