The hamstring syndrome
A new diagnosis of gluteal sciatic pain

J. PURANEN, MD, AND S. ORAVA,* MD

From the Department of Orthopedic Surgery, University Hospital, and the Department of Sports Medicine, Deaconess Institute and University of Oulu, Finland

ABSTRACT
A series of 59 patients was treated and operated on for pain felt over the area of the ischial tuberosity and radiating down the back of the thigh. This condition was labeled as the "hamstring syndrome." Pain was typically incurred by assuming a sitting position, stretching the affected posterior thigh, and running fast. The patients usually had a history of recurrent hamstring "tears." Their symptoms were caused by the tight, tendinous structures of the lateral insertion area of the hamstring muscles to the ischial tuberosity. Upon division of these structures, complete relief was obtained in 52 of the 59 patients.

Not all sciatic pains originate from the spine. Entrapment of the sciatic nerve, known as piriformis syndrome, involves pain felt over the upper part of the buttock, radiating down the leg.1,4 Hamstring muscle tears and strains also cause pain at the posterior thigh, usually locally at the injury site, or in recurrent cases, more diffusely.1,4 In athletes, chronic compartment syndrome of the posterior thigh is another cause of sciatic pain.7

Pain in the buttock may also be located in the area of the ischial tuberosity, accompanied by referred pain to the back of the thigh. This condition is commonly seen in athletes, especially in sprinters and hurdlers, but may also be seen in nonathletes. We have performed 65 operations for this type of pain, which can become chronic and disabling. On the basis of clinical and operative findings, the pain was labeled as the "hamstring syndrome."

PATIENTS
The operated series consisted of 59 patients, including 6 with bilateral hamstring syndrome. Twenty-five of the athletes were involved in sprinting, hurdling, and jumping sports (Table 1). The median age of the athletes (N = 50; 39M, 11F) was 25 years (range, 13 to 49 years). The median age of the joggers (N = 4, 4M) was 39 years (range, 34 to 48 years) and the median age of the nonathletes (N = 5; 2M, 3F) was 35 years (range, 26 to 43 years). There were 45 males and 14 females in the series. About half of the cases involved the patients’ right side and half involved the left side.

The patients’ symptoms had continued for several months, and conservative treatment had failed to give relief. All of the patients had been treated with physiotherapy (shortwave diathermy, ultrasound, electrotherapy, stretching, muscle exercises, etc.) and/or antiinflammatory drugs, muscle relaxants, and corticosteroid and local analgesic injections without success. None of the athletes were able to train effectively or compete seriously.

CLINICAL FEATURES
Symptoms were localized at the lower gluteal area and radiated down the posterior thigh, down to the popliteal space. In most cases, the pain began without any trauma. In 23 patients, one or several mild muscle tears of the hamstring had occurred. A characteristic complaint was pain felt while in the sitting position, for example, while driving a car or sitting during lectures. The pain was often relentless, causing the patient to change position or stand up for relief. The athletes complained of pain at the buttock caused by stretching while running or performing gymnastic exercises. The pain was typically induced by forcefully driving the leg forward, as in sprinting or hurdling. Pain was seldom felt while running slowly or lying down. The endurance athletes felt pain in sudden spurts and while trying to speed up. In soccer players, kicking the ball with maximal force also caused pain.

In most patients, physical examination revealed local tenderness around the ischial tuberosity. Sometimes it was possible to palpate the tautness of the hamstring muscle.
The examination was normal. A positive Lasègue's sign (pain on straight leg raising) and impulse pain were present in only a few cases. In the eight patients who underwent electroneuromyography (ENMG) examination, results were normal.

**DIFFERENTIAL DIAGNOSIS**

The diagnosis of hamstring syndrome is entirely clinical. The greatest difficulty in diagnosing this condition is the possibility of confusing it with spinal sciatica. Myelography and/or computed tomography (CT) may sometimes be necessary to rule out spinal sciatica, as in nine patients of this series who had normal findings.

