Differential Diagnosis of Piriformis Syndrome and Its Implication for Physiotherapy

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Abstract:
Piriformis Syndrome (PS) is an anemuscular condition that remains poorly understood and often misdiagnosed. It is a complex condition that must be considered in the differential diagnosis of chronic hip and low back pain, sacroiliac joint dysfunction, and hip pathology. Regardless of the physiopathologic origin of the complex disorder (muscular or nervous), symptoms, signs, and imaging should be combined to confirm the diagnosis. Physical examination, radiographic studies, and neuroelectric tests are also used to narrow the differential diagnosis toward piriformis syndrome by ruling out other pathologic conditions. Physiotherapy treatment can be used alone or in conjunction with medication in the management of piriformis syndrome in an attempt to avoid surgical intervention.

Keyword: Piriformis Syndrome (PS), Physiotherapy, Differential Diagnosis.

I. INTRODUCTION

Piriformis syndrome was defined by Edward¹ as neuritis of branches of the sciatic nerve caused by pressure of an injured or irritated piriformis muscle. Though many contrasting definitions exist, Piriformis syndrome was also defined as a neuromuscular disorder that is presumed to occur when the sciatic nerve is compressed or involved at the level of the piriformis muscle². It has been further subdivided into primary and secondary forms,³,⁴ with primary PS comprising of cases in which sciatic nerve entrapment occurs because of some intrinsic abnormality within the muscle itself (for example anomalous anatomy),⁵ while secondary PS is caused by direct, often blunt trauma to the piriformis muscle. A description of the pain's location by a patient is often imprecise, the pain variously being considered a pain in the hip, tailbone, buttock or groin, and often down the back of the leg as sciatica⁶. It most commonly goes unrecognized or is misdiagnosed in clinical settings. Little is known about piriformis syndrome from an anatomical, biomechanical and clinical viewpoint, and its diagnosis is accepted only after other causes of pain arising in the buttocks or lower limbs have been eliminated, thus, it is a diagnosis of exclusion⁷. Piriformis syndrome can “masquerade” as other common somatic dysfunctions, such as intervertebral discitis, lumbar radiculopathy, primary sacral dysfunction, sacroiliitis, sciatica, and trochanteric bursitis.⁸ It is estimated that at least 6% of patients who are diagnosed as having low back pain actually have piriformis syndrome⁹,¹⁰. Delay in diagnosing piriformis syndrome may lead to pathologic conditions of the sciatic nerve, chronic somatic dysfunction, and compensatory changes resulting in pain, paresthesia, hyperesthesia, and muscle weakness¹⁰. The challenge for physicians is to recognize symptoms and signs that are unique to piriformis syndrome, enabling appropriate treatment in a timely manner.¹¹ Therefore, the purpose of this article is to explore and review the clinical features of piriformis syndrome and the diagnostic and differentiating criteria and treatments available for patients with this condition.

II. EPIDEMIOLOGY

Difficulties arise in accurately determining the true prevalence of piriformis syndrome because it is frequently confused with other conditions.² Piriformis syndrome occurs most frequently during the fourth and fifth decades of life and affects individuals of all occupations and activity levels.¹¹-¹⁶ Reported incidence rates for piriformis syndrome among patients with low back pain vary widely, from 5% to 36%.⁶,⁸,¹⁵ Piriformis syndrome is more common in women than men, possibly because of biomechanics associated with the wider quadriceps femoris muscle angle (ie, “Q angle”) in the os coxae (pelvis) of women.⁸ Piriformis syndrome is frequently left undiagnosed and mistaken with other pains due to similar symptoms with back pain, quadriceps pain, lower leg pain, and buttock pain. These symptoms include tenderness, tingling and numbness initiating in low back and buttock area and then radiating down to the thigh and to the leg.¹⁷ A precise test for piriformis syndrome has not yet been developed and thus hard to diagnose this pain.¹⁸ The pain is often initiated by sitting and walking for a longer period.¹⁹ Piriformis syndrome does not occur in children, and is mostly seen in women of age between thirty and forty. This is due to hormone changes throughout their life, especially during pregnancy, where muscles around the pelvis, including piriformis muscles, tense up to stabilize the area for birth.³ Females are two times more likely to develop piriformis syndrome than males because females tend to have longer stays in hospital due to high prevalence of the pain in females.²⁰

