Conservative Management of Piriformis Syndrome

Douglas R. Keskula, MS, PT, ATC
Michael Tamburello, MS, PT

ABSTRACT: Piriformis syndrome is a questionable clinical entity that has been cited as a cause of buttock pain and sciatica. The intimate relationship between the piriformis and the sciatic nerve has been suspected as being the source of the signs and symptoms that often appear following minor trauma to the pelvic or buttock region. Muscle function is an important consideration in the evaluation and treatment of the athlete with suspected piriformis syndrome. The action of the piriformis muscle on the hip varies as the hip moves from a neutral to a flexed position. While in a flexed position, the piriformis internally rotates and abducts the hip, however, in a neutral position, the piriformis acts as an external rotator of the hip. A comprehensive evaluation provides the information necessary to design a treatment plan specific to the involved structures, while meeting the functional needs of the individual athlete. This paper describes the anatomy, pathomechanics, physical examination, and treatment options relevant to the piriformis syndrome. Treatment protocols stressing exercises that promote strength, flexibility, and functional activities are believed to be essential in restoring the athlete's ability to return to pain-free competition.

The piriformis syndrome has been implicated as a potential source of pain and dysfunction, not only in the general population, but in athletes as well (2,8,11). While there is disparity in the literature as to whether this syndrome actually exists (1,8,12), some suggest that it is more prevalent than citations in the literature would indicate (1). Whether or not one embraces this as a clinical entity, our purpose is to provide the reader with an understanding of piriformis syndrome by reviewing the relevant anatomy and the proposed pathomechanics of this syndrome. Moreover, practical and systematic strategies for evaluating and managing the athlete with suspected piriformis syndrome will be offered.

Douglas Keskula is a doctoral candidate at the University of Virginia in Charlottesville, VA.

Michael Tamburello is a commander in the United States Navy and a doctoral candidate at the University of Virginia.

Incidence/Etiology

The incidence of piriformis syndrome has been reported to be six times more prevalent in females than males (11). While no dominant etiological factors have been reported, piriformis syndrome often occurs following a minor trauma to the buttocks or pelvis (1,2,12). The trauma is thought to precipitate a spasm of the piriformis muscle, which subsequently inflames the adjoining sciatic nerve (2). Piriformis syndrome has typically been characterized by symptoms consistent with irritation of the sciatic nerve. Isolating the dysfunction to this region usually follows exclusion of the more common causes of buttock pain and sciatica. More specifically, complaints of buttock pain with distal referral of symptoms are not unique to piriformis syndrome. Similar symptoms are prevalent with the more clinically evident lower back pain syndromes and pelvic dysfunctions. Thus, a thorough evaluation of these regions must be performed to exclude underlying pathology.

Anatomy

The key elements of the piriformis syndrome are the anatomical relationships of the piriformis muscle to the sciatic nerve. The piriformis muscle arises from the pelvic surface of the sacrum, the greater sciatic notch, and the sacrotuberous ligament. The lower attachment is the superior border of the greater trochanter of the femur. The piriformis muscle passes over the sciatic nerve in the majority of cases. However, variations in this arrangement have been reported with the nerve crossing above or through the muscle belly itself (3,4). The typical relationship of the sciatic nerve and the piriformis is presented in Fig 1.

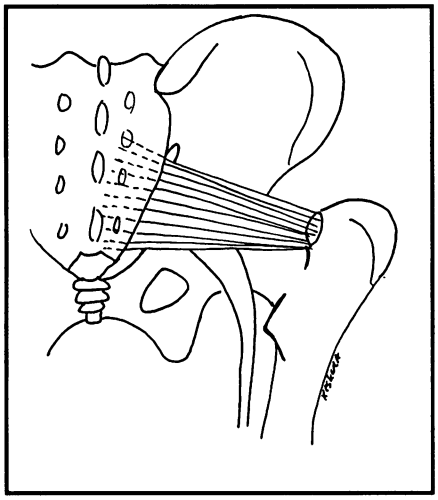


Fig 1.—Posterior view of the pelvis and right proximal lower extremity, illustrating the anatomical relationship between the piriformis muscle and the sciatic nerve

Some think that the piriformis can become hypertrophied or can spasm, resulting in compression of the nerve against the ischium, or, more specifically, against the bony edge of the sciatic notch (3). It also has been suggested that an accentuated lumbar lordosis and hip flexor tightness predisposes one to increased compression of the sciatic nerve against the sciatic notch by a shortened piriformis (7). Although differences in the anatomical relationships are helpful to facilitate understanding the mechanism of dysfunction, these differences do not affect conservative treatment strategies.

