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PIRIFORMIS SYNDROME: A REVIEW

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ABSTRACT: Piriformis syndrome is a painful musculoskeletal condition resembling sciatica, secondary to sciatic nerve entrapment in piriformis muscle at the greater sciatic notch and responsible for 6% cases of low back pain, also called back pocket sciatica or wallet sciatica, first described in 1928 by Yeoman. It usually occurs due to abnormalities in piriformis muscle such as hypertrophy, inflammation and anatomic variations resulting in irritation and entrapment of sciatic nerve. The diagnosis of piriformis syndrome is made by clinical features, electromyography and nerve conduction velocity, computed tomography, magnetic resonance imaging and bone scan. Management of piriformis syndrome includes nonsurgical and surgical interventions. Non-surgical management includes- nonsteroidal anti-inflammatory drugs, physical therapy, ultrasound, correction of biomechanical abnormality, lifestyle modifications, local anesthetic and/or steroid injection into the piriformis muscle. Surgical management includes-surgical release of piriformis muscle and decompression of the sciatic nerve. Piriformis Syndrome- a review.

KEYWORDS: Piriformis Syndrome.

INTRODUCTION: Piriformis syndrome is a painful musculoskeletal condition resembling sciatica, secondary to sciatic nerve entrapment in piriformis muscle at the greater sciatic notch.¹⁻² It is responsible for 6% cases of low back pain and frequently goes unrecognized or misdiagnosed in clinical settings as it mimics common clinical entity like lumbar radiculopathy, sacroiliitis, trochanteric bursitis, intervertebral discitis etc.³⁻⁵ First described in 1928 by Yeoman while studying the cause of low back pain.⁶ Robinson in 1947 introduced the term "piriformis syndrome" and applied it to sciatica due to abnormal muscle which is usually traumatic in origin.⁷

It usually occurs due to abnormality in piriformis muscle such as hypertrophy, inflammation and anatomic variations such as accessory piriformis muscle or tendon resulting in irritation and sciatic nerve entrapment.⁸⁻⁹ Predisposing factors include trauma, excessive exercise, leg length discrepancy (altered biomechanics causes stretching and shortening of piriformis muscle), cerebral palsy and narrowed sciatic foramen etc.¹⁰ Piriformis syndrome has been called back pocket sciatica or wallet sciatica since keeping wallets in back pocket of trousers or jeans is said to be a predisposing factor.¹⁰

The diagnosis of piriformis syndrome is made by clinical features, electromyography and nerve conduction velocity, computed tomography, magnetic resonance imaging and bone scan.¹¹⁻¹³ Management of piriformis syndrome includes nonsurgical and surgical interventions. Non-surgical management includes- nonsteroidal anti-inflammatory drugs,¹⁴ physical therapy,¹⁵ ultrasound,¹⁶ correction of biomechanical abnormality,¹⁷ lifestyle modifications,¹⁸ local anesthetic and/or steroid injection into the piriformis muscle.¹⁹⁻²⁰

Surgical management includes-surgical release of piriformis muscle and decompression of the sciatic nerve.²¹⁻²²

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The purpose of the study is to review the pathologic and diagnostic features and treatments of piriformis syndrome, moreover increase the awareness of the current understanding of piriformis syndrome.

EPIDEMIOLOGY: Piriformis syndrome most commonly present at fourth to fifth decade of life, ^{21, 23-27} more commonly in women with gender ratio female: male, 6:1.^{3,4,28} It is reported that at least 6% of patients who are diagnosed as having low back pain actually have piriformis syndrome.³

ANATOMY: Piriformis muscle originates at the anterior surface of the sacrum, at the S2 vertebrae through S4, upper margin of the greater sciatic notch, adjoining areas of the sacroiliac joint and of the sacrotuberous ligament.²⁹ Piriformis inserted to the superior medial aspect of the greater trochanter of femur through a round tendon, that in some individuals merged with the tendons of the obturator internus and gemilli muscle.^{2, 30, 31}

Piriformis muscle is supplied by S1 and S2 segment occasionally by L5 segment.²⁹ Piriformis acts as an external rotator, weak flexor and weak abductor of hip joint.^{4,24,30} To understand piriformis syndrome properly knowledge of relationship between sciatic nerve and piriformis muscle is needed. The sciatic nerve is the thickest nerve in the body and innervates the posterior compartment of the thigh and all compartments of the lower leg and foot.³² The sciatic nerve arises from the lumbosacral plexus containing fibers from L4 to S1 nerve.

