THE PIRIFORMIS MUSCLE SYNDROME: A CLINICAL LESSON

Carla Timmer[1,3], Prashant Komdeur[2,4]

Corresponding author: Carla Timmer, BSc (Carla.Timmer@radboudumc.nl)

[1] Radboud University Medical Center, Nijmegen, The Netherlands [2] Sports Medical Center Maartenskliniek, Nijmegen, The Netherlands [3] Master Medical Student [4] Supervisor, Sports Physician

ABSTRACT:

In the clinical lesson, we present a patient with piriformis muscle syndrome (PMS), an entrapment neuropathy of the sciatic nerve by the piriformis muscle. PMS is a controversial syndrome, currently without a comprehensive treatment protocol. Symptoms include radiating back and buttock pain during physical activity, such as running. Different diagnostic tests which can be used during physical examination are described. Additional diagnostic test and treatment options are reported. Treatment should include physical therapy focusing on strengthening core stability. Our patient recovered after 4 months of physical therapy.

KEYWORDS: Sciatica, piriformis muscle, Piriformis Muscle Syndrome

Introduction

The Piriformis Muscle Syndrome (PMS) is a controversial condition that is still a subject of much discussion. Currently there is no consensus about the existence of this syndrome. This contributes to the fact that there is no uniform definition or method to diagnose PMS. Treatment is also without a comprehensive protocol.

In recent publications, PMS is described as an entrapment neuropathy of the sciatic nerve entailing radiating pain in the gluteal region as a result of compression of the nerve by the piriformis muscle. In this clinical lesson we will describe a case of PMS and report the current possibilities in diagnosing and treating PMS.

Case

A 32-year old runner presented to our clinic with persistent complaints of lower back pain and pain in the left buttocks. These symptoms had been present for 2 years. Sometimes the pain radiated to the left leg. Symptoms were aggravated by running; normally, he could run 12.5 kilometers without complaints. Now his pain started during physical activity such as running and would continue for some hours following the activity. When visiting our clinic, he had stopped running to see if this would relieve the injury, which was not the case. There was no pain at rest.Patient had previously been referred to the neurologist; there was no significant compression of nerve roots on MRI of the lower back.

At physical examination, we found a normal range of motion of the lower back, hips and knees. Palpation of the left sacro-iliacal (SI-) joint was slightly painful but mobility was normal. Pain could be elicited by putting pressure on the left piriformis muscle by direct palpation and stretch on this muscle provoked the familiar pain known to the patient. Functional testing using the step-down test showed a hip drop and knee motion to the medial side, a motion called 'kneeing in' showing lack of strength of the hip abductors. Further core stability testing showed a lack of neuromuscular control around hip and core.

Background

Anatomy

The piriformis muscle, also known as the pear-shaped muscle, originates from the sacral bone at S2-S4 and inserts on the greater trochanter of the femur (Figure 1). When the hip and knee are extended the muscle functions as an exorotator of the hip joint. However, its main function is stabilization of the hip [1].

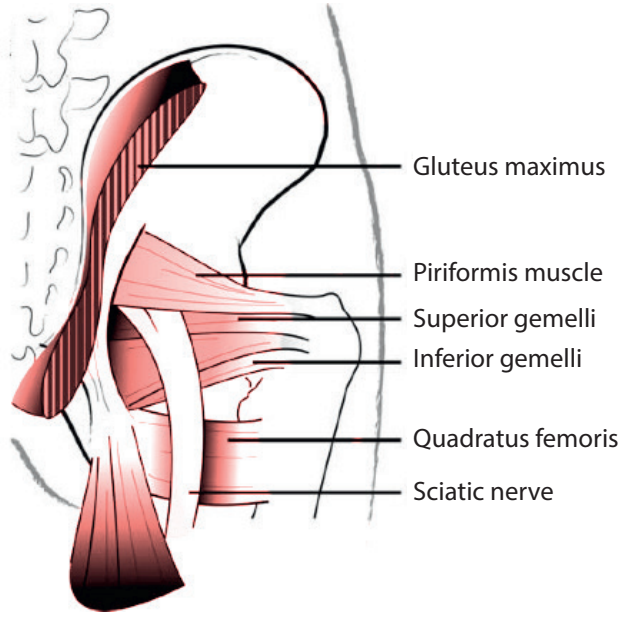

Figure 1 *Anatomy of the piriformis muscle and the sciatic nerve showing their close relationship*

Immediately caudal of this muscle, the sciatic nerve runs through the greater sciatic foramen of the pelvis. It originates from the spinal nerves L4-S3 and after splitting into the common peroneus nerve and the tibial nerve at knee-level it ends in the foot. The sciatic nerve supplies the sensory innervation of the skin of the majority of the lower limb and also innervates the lateral rotators and hamstring muscles.