The piriformis muscle primarily is innervated by the S1 and S2 spinal nerve segments via the sacral plexus. The sciatic nerve is derived from the same spinal segments with contributions from the L4, L5,

and S3 segments (4). Thus, one can appreciate the constellation of neurological signs and symptoms that could emanate locally or be referred distally to the lower extremity as a result of this syndrome.

The piriformis is an external rotator of the hip and functions in conjunction with the quadratus femoris, obturator externus, obturator internus, and the gemellus superior and inferior. The rotary component of this muscle group has been reported to decrease with flexion of the hip (9). At 90° hip flexion, this group of muscles has a significant abductor component. Some report that the piriformis functions as an internal rotator in hip flexion (5,15). The function of the piriformis at varying joint angles is an important consideration for the clinician who is evaluating and treating piriformis syndrome.

Evaluation

The diagnosis of piriformis syndrome is primarily a clinical determination; therefore, a thorough history must be taken, and a careful, comprehensive physical exam must be performed. Establishing a systematic routine of evaluation not only facilitates gathering objective information from the examination, but it ensures that significant factors are not overlooked. The evaluation of the spinal neuromusculoskeletal system is summarized in the Table.

Subjective Evaluation

Obtaining a thorough medical history from the athlete is an integral component of the evaluation. It serves to enhance the physical assessment process by providing insight for the clinician to use to better focus on the relevant signs and symptoms. The subjective evaluation should be directed toward determining causative factors, such as a history of a recent trauma, or changes in training regimen or lifestyle. Information regarding the location, intensity, behavior, and frequency of pain will assist in directing the clinician during the evaluation. Generally, individuals with piriformis syndrome will report deep pain that is localized to the posterior aspect of the hip and is accentuated with standing or activity. This discomfort often lessens when the patient is lying down. Also, flexion of the knees may further moderate the symptoms. Pain, numbness, and paresthesia radiating distally into the lower extremity may be encountered; however, these symptoms frequently are present with lumbo-pelvic dysfunctions as well. Therefore, it is crucial that you extend the exam to these regions to rule out associated lumbar or sacroiliac dysfunction.

Objective Evaluation

The objective evaluation must encompass an assessment of active and passive range of motion of the spine and lower extremities, as well as muscle strength and posture. Palpation of the area is necessary to delineate the specific tissues involved. Several provocation tests have been suggested to differentiate piriformis syndrome from other types of dysfunction and will be discussed later. In addition, a neurovascular assessment is necessary to rule out more severe spinal pathology. The evaluation also should include assessment of functional and sport specific abilities to allow the clinician to clearly define the athlete's functional limitations.

Range of Motion

Qualitative and quantitative assessment of the mobility of the piriformis muscle is an important component of the evaluation. Passive internal rotation of the hip while in 0° flexion may be painful, with limitation of motion secondary to pain and spasm. Passive external rotation and adduction while the hip is flexed to 90° would also be expected to be limited and painful. Saunders (14) suggests a clarifying test for assessing sciatic nerve entrapment by the piriformis. He advocates that when a straight leg raising test is positive for buttock pain you should then externally rotate the extremity to see if the symptoms diminish. A lessening of symptoms is purported to be confirmation that the piriformis muscle is impinging on the sciatic nerve.

