

Successful return to high level sports following early surgical repair of complete tears of the proximal hamstring tendons

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Received: 7 December 2008 / Revised: 26 January 2009 / Accepted: 26 January 2009 / Published online: 28 February 2009
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Abstract The purpose of this study was to investigate the outcome of surgical management of acute complete proximal hamstring tendon tears. This was a prospective review of a case series from a tertiary referral centre. Ten patients presenting with complete proximal hamstring tendon tears were confirmed on MRI. All patients underwent surgical exploration and repair of the torn tendons with the aim of returning to normal activities and sports. Isokinetic muscle testing was performed using a dynamometer. The Cybex dynamometer (Cybex International, Ronkonkowa, NY) testing revealed almost comparable readings for the operated versus the non-operated side. An average peak torque of the operated hamstring muscles of 82.78% (range 47.16–117.88%), compared to the contralateral leg, was noted at six months. An excellent outcome was found in terms of return to normal activities and sports. Early surgical repair and physiotherapy has been noted to be associated with a good outcome and enables an early return to high level sports after complete tear of the proximal hamstring tendons.

Introduction

A complete avulsion of the hamstring origin has been reported in sports such as athletics, dancing, water

skiing, judo and bull riding [2–4, 6, 8, 9]. The poor results of nonoperative treatment [9] have encouraged sports surgeons to undertake early surgical repair [7]. We report the successful outcome of early surgical repair of complete tears of the proximal hamstring origin in ten athletes.

Materials and methods

Between 2002 and 2007, the senior author undertook acute surgical exploration and repair of complete tears of the hamstring muscle origin in ten patients (Table 1). The average age of the group was 29.2 years (range 38–24 years, SD 4.29). All patients were semi-professional or professional athletes and presented within five weeks of their injury (average 12 days, range 4–35 days, SD 10.08). Four patients sustained the injury during an athletic event and the other six occurred during training. The mechanism of injury was typically hyperflexion of the hip with an extended knee.

All clinical presentations were due to pain, bruising or difficulty with active knee flexion. The prevalent clinical signs we observed were tenderness on palpation of the ischial tuberosity, petechial skin discolouration of the posterior thigh, palpable breach in continuity of the proximal hamstring muscle tendon mass, laxity of the distal hamstring insertion and weakness in muscle strength. Three patients experienced ‘pins and needles’ sensation along the posterior thigh, suggesting bleeding close to or compression of the sciatic nerve or posterior cutaneous nerve of the thigh. No objective sensory or motor deficits were observed.

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Table 1 Patient characteristics

| Age (y) | Gender | Side | Sport | Injury to repair time | Post operative nerve symptoms | Retraction of torn tendon |
|---------|--------|-------|----------|-----------------------|-------------------------------|---------------------------|
| 32 | M | Right | Athlete | 4 days | None | No |
| 28 | M | Right | Rugby | 7 days | None | No |
| 24 | F | Right | Athlete | 35 days | Cutaneous | >5 cm |
| 31 | M | Left | Rugby | 23 days | None | >5 cm |
| 38 | M | Left | Skiing | 11 days | Cutaneous | No |
| 27 | F | Right | Athlete | 6 days | None | No |
| 26 | M | Left | Football | 16 days | Cutaneous | >5 cm |
| 25 | M | Right | Football | 9 days | None | No |
| 28 | M | Right | Rugby | 4 days | None | No |
| 33 | M | Left | Skiing | 5 days | None | No |

Plain radiographs were performed in all cases to exclude an avulsion of the ischial tuberosity. Magnetic resonance imaging (MRI) was our diagnostic investigation of choice (Fig. 1).

Early surgical exploration and repair was planned in all cases. In our series the indications for surgery were a retracted tear of conjoint muscle tendon origin by more than 2.5 cm in a symptomatic patient who was keen to get back to sports at a high level. All patients were given the options of operative and nonoperative treatment and some opted for a trial of nonoperative treatment.

Surgical technique

All procedures were performed under general anaesthesia. Patients were positioned in a prone position. With the help of pillows taped to the operating table, the knee was positioned at 75–80° of flexion. Following

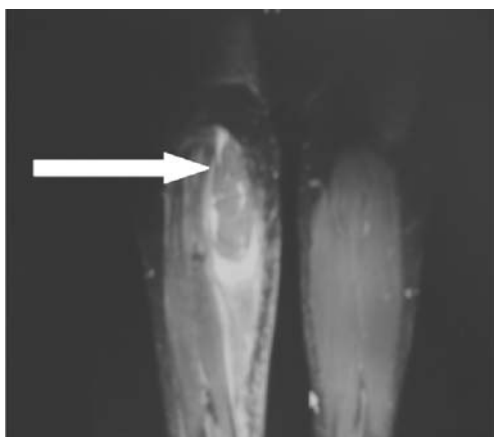


Fig. 1 Magnetic resonance imaging (MRI) of a torn proximal hamstring origin

meticulous preparation and draping of the surgical site, a horizontal skin incision was made along the gluteal crease (Fig. 2).

