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Information Specialists at the National Rehabilitation Information Center field requests on a wide range of disability rehabilitation issues. Information on Piriformis Syndrome is a common request. In this edition of reSearch, the topic of Piriformis Syndrome (PS) is addressed. According to the National Institute of Neurological Disorders and Stroke's Information Page on PS:

Piriformis syndrome is a rare neuromuscular disorder that occurs when the piriformis muscle compresses or irritates the sciatic nerve-the largest nerve in the body. The piriformis muscle is a narrow muscle located in the buttocks. Compression of the sciatic nerve causes pain-frequently described as tingling or numbness-in the buttocks and along the nerve, often down to the leg. The pain may worsen as a result of sitting for a long period of time, climbing stairs, walking, or running.

Of the 10 databases searched only the NARIC and PubMed databases resulted in citations on PS. The main search term used was "Piriformis Syndrome." Between the NARIC and PubMed database there were approximately 64 descriptor terms. A sample of these terms is listed below:

-  Acupuncture
-  Arthroscopy
-  Athletic Injuries
-  Back pain/low
-  Botulinum Toxins
-  Buttocks
-  Decompression, Surgical
-  Electromyography
-  Exercise Therapy
-  Fractures
-  Injections
-  Intervertebral Disk Displacement
-  Ischium
-  Leg Pathology
-  Magnetic Resonance Imaging
-  Manipulation, Chiropractic

reSearch

A collection of research reviews on rehabilitation topics from NARIC and other information resources.

-  Metalloendopeptidases
-  Muscle Contraction
-  Muscular Atrophy
-  Muscular Diseases/Impairments
-  Myofascial Pain Syndromes
-  Nerve Compression Syndromes
-  Neural Conduction
-  Neuromuscular Agents/Diseases
-  Neuroradiography
-  Pain/Measurement
-  Peripheral Nerves
-  Physical Therapy Modalities
-  Postoperative Complications
-  Rehabilitation
-  Sacrococcygeal Region
-  Sciatic Nerve
-  Sciatica/diagnosis/drug therapy
-  Spinal Nerve Roots
-  Surgical Procedures
-  Tendons
-  Treatment Outcomes

The REHABDATA search resulted in two documents ranging from 2002-2004. The PubMed's database search resulted in 29 documents ranging from 2002-2006. The complete citations are included at the end of this research brief.

In addition to document searches, NARIC searched its Program database of the National Institute on Disability and Rehabilitation Research (NIDRR) projects to locate grantees/projects related to the topic of PS. While not completely in the scope of the research subject there is a Rehabilitation Engineering Research Center which researches access to recreational opportunities and physical endurance of people with disabilities. This project and their publications are offered as additional resources for our patrons:

Rehabilitation Engineering Research Center on Recreational Technologies and Exercise Physiology Benefiting Persons with Disabilities (RERC RecTech).
Project Number: H133E020715
(Active)

Documents from NARIC's REHABDATA search listed are listed below:

2004

Broadhurst, Norman A., Simmons, Neil, & Bond, Malcolm J. (2004). **Piriformis syndrome: Correlation of muscle morphology with symptoms and signs.** *Archives of Physical Medicine and Rehabilitation*, 85(12), 2036-2039.

NARIC Accession Number: J48380

ABSTRACT: Presents study conducted to determine whether patients with low back or buttock pain had any piriformis muscle abnormalities and to correlate the diagnostic findings with two symptoms and two clinical signs commonly associated with patients who have buttock pain. The piriformis muscle was injected with bupivacaine after pain was assessed on a visual analog scale using the resisted abduction test. The symptoms examined were pain going up inclines or stairs and pain referred to the posterior thigh. The signs were pain on resisted abduction of the adducted flexed hip and pain produced by needling the muscle. Odds ratios and 95 percent confidence intervals were calculated comparing each of the signs and symptoms with normal morphology. The highest odds ratios were found for pain on walking up inclines (10.8), referred pain (5.3) and pain on needling the piriformis muscle (6.0).

2002

Fishman, L.M., Dombi, G.W., Michaelsen, C., Ringel, S., Rozbruch, J., Rosner, B., & Weber, C. (2002). **Piriformis syndrome: Diagnosis, treatment, and outcome: A 10-year study.** *Archives of Physical Medicine and Rehabilitation*, 83(3), 295-301.

NARIC Accession Number: J43761

ABSTRACT: Study was conducted to validate an operational definition of piriformis syndrome (PS) based on prolongation of the H-reflex with hip flexion, adduction, and internal rotation (FAIR) and to assess surgical and nonsurgical treatments. Researchers develop working diagnostic criteria, validate evidence of the syndrome, and assess treatment of cases diagnosed by each criterion. Authors conclude that the FAIR test correlates well with a working definition of PS and is a better predictor of successful physical therapy and surgery than the working definition. The FAIR test, used in conjunction with injections and physical therapy and/or surgery, appears to be effective for diagnosing and treating PS.