Epidemiology

Due to lack of a definition, the reporting of reliable prevalence or incidence percentages proved to be difficult. Of all patients with sciatica (back or gluteal pain with radiating pain), only a small percentage suffers from PMS; reported estimates of this percentage range from 1 to 15% [2-4]. Risk factors for developing PMS seem to include female gender, practicing endurance sports with mainly forward movements

of the lower extremity (i.e. cycling or running), and sports with frequent jumping combined with exorotation of the extended leg (i.e. ballet).

Pathophysiology

There are multiple hypotheses concerning the etiology of PMS. One of these, as mentioned in the introduction, states that PMS is caused by direct excitation of the sciatic nerve resulting from compression by the piriformis muscles in the infrapiriformis canal [2-4]. The most frequent cause of PMS is traumatic injury; scarring of the infrapiriformis canal after blunt trauma. Non-traumatic causes include surmenage following intensive exercise, abnormal mobility of the SI-joint and hyperpronation of the foot. Some case reports also mention external compression, by a wallet for example, as a cause of PMS [3,5]. Anatomical variations in the relationship between the sciatic nerve and the muscle fibers of the piriformis muscle do not predispose for development of PMS [1-4, 6,7].

Figure 2 *Typical location of the radiating pain associated with piriformis muscle syndrome on the lower back, buttock and upper leg.*

Other structures in the pelvis might also be responsible for complaints similar to PMS. Radiculopathy and discopathy should always be excluded. Compression of the sciatic nerve may also be caused by the internal obturator muscle or the gemelli muscles. Nerve compression by tumors of different origins (vascular, intestinal or gynaecological) can also cause pain as seen in PMS. Arthritis of the hip joint or SI-joint might be a primary or secondary (through surmenage of the piriformis muscle) cause of PMS-like pain [1-4, 6, 7].

Clinical presentation

Patients complain of a deep pain in the gluteal region, uni- or bilaterally. This pain often radiates to the dorsal and, in some cases, also the lateral side of the upper leg (Figure 2). Complaints are provoked by prolonged sitting and intensive strain of the piriformis muscle, for example during ballet dancing or other activities that require extensive hip stabilization. Typically, pain free intervals occur during the day [2, 3].

The following signs during examination of the locomotor apparatus can point the examiner in the direction of PMS. The patient might position the affected leg with a slight flexion in the knee and exorotation when supine; in this position the piriformis muscle is relaxed. Palpation of the piriformis muscle, which can be done by following its course through the buttock area while rotating the hip, on the ipsilateral side is more painful when compared to the contralateral leg. Neurologic abnormalities do not rule out PMS [1-4, 6, 7].

A number of clinical tests or maneuvers provoking strain on the piriformis muscle, have been described to help the examiner make the diagnosis PMS more probable. The passive tests, Frieberg and FADDIR test, are performed by the examiner. The Frieberg test (Fig 3b) involves internal rotation of the hip with the patient in a prone position. The FADDIR test (Fig 3a) is performed by simultaneously flexing, adducting and internally rotating the hip of the patient. The Pace and Beatty test are actively performed by the patient. The Pace test (Fig 3c) includes active adducting of the hip while the patient is in a sitting position. During Beatty's test (Fig 3d) the patient is in prone position and is asked to adduct the hip while the knee is flexed 90 degrees. The maneuvers are considered positive when the recognizable pain is elicited. While performing these tests, it is important to hold the positions for at least 10-20 seconds [1-4, 6, 7]. The diagnostic value of each test individually is not clear, but each positive test should help guide the examiner towards the possible diagnosis of PMS.

