



## Entrapment of the proximal sciatic nerve by the hamstring tendons

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The purpose of this study was to evaluate the results of operative treatment of entrapment of the sciatic nerve by tight fibrous structures associated with the hamstring tendons close to their proximal insertion. We retrospectively evaluated the results of 22 operations performed in 16 patients (6 bilateral operations), on average six years postoperatively. There was complete relief in 11 cases, good relief in 8 cases and fair relief in 3 cases.

Entrapment of the proximal sciatic nerve by the hamstring tendons is not presented in standard textbooks. However, this condition is not extremely rare. A wide range of material has been published on operative treatment of the hamstring syndrome, but the patients were essentially active athletes. Our material consisted of ordinary patients who were referred to the university central hospital for orthopaedic consultation. The results of surgical treatment of hamstring syndrome are very encouraging.

**Keywords :** entrapment ; sciatic nerve ; hamstring tendons ; operative treatment ; EMG.

### INTRODUCTION

In 1963 two neurologists, Singh and Jolly (9), described 30 young male farmers in India with progressive unilateral sciatic neuropathy. They had entrapment of the proximal sciatic nerve. Based on findings in anatomical dissections, the authors mentioned the hamstring tendons as one possible cause.

Surgically treated cases with fibrous bands causing the entrapment of the sciatic nerve have been

published by Banerjee and Hall (1), Sogaard (10) and Venna *et al* (11).

Puranen (7) published a report on a series of six surgically treated patients, who had entrapment of the proximal sciatic nerve caused by the hamstring tendons. He labelled this condition as the “hamstring syndrome”. Puranen and Orava (8) reported positive results of surgical treatment in 59 patients with entrapment of the proximal sciatic nerve by tight, tendinous structures and fibrous bands at the lateral insertion area of the hamstring muscles to the ischial tuberosity. Recently, Young *et al* (14) reported 47 cases and Lempainen *et al* (4) 103 cases with good results after operative treatment. The patients of Puranen, Orava, Young *et al* and Lempainen *et al* were active athletes, with few exceptions.

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## MATERIAL AND METHODS

During the time period from 1982 to 2002, one of the authors (KS) performed 27 operations for hamstring syndrome. Sixteen patients (22 operations) were re-examined retrospectively. The patients were 6 males and 10 females with a median age of 46.7 years (range : 24 to 83 years); six patients were operated on bilaterally at their request. The delay between the bilateral operations ranged from 2 months to 45 months.

Eleven patients with sixteen operations were clinically re-examined by one of the authors (JV). The results of six operations performed in five patients after 1996 were evaluated via personal telephone interview. After careful consideration we had arrived to the conclusion that the patients' residual symptoms, if any, could be reliably evaluated this way. The possible complications were registered in the immediate postoperative period.

Preoperatively the patients had had progressive symptoms for an average time period of three years (range : 4 months to 20 years), and their symptoms were unresponsive to conservative treatment.

The symptoms were localized in the region of the ischial tuberosity and radiated into the ipsilateral extremity. In 19 cases, the pain radiated to the thigh, in 15 cases to the leg and in 7 cases to the foot. The most characteristic symptom was a worsening pain upon sitting for prolonged periods ; many patients had to change their position or stand up for relief. In many cases the symptoms gradually increased over time and finally caused serious difficulties in daily life.

On physical examination, there was tenderness about the ischial tuberosity in 15 cases. Puranen and Orava (7) described a test in which active flexion of the hip with the knee extended caused pain in the buttock radiating into the extremity. This test was positive in 14 of our cases. The Lasègue sign was positive at about 70° in eight cases and at 90° in one case. The neurological status was normal. All the patients in these series had one common feature : when asked to localize the pain, they all pointed to the region of the ischial tuberosity.

In a differential diagnosis it is most important to rule out a lumbar nerve root lesion. Lumbar myelography, computed tomography, magnetic resonance imaging (MRI) and/or electromyography (EMG) was performed in all cases to rule out spondylogenic causes. Eighteen patients had EMG, and in six cases the investigator (PS) could trace signs of a proximal sciatic nerve lesion. EMG also helped to exclude a nerve root lesion.