Documents from the National Library of Medicine PubMed search at <http://www.pubmed.com/> are listed below:

2006

Chang, C.W., Shieh, S.F., Li, C.M., Wu, W.T., & Chang, K.F. (2006). **Measurement of motor nerve conduction velocity of the sciatic nerve in patients with piriformis syndrome: a magnetic stimulation study.** *Archives of Physical Medicine and Rehabilitation*, 87(10), 1371-5.

PMID: 17023248

ABSTRACT: To assess the motor nerve conduction of the sciatic nerve by a magnetic stimulation method in patients with piriformis syndrome (PS). **DESIGN:** Prospective study. **SETTING:** An electrodiagnostic laboratory in a university hospital. **PARTICIPANTS:** Twenty-three patients with PS and 15 healthy persons for control. **INTERVENTIONS:** Not applicable. **MAIN OUTCOME MEASURES:** Motor nerve conduction velocity (MNCV) of the sciatic nerve was measured at the gluteal segment by magnetic stimulation proximally at L5 and S1 roots and distally at sciatic nerve at gluteal fold and recording at the corresponding muscles. Diagnostic sensitivities were measured in the magnetic stimulation method and the conventional nerve conduction, long latency reflex, and needle electromyography studies. **RESULTS:** The mean MNCV of the sciatic nerve +/- standard deviation at the gluteal segment in L5 component was 55.4+/-7.8 m/s in patients with PS, which was slower than the mean value of 68.1+/-10.3 m/s obtained in healthy controls (P=.014). The MNCV of the sciatic nerve in S1 component showed no significant difference between the patients and controls (P=.062). A negative relation was found between the disease duration and the MNCV values of sciatic nerves in patients with PS (r=-.68, P<.01). The diagnostic sensitivity by magnetic stimulation is .467. **CONCLUSIONS:** Magnetic nerve stimulation provides a painless, noninvasive, and objective method for evaluation of sciatic nerve function in patients with PS.

Dressler, D., & Eleopra, R. (2006). **Clinical use of non-A botulinum toxins: botulinum toxin type B.** *Neurotoxicity Research*, 9(2-3), 121-5.

PMID: 16785108

ABSTRACT: Botulinum neurotoxin type B (BT, BT-B) has been used as NeuroBloc/MyoBloc since 1999 for treatment of cervical dystonia, hyperhidrosis, spastic conditions, cerebral palsy, hemifacial spasm, bladder dysfunction, spasmodic dysphonia, sialorrhoea, anal fissures, piri-

formis syndrome, various pain conditions, and cosmetic applications. Generally, its therapeutic effects are comparable to BT type A (BT-A). The adverse effect profiles of BT-B and BT-A, however, differ considerably. BT-B has been found to produce more regional as well as systemic anticholinergic adverse effects, such as dryness of mouth, accommodation difficulties, conjunctival irritation, reduced sweating, dysphagia, heartburn, constipation, bladder voiding difficulties, and dryness of nasal mucosa. In BT-B the relationship between autonomic and motor effects known from BT-A is substantially shifted towards autonomic effects. BT-B, therefore, should be used carefully in patients with autonomic disorders and in patients with concomitant anticholinergic therapy. If NeuroBloc/MyoBloc is used to treat cervical dystonia patients with antibody-induced failure of BT-A therapy, 86 percent of those will develop complete secondary therapy failure after five applications. If NeuroBloc/MyoBloc used to treat cervical dystonia patients without prior exposure to BT, 44 percent of those will develop complete secondary therapy failure after nine applications. NeuroBloc/MyoBloc, therefore, is associated with substantial antigenicity problems originating from a particular low specific biological potency. Systemic anticholinergic adverse effects and high antigenicity limits the clinical use of NeuroBloc/MyoBloc considerably.

Ferreira, J.J., Couto, M., Costa, J., Coelho, M., Rosa, M.M., & Sampaio, C. (2006). **Botulinum toxin for the treatment of pain syndromes.** *Acta Reumatológica Portuguesa*, 31(1), 49-62. (Article is in Portuguese). PMID: 17058384

