



Musculoskeletal Case No. 6, July 2000

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Presenting Symptom(s): Right proximal hamstring and gluteal pain

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Estimated Level of Difficulty: Advanced

Appropriate Audience: Senior residents, fellows, practicing physicians

Learning Objectives: After completing this educational activity, participants will be able to
1) formulate a complete history, 2) formulate an accurate history, 3) formulate a diagnosis,
4) have a biomechanical understanding of gait, and 5) develop a therapeutic plan.

History

A 45-year-old male who is an avid runner presents with right proximal hamstring and gluteal pain. It began 4 months prior to initial visit as a dull hip pain that occurred while running on the track. He felt a distinct pull that forced him to stop the run. He noticed some swelling at the proximal hamstring, but no bruising. One month later, he experienced sharp pain in the proximal hamstring while running speed work. Two months later, he described sharp episodes of spasm-like pain in the area of his proximal hamstring during a track workout that forced him to stop. Hills and speed work seem to be the most aggravating activities. He notes pain when leading with his right leg and when stepping up onto a curb. He also began having pain with other motions such as anterior pelvic tilt in the supine position, forward bending from a standing position and from a seated position in the car, prolonged sitting and occasional nighttime pain with rolling over. He generally does not notice the pain when he is not running. He receives some relief by using a heated car seat when driving.

He began running in 1985 and runs 40-60 miles per week. He does speed work approximately twice a week as well as track work. He runs at a 7-8 minute mile pace. Recently, he has reduced his mileage to 40 per week, running between 5-10 miles per session.

- *Prior to continuing, please develop a differential diagnosis and list each possible diagnosis in order of likelihood.*
- *Is there any additional information regarding the clinical history that might be helpful in clarifying your differential list or changing its order of priority?*

Commentary I

Differential Diagnoses

1. Hamstring strain
2. Gluteal strain
3. L5 or S1 Radiculopathy
4. Sacroiliac dysfunction
5. Femoral or pelvic ramus stress fracture
6. Lumbosacral Facet Pain
7. Hip pathology, such as avascular necrosis (AVN)
8. Piriformis syndrome



A good approach in developing a differential diagnosis in this case is to review the history, break it down chronologically and then look at the whole picture. First of all, the patient experienced a traumatic event described as a distinct pull in the hamstring that forced him to stop the run, which is very characteristic of a hamstring strain. Moreover, he experienced pain in the inferior gluteal region, which may lead you to suspect his injury was more extensive and also involved a gluteal strain or developing proximal hamstring tendinitis. Also, a L5 or S1 radiculopathy could be the cause for the chronicity of his hamstring strain. Next on the list is sacroiliac dysfunction. Sacroiliac(SI) dysfunction often results in pain experienced in the hamstring and gluteal region. Historical findings that are suspicious of a SI dysfunction include pain in the hamstring origin when leading with his right leg, stepping up onto a curb, forward bending from a standing as well as seated position and occasional nighttime pain with rolling over. A stress fracture is possible due to the type of activity, i.e., running and occasional nighttime pain. Lumbosacral facet pain, hip pathology and piriformis syndrome are possible but unlikely from initial history.

Further history should try to ascertain the etiology of his injury, previous treatments and outcomes, runner preparation and complete past, family and social history and review of systems.

History, continued

Patient has a long history of foot pain that includes bilateral ankle fractures and plantar fasciitis. He was previously fit with orthotics in 1992, and obtained new rigid orthotics, 1 month prior to the onset of his current symptoms. The previous orthotics had provided significant relief. Wearing the new orthotics, he relates that he has a constant dull aching pain in his left ankle region. It is worse with his first steps in the morning and at the beginning of a run. Moreover, the left foot pain is worse when he is running on a canted road.

Previous treatments/outcome:

- Physical therapy for previous hamstring strains; he has continued to have recurrent strains.
- Chiropractic manipulation and electrical stimulation; transient relief of current hamstring strain.

