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Does the Piriformis Compress the Sciatic Nerve During Limb Length Equalisation?

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ABSTRACT

Background: Correction of limb length inequality during reconstruction procedures at the hip has the inherent danger of sciatic nerve injury. Among others, we think that constriction by a tightened Piriformis tendon may be a significant cause during longitudinal traction at the time of surgery.

Patients: A specific protocol involving the use of staged surgical release at the time of intra-operative traction/limb length equalisation gave only partial nerve compromise in one out of 11 cases; three other patients treated without this protocol developed sciatic nerve problems.

Conclusion: The authors feel that prior to the application of longitudinal traction, routine sectioning of the conracted piriformis tendon is important to prevent this complication; it is suggested that further investigations like intra operative nerve conduction studies during traction may perhaps substantiate these findings.

Keywords: sciatic neve, piriformis, leg length discrepancy

INTRODUCTION

Surgical correction of limb length inequality due to problems localised solely at the hip is fraught with many dangers, primary among which is an injury to the sciatic nerve[1]. Commonly encountered conditions where limb length discrepancy is significant are neglected congenitally dislocated hips, old septic arthritis or mismanaged fracture dislocation at the hip. Advances in surgical concepts and techniques have made limb length equalisation an accomplishable task, especially if it involves the use of total hip arthroplasty. In 1986 – 87 we operated on three such cases, all of which developed a post-operative sciatic nerve palsy. Due to this complication the operative procedure was analysed in detail; dissection studies which were subsequently carried out on anatomic specimens revealed that the pressure caused by the unsectioned piriformir muscle on the sciatic nerve during traction caused significant constriction of the nerve against the rim of the greater sciatic notch. Subsequently a protocol was devised for the clinical cases where the piriformis muscle was routinely sectioned before any other soft tissue release, and prior to intraoperative traction for length equalisation. This protocol was employed in a prospective series of 11 cases and their results are presented.

MATERIALS AND METHODS

Over a six-year period 14 cases of limb length discrepancy due to neglected congenitally dislocated hip (CDH), old Tom Smith's arthritis, old fractures or dislocations of the hip previously operated or otherwise, were subjected to reconstructive procedures. There were five female and nine male patients with an age range of 16 to 54 years (average 34.3 years). Two neglected cases of congenital dislocation hip underwent open reduction after adequate soft tissue release and 12 other cases underwent total hip arthroplasty (THA). The first three patients to be operated on (all THA) were given preoperative skeletal traction prior to the definitive procedure. The latter 11 cases were treated by surgical release adhering to the protocol given below. All patients had limb length inequality of three centimeters or more.

Surgical anatomy and operative procedure

The piriformis arises from the pelvic surface of the pars lateralis of the sacrum at the level of the 2nd to 4th sacral segments[2]; it receives some additional fibres from the upper margin of the greater sciatic notch and the pelvic surface of the sacrotuberous ligament as it exits the pelvis (Fig 1). The rounded tendon formed in the buttock inserts into the medial side of the upper border of the greater trochanter under cover of the gluteus medius insertion[2].

Dissection of anatomic specimens showed definite sandwiching of the sciatic nerve between the intact piriformis and the lower lateral border of the greater sciatic notch on application of traction (Fig 2).

All cases in the present series were operated using the Watson Jones lateral approach. After release of the capsular structures, the piriformis was seen to stand out as a rounded cord on internally rotating the limb. In the latter 11 cases of our series,

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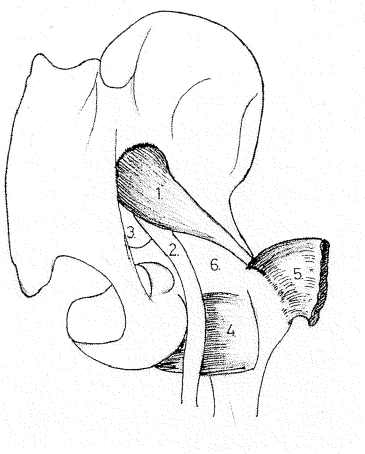

Fig 1 – Relationship of piriformis muscles to the sciatic nerve in a normal hip.