III. CLINICAL ANATOMY

Understanding the manifestations of piriformis-induced entrapment requires an insight into the anatomy of the muscle...
and surrounding structures. The PM is the only muscle that courses transversely through the greater sciatic notch, and it is the key landmark to all the important nerves and vessels that pass from the pelvis to the gluteal region.\footnote{32} The piriformis muscle has the shape of a flat pyramid and originates at levels S2-S4 on the ventrolateral aspect of the sacrum. It exits transversely through the greater sciatic notch and inserts into the piriform fossa located at the superior medial aspect of the greater trochanter via a round tendon that, in many individuals, is merged with the tendons of the obturator internus and gemelli muscles of the greater trochanter (Figure 1).\footnote{22,25} It is innervated by a nerve that originates in the S1 and S2 segments. However, considerable variation exists, with the S2 and S3 nerve roots said to pass through the muscle in some symptomatic patients,\footnote{5} and in a large percentage of asymptomatic live controls\footnote{22} and cadavers.\footnote{23,24}

The proper understanding of piriformis syndrome requires knowledge of variations in the relationships between the sciatic nerve and the piriformis muscle (Figure 2).\footnote{3} In as much as 96\% of the population, the sciatic nerve exits the greater sciatic foramen deep along the inferior surface of the piriformis muscle.\footnote{24,26,27} In as much as 22\% of the population, the sciatic nerve pierces the piriformis muscle, splits the piriformis muscle, or both, predisposing these individuals to piriformis syndrome. The sciatic nerve may pass completely through the muscle belly, or the nerve may split—with one branch (usually the fibular portion) piercing the muscle and the other branch (usually the tibial portion) running inferiorly or superiorly along the muscle.\footnote{11,24,26,28-30} Rarely, the sciatic nerve exits the greater sciatic foramen along the superior surface of the piriformis muscle.\footnote{24,26,27}

### Figure 1. Anatomic features of the hip, including the most common orientation of the sciatic nerve, running inferior to the piriformis muscle (Boyajian-O'Neill et al 2008).

### Figure 2. Variations in the relationship of the sciatic nerve to the piriformis muscle: (A) the sciatic nerve exiting the greater sciatic foramen along the inferior surface of the piriformis muscle; the sciatic nerve splitting as it passes through the piriformis muscle with the tibial branch passing (B) inferiorly or (C) superiorly; (D) the entire sciatic nerve passing through the muscle belly; (E) the sciatic nerve exiting the greater sciatic foramen along the superior surface of the piriformis muscle (Boyajian-O'Neill et al 2008).
The muscle’s main functions are 1) to externally rotate the thigh and 2) to abduct the thigh when the hip is flexed.\textsuperscript{3,8,21} It also can be a weak hip flexor providing postural stability during ambulation and standing. It should be noted that changing the position of the hip changes the function of the piriformis. With the hip in flexion, the piriformis is an abductor; however with the hip in extension, it is an external rotator.\textsuperscript{31}

IV. ETIOLOGY

There are two types of Piriformis syndrome—primary and secondary. Primary piriformis syndrome has an anatomic cause, such as a split piriformis muscle, split sciatic nerve or an anomalous sciatic nerve path. Secondary Piriformis Syndrome occurs as a result of a precipitating cause, including macrotrauma, microtrauma, ischemic mass effect, and local ischemia. Among patients with piriformis syndrome, fewer than 15% of cases have primary causes.\textsuperscript{3} A history of trauma is usually elicited in approximately 50% of the cases: The trauma is usually not dramatic and may occur several months before the initial symptoms. It may occur after total hip replacement surgery or laminectomy.\textsuperscript{54} Trauma to the buttock leads to inflammation and spasm of the muscle. Inflammatory substances such as prostaglandin, histamine, bradykinin, and serotonin are released from the inflamed muscle and may irritate the sciatic nerve resulting in pain–spasm–inflammation irritation cycle. The stretched, spastic, and inflamed piriformis muscle may compress the sciatic nerve between the muscle and the pelvis, with the compression occurring between the tendinous portion of the muscle and the bony pelvis.\textsuperscript{27,35,36} Length discrepancy altered biomechanics leading to stretching and shortening of the piriformis muscle.\textsuperscript{32} The real cause of this particular syndrome does not only depend on the relationship between sciatic nerve and piriformis muscle, because the incidence of the anatomical anomalies of these entities is definitely superior to those treated in the reported cases.\textsuperscript{33}