Runner preparation:

- No regular stretching
- Regularly rotates his Asics 2040 (a stability shoe, appropriate) shoes with Brooks Cheetah racing flats (no stability features, inappropriate) shoes.

Past medical history:

- Hamstring strains
- Back pain with sciatica
- Rhinoplasty following a rugby injury
- Elbow fracture and repair



Family history:

- Negative for spondyloarthropathies
- Parents and siblings are in good health

Review of systems:

- Denies sciatica, bowel and bladder dysfunction, rash, numbness or tingling, pain with sneezing or coughing, or previous hip injury. All other system review was negative.

Social history:

- Social drinker, Denies Tobacco; CPA

Medications:

- Ibuprofen 600mg once daily
- If necessary, revise your differential diagnosis based on the additional clinical history
- *On which details of the physical examination should you focus at this point?*

Commentary II

The patient's foot pain and relatively recent change in orthotics may be significant. Furthermore, using his racing flats to train in is not helping his poor foot mechanics as they lend no support to his excessively pronated and stressed feet. His previous hamstring injury increases his risk to suffer recurrent problems to the exact same area or to the same limb, particularly since he does not stretch or perform any lower extremity strengthening.

Revised Differential Diagnoses

1. Hamstring strain
2. Sacroiliac dysfunction
3. Gluteal strain
4. L5 or S1 Radiculopathy
5. Stress fracture
6. Lumbosacral Facet Pain
7. Hip pathology, i.e. AVN
8. Piriformis syndrome

It is apparent that the patient has had a hamstring strain. However, sacroiliac dysfunction should be considered because of his symptoms with sitting, the proximal hamstring pain and his foot pain and orthotic history. Previous history also makes radiculopathy a possibility since he has had recurrent hamstring injuries, suggestive of weakness or irritability. However, radicular pain in the thigh is usually not spasm-like. Although a stress fracture, facet pain, piriformis syndrome and hip pathology are unlikely, it is difficult to completely rule them out at this point.

The physical examination should be directed towards strengthening your differential diagnoses and evaluating the etiology of his hamstring strain as well as investigating symptoms that are indicative of sacroiliac dysfunction.



Physical Examination

Physical examination reveals a well developed but thin gentleman, 6' tall, 165 pounds, who stands with asymmetric foot posture visual inspection of the lumbar spine and pelvis reveals no obvious asymmetry.

Lumbar spine range of motion testing is functional with minimal restriction in left lateral bending and right rotation. Gillet test often described as the march test or one-legged stork test, consists of placing the examiner's right thumb on posterior aspect of the right PSIS with left thumb over the sacral crest at the same level. A normal response is the thumb on the PSIS moving caudad in relation to the thumb on the sacrum. It is markedly positive on the right.

Standing and Seated Flexion Tests are positive on the right. Trendelenburg is negative. Paraspinals are non-tender to palpation. Lumbar facet stress testing is negative. Lumbar compression testing is negative.

Pelvis palpatory examination reveals a contranulated right ilium. The right sacral sulcus is deep, worse with extension. The right iliac is out-flared in comparison to the left. ASIS is inferior on the right. PSIS is superior on the right. Pubic symphysis is symmetric. Medial malleolus is inferior on the right. Four-Point Sacral Motion reveals a left inferior lateral angle increased on forward flexion. Prone sacroiliac motion testing is reduced on the right. Provocative piriformis maneuvers are negative. These included resisted activation and palpation of the piriformis muscle in the hip flexed, internally rotated and lateral recumbent position. Palpation over stretched gluteus minimus, medius and maximus does not elicit tenderness.

Hamstring examination reveals tight hamstrings bilaterally, popliteal angles are 50° on the right and 70° on the left. The right hamstring origin is ropy and modestly tender. No palpable defect is noted. Hip internal rotation is increased, external rotation is decreased and extension is decreased on the right. The hip is non-painful to motion testing, one-legged hop or jumping. Faber's test (hip flexed, abducted and externally rotated, resting ipsilateral foot on the contralateral knee) is negative for hip or back pain.