ABSTRACT: Although botulinum toxin (BoNT) is being used for therapeutic purposes for more than 20 years, the list of potential new indications continues to increase and includes various pain syndromes. The pain relief experienced by patients with dystonia and spasticity from intramuscular BoNT injections suggested that other chronic skeletal-muscles pain conditions may also benefit. BoNT inhibits the release of acetylcholine at the neuromuscular junction thereby reducing striatal muscle contractions and the proposed analgesic property was initially attributed to muscular relaxation. A specific analgesic BoNT effect is difficult to conclude from studies where pain is conditioned by other associated symptoms like dystonia, muscle contraction or spasticity. One alternative is to critically appraise clinical trials where BoNT was studied as the active intervention and pain evaluated as an outcome. From this analysis there is convincing evidence for the effectiveness of BoNT in the treatment of pain associated with cervical dystonia. For all other pain syndromes there have been relatively few, small sized,

placebo-controlled studies (myofascial pain syndrome, chronic neck and low back pain, piriformis syndrome and fibromyalgia) and the results of these studies have been contradictory or non conclusive. To establish the analgesic properties of BoNT there is a need for appropriately designed, exploratory randomized controlled studies in well accepted human models of nociceptive or neuropathic pain. This does not exclude the subsequent need to conduct pragmatic trials to evaluate the effectiveness of BoNT in conditions where the improvement of pain or any associated clinical sign or symptom may be of clinical relevance.

Kosukegawa, I., Yoshimoto, M., Isogai, S., Nonaka, S., & Yamashita, T. (2006). **Piriformis syndrome resulting from a rare anatomic variation.** *Spine*, 31(18), E664-6. PMID: 16915082

ABSTRACT: STUDY DESIGN: Case report. OBJECTIVES: We report a rare case of piriformis syndrome (PS) accompanying anatomic variation in the piriformis muscle and sciatic nerve. SUMMARY OF BACKGROUND DATA: Beaton classified anatomic variation in the piriformis muscle and sciatic nerve into six types based on cadaver studies. There has been no report in the English literature of surgical treatment for a case of PS accompanying Beaton type d anatomic variation. METHODS: A patient with sciatica showing no nerve root compression in lumbar MRI underwent pelvic MRI and perineurography of the sciatic nerve followed by CT. The findings in these images suggested PS accompanying anatomic variation of the piriformis muscle and sciatic nerve. Surgical treatment was performed. RESULTS: Surgical exploration of the piriformis muscle revealed Beaton type d anatomic variation. Both anterior and posterior lobes of the piriformis muscle were resected. The pain in the leg had completely disappeared after surgery. CONCLUSIONS: This is a very rare case of surgically treated PS resulting from type d anatomic variation in Beaton's classification. Pelvic MRI and perineurography of the sciatic nerve were useful for diagnosis in this case.

Mayrand, N., Fortin, J., Descarreaux, M., & Normand M.C. (2006). **Diagnosis and management of posttraumatic piriformis syndrome: a case study.** *Journal of Manipulative and Physiological Therapeutics*, 29(6), 486-91.

PMID: 16904496

ABSTRACT: OBJECTIVE: The aim of this study is to describe the clinical management of a young male patient with sciatica symptoms that developed after an avulsion of the ischial tuberosity. This is a rare injury, but complications may occur. CLINICAL FEATURE: A 19-

year-old patient developed sciatica six months after a football injury. The patient described his symptoms as a shooting pain from the buttock to the lateral part of the foot, along the back of his thigh and calf, sometimes accompanied by paresthesia. Physical examination showed restricted hip range of motion and a positive Bonnet's test. X-ray analysis revealed a bony overgrowth of the right ischial tuberosity. **INTERVENTION AND OUTCOME:** A treatment plan was designed to decrease the pain level, increase sacroiliac and lumbar joint mobility, and augment muscular extensibility. The patient received 20 treatments over a period of approximately three months. Complete recovery was observed five months later. **CONCLUSION:** Although many differential diagnoses were contemplated, it is most likely that changes in muscular tension and gait pattern, resulting from the ischial tuberosity avulsion, contributed to overuse of the piriformis muscle leading to a piriformis syndrome.

Monnier, G., Tatu, L., & Michel, F. (2006). **New indications for botulinum toxin in rheumatology.** *Joint, Bone, Spine : Revue du Rhumatisme*, [Epub ahead of print]. PMID: 16997603

ABSTRACT: Previously known only as a deadly bacterial poison responsible for severe paralysis, botulinum toxin is now a well-recognized therapeutic agent used to relieve involuntary movements, dystonia-related functional impairments, spasticity, and autonomic disorders such as hyperhidrosis. Musculoskeletal pain in patients with rheumatic disorders is among the emerging indications for botulinum toxin therapy. Preliminary data have been obtained in patients with cervical or thoracolumbar myofascial pain syndrome, chronic low back pain, piriformis muscle syndrome, tennis elbow, and stiff person syndrome. At present, the effects of botulinum toxin and its use for pain relief remain controversial. Carefully designed prospective trials are needed to investigate the efficacy and safety of botulinum toxin in pain disorders.

