MR neurography of Piriformis syndrome: A Myth or reality

Poster No.: C-1494
Congress: ECR 2017
Type: Educational Exhibit
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Keywords: Neoplasia, Inflammation, Oedema, Diagnostic procedure, MR, Neuroradiology spine, Neuroradiology peripheral nerve, Musculoskeletal soft tissue
DOI: 10.1594/ecr2017/C-1494

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Learning objectives

To elucidate the anatomy and pathophysiology and etiological scenarios of Piriformis syndrome and its imaging correlates.

Clinical Symptoms and Signs of Piriformis syndrome are illustrated.

Common and uncommon pathologies of piriformis syndrome are highlighted.
Background

Piriformis syndrome is a peripheral neuritis of the sciatic nerve caused by an abnormal condition of the piriformis muscle.\(^1\) It frequently goes unrecognized or is misdiagnosed in clinical settings. Piriformis syndrome can "masquerade" as other common somatic dysfunctions, such as intervertebral discitis, lumbar radiculopathy, primary sacral dysfunction, sacroiliitis, sciatica, and trochanteric bursitis.

It is estimated that at least 6% of patients who are diagnosed as having low back pain actually have piriformis syndrome.\(^3-5\)

Epidemiologic Considerations

Piriformis syndrome occurs most frequently during the fourth and fifth decades of life and affects individuals of all occupations and activity levels.\(^7-12\) Reported incidence rates for piriformis syndrome among patients with low back pain vary widely, from 5% to 36%.\(^3,4,11\) 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.

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.

Anatomic Characteristics

The piriformis muscle acts as an external rotator, weak abductor, and weak flexor of the hip, providing postural stability during ambulation and standing.\(^4,9,13\) The piriformis muscle originates at the anterior surface of the sacrum, usually at the levels of vertebrae S2 through S4, at or near the sacroiliac joint capsule. The muscle attaches to 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 (Figure 1).\(^1,13,14\) The piriformis muscle is innervated by spinal nerves S1 and S2-and occasionally also by L5.

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.\(^15-17\) 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.\textsuperscript{7,13-16,18,19} Rarely, the sciatic nerve exits the greater sciatic foramen along the superior surface of the piriformis muscle.\textsuperscript{15-17}

Some symptoms of piriformis syndrome occur as a result of local inflammation and congestion caused by the muscular compression of small nerves and vessels-including the pudendal nerve and blood vessels, which exit at the medial inferior border of the piriformis muscle.\textsuperscript{13}

Etiologic Considerations

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.\textsuperscript{8,9,20} Secondary piriformis syndrome occurs as a result of a precipitating cause, including macrotrauma, microtrauma, ischemic mass effect, and local ischemia.\textsuperscript{1,6,11,21,22} Among patients with piriformis syndrome, fewer than 15% of cases have primary causes.\textsuperscript{4,11}

Piriformis syndrome is most often caused by macrotrauma to the buttocks, leading to inflammation of soft tissue, muscle spasm, or both, with resulting nerve compression.\textsuperscript{1,8,9,11,21} Microtrauma may result from overuse of the piriformis muscle, such as in long-distance walking or running or by direct compression. An example of this kind of direct compression is "wallet neuritis" (ie, repetitive trauma from sitting on hard surfaces).
Findings and procedure details

**Symptoms of Piriformis syndrome:**

Pain with sitting, standing or lying longer than 15 to 20 minutes

Pain and paraesthesia radiating from sacrum through gluteal area and down posterior aspect of thigh usually stopping above knee.

Pain Improves with ambulation and worsens with no movement.

Pain when rising from seated or squatted position.

Change of position does not relieve pain completely.

Contra lateral sacroiliac pain

Difficulty in walking, antalgic pain, foot drop, numbness in foot

Weakness in ipsilateral lower extremity.

Dyspareunia in women, Pain with bowel movements

**Clinical Signs of Piriformis syndrome:**

Tenderness over piriformis muscle

Sausage shaped palpable mass in ipsilateral buttock

Traction of affected limb provides moderate relief of pain.