Strength

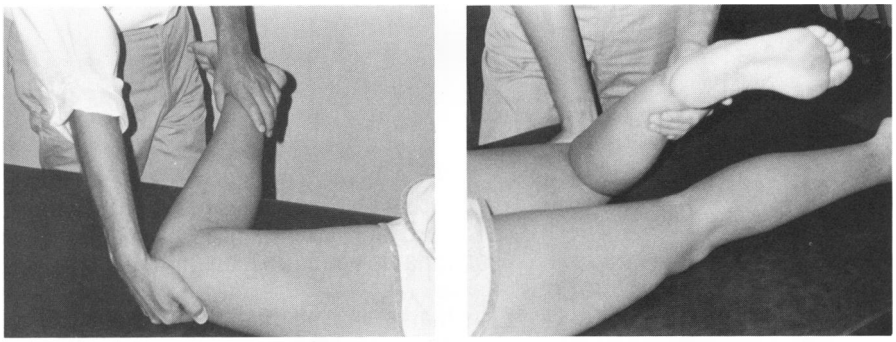
The conventional manual muscle test for the external rotators, including the piriformis, is carried out while the patient is sitting (6). The test position is represented in Fig 2. However, testing hip rotation in this position may provide misleading information about the status of the piriformis and other internal rotators (9), because, in hip flexion, the piriformis acts as an internal rotator. The correct manual muscle test for the piriformis with the hip flexed to 90° would be resisted internal rotation. Also, test the piriformis as an external rotator with the hip in 0° flexion as the patient lies on his or her side or is prone

Fig 2.—Conventional manual muscle test position to assess the external rotators of the hip including the piriformis muscle (Adapted from Kendall (6))

Evaluation of the Spinal Neuromusculoskeletal System

1. Observe the athlete's gait, stance, and sitting posture/position.
2. Take a thorough history of the sequence and nature of the problem.
3. Examine the structure and posture.
4. Assess the range of motion and muscle length, qualitatively and quantitatively.
5. Assess strength, qualitatively and quantitatively.
6. Palpate to determine the tension, texture, and temperature of the tissue.
7. Perform neurological assessment: deep tendon reflexes, myotome screening, sensation, and special tests.
8. Assess functional ability and sport-specific activity.
9. Examine X-rays, CT scans, and reports.
10. Define problem areas.
11. Establish short- and long-term goals.
12. Develop treatment strategies to meet goals.
13. Reassess to determine effectiveness of the treatment program.

(Fig 3). Testing hip rotation in both neutral and flexed positions provides you with a more comprehensive clinical picture of muscle performance.



A B

Fig 3.—Alternative manual muscle testing positions to assess the piriformis muscle while the hip is in a neutral position. The athlete may be evaluated in A, the prone position, or B, the sidelying position.

Manual muscle testing applied to hip rotation may elicit contractions that are strong, but painful. Because many functional activities are performed while standing, testing in a neutral hip position may provide you with a more functionally applicable strength test.

The piriformis is an abductor of the hip in a flexed position. Carter (2) described an abduction provocation test where the athlete is seated over the edge of the table and asked to push his or her legs apart against maximal manual resistance (Fig 4). The test is positive for a piriformis syndrome if pain is localized directly over the piriformis muscle.

Fig 4.—Manual muscle test for hip abduction with the athlete sitting

Palpation

Careful palpation about the lumbopelvic region not only provides you with information about tissue turgor, but will adequately locate hyperirritable regions in the soft tissues. The piriformis can be difficult to palpate because of the depth of the muscle and the often large mass of overlying muscle and soft tissues. However, you can locate the piriformis muscle in the prone athlete using deep palpation. If a line were drawn from the posterior superior iliac spine (PSIS) to the greater trochanter, and an intersecting line were drawn from the anterior superior iliac spine (ASIS) to the ischial tuberosity, the piriformis muscle would lie where the lines cross (Fig 5) (10).

Fig 5.—Anatomical references used to locate the piriformis muscle

Others (2,12) advocate placing the athlete on his or her side with the involved hip flexed, and palpating at the midpoint between the ischial tuberosity and greater trochanter. This position seems to displace the gluteus maximus superiorly to partially uncover the sciatic notch for palpation of the piriformis and sciatic nerve. In addition to assessing tenderness with palpation, you should note evidence of muscular spasm. When using deep palpation to locate suspected trigger areas, be careful when interpreting the athlete's report of pain in this area. This region is normally tender to palpation, and you must compare it with the uninvolved side to verify findings of painful areas. Furthermore, this region is the site of referred pain for lower back disorders and may develop trigger areas that could be confused with piriformis syndrome.

Functional Abilities

The athlete with piriformis syndrome may exhibit functional limitations; however, it is the pain that restricts activity or limits normal function. Difficulty may be encountered when moving the leg outside a car to stand up, moving laterally while in a sitting position, and maintaining balance on a movable surface. Sport-specific limitations may be present and must be evaluated to further enhance the clinical decision-making process.

