TECHNICAL NOTE

Surgical technique for repair of acute proximal hamstring tears

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Accepted: 14 May 2012

KEYWORDS
Acute proximal hamstring tear; Surgical repair; Activity level; Return-to-sport

Summary The surgical technique for repair of acute proximal hamstring tears is relatively recent. Installation of the patient is critical. The approach is either vertical under the gluteal fold in case of a complete tear with tendon retraction of more than 6 cm, or horizontal in the gluteal fold for retraction of less than 6 cm or for partial tears. After identification and neurolysis of the sciatic nerve, transosseous tendon reinsertion is performed with three or four metal or resorbable suture anchors. A rigid brace keeping the leg at 30° of flexion is worn for few days, then replaced by an articulated knee brace for 45 days, which limits extension but allows full flexion. Rehabilitation is begun early. Thirty-four patients underwent surgery for acute proximal hamstring tear and received this treatment. All of the athletic patients were able to return to their pre-injury activities after a mean 5.7 ± 1.6 months (2.3–9.3 months).

Introduction

A proximal hamstring tear is a rare, poorly understood entity [1,2] whose diagnosis is not always immediate. Only 12% of hamstring traumas are proximal tears [1]. Sallay et al. [3] showed that functional results were better after surgical repair than after conservative treatment. Cohen and Bradley [4] recommended surgery in case of a tear of more than 2 cm or a complete tear. Acute and a chronic tear must be differentiated, depending upon the time between the trauma and surgical repair. Klingele and Sallay [5] have placed the limit at 4 weeks, after which surgery becomes more difficult because fibrosis begins to develop around the sciatic nerve.

Surgical repair of acute proximal hamstring tears considerably improves the functional prognosis in patients and their return to sports [6] but the technique is difficult because the region of the ischium is not well known, is difficult to approach and involves a real risk of vascular or nervous damage. We performed this study to clarify these elements and describe the main technical points based on our experience of 34 acute tears.

Anatomical update

The region of the gluteus maximus is the posterior part of the hip. From a topographical point of view it is important
to note that the gluteal fold does not correspond to the lower part of the gluteus maximus but crosses it diagonally. Under the thick, smooth skin is a layer of fat, composed of adipose deposits separated by fibrous bands, which are attached to the deep derma and underlying fascia. There is no superficial fascia, making surgical incision difficult. The gluteal cutaneous branch of the small sciatica nerve and the perforating cutaneous nerve run along this fatty layer. The posterior femoral region includes the posterior part of the thigh under the gluteal fold. The skin is thick and rigid and the subcutaneous cellular tissue is separated from the deeper layer by superficial fascia. The first layer of muscles is formed by the semi-tendinosus medially and the long portion of the biceps laterally. They share a common proximal tendon, which is attached to the posterior side of the ischial tuberosity. The second layer of muscle is formed by the semi-membranosus muscle. Its proximal tendon attaches outside the semi-tendinosus-biceps. The sciatic nerve runs along the layer of cellular adipose tissue vertically under these two layers of muscle (Fig. 1). The hamstring muscle complex includes these three muscles, which are mainly the flexors of the leg but also the extensors of the thigh. The proximal aspect of these muscles is attached to the ischial tuberosity and the bottom to the tibia and the head of the fibula [7].

**Surgical technique**

Surgery is performed with the patient under general anesthesia or spinal anesthesia. The patient is placed in the prone position with the hip slightly flexed at 20° and the knee flexed at 60° on a knee bar (Fig. 2). This releases the hamstring muscles and facilitates reinsertion of the tendons without tension.

**Vertical approach**

This approach is taken in case of complete tear and tendon retraction of more than 6–7 cm. A 5–8 cm (Fig. 3) vertical incision is performed under the gluteal fold in line with the ischial tuberosity. After making an incision in the superficial fascia the hamstring muscle complex is exposed (Fig. 4); it is usually surrounded by a large hematoma, which is in the process of healing and creates a detached pocket that facilitates the incision. In case of a recent tear (less than 15 days), the sciatic nerve can simply be freed by blunt dissection. Sometimes surgical neurolysis of the sciatic nerve is necessary because fibrotic scar tissue has begun to develop. Identifying the ischial tuberosity is difficult because the ischium is deep and buried under the gluteus maximus. A valve should be placed under the gluteus maximus so that it can be pulled up and out. The ischium should be exposed with a rongeur for correct healing of the tendons. Transosseous reinsertion of the tendons is performed using 3 or 4 suture anchors and non-absorbable sutures (DePuy Mitek, Norwood, MA, USA). The use of metal suture anchors (Mitek Gil SuperAnchor™) requires perfect visualization of the ischium. The tunnel for the anchors is drilled with an awl then the anchor is inserted with a hammer under visual control. The use of absorbable suture anchors (Mitek Lupine™ Loop Anchor, Raynham, MA, USA) is easier. The Lupine system includes a cannulated drill guide, which allows drilling of the ischium with no risk of injury to the sciatic nerve. After drilling the tunnel for the suture anchor with a motorized drill (Fig. 5), the anchor is inserted through the guide with a hammer (Fig. 6). Lupine™ Loop suture anchors are provided with two non-loaded sutures. The two sutures must be removed and a suture anchor preloaded with absorbable suture should be used (Orthocord™ Suture, Raynham, MA, USA).

Modified Mason-Allen stitches are used to stitch the tendons (Fig. 7). Reduction and attachment of the tendons is achieved by simple traction of the free suture which slips in the anchor so that the tendon can be raised like a "halnyard or a cable raising a sail on the mast of a boat". A series of simple half hitch knots will stabilize the system.
Acute proximal hamstring tears

Figure 3  a: vertical approach in line with the ischium; b: horizontal approach in the gluteal fold.