Ripani, M., Continenza, M.A., Cacchio, A., Barile, A., Parisi, A., & De Paulis, F. (2006). **The ischiatic region: Normal and MRI anatomy.** *The Journal of Sports Medicine and Physical Fitness*, 46(3), 468-75. PMID: 16998454

ABSTRACT: **AIM:** The aim of this study was to describe the anatomy correlated to the normal magnetic resonance imaging (MRI) images of the proximal thigh region and the ischial tuberosity. **METHODS:** MRI coronal and axial sequences were obtained from 20 asymptomatic volunteers (10 male and 10 female) ages 20 to 38 years (mean age: 28 years), and then they were compared with two anatomical dissections and seven cryosections of six ca-

daver thighs. **RESULTS:** The anatomical specimens were directly correlated with MRI scans. From the comparison it could be seen how the axial MRI sequences well outlined the sciatic nerve, usually observed oval in shape with moderate signal intensity, and thus easily detectable from other surrounding organs. Other structures were also identified by axial images: the ischial tuberosity, the proximal origin of the hamstring muscles arising from the ischium and the related bursae, the gluteus maximus and its bursa, the quadratus femoris and its inconstant bursa, a triangular adipose body and vessels. Coronal scans also showed well the hamstring muscles, both in length and thickness. **CONCLUSIONS:** Both MRI images and cadaver dissections showed the ischial tuberosity as an interesting intersection area that could be delimited as follows: on the dorsal border the gluteus maximus and its bursa, on the dorso-medial side the hamstring muscle origin, and on the antero-lateral side the quadratus femoris muscle with its inconstant bursa and the ischial tuberosity. These anatomical and MRI descriptions are very useful to give a contribution to the right explanation of sciatic symptoms caused by those sports specifically overloading the hamstring muscles. Frequently, in fact, in these athletes a sciatic syndrome arise drawing the physician's attention to the lumbosacral joint or to the sciatic nerve course near the piriformis muscle. Another very important site where the sciatic symptoms can rise, indeed, could also be found in the hamstring muscle region, where the nerve run under the gluteus maximus beside the ischiatic bone. Athletes who manifest notorious muscle overload in this anatomical region usually show sciatic pain symptoms that are not to be related with pathologies of the lumbosacral junction nor to relationships of the sciatic nerve with the piriformis muscle but rather to relationships that this nerve acquires with either gluteal muscles as well as with muscles of the underneath ischiatic region.

2005

Filler, A.G., Haynes, J., Jordan, S.E., Prager, J., Villablanca, J.P., Farahani, K., McBride, D.Q., Tsuruda, J.S., Morisoli, B., Batzdorf, U., & Johnson, J.P. (2005). **Sciatica of nondisc origin and piriformis syndrome: diagnosis by magnetic resonance neurography and interventional magnetic resonance imaging with outcome study of resulting treatment.** *Journal of Neurosurgery. Spine*, 2(2), 99-115. PMID: 15739520

ABSTRACT: **OBJECT:** Because lumbar magnetic resonance (MR) imaging fails to identify a treatable cause of chronic sciatica in nearly one million patients annually,

the authors conducted MR neurography and interventional MR imaging in 239 consecutive patients with sciatica in whom standard diagnosis and treatment failed to effect improvement. **METHODS:** After performing MR neurography and interventional MR imaging, the final rediagnoses included the following: piriformis syndrome (67.8 percent), distal foraminal nerve root entrapment (6 percent), ischial tunnel syndrome (4.7 percent), discogenic pain with referred leg pain (3.4 percent), pudendal nerve entrapment with referred pain (3 percent), distal sciatic entrapment (2.1 percent), sciatic tumor (1.7 percent), lumbosacral plexus entrapment (1.3 percent), unappreciated lateral disc herniation (1.3 percent), nerve root injury due to spinal surgery (1.3 percent), inadequate spinal nerve root decompression (0.8 percent), lumbar stenosis (0.8 percent), sacroiliac joint inflammation (0.8 percent), lumbosacral plexus tumor (0.4 percent), sacral fracture (0.4 percent), and no diagnosis (4.2 percent). Open MR-guided Marcaine injection into the piriformis muscle produced the following results: no response (15.7 percent), relief of greater than eight months (14.9 percent), relief lasting two to four months with continuing relief after second injection (7.5 percent), relief for two to four months with subsequent recurrence (36.6 percent), and relief for 1 to 14 days with full recurrence (25.4 percent). Piriformis surgery (62 operations; three-cm incision, transgluteal approach, 55 percent outpatient; 40 percent with local or epidural anesthesia) resulted in excellent outcome in 58.5 percent, good outcome in 22.6 percent, limited benefit in 13.2 percent, no benefit in 3.8 percent, and worsened symptoms in 1.9 percent. **CONCLUSIONS:** This Class A quality evaluation of MR neurography's diagnostic efficacy revealed that piriformis muscle asymmetry and sciatic nerve hyperintensity at the sciatic notch exhibited a 93 percent specificity and 64 percent sensitivity in distinguishing patients with piriformis syndrome from those without who had similar symptoms ($p < 0.01$). Evaluation of the nerve beyond the proximal foramen provided eight additional diagnostic categories affecting 96 percent of these patients. More than 80 percent of the population good or excellent functional outcome was achieved.