The sciatic nerve exits the greater sciatic foramen deep along the inferior surface of the piriformis muscle in 96% of the population.³³⁻³⁵ The sciatic nerve may pass completely through the muscle belly, or the nerve may split—with one branch (usually the peroneal portion) piercing the muscle and the other branch (usually the tibial portion) running inferiorly or superiorly along the muscle.^{23, 31-34, 36} Rarely the sciatic nerve exits the greater sciatic foramen along the superior surface of the piriformis muscle.³³⁻³⁵ Rarely there may be presence of an accessory piriformis muscle with accessory muscle fibers crossing anterior to the sacral foramen and sacral nerve.¹⁰ The tibial nerve division of sciatic nerve is involved less often than peroneal division, since former is located more medially in the sciatic notch.



Fig. 1: Usual orientation of Sciatic nerve-Inferior to piriformis muscle

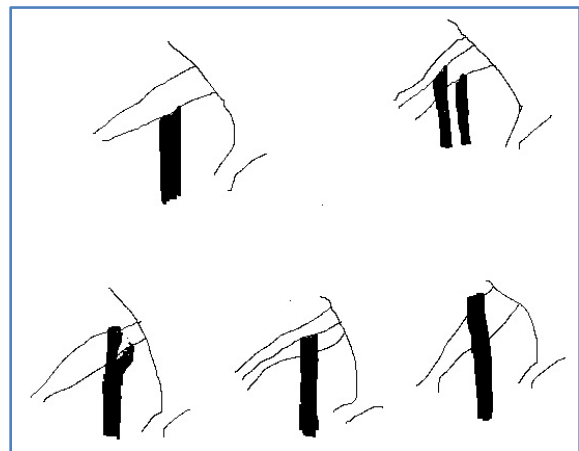


Fig. 2: Variations in the relationship of the sciatic nerve to the piriformis muscle

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Lasegue Sign



Pace Sign



Piriformis Sign 2



Piriformis Sign

ETIOLOGY: Piriformis syndrome may be primary or secondary which is more common than primary (15% cases).^{4,26} Primary piriformis syndrome has an anatomic background such as split piriformis muscle, split sciatic nerve, or an anomalous sciatic nerve path.^{21,24,37} Secondary piriformis syndrome occurs as a result of precipitating cause including trauma, leg length discrepancy, cerebral palsy and narrowed sciatic foramen etc.^{2,26,38-40}

Macrotrauma to the buttocks, leading to inflammation of the soft tissue, muscle spasm, or both causing nerve compression. Microtrauma may result from overuse of the piriformis muscle such as in long distance walking or running, excessive exercise. It may be due to direct pressure due to keeping the wallet in right back pocket of trousers or jeans.¹⁰

Leg length discrepancy altered biomechanics leading to stretching and shortening of the piriformis muscle.

CLINICAL FEATURES: Most common presentation is increasing pain in the buttock especially over the piriformis muscle attachments or lower part of the back when rising after sitting or squatting longer than 15 to 20 minutes.^{32,41} The pain improves with ambulation & worsens with no movement but does not relieved completely on changing position. The pain and or paresthesia radiating from

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sacrum through the gluteal area and down posterior aspect of thigh, usually stooping above knee.³²

Patient may complain of difficulty in walking and pain with internal rotation of ipsilateral leg, such as occurs during cross-legged sitting or ambulation.^{2, 21, 24, 26, 38, 39, 42} There may be groin or pelvic pain.^{24, 38, 40} Women sometimes complaining of dyspareunia.⁴¹ Patient may present with cervical, thoracic and lumbar pain as well as gastrointestinal symptoms and headache due compensatory or facilitative mechanism.^{24, 38, 40}

On examination the sacroiliac joint region, greater sciatic notch and piriformis muscle may be tender.^{2, 21, 24, 26, 38, 39, 42} There may be palpable mass at the buttock or gluteal atrophy (in chronic cases).^{7, 24, 38} Affected limb lies in external rotation with decreased internal rotation of the ipsilateral hip joint.^{2, 24, 26, 38, 39} Asymmetrical weakness of the limb may occur.

Diagnostic Tests: There are several clinical tests but no single test is specific for piriformis syndrome.