Figure 4  Stump of the tendon with the tear of the three hamstring tendons (vertical approach).

Figure 5  Motorized drilling of tunnels for suture anchors using Lupine™ protective drill guide.
Figure 6  Placement of Lupine™ suture anchors through the drill guide (anchors inserted with a hammer).

Horizontal approach in the gluteal fold

This approach is used in case of tendon retraction of less than 6 cm (Fig. 3) or partial tears. The cosmetic outcome is more attractive, however dissection is more difficult and there is less visibility. The horizontal approach crosses the gluteus maximus diagonally. The fatty layer must be passed through and the gluteus maximus must be identified but left intact. The incision must be performed very carefully to avoid injuring the cutaneous gluteal branch of the small sciatica nerve and the perforating cutaneous nerve, which can cause secondary dysthesia. The technique for transosseous tendon reinsertion is identical.

Postoperative course

Immobilization in a rigid brace for 3 to 5 days with the knee in 30—45° flexion protects the tendon repair and avoids extension of the knee, hip flexed. This is replaced by an articulated knee brace, which allows knee flexion. This is worn for 45 days. Walking is begun early (24—48 hours).

Partial weight bearing is possible immediately with two forearm crutches.

Rehabilitation is begun early with isometric exercises of the quadriceps and hamstrings with the knee in 30—45° flexion. After 6 weeks, active rehabilitation is begun including dynamic exercises of the quadriceps with closed chain exercises and active assisted exercise of the hamstring muscles. Between weeks 12 and 16 the patient can resume rapid walking and if possible light jogging. Strengthening of the hamstring muscles is continued with isokinetic exercises first, then eccentric exercises. Between the 16th and 32nd weeks, the usual sports activities can be resumed.

Results

Between January 2002 and July 2011, 60 patients underwent surgery for total or partial proximal hamstring tears including 34 acute cases. Diagnosis of the tear was suggested clinically (pain, posterior hematoma, and muscle weakness) and confirmed by emergency MRI. All patients were treated surgically. Patients underwent regular, prospective clinical follow-up. A control MRI and isokinetic Biodex™ (Lyon, France) tests were performed a minimum of 6 months after
surgery. Judgment criteria were the return to sports based on the responses in an interview, healing of tendons on control MRI, the hamstring/quadriceps ratio on isokinetic tests and at the final follow-up and the presence of residual pain (Table 1).

Table 1  Description of the results of the series of “Acute tears”.

| Patients | 
| --- | --- |
| **Sex** | Women 9/34  
Men 25/34 |
| **Mean age (years)** | 39.3 ± 11.4 (18—60) |
| **Level of sports activity** | No sports 2/34  
Professional 3/34  
Competitive sports 12/34  
Recreational sports 17/34 |
| **Cause of trauma** | Sports activity 29/34  
Domestic accident 5/34 |
| **Mean delay trauma/surgery (days)** | 13.6 ± 6.4 (5—30) |
| **Delay until preoperative MRI (days)** | 5.9 ± 3 (1—15) |
| **Number of tendons torn** | Three 23/34  
Two (biceps and semi-tendinosus) 7/34  
One (semi-membranosus) 4/34 |
| **Mean tendon retraction (cm)** | 5.8 ± 1.9 (2—10) |
| **Mean follow up (months)** | 27.2 ± 22.9 (6—85.7) |
| **Number of lost to follow up** | None |
| **Results** | Return to sports 32/32 athletic patients  
Return to sports at same level 27/32 athletic patients  
Delay until the return to sports (months) 5.7 ± 1.6 (2.3—9.3)  
Healing on control MRI 19/19 performed  
Mean strength H compared to contralateral limb 240° per second (%) 100, 8 ± 12.5 (83—125)  
Mean H/Q ratio at 240° per second (%) 54.7 ± 8.6 (41—74)  
Events during follow-up Recurrent tear 0/34  
Sciatic paralysis 0/34  
Pain during prolonged sitting 3/34 |

H: hamstring; H/Q: hamstring/quadriceps ratio.

Discussion

Surgical reinsertion of acute proximal hamstring tendon tears resulted in tendon healing in all patients and patients returned to sports after a mean 5.7 months. The results of this series are consistent with those of previous studies [8,9] and there are numerous advantages to this technique:

- the patient is installed on the operating table with the leg on a simple knee bar and not suspended [8];
- based on their experience the authors suggest a horizontal approach in case of a partial tear or retraction of less than 6 cm on MRI. The esthetic advantage is clear, although the learning curve for this approach is longer;
- the surgical approaches described do not require any sectioning of the gluteus maximus muscles;
- there are two advantages to using Lupine™ suture anchors: first, they are absorbable, so there is less risk of bothersome secondary migration and second, the drill guide of the Lupine™ Loop system protects the sciatic nerve and the soft tissue when the tunnel is being drilled.

Unlike trauma to the hamstring muscles, functional treatment is not indicated in case of proximal tendon tear [9]. Several studies have shown that functional results were better after surgical repair [3,6] and that certain patients who underwent surgery after failure of conservative treatment [10—12] recovered satisfactory function.

Conclusion

Surgical repair of acute proximal hamstring tear has significantly improved the functional prognosis of patients. However, this technique is relatively recent, difficult and requires a good knowledge of ischial anatomy.

Disclosure of interest

The authors declare that they have no conflicts of interest concerning this article.

Acknowledgements

We would like to thank Mr Mathieu Pinet for illustrating this article.

References