Ugrenovic, S., Jovanovic, I., Krstic, V., Stojanovic, V., Vasovic, L., Antic, S., & Pavlovic, S. (2005). **The level of the sciatic nerve division and its relations to the piriform muscle.** *Vojnosanitetski Pregled. Military-Medical and Pharmaceutical Review*, 62(1), 45-9. (Article is in Serbian).
PMID: 15715349

ABSTRACT: BACKGROUND: The sciatic nerve, as the terminal branch of the sacral plexus, leaves the pelvis through the greater sciatic foramen beneath the piriform muscle. Afterwards, it separates into the tibial and the common peroneal nerve, most frequently at the level of the upper angle of the popliteal fossa. Higher level of the sciatic nerve division is a relatively frequent phenomenon and it may be the cause of an incomplete block of the sciatic nerve during the popliteal block anesthesia. There is a possibility of different anatomic relations between the sciatic nerve or its terminal branches and the piriform muscle (piriformis syndrome). The aim of this research was to investigate the level of the sciatic nerve division and its relations to the piriform muscle. It was performed on 100 human fetuses (200 lower extremities) which were in various gestational periods and of various genders, using micro-dissection method. Characteristic cases were photographed. **RESULTS:** Sciatic nerve separated into the tibial and common peroneal nerve in popliteal fossa in 72.5 percent of the cases (bilaterally in the 66 percent of the cases). In the remainder of the cases the sciatic nerve division was high (27.5 percent of the cases) in the posterior femoral or in the gluteal region. Sciatic nerve left the pelvis through the infrapiriform foramen in 192 lower extremities (96 percent of the cases), while in eight lower extremities (4 percent of the cases) the variable relations between sciatic nerve and piriform muscle were detected. The common peroneal nerve penetrated the piriform muscle and left the pelvis in five lower extremities (2.5 percent of the cases) and the tibial nerve in those cases left the pelvis through the infrapiriform foramen. In three lower extremities (1.5 percent of the cases) common peroneal nerve left the pelvis through suprapiriform, and the tibial nerve through the infrapiriform foramen. The high terminal division of sciatic nerve (detected in 1/3 of the cases), must be kept in mind during the performing of popliteal block anesthesia. **CONCLUSION:** Although very rare, anatomical abnormalities of common peroneal nerve in regard to piriform muscle are still possible.

2004

Betts, A. (2004). **Combined fluoroscopic and nerve stimulator technique for injection of the piriformis muscle.** *Pain Physician*, 7(2), 279-81.

PMID: 16868605

ABSTRACT: The diagnosis of radicular pain secondary to Piriformis Muscle Syndrome has been historically difficult due to lack of accurate means to identify and selectively inject the piriformis muscle. This paper describes a

simple and reproducible technique to safely inject the piriformis muscle, using a combination of fluoroscopic guidance and a standard neuro-muscular stimulator.

Broadhurst, N.A., Simmons, D.N., & Bond, M.J. (2004). **Piriformis syndrome: Correlation of muscle morphology with symptoms and signs.** *Archives of Physical Medicine and Rehabilitation*, 85(12), 2036-9.

PMID: 15605344

ABSTRACT: **OBJECTIVE:** To determine the relation of symptoms and pain provocation tests to abnormal piriformis morphology among people with chronic buttock pain. **DESIGN:** Each of two clinical symptoms and two clinical signs were compared with the abnormal morphology found on ultrasound. The pain-free side was used as an internal control. **SETTING:** A tertiary referral center. **PARTICIPANTS:** A series of 27 consecutive patients (26 women, one man; average age, 48 years) with chronic low lumbosacral or buttock pain, who presented to a musculoskeletal clinic over a 12-month period, underwent ultrasound assessment of piriformis muscle morphology. Four patients were excluded because their body mass index was in excess of 30 kg/m. **INTERVENTION:** The symptomatic piriformis muscle was injected with bupivacaine after pain was assessed on a visual analog scale (VAS), using the resisted abduction test. **MAIN OUTCOME MEASURE:** A 70 percent reduction of pain on the VAS was considered positive for pain in the piriformis muscle. **RESULTS:** Odds ratios (ORs) and 95 percent confidence intervals were calculated comparing each of the signs and symptoms with normal morphology. The highest ORs were found for pain on walking up inclines (10.8), referred pain (5.3), and pain on needling the piriformis muscle (6.0). **CONCLUSIONS:** This study did not provide a criterion standard for the diagnosis of piriformis syndrome, but it did support the syndrome as a contributing factor in chronic buttock pain and very low back pain.

Fishman, L.M., Konnoth, C., & Rozner, B. (2004). **Botulinum neurotoxin type B and physical therapy in the treatment of piriformis syndrome: a dose-finding study.** *American Journal of Physical Medicine & Rehabilitation*, 83(1), 42-50; quiz 51-3.