Asymmetrical weakness in affected limb

Limited medial rotation of ipsilateral lower extremity

Ipsilateral short leg
Gluteal atrophy (chronic cases only)

Persistent sacral rotation toward contralateral side with compensatory lumbar rotation

Positive test signs:


The Lasègue sign: Lase#gue sign is localized pain when pressure is applied over the piriformis muscle and its tendon, especially when the hip is flexed at an angle of 90 degrees and the knee is extended.

Frieberg sign: Freiberg sign is pain experienced during passive internal rotation of the hip.

Piriformis sign: Ipsilateral external rotation of the lower extremity in a patient who is relaxed in the supine position, a positive Piriformis sign.

Pace sign, revealed with the FAIR (flexion, adduction, and internal rotation) test, involves the recreation of sciatic symptoms. 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. The FAIR test result is positive if sciatic symptoms are recreated.

The Beatty test is another diagnostic test for piriformis syndrome. 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.

Diagnpsos

A combination of the medical history and physical assessment as well as neurologic and radiologic testing can be used to 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. Sacroiliitis, other sacroiliac joint dysfunction, and somatic dysfunction of the sacrum and innominates should be considered as possible causes or effects.
of piriformis syndrome and can be determined with a thorough osteopathic structural
examination and radiographic testing.

**Neurophysiologic testing** can also be used in the diagnosis of piriformis syndrome. Electromyography (EMG) may be beneficial in differentiating piriformis syndrome from intervertebral disc herniation. $^{1,3,8,29}$

**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. $^{8,17,31-33}$
Fig. 1: Piriformis syndrome on right: Note the abnormal muscle bulk with atrophy.

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Fig. 2: Piriformis syndrome with abnormal Sciatic nerve course through the muscle with atrophy, Fibrosis. Wallet Neuritis

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Fig. 3: Piriformis Syndrome Right Piriformis Muscle denervation atrophy with good interface with sciatic nerve on right

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Fig. 4: Piriformis Syndrome on Right: Thickening and oedema of right Sciatic nerve with reduced bulk of right Piriformis muscle

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Fig. 5: PROSET MR Neurography coronal sequence showing thickening of S1 root and sciatic nerve on Left passing through Piriformis muscle unlike right side where it passes over the muscle surface

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Fig. 6: Para spinal soft tissue Tuberculosis with exudate tracking along right Piriformis muscle with edema - Right Piriformis syndrome

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Fig. 7: Lumbar spinal Koch’s with exudate along sciatic nerve and Piriformis muscle on left Piriformis syndrome mimic.

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**Fig. 8**: Piriformis Syndrome Right: STIR coronal sequences: Right Piriformis muscle shows altered T2 signal with STIR hyper intensity (arrow) involving muscle belly. Right Sacral trunk shows edema extending in to right superior gluteal nerve

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**Fig. 9:** Chronic Piriformis Syndrome Piriformis muscle atrophy on Left

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Fig. 10: Piriformis syndrome: Thickening of left Lumbo-sacral trunk and Left Sciatic nerve (Red arrow) and Piriformis entrapment with atrophy of left piriformis muscle (Green arrow)
Fig. 11: Chronic Piriformis syndrome: Piriformis atrophy on right > left.
Fig. 12: Hereditary neuropathy with liability to pressure palsies (HNPP) with associated discogenic Pathology Right Piriformis muscle atrophy with edema of right Sciatic nerve-coexisting Piriformis syndrome.

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Fig. 13: Piriformis Muscle atrophy And fibrosis- Piriformis syndrome Post Radiotherapy Invasive Carcinoma Cervix Invading the Sacral plexus and right Piriformis muscle and right Sciatic Nerve -Piriformis syndrome mimic

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**Fig. 14:** Hereditary neuropathy with liability to pressure palsies (HNPP) with associated disco genic Pathology and Piriformis syndrome

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Fig. 15: Post Radiotherapy Invasive Carcinoma Cervix Invading the Sacral plexus and right Pyriformis muscle and right Sciatic Nerve - Piriformis syndrome mimic

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Conclusion

This exhibit comprehensively addresses the anatomical, pathophysiological clinical features of Piriformis syndrome with its and MR neurographic Imaging correlates.
References


