

# Piriformis syndrome

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**Piriformis syndrome** is a neuromuscular disorder that occurs when the sciatic nerve is compressed or otherwise irritated by the piriformis muscle causing pain, tingling and numbness in the buttocks and along the path of the sciatic nerve descending down the lower thigh and into the leg. Diagnosis is often difficult due to few validated and standardized diagnostic tests, but two have been well-described and clinically validated: one is electrophysiological, called the FAIR-test,<sup>[1]</sup> which measures delay in sciatic nerve conductions when the piriformis muscle is stretched against it.<sup>[1]</sup> The other is magnetic resonance neurography, a type of MRI that highlights inflammation and the nerves themselves.<sup>[1]</sup> Some say that the most important criterion is the exclusion of sciatica resulting from compression/irritation of spinal nerve roots, as by a herniated disc. However, compression may be present, but not causal, in the setting of sciatica due to piriformis syndrome.<sup>[1]</sup>

The syndrome may be due to anatomical variations in the muscle-nerve relationship, or from overuse or strain.<sup>[1][2]</sup>

Uncontrolled studies have suggested theories about the disorder; however, a large scale formal prospective outcome trial found that the weight of the evidence-based medicine is that piriformis syndrome should be considered as a possible diagnosis when sciatica occurs without a clear spinal cause.<sup>[3][4]</sup> The need for controlled studies is supported by studies of spinal disc disease that show a high frequency of abnormal discs in asymptomatic patients.<sup>[5]</sup>

## Piriformis syndrome

*Classification and external resources*

<b>ICD-10</b>	G57.0 ( <a href="http://apps.who.int/classifications/icd10/browse/2010/en#/G57.0">http://apps.who.int/classifications/icd10/browse/2010/en#/G57.0</a> )
<b>ICD-9</b>	355.0 ( <a href="http://www.icd9data.com/getICD9Code.aspx?icd9=355.0">http://www.icd9data.com/getICD9Code.aspx?icd9=355.0</a> )
<b>eMedicine</b>	article/87545 ( <a href="http://emedicine.medscape.com/article/87545-overview">http://emedicine.medscape.com/article/87545-overview</a> )
<b>MeSH</b>	D055958 ( <a href="https://www.nlm.nih.gov/cgi/mesh/2014/MB_cgi?field=uid&amp;term=D055958">https://www.nlm.nih.gov/cgi/mesh/2014/MB_cgi?field=uid&amp;term=D055958</a> )

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## Pathophysiology

When the piriformis muscle shortens or spasms due to trauma or overuse, it can compress or strangle the sciatic nerve beneath the muscle. Generally, conditions of this type are referred to as nerve entrapment or as entrapment neuropathies; the particular condition known as *piriformis syndrome* refers to sciatica symptoms not originating from spinal roots and/or spinal disc compression, but involving the overlying piriformis muscle. In 17% of an assumed normal population the sciatic nerve passes through the piriformis muscle, rather than underneath it, and in 16.2% of patients undergoing surgery for a suspected piriformis syndrome such an anomaly was found leading to doubt about the importance of the anomaly as a factor in piriformis syndrome.<sup>[6]</sup> Some researchers discount the importance of this relationship in the etiology of the syndrome.<sup>[6][7]</sup>

Inactive gluteal muscles also facilitate development of the syndrome. These are important in both hip extension and in aiding the piriformis in external rotation of the femur. A major cause for inactive gluteals is unwanted reciprocal inhibition from overactive hip flexors (psoas major, iliacus, and rectus femoris). This imbalance usually occurs where the hip flexors have been trained to be too short and tight, such as when someone sits with hips flexed, as in sitting all day at work. This deprives the gluteals of activation, and the synergists to the gluteals (hamstrings, adductor magnus, and piriformis) then have to perform extra roles they have not evolved to do. Resulting hypertrophy of the piriformis then produces the typical symptoms.

Overuse injury resulting in piriformis syndrome can result from activities performed in the sitting position that involves strenuous use of the legs as in rowing/sculling and bicycling.

Runners, bicyclists and other athletes engaging in forward-moving activities are particularly susceptible to developing piriformis syndrome if they do not engage in lateral stretching and strengthening exercises. When not balanced by lateral movement of the legs, repeated forward movements can lead to disproportionately weak hip abductors and tight adductors.<sup>[8]</sup> Thus, disproportionately weak hip abductors/gluteus medius muscles, combined with very tight adductor muscles, can cause the piriformis muscle to shorten and severely contract. Upon a 40% increase in piriformis size, sciatic nerve impingement is inevitable. This means the abductors on the outside cannot work properly and strain is put on the piriformis.<sup>[8]</sup>

The result of the piriformis muscle spasm can be impingement of not only the sciatic nerve but also the pudendal nerve.<sup>[9]</sup> The pudendal nerve controls the muscles of the bowels and bladder. Symptoms of pudendal nerve entrapment include tingling and numbness in the groin and saddle areas, and can lead to urinary and fecal incontinence.