PMID: 14709974

ABSTRACT: **OBJECTIVE:** To measure dosage effects of botulinum neurotoxin type B with physical therapy in piriformis syndrome (PS). **DESIGN:** Prospective study

of consecutive patients complaining of buttock pain and sciatica, measuring serial H-reflex tests in flexion, adduction, and internal rotation; visual analog scale; and adverse effects at 0, 2, 4, 8, and 12 wks. We used an electrophysiologic criterion for PS: a 1.86-msec prolongation of the H-reflex with the flexion, adduction, and internal rotation test. Four PS groups were identified. Serial groups were injected once with either 5000, 7500, 10,000, or 12,500 units of botulinum neurotoxin type B in successive months under electromyographic guidance in four separate locations of the affected piriformis muscle, with a one-month safety observation period between groups. Patients received physical therapy twice weekly for three months. **RESULTS:** The flexion, adduction, and internal rotation test and visual analog scale declined significantly, correlating at 72 percent sensitivity and 77 percent specificity. A total of 24 of 27 study patients had ≥ 50 percent pain relief. Mean visual analog scale score declined from 6.7 to 2.3. A volume of 12,500 units of botulinum neurotoxin type B was superior to 10,000 units at two weeks post-injection. The most severe adverse effects were dry mouth and dysphagia, approaching 50 percent of patients at two and four weeks. **CONCLUSION:** Physical therapy and 12,500 units of botulinum neurotoxin type B seem to be safe and effective treatment for PS. In addition, the flexion, adduction, and internal rotation test seems to be an effective means of diagnosing PS and assessing its clinical improvement. Injection may benefit patients for greater than three months.

Lang, A.M. (2004). **Botulinum toxin type B in piriformis syndrome.** *American Journal of Physical Medicine & Rehabilitation*, 83(3), 198-202.

PMID: 15043354

ABSTRACT: **OBJECTIVE:** To evaluate the clinical safety and efficacy of botulinum toxin type B (MYOBLOC) in reducing myofascial pain associated with piriformis syndrome (PS). **DESIGN:** This was a single-center, outpatient, open-label study of patients with PS. Subjects were treated unilaterally or bilaterally, depending on their symptoms. Evaluations and procedures were performed by a single examiner who was not blinded, and there were no control subjects in this case series. Each piriformis muscle was infiltrated from one injection site under electromyographic guidance with 5000 units of botulinum toxin type B. **RESULTS:** A total of 20 patients were enrolled in this study. Significant reductions in mean visual analog scale scores for buttock and hip pain were

noted at weeks 4, 12, and 16 and for low back pain at weeks 2, 12, and 16. Visual analog scale scores for general and low back pain, pain radiating into lower limbs, and tingling were significantly lower at week two after injection, suggesting early onset. A total of 95 percent of patients reported fair to excellent improvement in pain. Botulinum toxin type B was considered to have fair to excellent efficacy in 90 percent of patients, as evaluated by the investigator rating of overall efficacy. Botulinum toxin treatment was well tolerated. Dry mouth was the most common treatment emergent adverse event, reported in 6 of 20 patients. **CONCLUSIONS:** Findings suggest the possibility that botulinum toxin type B may be of potential benefit in the treatment of pain attributed to PS.

Lee, E.Y., Margherita, A.J., Gierada, D.S., & Narra, V.R. (2004). **MRI of piriformis syndrome.** *American Journal of Roentgenology*, 183(1), 63-4.

PMID: 15208111

ABSTRACT: No abstract is available.

Papadopoulos, E.C., & Khan, S.N. (2004). **Piriformis syndrome and low back pain: a new classification and review of the literature.** *The Orthopedic Clinics of North America*, 35(1), 65-71.

PMID: 15062719

ABSTRACT: Piriformis syndrome (PS) is a common cause of low back pain. It is often not included in the differential diagnosis of back, buttock, and leg pain. Additionally it has received minimal recognition because it is often seen as a diagnosis of exclusion. Familiarity with the common elements of the syndrome should increase its recognition and facilitate the appropriate treatment. These include buttock pain and tenderness with or without electrodiagnostic or neurologic signs. Pain is exacerbated in prolonged sitting. Specific physical findings are tenderness in the sciatic notch and buttock pain in flexion, adduction, and internal rotation of the hip. Imaging modalities are rarely helpful, but electrophysiologic studies should confirm the diagnosis, if not immediately, then certainly in a patient re-evaluation and as such should be sought persistently. Physical therapy aims at stretching the muscle and reducing the vicious cycle of pain and spasm. It is a mainstay of conservative treatment, usually enhanced by local injections. Surgery should be reserved as a last resort in case of failure of all conservative modalities. PS may constitute up to five percent of cases of low back, buttock, and leg pain. Recognition and widespread appreciation of the clinical presentation improves its early detection and accurate treatment.