The piriformis syndrome is another reason for gluteal sciatica. In this condition, the tenderness is located more proximally at the buttock, over the belly of the piriformis muscle. Pain caused by resisted abduction in conjunction with external rotation of the thigh (Pace's sign) and forced internal rotation of the extended thigh (Freiberg's sign) are tests of the syndrome.

Ischiogluteal bursitis also causes buttock pain similar to that of the hamstring syndrome. It differs from the latter in that the pain is also felt at rest and patients have difficulties in finding a comfortable position at night.

Pain caused by chronic compartment syndrome in the posterior thigh is present during exercise. No gluteal pain is present while sitting. In our series, we performed a posterior fasciotomy on one patient who we suspected had a compartment syndrome. His symptoms did not disappear until the discussion of the tight edge of the biceps femoris muscle.

Pain can also result from scar tissue caused by a hamstring muscle tear or tears. The pain is usually local, but may radiate up and down. Recurrent tears very often occur at the proximal part of the hamstring muscles.

**OPERATIVE FINDINGS**

The sciatic nerve passes laterally to the biceps femoris muscle near the ischial tuberosity and then under the posterior thigh muscle (Fig. 2A). From the hamstring muscle, the long head of the biceps and semitendinous muscle are raised by the common aponeurosis from the tuberosity of the ischium. Normally, these muscles have tendinous tissue near the site of origin. In patients with hamstring syndrome, the tendinous structure was distinct and tense like a violin string (Fig. 2B). In the bulk of the muscle, there were usually two or even three tendinous parts, of which the strongest was like the Achilles tendon and was located close to the sciatic nerve (Fig. 2C). The nerve lay posteriorly on the tendinous band of the biceps muscle insertion on the lateral prominent part of the ischial tuberosity. In some cases, adhesions between the nerve and tendon were seen. No clearly visible scar tissue or bursitis were found at this area. In one case, only a bony elevation and old heterotopic ossification were noticed, probably having developed following apophyseolysis several years earlier. This patient was also found to have a tight band at operation.

**OPERATIVE TECHNIQUE**

In most cases (65%), a modified Kocher's incision was used, with patients lying on the unaffected side (Fig. 3). The sciatic nerve was explored and its relation to the piriformis muscle was noted. Then the nerve was followed distally to the ischial tuberosity and loosened from any possible adhesions. The taut, tendinous structures of the hamstring muscle over the nerve were divided near the site of origin without loosening the muscle from the ischial tuberosity. After division, the tendon ends were completely separated from each other. The tension was thus relieved and the sciatic nerve freed. In 35% of the cases, the straight posterior incision over
the lower edge of the gluteus maximus muscle was used while the hips were flexed about 30° with the patient prone. By lifting the freed edge of the gluteus, the ischial tuberosity and nerve could be seen.

After operation, the patient was allowed to move freely. Three to four weeks later, gradual weightlifting was allowed. Running was allowed soon after that. Physiotherapy was seldom necessary. Information on proper muscle training was routinely given to all patients.

ULTRASOUND (ECHOGRAPHY) AND CADAVERIC EXAMINATIONS

During the treatment of the latter half of the series of patients, ultrasound examination was performed preoperatively in 11 patients, using 5 MHz and 3.5 MHz crystal probes. A dense, fibrotic band was found or suspected in nine cases. The correlation between the echography and operative findings was good.

In cadaveric dissections (N = 7; mean age, 56 years), the insertion area of hamstring muscle was differentiated. Irregularity of the lateral edge with tense "strings" could also be found in normal patients. However, no thick "violin strings" were found in the cadaver specimens.

HISTOLOGY

The histology slides of the excised fibrotic bands showed dense, tendon-like fibrosis in all cases in which biopsy was performed during operation. Hyaline degeneration as well as scar tissue was seen in some cases.