When piriformis syndrome is caused by weak abductors combined with tight adductors, a highly effective and easy treatment includes stretching and strengthening these muscle groups. An exercise regimen targeting the gluteus medius and hip abductor muscle groups can alleviate symptoms of piriformis syndrome within days.

Another purported cause for piriformis syndrome is stiffness, or hypomobility, of the sacroiliac joints. The resulting compensatory changes in gait would then result in shearing of one of the origins of the piriformis, and possibly some of the gluteal muscles as well, resulting not only in piriformis malfunction but in other low back

pain syndromes as well.

Piriformis syndrome can also be caused by overpronation of the foot. When a foot overpronates it causes the knee to turn medially, causing the piriformis to activate to prevent over-rotating the knee. This causes the piriformis to become overused and therefore tight, eventually leading to piriformis syndrome.

Piriformis syndrome may also be associated with falling injury.<sup>[10]</sup>

## The Sciatic Nerve

The affected nerve in piriformis syndrome is the sciatic nerve. Collectively the tibial and common fibular nerve makes up the general term sciatic nerve.<sup>[11]</sup> Since the sciatic nerve is so close to the piriformis it is acknowledged that the muscle plays a role in irritating the nerve. The sciatic nerve originates from the L4- S2 nerve roots and goes to the front of the sacrum, passing under the piriformis muscle. Different anatomical variations of the sciatic nerve have an effect on piriformis syndrome. The peroneal and tibial are the two divisions of the sciatic nerve. These two divisions are commonly bound together, but in certain cases they are split when they pass through the piriformis muscle, which can have different effects on the piriformis syndrome.<sup>[12]</sup>

## Epidemiology

Piriformis syndrome (PS) data is often confused with other conditions<sup>[13]</sup> due to differences in definitions, survey methods and whether or not occupational groups or general population are surveyed.<sup>[14]</sup> This causes a lack of group harmony about the diagnosis and treatment of PS, affecting its epidemiology.<sup>[15]</sup> In a study, 0.33% of 1293 patients with lower back pain cited an incident for PS.<sup>[15]</sup> A separate study showed 6% of 750 patients with the same incidence.<sup>[15]</sup> About 6% - 8% of lower back pain occurrences were attributed to PS,<sup>[16][17]</sup> though other reports concluded about 5% - 36%.<sup>[13]</sup> In a survey conducted on the general population, 12.2% - 27% included a lifetime occurrence of PS, while 2.2% - 19.5% showed an annual occurrence. However further studies show that the proportion of the sciatica, in terms of PS, is about 0.1% in orthopaedic practice.<sup>[14]</sup> This is more common in women with a ratio of 3 to 1<sup>[15]</sup> and most likely due to the wider quadriceps femoris muscle angle in the os coxae.<sup>[13]</sup> Between the years of 1991- 1994, PS was found to be 75% prevalent in New York, Connecticut, New Jersey, Pennsylvania; 20% in other American urban centers; and 5% in North and South America, Europe, Asia, Africa and Australia.<sup>[16]</sup> The common ages of occurrence happen between thirty and forty, and are scarcely found in patients younger than twenty;<sup>[15]</sup> this has been known to affect all lifestyles.<sup>[13]</sup>

Piriformis syndrome is often 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 lower back and buttock area and then radiating down to the thigh and to the leg.<sup>[18]</sup> A precise test for Piriformis syndrome has not yet been developed and thus hard to diagnose this pain.<sup>[19]</sup> The pain is often initiated by sitting and walking for a longer period.<sup>[20]</sup> In 2012, 17.2% of lower back pain patients developed Piriformis syndrome.<sup>[19]</sup> Piriformis syndrome does not occur in children, and 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.<sup>[21]</sup> In 2011, out of 263 patients between the ages of 45 to 84 treated for Piriformis syndrome, 53.3% were

female. Females are two times more likely to develop Piriformis syndrome than males. Moreover, females had longer stay in hospital during 2011 due to high prevalence of the pain in females. The average cost of treatment was \$29,070 for hospitalizing average 4 days.<sup>[22]</sup>

## Other presentations

In addition to causing gluteal pain that may radiate down buttocks and the leg, the syndrome may present with pain that is relieved by walking with the foot on the involved side pointing outward. This position externally rotates the hip, lessening the stretch on the piriformis and relieving the pain slightly. Piriformis syndrome is also known as "wallet sciatica" or "fat wallet syndrome," as the condition can be caused or aggravated by sitting with a large wallet in the affected side's rear pocket.<sup>[24]</sup>