Skriabin, E.G. (2004). **Exercise therapy and massage in the treatment of piriformis muscle syndrome in pregnant women.** *Voprosy kurortologii, fizioterapii, i lechebnoi fizicheskoi kultury*, Mar.-Apr.(2), 42-4. (Article is in Russian).

PMID: 15154359

ABSTRACT: No abstract is available.

Vallejo, M.C., Mariano, D.J., Kaul, B., Sah, N., & Ramanathan, S. (2004). **Piriformis syndrome in a patient after cesarean section under spinal anesthesia.** *Regional Anesthesia and Pain Medicine*, 29(4), 364-7.

PMID: 15305258

ABSTRACT: **OBJECTIVES:** The diagnosis, pathogenesis, and treatment of piriformis syndrome (PS) as a cause of persistent buttock and hip pain after spinal anesthesia are presented in this case report. **CASE REPORT:** A 29-year-old woman presented five days after cesarean delivery with sudden onset of pain in the left buttock and left hip radiating to the posterior knee with fever. She was subsequently diagnosed with PS. **CONCLUSIONS:** Back pain with radiation into the buttocks after spinal anesthesia is frequently attributed to the spinal procedure itself. However, prolonged sitting and weight bearing in the upright position after cesarean delivery can cause sciatic nerve compression at the sacroiliac joint with concomitant irritation, inflammation, and spasm of the piriformis muscle. PS is frequently underdiagnosed in the obstetric population. Because the diagnosis of PS is based mainly on clinical signs and symptoms, the clinician must have a high index of suspicion.

2003

Benzon, H.T., Katz, J.A., Benzon, H.A., & Iqbal, M.S. (2003). **Piriformis syndrome: anatomic considerations, a new injection technique, and a review of the literature.** *Anesthesiology*, 98(6), 1442-8.

PMID: 12766656

ABSTRACT: **BACKGROUND:** Piriformis syndrome (PS) can be caused by anatomic abnormalities. The treatments of PS include the injection of steroid into the piriformis muscle and near the area of the sciatic nerve. These techniques use either fluoroscopy and muscle electromyography to identify the piriformis muscle or a nerve stimulator to stimulate the sciatic nerve. **METHODS:** The authors performed a cadaver study and noted anatomic variations of the piriformis muscle and sciatic nerve. To standardize their technique of injection, they also noted the distance from the lower border of the sacroiliac joint (SIJ)

to the sciatic nerve. They retrospectively reviewed the charts of 19 patients who had received piriformis muscle injections, noting the site of needle insertion in terms of the distance from the lower border of the SIJ and the depth of needle insertion at which the motor response of the foot was elicited. The authors tabulated the response of the patients to the injection, any associated diagnoses, and previous treatments that these patients had before the injection. Finally, they reviewed the literature on PS, a rare cause of buttock pain and sciatica. **RESULTS:** In the cadavers, the distance from the lower border of the SIJ to the sciatic nerve was 2.9 +/- 0.6 (1.8-3.7) cm laterally and 0.7 +/- 0.7 (0.0-2.5) cm caudally. In 65 specimens, the sciatic nerve passed anterior and inferior to the piriformis. In one specimen, the muscle was bipartite and the two components of the sciatic nerve were separate, with the tibial nerve passing below the piriformis and the peroneal nerve passing between the two components of the muscle. In the patients who received the injections, the site of needle insertion was 1.5 +/- 0.8 (0.4-3.0) cm lateral and 1.2 +/- 0.6 (0.5-2.0) cm caudal to the lower border of the SIJ as seen on fluoroscopy. The needle was inserted at a depth of 9.2 +/- 1.5 (7.5-13.0) cm to stimulate the sciatic nerve. Patients had comorbid etiologies including herniated disc, failed back surgery syndrome, spinal stenosis, facet syndrome, SIJ dysfunction, and complex regional pain syndrome. Sixteen of the 19 patients responded to the injection, their improvements ranged from a few hours to three months. **CONCLUSIONS:** Anatomic abnormalities causing PS are rare. The technique used in the current study was successful in injecting the medications near the area of the sciatic nerve and into the piriformis muscle.

Dezawa, A., Kusano, S., & Miki, H. (2003). **Arthroscopic release of the piriformis muscle under local anesthesia for piriformis syndrome.** *Arthroscopy: The Journal of Arthroscopic & Related Surgery*, 19(5), 554-7.