Diagnosis

Imaging studies

Imaging is essential in excluding other causes of irritation or compression of the sciatic nerve. Degenerative changes of the hip or SI-joint can be ruled out by conventional X-ray. An MRI of the lumbar spine is necessary to exclude nerve root compression; although MRI also shows possible hypertrophy or atrophy of the piriformis muscle, this does not prove PMS [1, 2, 6]. MR-neurography, a MRI-scan with special settings, can show irritation of the sciatic nerve [1, 2].

Electromyography

Electromyography (EMG) of the affected leg might show a delayed conduction of neurological activation. Change of position of the leg, from a neutral position to the position as used during the FADIR test (Figure 3a), can also affect nerve conduction [1-4, 6]. However, it remains unclear how to interpret these delays, and thereby the diagnostic value of EMG for PMS is not yet established [8]. EMG can also be used to exclude radiculopathy and other forms of entrapment of the sciatic nerve [1-4, 6, 7].

Treatment

Physical therapy

In general, physical therapy (PT) is the first step in treatment of PMS. PT can be combined with pain medication, when needed. PT involves daily stretching and relaxation of the piriformis muscle. Deep tissue massage or friction of the muscle can be used to relieve tension and remove adhesions. Training of other exorotators of the hip is essential. When inadequate core stability is present, PT should also focus on strengthening muscles necessary for core stability. Movements and activities that have been known to provoke symptoms should be avoided [1-4].

The controversy surrounding PMS, the lack of a clear definition and a golden standard for diagnosis, makes the comparison of different treatment regiments used in scientific research papers extremely difficult. For PT, the variation in regimes and variation in intensity of the provided guidance, makes evidence based research of a clear treatment regime almost impossible. It is, however, evident that PT, as described in the previous paragraph, combined with medication (paracetamol and/or non-steroidal anti-inflammatory drugs), significantly reduced symptoms for a large number of patients [1-4, 6, 7].

Intramuscular injections

Injections with botulinum neuroxine (Botox) can be used to relax the muscle fibers of the piriformis muscle. Guidance, through sonography, MRI or CT, ensures the correct position of the injection; without

guidance the majority of intramuscular injection are not administered at the desired location. Almost half of the patients report a reduction of complaints after injection with Botox [2]. When indicated, by a clear and prolonged result, injections can be repeated [2-4]. In a similar way, a guided injection with analgesics or corticosteroids can be administered. The exact location of the injection to achieve maximum results, be it the punctum maximum of the pain, or in the course of the piriformis muscle is not yet known [1-4].

Surgery

Surgical intervention is often the last step in treatment of PMS, after conservative methods had unsatisfactory results. A common technique is a tenotomy of the insertion of the piriformis tendon on the greater trochanter. During the procedure any adhesions of the fascia on the sciatic nerve can be removed. In many cases, a satisfactory result is achieved following surgical treatment of patients with PMS [1-7].

Figure 3 *Clinical tests and maneuvers eliciting strain on the piriformis muscle:*
A - FADDIR test (flexion, adduction and internal rotation of the hip)
B - Freiberg test (internal rotation of the hip in prone position)
C - Pace test (active adduction of the hip in seated position)
D - Beatty's test (adduction of the hip with knee in 90 degrees flexion in prone position)

Case - continued

The aforementioned patient had a clear lack of core and functional stability. Together with the pattern of radiating pain we considered PMS as diagnosis. We did not perform any additional testing, since other nerve entrapment or compression was already ruled out by MRI. Due to the controversy regarding the treatment of choice, we advised the patient to start with PT. He started with core and functional stability training at our sports medical centre, in combination with stretching and deep friction of the piriformis muscle. After 4 months of treatment, he could start running again and his back pain and buttock pain were almost gone.

Conclusion

When confronted with a patient complaining of radiating back or buttocks pain, PMS should be considered as a possible diagnosis. Other possible causes, including nerve root compression, should be excluded with a MRI of the lower back and conventional X-ray of the pelvis. Painful palpation of the piriformis muscle and positive FADDIR, Freiberg, Pace and Beatty tests could further assist physicians and physical therapists in their diagnostic process. While treatment options vary, it seems clear that physical therapy should be the first step in treating PMS. Further research on the prevalence, diagnosis and treatment of PMS could also help therapist to treat patients with lower back pain.

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