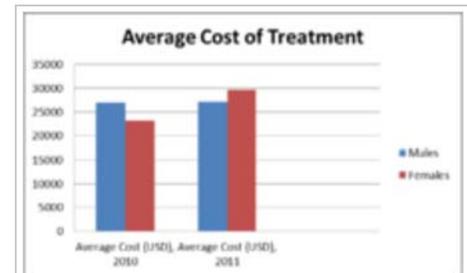
## Diagnosis

Piriformis syndrome occurs when the Sciatic nerve is compressed or pinched by the Piriformis muscle. Indications include sciatica (radiating pain in the buttock, posterior thigh and lower leg) and the physical exam finding of tenderness in the area of the sciatic notch. The pain is exacerbated with activity, prolonged sitting, or walking. The diagnosis is largely clinical and is one of exclusion. In physical examination, attempts are made to stretch the irritated piriformis and provoke sciatic nerve compression, such as the Freiberg, the Pace, the FABER (flexion, abduction, external rotation), and the FAIR (flexion, adduction, internal rotation) maneuvers. Conditions to be ruled out include herniated nucleus pulposus (HNP), facet arthropathy, spinal stenosis, and lumbar muscle strain.<sup>[2]</sup>

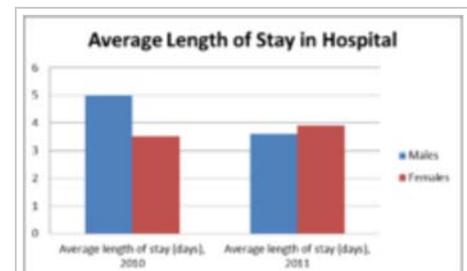
Diagnostic modalities such as CT, MRI, ultrasound, and EMG are mostly useful in excluding other conditions. However, magnetic resonance neurography is a medical imaging technique that can show the presence of irritation of the sciatic nerve at the level of the sciatic notch where the nerve passes under the piriformis muscle. Magnetic resonance neurography is considered "investigational/not medically necessary" by some insurance companies. Neurography can determine whether or not a patient has a split sciatic nerve or a split piriformis muscle – this may be important in getting a good result from injections or surgery. Image guided injections carried out in an open MRI scanner, or other 3D image guidance can accurately relax the piriformis muscle to test the diagnosis. Other injection methods such as blind injection, fluoroscopic guided injection, ultrasound, or EMG guidance can work but are not as reliable and have other drawbacks.

## Prevention

The secondary and most common form of piriformis syndrome, is a result of previous injury due to trauma.<sup>[25]</sup> Larger injuries include trauma to the buttocks while micro traumas result from small repeated bouts of stress on the piriformis.<sup>[26]</sup> Secondary causes are preventable, especially those occurring in daily activities. Periods of



Comparison of the average cost of treatment between males and females in 2010 and 2011. The average cost is nearly the same for males within these two years. However, the cost of treatment increased in 2011 for females. Hcupnet.ahrq.gov (2010, 2011)



Comparison of Length of stay between males and females in 2010 and 2011. The number of stay decreased for males in 2011. However, the number of hospital stay for females increased in 2011.<sup>[23]</sup>

prolonged sitting, especially on hard surfaces, produce minor stress that can be relieved with bouts of standing. An individual's environment including lifestyle factors and physical activity, determine susceptibility to trauma. Taking precaution during high impact sports or working in physically demanding conditions help decrease risk. To avoid these situations, proper safety and padded equipment should be worn for protection during any type of contact. In the work place, individuals must be aware of their surroundings and recognize anything in their routine that may produce micro or macro traumas.

Other prevention strategies include warming up before physical activity, practicing correct exercise form, stretching, and strength training.<sup>[27]</sup> Warm ups decrease the risk of injury during flexion or rotation of the hip. Stretching increases range of motion, while strengthening hip adductors and abductors allows the piriformis to tolerate trauma more readily.<sup>[25]</sup> It is important to stop activity when experiencing pain so further damage does not result.