Treatment

Treatment options for piriformis syndrome focus around the subjective and objective findings of the assessment. In most circumstances of piriformis syndrome, an inflammatory response is suspected in the muscle and/or sciatic nerve. Therefore, the treatment goals are directed initially toward decreasing inflammation, associated pain, and spasm, if present. Treatment options may include rest, cryotherapy, gentle pain-free stretching exercises, and electrical modalities. Heating modalities often are useful later in the rehabilitation process, when more vigorous stretching exercises are necessary. These modalities are beneficial because soft tissue elongation seems to be facilitated by the application of heat (18).

Exercise is perhaps the optimal means of managing this disorder. Active exercise, passive stretching, soft tissue mobilization, and proprioceptive neuromuscular facilitation (PNF) techniques are particularly effective in moderating the symptoms and restoring range of motion. Fig 6 illustrates specific exercise techniques that promote lengthening and relaxation of the piriformis muscle, facilitating the restoration of pain-free range of motion. The exercises are easily adapted for use in the clinic or as a component of the home exercise program. When incorporating these techniques into a plan, the clinician must remember the internal rotation and abduction function of the piriformis in the flexed hip. Therefore, the direction to stretch the

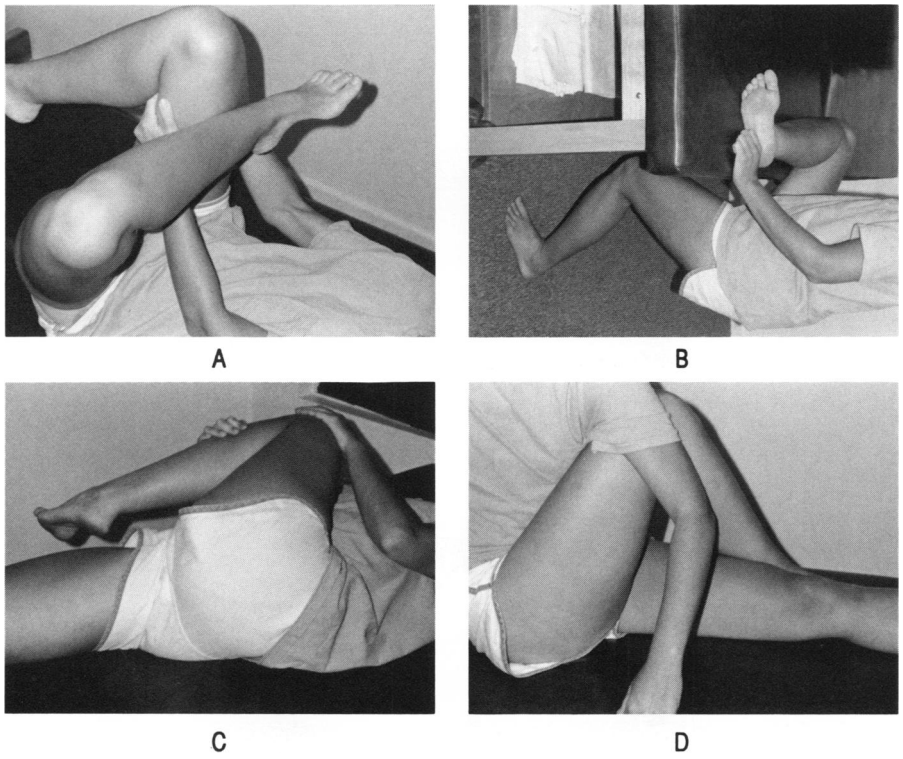


Fig 6.—Suggestions for exercises directed at lengthening the piriformis muscle. When the hip is flexed, the athlete applies pressure into adduction, as in A and B, or external rotation, as in C and D, to stretch the piriformis.

muscle should be opposite to that used with the hip in a neutral position.

The intensity, frequency, and duration of the exercise regimens are determined by the tolerance of the athlete. Initially, a practical guideline for active exercise includes few repetitions (ie, five to ten) performed in three sets, two to three times daily. Once a base level of exercise tolerance is established, the exercise program is progressed as tolerated. More aggressive stretching methods, including contract-relax PNF techniques, can be employed in the sub-acute phase.