- a. Piriformis sign-In supine position when the patient is relaxed the ipsilateral foot is externally rotated and active efforts to bring the foot in midline results in pain, a positive piriformis sign.^{24, 26, 38, 39}
- b. Lasegue sign-Patient in supine position flex the hip and knee to 90 degree, then keeping the hip flexed extend the knee, if the patient has posterior thigh pain, a positive lasegue test.⁴³
- c. Freiberg sign-Pain is experienced during passive internal rotation of hip joint.^{44, 45}
- d. Pace sign- Pace sign, revealed with the FAIR (flexion, adduction, and internal rotation) test, involves the recreation of sciatic symptoms.⁴⁴ The FAIR test is performed with the patient in a lateral recumbent position, with the affected side up, the hip flexed to an angle of 60 degrees, and the knee flexed to an angle of 60 degrees to 90 degrees. While stabilizing the hip, the examiner internally rotates and adducts the hip by applying downward pressure to the knee. Alternatively, the FAIR test can be performed with the patient supine or seated, knee and hip flexed, and hip medially rotated, while the patient resists examiner attempts to externally rotate and abduct the hip. The FAIR test result is positive if sciatic symptoms are recreated.^{3, 26, 35, 44, 46, 47}
- e. Beatty test- In this test, the patient lies on the unaffected side, lifting and holding the superior knee approximately 4 inches off the examination table. If sciatic symptoms are recreated, the test result is positive.²⁷

INVESTIGATIONS:

- a. Electromyography (EMG) and Nerve conduction velocity (NCV) - EMG may be beneficial in differentiating piriformis syndrome from intervertebral disc herniation.^{2, 3, 21, 48} Interspinal nerve impingement will cause EMG abnormalities of muscles proximal to the piriformis muscle. In patients with piriformis syndrome, EMG results will be normal for muscles proximal to the piriformis muscle and abnormal for muscles distal to it. NCV studies may show delayed F waves and H reflex.^{41, 49}
- b. Radiography- Radiographic studies have limited application to the diagnosis of piriformis syndrome. Although magnetic resonance imaging and computed tomography may reveal enlargement of the piriformis muscle, these imaging technologies are most useful in this setting when ruling out disc and vertebral pathologic conditions.^{21, 35, 49, 50-52}

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DIFFERENTIAL DIAGNOSIS: Piriformis syndrome may mimic other conditions. Alternatively, it may be a comorbid condition. The differential diagnosis of the piriformis syndrome includes all other causes of low back pain and sciatica such as spinal stenosis, facet syndrome, sacroiliac joint dysfunction, trochanteric bursitis, pelvic tumor, endometriosis and various conditions irritating the sciatic nerve.^{4,8} 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.^{3,24}

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.^{24,27,39,44,46,53}

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. By contrast, patients with piriformis syndrome typically exhibit weakness and atrophy only in distal musculature.^{46,47}

Sacroiliitis, other sacroiliac joint dysfunction, and somatic dysfunction of the sacrum and innominates should be considered as possible causes or effects of piriformis syndrome.^{2,4,21,24,35,39,40} Leg length discrepancy warrants an investigation to distinguish between physiologic or anatomic causes.^{24,39,53} Diseases of the hip, including arthritis and trochanteric bursitis, as well as fracture, should be considered in differential diagnoses.

Computed tomography, magnetic resonance imaging, and ultrasound technologies can be used to rule out referred pain from gastrointestinal or pelvic causes, such as colon cancer, endometriosis, and interstitial cystitis.^{4,26,38,44,54}

PREVENTION: Prevention of repetitive trauma (i.e., microtrauma) is effective in decreasing a patient's risk of piriformis syndrome. Correction of the biomechanical deficiencies and functional adaptations to those deficiencies can reduce the incidence of piriformis syndrome.^{5,55}

TREATMENT: Early conservative treatment is the most effective treatment, in patients with piriformis with the use of nonsteroidal anti-inflammatory drugs (NSAIDs), muscle relaxants, ice, and rest.⁴⁶ Stretching of the piriformis muscle and strengthening of the abductor and adductor muscles is also helpful in treatment of patients with piriformis syndrome.⁵⁴ A conservative approach may combine muscle stretches, Gebauer's spray and stretch technique, and soft tissue, myofascial, muscle energy, and thrust techniques to address all somatic dysfunctions in the patient with piriformis syndrome.^{2,4,24,38}

If the patient does not respond adequately to the above treatment, then acupuncture and trigger point injection with lidocaine hydrochloride, steroids, or botulinum toxin type A (BTX-A) may be considered.^{4,35,44,56} If all of the pharmacologic and medicinal treatments fail, the final treatment option is surgical decompression.^{4,21,24,34}

Pharmacologic treatment: Nonsteroidal anti-inflammatory drugs and acetaminophen have been considered the medications of choice in the management of the many conditions that manifest as low back pain, including piriformis syndrome.⁵⁷ Patients using NSAIDs, compared with those using placebo, reported global reduction of symptoms after 1 week of treatment.⁵⁸

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Muscle relaxants are also prescribed frequently for the patients with piriformis syndrome. Patients taking muscle relaxants are nearly five times as likely to report improvement of symptom by day 14, compared with patients given placebo.⁵⁹ Dryness of mouth, drowsiness, and dizziness are common adverse effects of muscle relaxants.