RESULTS

Fifty-two of the patients were completely relieved following their operation (Table 2). The pain that had been elicited on sitting disappeared and all of the patients were able to run freely. Seven of the patients had symptoms for longer than 6 months after the surgery. In two patients, a lumbar disk herniation was removed later and in one case a decompressive laminectomy was performed. These patients did not have any back or distal leg and foot complaints before the first operation, but in two patients, Lasègue's sign was positive. In all seven patients whose symptoms lasted longer than 6 months, the end result concerning maximal sports was poor, although they were able to manage well in everyday life. Table 3 shows the postoperative complications. The cases of slow healing usually followed hamstring muscle atrophy, which required long and intensive physiotherapy. All patients were followed for at least 2 years (range, 2 to 8 years). In all bilateral cases the end result was good.

CASE REPORTS

Case 1

A 23-year-old hurdler tore his right hamstring muscle while running. Healing occurred without leaving residual symptoms, but after a few weeks he felt pain in the right buttock, radiating down to the popliteal space. Pain was felt during fast running but not during jogging. Pain also occurred while sitting. Changing his sitting position or standing up brought relief of the pain. He was treated for sciatica because of occasional low back pain. Despite rest, physiotherapy, acupuncture, and antiinflammatory drugs, his pain worsened.
He was not able to participate in training. There were no neurological findings upon physical examination. Lasègue's sign was negative. A distinct area of tenderness over the ischial tuberosity was palpated. He had no complaints of symptoms in the lumbar spine area. Leg stretching provoked pain. At operation, the sciatic nerve was exposed in the gluteal region. It was in close contact with a thick tendinous band in the biceps femoris muscle. The structure was as tense as a violin string. In addition, two other tight, but thinner, tendinous parts of the hamstring muscle were seen. These were divided and the adhesions loosened upon operation. Complete relief was obtained. One and a half years later, the patient won the World Championship silver medal in the 110 meter hurdle.

Case 2
A 26-year-old nonathletic female medical student underwent spinal fusion for spondylolisthesis. For 6 years she was nearly symptomless. Then radiating pain began in the right gluteal region, extending to the second and third toes. The pain increased when sitting. She also had less prominent low back pain. During a 6 month followup, the pain upon sitting became so severe that she was no longer able to attend lectures. The only positive clinical sign was tenderness in the lower gluteal area. No cause of pain was found on a CT scan of the lumbar spine. Operative findings and treatment were the same as in Case 1. The symptoms disappeared following operation. At the 2 year followup there was no recurrence of pain.

DISCUSSION

When diagnosing the cause of radiating leg pain, gluteal sciatica should be kept in mind. The piriformis syndrome has been well known for a long time. We now present the hamstring syndrome as a new clinical entity. Our first operation was performed in 1978. In the report of Galasko et al., there is among the surgical procedures performed for athletic injuries one "hamstring tendinitis release" mentioned without more clear definition. Exploration in chronic cases of other gluteal or posterior thigh pains has been performed. The hamstring syndrome seems to be more common than the piriformis syndrome, as is shown by the figures from the last 2 years: for each operation performed for piriformis syndrome, three operations have been performed for hamstring syndrome.

The symptoms of hamstring syndrome are caused by the tight tendinous structures of hamstring muscle. The bands may be as tight as violin strings. The thickest tendinous band lies in the bulk of the biceps muscle and is closely connected to the sciatic nerve, mostly anterior to it at the ischial tuberosity. The pain caused by sitting and stretching, typical to hamstring syndrome, is caused by sciatic nerve compression or irritation from the tense tendinous structures. The pain disappears upon sectioning the tendinous bands.

The reason for the hamstring muscle tightness, especially
in sprinters and hurdlers, may be the style of running or the repetitive explosive spurts of forward motion. One explanation for the pathogenesis may be the muscle hypercompensation caused by excessive stretching.

Hamstring syndrome is a clinical entity. It is a disease of athletes, especially of sprinters. It may also, however, appear in nonathletes. The diagnosis of this syndrome is clear, if the history and clinical findings are typical. Otherwise, further examinations (myelography, CT, magnetic resonance imaging, etc.) are needed. EMG or nerve conduction velocity measurements are normal in patients with hamstring syndrome. This is because the symptoms are not felt all the time and therefore the sciatic nerve incurs no axonal damage. Surgical treatment for hamstring syndrome is simple, with good results.

REFERENCES