V. SYMPTOM

Symptoms can be sudden or gradual these includes:
- Numbness in the foot
- Dyspareunia in women
- Pelvic pain
- Inguinal pain
- Difficulty walking
- Paresthesia
- Piriformis muscle spasm
- Pain improves when attending standing from sitting or squatting
- Increase pain when sat for more than 15 to 20 minutes
- Pain with internal rotation of the ipsilateral leg\textsuperscript{41}

VI. DIAGNOSIS

Diagnosis is based on symptoms and physical examination. There are several clinical tests but no single test is specific for piriformis syndrome.

- Piriformis sign- This is performed in supine position when the patient is relaxed and then the ipsilateral foot is externally rotated and any active efforts to bring the foot in midline results in pain, a positive piriformis sign is recorded.
- Lasegue sign-Patient is in supine position with flexed hip and knee at 90 degree, then keeping the hip flexed while the knee in extension, posterior thigh pain is an indicative of a positive lasegue test.
- Freiberg sign-Pain is experienced during forceful passive internal rotation of hip joint\textsuperscript{57}.
- Pace’s sign- Patient is in sitting position, during resisted abduction and external rotation of the thigh, the small rotators of the hip are stretched. If pain and weakness on resisted abduction of the hip is registered, the test is positive.
- Beatty test- this test involves that the patient lies on the asymptomatic side, while lifting and holding the superior knee approximately 4 inches off the examination table, the test result is positive if sciatic symptoms are recreated.
- FAIR (flexion, adduction, and internal rotation) test, involves recreation of sciatic symptoms. The FAIR test is usually performed with the patient in a lateral recumbent position, with the symptomatic side up, with hip flexed to an angle of 60 degrees, while the knee is flexed to an angle of 60 degrees to 90 degrees. On stabilizing the hip, the examiner internally rotates and adducts the hip by applying downward pressure to the knee\textsuperscript{38}. Another way to perform FAIR test is placing the patient in supine or seated position, withflexed knee and hip, while hip medially rotated, the patient resists examiner attempts to externally rotate and abduct the hip. The FAIR test result is positive if sciatic symptoms are recreated\textsuperscript{39}.

VII. INVESTIGATIONS

- Electromyography (EMG)- EMG usually helps in differentiating piriformis syndrome from intervertebral disc herniation\textsuperscript{12-41}. Interspinal nerve impingement causes EMG abnormalities of muscles that are proximal to the piriformis muscle: patients with piriformis syndrome, result of the EMG shows normal to proximal muscles of the piriformis and abnormal to muscles that are distal to it. Nerve conduction velocity studies may show delayed F waves and H reflex.
- Computed tomography (CT)-Computed tomography usually reveals enlargement piriformis syndrome.
- Radiography- Radiographic studies have shown limited application to the diagnosis of piriformis syndrome. Magnetic resonance imaging and computed tomography may likely reveal enlargement of the piriformis muscle, these imaging technologies usually are beneficial when ruling out disc and vertebral pathologic conditions\textsuperscript{12,42}. Magnetic resonance imaging of the pelvis helps to rule out intrapelvic lesion or mass effect at the sciatic notch\textsuperscript{39,40}.

VIII. DIFFERENTIAL DIAGNOSIS

There are other medical conditions that resemble piriformis syndrome and it can be distinguished with various diagnosis. Alternatively, it may be a co morbid condition. The differential diagnosis of the piriformis syndrome includes the following;

- facet syndrome\textsuperscript{15}.
- Arteriovenous malformation
- Hamstring injury
- trochanteric bursitis,
- Lumbosacral disc injury
- Inferior gluteal artery aneurysm
- Spondylolisthesis / Spondyloysis

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Sacroiliac Joint dysfunction\textsuperscript{46}.