Flexibility testing reveals tight hip flexors and rectus femoris by Thomas test and Rectus Femoris test. Ober's test is negative.

Muscle stretch reflexes are symmetric: 3+ patellar (L4), 2+ medial hamstring (L5) and 1+ achilles (S1). Sensory examination is intact to light touch and pin prick. Manual muscle testing of the following muscles was 5/5 bilaterally (except as indicated): hip flexors, hip adductors, left hip abductors and extensors, hip external rotators, knee extensors, left knee flexors, ankle dorsiflexors and plantar flexors. The right hip abductors, extensors and knee flexors were 4+/5. Bilateral foot invertors 3+/5 and evertors 4+/5. Straight leg raising is negative.

The left foot is markedly pronated at the mid-foot and slightly abducted from the midline. The right foot is somewhat less pronated. There is significant rear foot valgus, left greater than right. Bilateral forefoot varus that is non-compensated is present. There is significant deviation into pronation from the subtalar neutral position. During subtalar neutral the great toe is elevated off the floor. The feet are stiff bilaterally in the forefoot. The first ray is stiff extending only 45°. The left posterior tibialis tendon is tender to palpation.

- *At this point review your differential diagnosis and revise as appropriate.*



- *Are there additional observations on physical examination that might be helpful in narrowing your differential list.*

Commentary III

Sacroiliac dysfunction indicated by grossly abnormal SI motion is most likely contributing to the recurrent hamstring strain. Furthermore, the foot exam, which revealed a non-compensated forefoot varus bilaterally and left posterior tibialis tendonitis, is significant to the proximal dysfunction. On the other hand, the normal facet and lower extremity neurological exam, negative hip pain and absence of pain with pelvic stressing decreases the likelihood of involvement from the lumbar facets, a stress fracture, piriformis syndrome or hip pathology. The weakness seen in the right hip and thigh could be attributed to a chronic L5 or S1 radiculopathy; it was felt that it was more likely due to inhibition from SI dysfunction as well as incomplete rehabilitation of his previous hamstring strains. The bilateral inversion and eversion weakness was thought to be the result of poor conditioning

- *What diagnostic tests would you order at this time?*

Commentary IV

Radiographs, weight bearing lateral and AP views of the foot and ankle are appropriate to evaluate for degenerative changes as well as other lesions resulting from poor foot mechanics.

Test Results:

Degenerative joint changes of the subtalar joint, namely the view of the medial and anterior facets as well as the talonavicular joint osteophyte dorsally, left more significant than right.

Commentary V

The results of the radiographs revealed somewhat surprising degenerative changes in the subtalar joint, which may be forming a coalition. However, the results do give credibility to a chronic progressive process that may be influencing a more proximal dysfunction.

- *What additional diagnostic testing would you order?*

Commentary VI

No additional tests were ordered. The historical data and gross abnormalities on physical examination and radiographs of the foot supported our diagnosis. A diagnostic SI joint injection may have been helpful in confirming the diagnosis, however, we analyzed the cost vs. benefit ratio and did not feel any additional studies were warranted at this time. Furthermore, SI pain was not the issue as much as the sequelae of SI dysfunction, namely the hamstring strain.