PMID: 12724687

ABSTRACT: We developed a minimally invasive technique of releasing the piriformis muscle under endoscopic control for entrapment neuropathy of the sciatic nerve because of tension and contraction of the piriformis muscle. This surgical technique was performed in patients who fulfilled at least five of nine diagnostic criteria we established and who did not respond to conservative therapy for six months or more. Although a cavity was maintained using a disposable syringe (10 mL) with a cut

tip, an arthroscope (4 mm in diameter) was inserted at an oblique viewing angle of 30 degrees, and the muscle was identified. The area from the musculotendinous junction to the muscle was gradually incised using a special scraper. In particular, pain disappeared simultaneously with release of the piriformis muscle during surgery. With this technique, an adequate cavity can be produced and maintained in a manner similar to that in posterior endoscopic surgery for intervertebral disc herniation. This technique is useful for reducing postoperative pain and allows early return to activity.

Fishman, L.M., & Schaefer, M.P. (2003). **The piriformis syndrome is underdiagnosed.** *Muscle & Nerve*, 28(5), 646-9.

PMID: 14571472

ABSTRACT: No abstract is available.

Jroundi, L., El Quessar, A., Chakir, N., El Hassani, M.R., & Jiddane, M. (2003). **The piriformis syndrome: a rare cause of non discogenic sciatica. A case report.** *Journal de Radiology*, 84(6), 715-7. (Article is in French).

PMID: 12910180

ABSTRACT: Atypical sciatic pain without apparent discogenic origin should raise the possibility of a non-discogenic etiology, especially tumoral but also infectious or inflammatory. We report the case of a young patient presenting with non-discogenic S1 radiculopathy due to sciatic nerve involvement in the subpiriformis canal secondary to piriformis muscle inflammation. The authors review technical considerations and results of MRI which is of great value in the evaluation of piriformis muscle pathology.

Shu, H. (2003). **Clinical observation on acupuncture treatment of piriformis syndrome.** *Journal of Traditional Chinese Medicine*, 23(1), 38-9.

PMID: 12747195

ABSTRACT: No abstract is available.

Stewart, J.D. (2003). **The piriformis syndrome is overdiagnosed.** *Muscle & Nerve*, 28(5):644-6.

PMID: 14571471

ABSTRACT: No abstract is available.

Wu, Q. (2003). **Piriformis syndrome treated by triple puncture with the bai hu yao tou maneuver.** *Journal of traditional Chinese medicine*, 23(3):197-8.

PMID: 14535185

ABSTRACT: No abstract is available.

2002

Diop, M., Parratte, B., Tatu, L., Vuillier, F., Faure, A., & Monnier, G. (2002). **Anatomical bases of superior gluteal nerve entrapment syndrome in the suprapiriformis foramen.** *Surgical and Radiologic Anatomy*, 24(3-4), 155-9.

PMID: 12375066

ABSTRACT: Observation of a 60 year-old-man with superior gluteal nerve (SGN) entrapment neuropathy in the suprapiriformis foramen encouraged us to explore, through anatomical dissection, the possible morphological etiologies of this condition. Ten SGNs in five embalmed cadavers were dissected via gluteal and pelvic access. The origin, course and distribution of the nervous trunk and its relations were studied. In most cases, the nerve fibers of the SGN arose from ventral branches of L4, L5 and S1 to constitute the nervous trunk in the pelvis, then reached the gluteal area and divided into two branches, cranial and caudal. By running through the suprapiriformis foramen with the cranial gluteal vascular pedicle, the nervous trunk was always up between the superior edge of the piriformis muscle and the greater sciatic notch; rarely some of the nerve fibers went through the muscle. Bone, muscular and vascular morphological factors liable to cause SGN entrapment syndrome, and the circumstances of discovery, were analyzed. The role of hypertrophy of the piriformis muscle, resulting in a narrow suprapiriformis foramen, was confirmed through surgery.

Foster, M.R. (2002). **Piriformis syndrome.** *Orthopedics*, 25(8), 821-5.

PMID: 12195908

ABSTRACT: Seven patients underwent release of the piriformis from the femur. Patients with residual symptoms after conservative treatment had dramatic relief of sciatica and 70 percent resumed customary work after surgery. Minimum follow-up was 31 months (average: 51 months). Early diagnosis can avoid prolonging ineffective empiric treatment and disability with satisfactory results achieved in most patients by conservative treatment and relief of sciatica in selected surgical cases.

Indrekvam, K., & Sudmann, E. (2002). **Piriformis muscle syndrome in 19 patients treated by tenotomy—a 1- to 16-year follow-up study.** *International Orthopaedics*, 26(2), 101-3.

PMID: 12078870

ABSTRACT: We treated 19 patients with piriformis muscle syndrome. All patients complained of pain in the buttocks and the posterior thigh. Clinically the buttock

was tender and passive stretching increased the pain. In ten patients skin sensation was reduced and three had a limp. All patients were treated with tenotomy. At follow-up after an average of eight (1-16) years, eight patients had pain relief. Two-thirds of the patients evaluated their clinical state as being better.

Read, M.T. (2002). **The “piriformis syndrome”—myth or reality?** *British Journal of Sports Medicine*, 36(1), 76.

PMID: 11867501

ABSTRACT: No abstract is available.

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