The piriformis syndrome has been recognized for a long time as a source of sciatic pain (3,12,13). In this

condition, the tenderness is located more proximally at the buttock, over the belly of the piriformis muscle. Freiberg and Vinkle (2) and Pace (6) have described specific tests for this syndrome.

Pain similar to that caused by proximal sciatic nerve entrapment by the hamstring tendons may also be seen in association with ischiogluteal bursitis, chronic compartment syndrome of the posterior thigh, a sequel of hamstring tears and degenerative arthritis.

A modified Kocher's incision dividing the gluteus maximus muscle was used to explore the proximal sciatic nerve, with the exception of one case. The patients were lying on the unaffected side. The nerve was explored from the level of the piriformis muscle to below the level of the ischial tuberosity. Possible adhesions were released. Atypical tendinous structures were divided near their origin without loosening the hamstring tendons from the ischial tuberosity. If only adhesions between the sciatic nerve and the ischial tuberosity were observed, a subcutaneous tissue transplant was used after releasing the adhesions.

From the posterior view, the sciatic nerve exits the pelvis through the sciatic notch under the piriformis muscle, then continues distally, lateral to the ischial tuberosity which is in close proximity. In the proximal thigh, the long head of the biceps femoris crosses obliquely over the nerve.

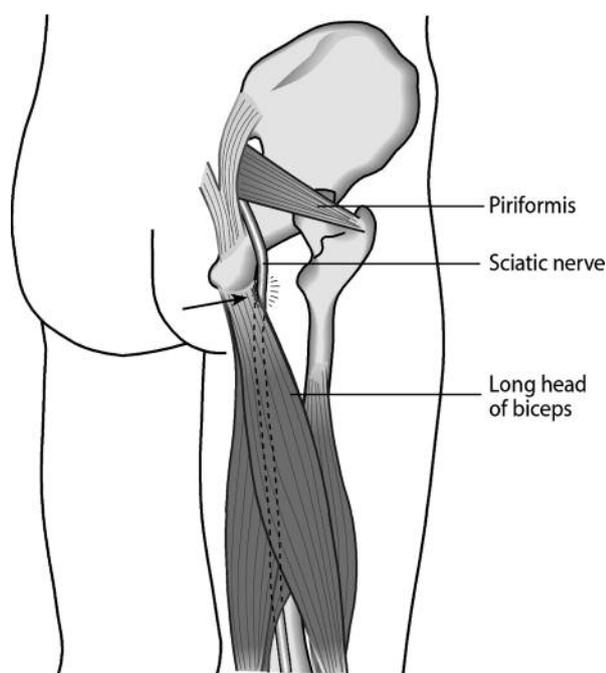
The patients had one or more atypical tendinous structures along the long head of the biceps femoris adjacent to the sciatic nerve. These tendinous structures could be as tense as a violin string and extend to the thigh over the sciatic nerve. When a finger was placed along the sciatic nerve and the hip was flexed with the knee extended one could feel how these tendinous structures compressed the nerve. In most cases the diameter of these tendinous structures was about 1 cm ; it exceeded 2 cm in two cases.

In one case there was a macroscopic alteration in the sciatic nerve. The nerve was thinner and paler than normal in the area of entrapment. In four cases there were adhesions between the sciatic nerve and the surrounding tissues. Three patients also had a tendinous structure along the lower border of the piriformis muscle. One patient had only adhesions from the sciatic nerve to the ischial tuberosity.

## ILLUSTRATIVE CASES

### Case 1

A 53-year-old female with a sedentary occupation was referred to us from the Department of



*Fig. 1.* — Schematic posterior view of the sciatic nerve and the hamstring tendons.

Neurology, Helsinki University Central Hospital. She had had worsening symptoms for 11 months and had been on sick leave for 6 months because she was unable to sit. Preoperatively, she had an inconclusive EMG examination. As an operative finding, there was one atypical hamstring tendon, which was divided. After the operation she was able to return to her occupation. When re-examined eleven years postoperatively, she was symptom free.

## Case 2

A 24-year-old male conscript had had worsening symptoms for 8 months and had to use crutches for 5 months preoperatively because of the pain. Preoperatively, an MRI of the lumbar spine and pelvis was normal, as well as the EMG examination, performed in another institution. At operation, an atypical tendinous structure with a diameter exceeding 2 cm was found. The sciatic nerve was thinner and paler than normal. The atypical tendon was divided. Seven years after the operation he is

symptom-free and installing antennas on high masts and roofs.