Soft tissue mobilization may be integrated into the treatment plan to further enhance soft tissue extensibility. The athlete is positioned in a prone position with a pillow under the abdomen. Apply gentle pressure to the piriformis muscle with the heel of your hand in a medial, superior direction. You may flex the athlete's knee to 90° and passively internally and externally rotate the hip at a slow speed. This technique may be contraindicated in athletes with knee pathology because it places increased stress on the knee joint during rotation of the hip.

You also may use modalities to facilitate relief from exercise-induced soreness and may begin additional exercises to stretch other shortened muscle groups (such as the hip flexors) at this point. Strength deficits in the piriformis and surrounding pelvic musculature also must be addressed in the rehabilitation program. Usually a progressive strengthening program for the piriformis may be initiated early in the rehabilitation plan. Strengthening of the piriformis should be carried out with the hip in a flexed position, emphasizing abduction and internal rotation, as well as in a neutral position addressing external rotation. Resistance may be provided manually with cuff weights, or using rubber tubing. Entry-level exercises designed to strengthen the piriformis are presented in Fig 7.

To facilitate strength gains while minimizing adverse symptoms, the strength program should begin with few repetitions and little resistance. The athlete should progress based on his or her tolerance to the exercise. Strength training also might include the use of PNF diagonal patterns, specifically D2 flexion and D2 extension patterns (13,17).

Functional activities are an integral component of the rehabilitation program. Proprioceptive, balance, and coordination activities are introduced when the necessary mobility and strength elements become evident. Progressing from controlled mobility activities (distal component fixed) to skill activities (distal component free) provides the clinician with a myriad of treatment options to meet the specific goals of the athlete. Consult the work of Sullivan, et al (16) to expand your knowledge of the stages of motor control and its application to the rehabilitation of piriformis syndrome. As basic activities are tolerated, sport-specific skills may be introduced.

A home exercise program is an integral component of the overall rehabilitation program. Consider independence and compliance with the program in planning short-term objectives. Providing the athlete with clear and concise illustrated instructions should promote independence and compliance with the exercise regimen.

Additional treatment options may

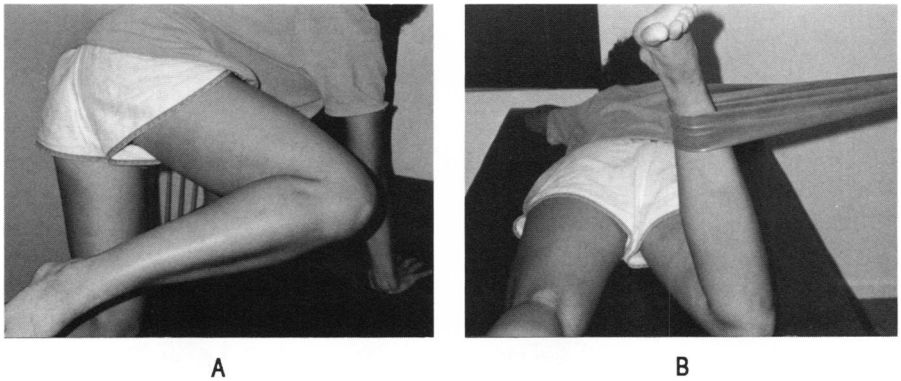


Fig 7.—Suggestions for exercises directed at strengthening the piriformis muscle. When the hip is flexed, the athlete abducts the lower extremity, as in A. When the hip is in a neutral position, the athlete externally rotates the thigh, as in B. External resistance may be applied with rubber tubing to either exercise as illustrated in B.

include education with respect to body mechanics and posture, activity modification, and use of foot orthotic devices. In cases where conservative measures fail, injection of the piriformis muscle with a steroid has been advocated, with surgical resection being reserved for the most recalcitrant cases (1,2,11).

Summary

Piriformis syndrome is both a diagnostic enigma and a questionable clinical entity touted as a cause of buttock and lower extremity pain. While piriformis syndrome is not frequently encountered in the sports medicine setting, a basic understanding of the relevant anatomical relationships, evaluative techniques, and treatment options is necessary to effectively manage the athlete who presents with symptoms suggestive of piriformis syndrome.

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