- *Considering all the data from the history, physical examination and laboratory studies, what is/are your final diagnostic impression(s)?*

Final Diagnostic Impression

1. Hamstring strain with chronic tendonitis
2. Sacroiliac dysfunction
3. Non-compensated forefoot varus contributing to #2



Commentary VII

This case may appear to be a straightforward hamstring strain. However, with the patient's history of previous hamstring strains and lack of improvement over time with the current injury a comprehensive history and physical examination was required. Was the chronicity of the hamstring strain due to incomplete rehabilitation, increased vulnerability for reinjury, inadequate diagnosis or a combination of those? The history gives clues to suspect a SI dysfunction, and the grossly abnormal pelvic/sacral motion testing on physical exam bolsters suspicion of this disorder. The gluteal pain, according to pain referral mapping by Fortin JD et al., could be referred pain from the SI joint. A painful sacroiliac joint may also cause reflex inhibition of the gluteus medius, according to Magee. Thus explaining the weakness of the hip abductors. SI dysfunction leads to a decreased stride length. Netter describes a connection of the sacrotuberous ligament to the proximal hamstring. Thus, an athlete who has a SI dysfunction experiences increased tension on the hamstring during high demand activities such as running, hills and speed work, therefore increasing the likelihood of a hamstring injury and re-injury (Cibulka MT, et. al.). Previously we mentioned that the foot exam was significant to the proximal dysfunction. As you recall, his feet (predominately the left) were stiff and had a non-compensated forefoot varus. Also, one month prior to his injury, he was given rigid biomechanical orthotics. A typical treatment would preclude the use of rigid biomechanical orthoses for a rigid foot. An orthoses that could better accommodate to his foot deformity would be more appropriate. In essence, the patient was attempting to force pronation with a rigid biomechanical orthoses in a foot that could not pronate to compensate the forefoot varus. Furthermore, the orthoses exacerbated the dysfunction by increasing lower extremity internal rotation that is translated to the hip and pelvis contributing to increased stress on the opposite hamstring through pelvic torsion.

- *What treatment would you now initiate?*

Commentary VIII

1. Activity modification such as reducing miles run each week in half, and incorporating cross training, aquatherapy and upper extremity strengthening.
2. Physical therapy to address the sacroiliac dysfunction. The therapy should include intensive soft tissue and joint mobilization, muscle energy techniques, stretching and resistive exercises in attempt to realign the pelvis; heat modalities; and excercises for strengthening of the hip abductors, extensors and knee flexors (hamstring) and ankle invertors and evertors.
3. Podiatry consult, or prescription to orthotist to evaluate for new accommodative orthotics.
4. Once the biomechanical deficit is corrected, increase mileage weekly as tolerated and consider a frame by frame motion gait analysis.
5. Consider acupuncture for pain relief.

Final Discussion and Follow Up

The rehabilitation program to address the biomechanical SI dysfunction, muscle weakness and myofascial therapy to the proximal hamstring has been implemented. The patient has made good progress in a short period of time. He reports less intense pain at the initiation of the run and experiences no spasms. He denies any pain after the run or



at night. Subsequent SI examinations reveal that he has improved motion, however, not yet reciprocal. More work is needed in functional flexibility. Aggressive mobilization and stabilization of the pelvis and functional flexibility exercises will be continued until he is realigned and pain free. Once pain free, his running mileage will be increased weekly as tolerated and he will be transitioned to a home or gym based exercise program. Meanwhile, we are awaiting completion of the construction and addition of medial forefoot accommodative posts to his orthotics.

If treatment had been ineffective and certainly if his condition worsened, we would consider further investigation. This would include MRI of the pelvis to investigate the possibility of ischial stress response or chronic hamstring scar tissue from recurrent strain and repetitive stress from the SI dysfunction. Additionally, an EMG would give useful information for evidence of a chronic or low grade acute radiculopathy causing the symptoms. Surgical debridement of the scar tissue, as described by Puranen and Orava, might be very helpful for chronic hamstring strain with scar tissue. Radiculopathy would require ongoing modification of activity would be recommended if there were a chronic radiculopathy and selective nerve root block would be recommended for an acute radiculopathy.

This case illustrates the need for a complete and accurate diagnosis prior to initiating treatment. Moreover, a knowledge of functional biomechanics can assist you in correctly identifying a direct muscle injury versus a distal manifestation of a dysfunction in another part of the kinetic chain.

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