## RESULTS

At follow-up, up to 11 years postoperatively (average follow-up : 5.6 years), there was complete relief in 11 cases. In 8 cases there were slight residual symptoms (occasional aching or an uncomfortable feeling in the operated extremity), which did not impair the patient's daily living or sports activities. These results were rated as good.

The results were fair in 3 cases. One patient rated her pain diminished on the VAS (visual analogical scale) from 10 to 3 at re-examination six years postoperatively. Because of residual symptoms, she had some restrictions in aerobics training. One patient, age 83 years, was operated on bilaterally at his request within a two-month interval. One year later he said his back was pain-free, but there was pain about his legs.

No patient reported any weakness of the operated extremity after cutting off the offending tendons. As a complication, two patients had a transient lesion (hypoesthesia) in the area of the posterior femoral cutaneous nerve for several months. This was probably due to stretching of the nerve. One patient had hypoesthesia on the lateral side of the leg for two weeks. There was one postoperative haematoma, which resolved spontaneously.

## DISCUSSION

How does the hamstring syndrome develop? Singh and Jolly (9) wrote in their article that "the farmers have to work very strenuously for long hours and they adopt a peculiar squatting posture in which the sciatic nerve is likely to be compressed". Orava (5), a prominent expert on this condition, wrote : "There is a degenerative tendinopathy of the normal tendon structures. The semimembranosus muscle under the biceps femoris thickens and adheres to the biceps tendon and there develops adhesions around the sciatic nerve. Histologically it is analogous with the chronic Achilles tendonitis, for example". Orava (5) has described his operative techniques in detail in 1997. Most of the patients of

Puranen and Orava (8) were competitive athletes, but there were also four joggers and five non-athletes. In the material studied by Young *et al* (14) and Lempainen *et al* (4) the patients were high-level athletes. In our material the patients were ordinary people sent to the orthopaedic surgeon for consultation. Their athletic activities varied from none to some sports activity as a hobby.

In the hamstring syndrome the sciatic nerve is under compression only in certain activities. When the situation is persistent and progressive, development of demyelination or axonal nerve pathology is more likely. In the Puranen and Orava (8) series there were eight EMG examinations preoperatively, all inconclusive.

In our series there were signs of irritation of the sciatic nerve in 6 of 18 examinations.

A neurophysiologist (PS) performed a needle electromyography on selected muscles innervated by the sciatic and inferior gluteal nerves. To assess the involvement of radicular compression, the paraspinal muscles were also checked. H-reflex and the sural nerve were studied bilaterally. Varying degrees of abnormality in the motor units, fibrillation potentials, and asymmetry of H-reflexes were recorded in one third of the patients. In these cases the paraspinal muscle did not show a significant denervation activity (fibrillations). In the light of these electrodiagnostic (EDX) findings, compression of the proximal sciatic nerve was suggested.

In addition to an MRI of the lumbar spine, an MRI of the pelvis is recommended. According to Orava (5) there can be, especially in unilateral cases, a narrowing of the adipose triangle around the sciatic nerve or fibrosis of the tendons in the transverse sections when compared with the other side. We were however unable to precisely determine the localisation of the entrapment with MRI examination. MRI is nevertheless of interest: in a patient not included in this series, MRI disclosed a schwannoma of the proximal sciatic nerve just inside the pelvic ring; the patient was sent back to the neurosurgeon.

Patients with disabling sciatic pain and no radiological or electromyographic evidence of a nerve or nerve root lesion are often sent to a neurosurgeon for consultation. The Department of Neurosurgery,

Helsinki University Central Hospital sent six patients to us. One patient was referred from the Department of Neurology.

When surgically treating patients with sciatica, it is crucial to realize that exploration of the proximal sciatic nerve is by no means to be seen as an "off-chance" salvage procedure after failed back surgery. Entrapment of the proximal sciatic nerve caused by tendinous structures along the hamstring muscles, "the hamstring syndrome", is a clinical entity. When the symptoms indicate entrapment of the proximal sciatic nerve, and when the usual assortment of conservative treatments does not help and other causes are ruled out, surgery is a good option for treatment.

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