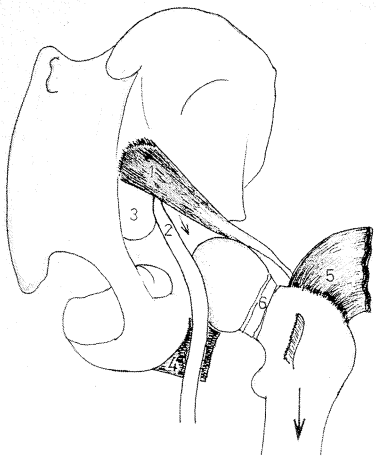

Fig 2 – Compression of sciatic nerve between the piriformis muscles and the border of greater sciatic notch on longitudinal traction.

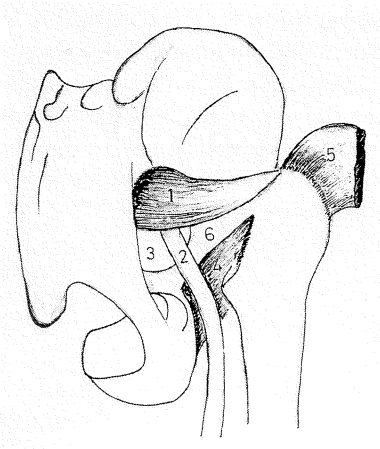

Fig 3 – Contracted piriformis standing out as a thick cord on attempted internal rotation of the involved hip.

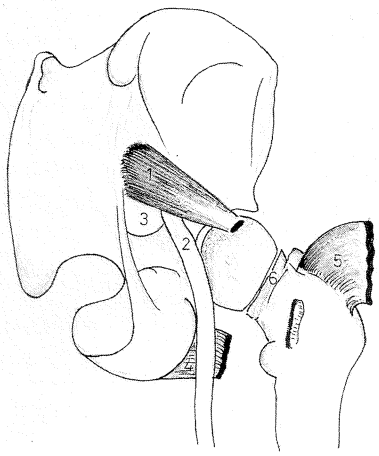

Fig 4 – Piriformis tendon released before any other soft tissue correction or traction.

special care was taken to section the rounded tendon of the piriformis close to its insertion, prior to applying traction to reduce the hip or correct leg length discrepancy. The shortening corrected in our cases ranged from 3 to 6 cm (average 4.2 cm) and only one of the case where this protocol was followed developed partial sciatic nerve palsy (common peroneal), in the form of foot drop.

RESULTS

The details are presented in Table I. All patients had limb length inequality ranging from 3 to 6 cms (average 4.2). Preoperatively, the sciatic nerve was found to be normal on clinical examination. Two patients were cases of neglected CDH, three of old Tom Smiths arthritis and seven had fracture neck of femur as the primary injury while there were two cases of unreduced posterior dislocation hip. Out of the seven cases of femoral neck fracture, three had non union with proximal femoral migration and in three others, McMurray's osteotomy had been performed as a secondary procedure for non union of fracture neck of femur. In one case Girdlestone excision arthroplasty was done after failure of hemiprosthesis. In our series, limb length discrepancy (average 4.2cm) was found to be maximum in cases of Tom Smiths arthritis and neglected non-unions of femoral neck fracture.

All the three patients who developed sciatic nerve palsy had been operated on after a period of heavy skeletal traction, without a specific soft tissue release protocol. Nerve palsy was partial in one and complete in the other two cases. At an average of 8.1 years of follow up, two of the patients had recovered completely while one had residual paralysis.