Some patients with chronic pain are benefited from narcotic analgesics.^{60,61} Narcotics can be helpful in controlling episodes of severe or debilitating pain, but they should be considered a short-term relief of pain. Constipation, gastrointestinal upset, and sedation are common adverse effects of narcotics.⁶² The potential for addiction should always be considered when treating with narcotics.⁶² Perisciatic steroid or local anesthetic injections at the site of nerve compression was shown to reduce nerve swelling-can produce an anti-inflammatory effect, reduce ectopic discharge and facilitate the recovery of nerve conduction following nerve injury. Although evidence for the efficacy of steroids in cases of chronic musculoskeletal pain is inconclusive, steroid injections have proven helpful in the treatment of carefully selected patients.⁶³

Perisciatic injection can be given under fluoroscopy, ultrasound or CT guidance but the traditional procedure consists of blind injection into the area of maximum pain.^{3,64-66} The inferior gluteal artery used as a landmark is easily identifiable with color power Doppler; we can also direct the needle towards the periphery of the sciatic nerve and control the advance of the needle at all time. Local Botulinum toxin injection at the piriformis muscle followed by physiotherapy is an effective treatment.⁵⁶ Botox-A 100U-200U given locally.⁶⁷ Infection is the most common complication of this invasive treatment. Contraindications to Botox-A therapy include known resistance or antibodies and concurrent use of aminoglycoside antibiotics.⁶⁷

Manipulative treatment: The goals of manipulative treatment of 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 reported for the management of piriformis syndrome are counter strain and facilitated positional release.^{2,53} Both 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, articular, Still, and high velocity/low amplitude.²

Physiotherapy: Patients with piriformis syndrome are treated with physiotherapy involving a variety of motion exercises and stretching techniques. The goal of physiotherapy 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. In particular, the strengthening of the adductor muscles of the hip has been shown to be beneficial for patients with piriformis syndrome.³⁵ Several studies have reported that additional benefit can be derived from physiotherapy modalities, such as heat therapy, cold therapy, botulinum toxin injection, and ultrasound.^{5,40,47,55}

Heat or cold therapy is usually most effectively applied before the physiotherapy or home therapy sessions because it may lessen the discomfort associated with direct treatment applied to an irritated or tense piriformis muscle.^{40,47,55} Injections of botulinum toxin, when used as an adjunct to physical therapy, have been shown to produce more pain relief than lidocaine with steroids or

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placebo.⁶⁸ Iontophoresis, the use of electrical current to transport solubilized medication across the skin, and sonophoresis, the use of ultrasonic energy to drive the cutaneous transport of medication molecules, have both been advocated as adjuncts to physical therapy though neither has been studied extensively in the treatment of patients with piriformis syndrome.⁶⁸

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.¹⁸ The goal of surgery in these cases is to reduce any tension under which the piriformis muscle may be placed, as well as to explore the sciatic notch to ensure that there are no fibrous bands or constrictions compressing the sciatic nerve.^{21, 26}

In a prone position using Kocher-langenbeck incision, the piriformis muscle is reached through the fibers of the gluteus maximus and sectioned after dissection of the nerve and neurolysis of the sciatic nerve is performed.¹

CONCLUSIONS: There are lack of knowledge regarding piriformis syndrome in many of us. An increase in knowledge regarding piriformis syndrome is necessary for optimal treatment. Further research and study is needed focusing epidemiologic factors, risk factors, and optimal treatment in patients of piriformis syndrome, however, there is an obvious paucity of high-quality research. There should be definite criteria for the diagnosis of piriformis syndrome. The number of patients presenting with low back pain who actually have piriformis syndrome is also unknown and needs further consideration.

Piriformis syndrome is a complex condition that is often not considered in the differential diagnosis of chronic hip and low back pain. Regardless of the physiopathologic origin of the complex disorder (muscular or nervous), symptoms, signs and imaging should be combined to confirm the diagnosis. Radiographic studies and neuroelectric tests are also used to narrow the differential diagnosis toward piriformis syndrome by ruling out other pathologic conditions. Nonpharmacologic therapies can be used alone or in conjunction with pharmacologic treatments in the management of piriformis syndrome in an attempt to avoid surgical intervention.

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