- Hip pathology
- Referred pain to the buttock caused by pronator forces of the foot
- Malignancy
- Spinal stenosis
- pelvic tumor,
- endometriosis
- Sciatica and various conditions irritating the sciatic nerve.

A complete history and physical assessment of the patient is essential for accurate diagnosis. The history should encompass any trauma to the buttocks and the presence of any bowel and bladder changes\textsuperscript{6,13}. The physical assessment should also include musculoskeletal system examination with special attention to the lumbar spine, pelvis, and sacrum, as well as any leg length disparities, neurological system and the diagnostic tests previously mentioned. Rule out lumbosacral radiculopathies, degenerative disc disease, compression fractures, and spinal stenosis. Radiculopathies are usually accompanied by both proximal and distal muscle weakness and atrophy. Contrarily, patients with piriformis syndrome usually exhibit weakness and atrophy only in distant musculature\textsuperscript{8,43}.

**IX. TREATMENT**

Early conservative treatment has become the most efficacious treatment in patients with piriformis syndrome\textsuperscript{45}. Some medications like nonsteroidal anti-inflammatory drugs (NSAIDs), muscle relaxants, ice, and rest. Stretching of the piriformis muscle and strengthening of the abductor and adductor muscles is also helpful in treatment of patients with piriformis syndrome. A conservative approach may combine muscle stretches, soft tissue release techniques, myofascial, muscle energy, and thrust techniques to address all somatic abnormalities in the patient with piriformis syndrome\textsuperscript{8,43}.

**Medications:** Nonsteroidal anti-inflammatory drugs and acetaminophen are medications of choice in the management of the many conditions that present as low back pain, including piriformis syndrome\textsuperscript{44}. Steroid injections around the piriformis muscles helps to decrease inflammation and pain\textsuperscript{45}. Botulinum toxin also helps in the reallease of symptoms.

**PHYSICAL THERAPY**

Patients with piriformis syndrome are treated with physical therapy, these includes a variety of motion exercises and stretching techniques. The goal of physical therapy is symptom elimination through a systematic program designed to increase the range of motion of the surrounding muscle groups and joints, as well as to increase the supporting strength of these muscle groups\textsuperscript{27}.

**Stretching:** This aims to correct the underlying pathology by relaxing a tight piriformis, and related muscle stretching to relieve nerve compression. Because the piriformis lies deep in the gluteus maximus, using moist heat or ultrasound prior to stretching is most often suggested. Stretches can be done in both the standing and supine positions, and they involve hip and knee flexion, hip adduction, and internal rotation of the thigh, as in the flexion, adduction, internal rotation position. This may take some time for patients to tolerate, as this is the same position used to provoke piriformis pain. After stretching, lumbosacral stabilization, hip strengthening exercises, and myofascial release are performed. In particular, the strengthening of the adductor muscles of the hip has been shown to be beneficial for patients with piriformis syndrome. Strengthening of the hip abductors is added to the regimen when the symptoms improve. Abnormal biomechanics caused by posture, pelvic obliquities, and leg-length inequalities need to be corrected.

**Physical therapy modalities,** such as heat therapy, cold therapy and ultrasound. Heat or cold therapy is usually most effectively applied before the physical therapy sessions as it reduces the discomfort associated with direct treatment applied to an irritated or tense piriformis muscle\textsuperscript{47,48}.

**Manipulative therapy** is also very important. The goals of manipulative treatment in piriformis syndrome are to restore normal range of motion and decrease pain. These goals can be achieved by decreasing piriformis spasm. The two indirect manipulative techniques most commonly used for the management of piriformis syndrome are counter strain and facilitated positional release\textsuperscript{6,49}. These techniques involve the principle of removing as much tension from the piriformis muscle as possible. Direct manipulative techniques can be performed using either active or passive methods. The direct manipulative techniques that are the most useful in treating patients with piriformis syndrome include muscle energy, articulatory, Still, and high velocity/low amplitude\textsuperscript{41}.

**Surgery:** As a last resort, surgery has been occasionally used in selected cases that have failed to resolve with the use of other treatment measures. The goal of surgery is to reduce any tension under which the piriformis muscle may be placed, and also explore the sciatic notch to ensure that there are no fibrous bands or constrictions compressing the sciatic nerve\textsuperscript{2,15}.

**X. REFERENCES**


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