Table I – Results of limb length equalisation

Case No.	Age/Sex	Diagnosis	Shortening (cm)	Procedure	Follow-up (in years)	Nerve palsy
1.	28/M	Non-union # neck femur	3.5	THA	9	Common peroneal
2.	20/M	Tom Smith's arthritis	6	THA	8	Sciatic
3.	18/F	Tom Smith's arthritis	5.0	THA	7.5	Sciatic
4.	16/M	Neglected CDH	4.0	OR	6.2	–
5.	18/F	Neglected CDH	3.5	OR	6.2	–
6.	18/M	Tom Smith's arthritis	6.0	THA	6.8	Common peroneal
7.	50/M	Non-union # neck femur	4.4	THA	6.8	–
8.	48/M	Non-union # neck femur	4.5	THA	5.8	–
9.	54/M	Non-union # neck with girdle stone arthroplasty	4.8	THA	5.1	–
10.	54/F	McMurray osteotomy	3.8	THA	4.6	–
11.	50/F	McMurray osteotomy	3.5	THA	4.2	–
12.	53/F	McMurray osteotomy	3.0	THA	3.6	–
13.	49/M	Unreduced PDH	3.5	THA	2.8	–
14.	53/M	Unreduced PDH	3.7	THA	2.0	–

PDH – Posterior dislocation hip

CDH – Congenital dislocation hip

In the latter 11 cases in our series, pre-operative skeletal traction was also used; during surgery, the piriformis tendon was exposed and was found to be contracted in all cases and stood out like a thick cord on internal rotation of the limb (Fig 3). This was released from its attachment to the trochanteric fossa prior to intra operative longitudinal traction (Fig 4). Limb length was equalised with a difference of up to 1 cm in these patients. Only one of these eleven patients developed partial sciatic nerve palsy in the form of foot drop. No specific cause could be ascertained except that limb length discrepancy was 6 cm and longitudinal stretching was significant.

DISCUSSION

One of the most common problems encountered after limb length equalisation of significant proportion is sciatic nerve injury. Stretching of the nerve is reported to occur in cases having more than 4 cm of shortening[1,3]. Significant lateralisation during THA adds to the problems and a combination of these factors may cause neural damage during equalisation of leg length discrepancy of lesser degree also. Various other factors like damage from acrylic bone cement, injury from retractors and intra-neural haemorrhage[3] have been known to play an important role in the causation of post-operative sciatic nerve palsy. On the other hand, pathological states of piriformis muscle like pyomyositis and an anatomically variant bifid piriformis muscle have been shown to cause sciatica[4,5]. However the role of the contracted piriformis in the causation of sciatic nerve palsy during reconstructive procedures at the hip has not been emphasised. On cadaveric dissection, it was observed that the sciatic nerve lies sandwiched between the lower margin of greater sciatic notch and the piriformis muscle. It is likely to be compressed against the sharp rounded bony margin of the pelvis by a contracted piriformis when longitudinal traction is applied to a limb with a proximally migrated trochanter.

Edwards[6], in a report of 21 cases of THA, demonstrated an association between the degree of limb lengthening and the development of sciatic or peroneal nerve palsy. In his study, peroneal nerve palsy was associated with leg lengthening of less than 3.8 cm whereas sciatic nerve palsy developed in cases where lengthening exceeded 4.0 cm. In one case in our series, where partial sciatic nerve palsy occurred inspite of pre-traction sectioning of the piriformis tendon, the authors believe that the excessive longitudinal stretching of the nerve (leg length discrepancy was 6 cm), or even intraneural haemorrhage may have been the probable factor. Only the peroneal component was involved, and this is known to be more vulnerable to stretching than the tibial fibers of the nerve.

The present hypothesis of the tightened piriformis as a compressive force cannot be proven indefinitely by this series as it is too small to be statistically significant. However, we believe that this warrants further investigation. An important method may be intra-operative nerve conduction studies or similar tests, which can be conducted after applying traction with an intact piriformis. This facility is not available at our institute, but may give other investigators food for thought. Nevertheless, it must be emphasised that we do not label the piriformis as the primary cause of sciatic nerve compromise; numerous other factors are equally or more important, and all must be considered during reconstruction procedures at the hip in which limb length equalisation is to be done.

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