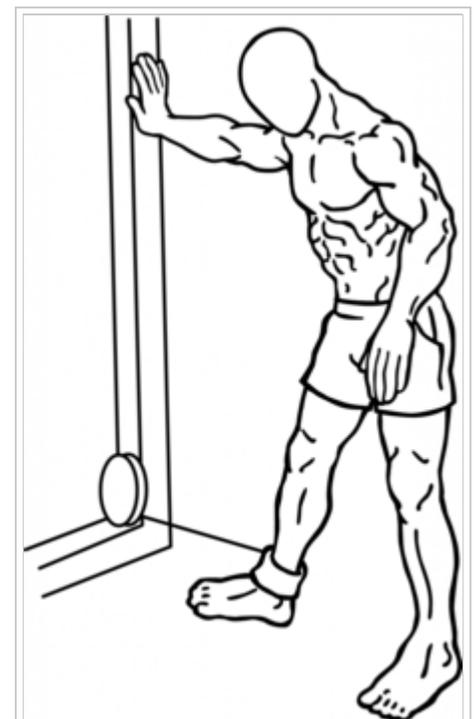
## Treatment

Symptomatic relief of muscle and nerve pain can be obtained by non-steroidal anti-inflammatory drugs and/or muscle relaxants. Conservative treatment usually begins with stretching exercises, myofascial release, massage, and avoidance of contributory activities, such as running, bicycling, rowing, etc. Some clinicians recommend formal physical therapy, including soft tissue mobilization, hip joint mobilization, teaching stretching techniques, and strengthening of the gluteus maximus, gluteus medius, and biceps femoris to reduce strain on the piriformis. More advanced Physical therapy treatment can include pelvic-trochanter isometric stretching, hip abductor, external rotator and extensor strengthening exercises, transcutaneous electrical nerve stimulation (TENS), and massage physiotherapy of the piriformis muscle region.<sup>[28]</sup> Rehabilitation programs that include physical therapy, low doses of muscle relaxants and pain relief medication are effective at alleviating most muscle and nerve pain caused by piriformis syndrome.<sup>[28]</sup>

## Stretching

Stretching is recommended every 2 to 3 waking hours. For optimal stretching capacity, move the hip joint capsule anteriorly and posteriorly.<sup>[29]</sup> The muscle is manually stretched by applying pressure perpendicular to the long axis of the muscle and parallel to the surface of the buttocks until the muscle is relaxed.<sup>[30]</sup> Another stretching exercise is to lie on the side opposite of the pain with the hip and knee of the upper leg flexed and adducted towards the ground while the torso is rotated so that the back of the upper shoulder touches the ground.<sup>[16]</sup>

Physical Therapists may suggest stretching exercises that will target the piriformis, but may also include the hamstrings and hip muscles in order to adequately reduce pain and increase range of motion. Patients with piriformis syndrome may also find relief from ice. Ice can be helpful when the pain starts, or immediately after an activity that causes pain. This may be simply an ice pack, or ice massage.



Hip adduction is a strengthening exercise for the piriformis muscle. A cable attached strapped at the ankle can be used to adduct the hip, bringing the leg in towards the opposite side of the body. The same equipment can also be used for hip abduction where the leg starts beside the opposing leg and moves out to the side, away from the body.

## Strengthening

Muscle strengthening involves working on the hip abductors, external rotators and extensors.<sup>[31]</sup> This treatment involves three phases: non-weight bearing exercises, weight bearing exercises, and ballistic exercises. The purpose of non-weight bearing exercises is to focus on isolated muscle recruitment.<sup>[31]</sup> Ballistic and dynamic exercises consists of plyometrics.

Failure of conservative treatments described above may lead to consideration of various therapeutic injections such as local anesthetics (e.g., lidocaine), Anti-inflammatory drugs and/or corticosteroids, botulinum toxin (BTX, BOTOX), or a combination of the three.<sup>[2]</sup> Injection technique (discussed in above section) is a significant issue since the piriformis is a very deep seated muscle. A radiologist may assist in this clinical setting by injecting a small dose of medication containing a paralyzing agent such as botulinum toxin under high-frequency ultrasound or CT control. This inactivates the piriformis muscle for 3 to 6 months, without resulting in leg weakness or impaired activity.<sup>[32]</sup>

Rarely surgery may be recommended. The prognosis is generally good. Minimal access surgery using newly reported techniques has also proven successful in a large-scale formal outcome published in 2005.<sup>[33]</sup>

Failure of piriformis syndrome treatment may be secondary to an underlying obturator internus muscle injury.<sup>[34]</sup>

## See also

- Sciatica

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  34. ^ "Physical Medicine and Rehabilitation for Piriformis Syndrome Treatment & Management" (<http://emedicine.medscape.com/article/308798-treatment#TreatmentMedicalIssuesComplications>). Retrieved 10 January 2014.

## External links

- Image sequence of piriformis muscle being injected under CT guidance ([http://www.melbournradiology.com.au/index.php?option=com\\_content&view=article&id=102&Itemid=130](http://www.melbournradiology.com.au/index.php?option=com_content&view=article&id=102&Itemid=130))
- Miller TA, White KP, Ross DC (September 2012). "The diagnosis and management of Piriformis Syndrome: myths and facts" (<http://cjns.metapress.com/openurl.asp?genre=article&issn=0317-1671&volume=39&issue=5&spage=577>). *The Canadian Journal of Neurological Sciences. Le Journal Canadien Des Sciences Neurologiques* **39** (5): 577–83. PMID 22931697 (<https://www.ncbi.nlm.nih.gov/pubmed/22931697>).
- *piriformis\_syndrome* ([http://www.ninds.nih.gov/disorders/piriformis\\_syndrome](http://www.ninds.nih.gov/disorders/piriformis_syndrome)) at NINDS

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