In cases where the torn muscle origin had retracted more than 5 cm, the incision was modified to a figure ‘7’ incision with the vertical limb of the ‘7’ running perpendicular to the gluteal crease (Fig. 2). The incision was extended through the superficial fascia and the deep fascia. Deep to the posterior fascia of the thigh, the gluteus maximus muscle was identified. The muscle was retracted superiorly to expose the desired surgical plane.

We routinely noted the presence of an haematoma immediately following the incision of the deep fascia, confirming the desired surgical plane and guiding us to the torn tendon. The haematoma was routinely lavaged. The sciatic nerve, which can be marked on the surface at the midline of the thigh at the level of the gluteal crease, was



Fig. 2 Bruising at the site of hamstring origin and the figure of ‘7’ incision

identified lateral to the tendon origin and protected. The torn tendon stump was identified and mobilised in all cases (Fig. 3). It was then secured with a suture while the ischium was prepared for re-attachment by clearing any remains of the torn tendon. In our series, we found that the torn hamstring origin usually had a thick sleeve of perimysium enveloping it, which facilitated robust anchorage of the tendon with the sutures. In the absence of such a fascial envelope, additional care must be taken while placing the sutures to prevent pull-through of the sutures through the weak tendon. In the latter cases, the construction may also need to be protected for a longer period during rehabilitation to prevent a postoperative failure of repair.

In three cases (all operated beyond 14 days), the sciatic nerve was already found in apposition to the avulsed tendon mass, and nerve dissection or neurolysis was essential. Care was taken to also preserve the posterior cutaneous nerve of the thigh. The inferior gluteal neuro-vascular bundle which lies proximal to the incision site (approximately 5 cm proximal to the inferior border of the gluteus maximus muscle) was not seen or damaged in any of the cases.

A tension-free reattachment (Fig. 4) of the tendon to the bone was performed using three to five bone suture anchors (DePuy Mitek, Norwood, MA) using a modified Mason-Allen stitch [1, 10]. The suture anchors have a metal peg which is fastened into the ischial tuberosity. The synthetic sutures attached to the metal peg can then be passed through the mobilised tendon to fashion a well-tensioned bone–tendon approximation.

All patients were placed in a total range of movement knee brace (DonJoy, Inc., Carlsbad, CA) postoperatively.

Rehabilitation

Specialist physiotherapy and a supervised rehabilitation programme, tailored to individual patients, was commenced postoperatively. An approximate weekly rehabilitation guide is listed as follows.

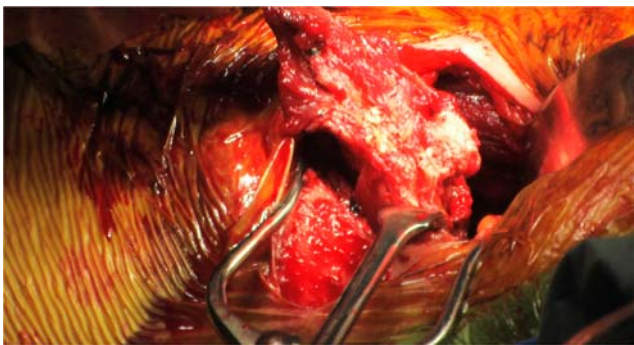


Fig. 3 The torn hamstring tendon identified

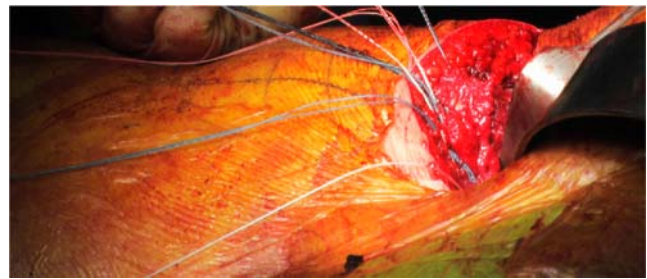


Fig. 4 Suture anchors used to approximate the tendon to bone

- Weeks 1 & 2 The knee is immobilised at 90° in brace. Flexion beyond 60°, weight-bearing and sitting on the affected ischial tuberosity is avoided.
- Weeks 3 & 4 The knee is now at 60° in a brace. Passive knee flexion and hip extension are allowed.
- Weeks 5 & 6 The knee now at 30° in a brace and the patient can touch weight bear if able.
- Weeks 7–10 A brace is not used at this point. The knee is fully extended. Progression to full weight bearing is permitted. Passive and active range of movement is encouraged while avoiding extremes of motion. Closed chain exercises are started. Hydrotherapy may be commenced.
- Weeks 11–14 The gait is normal by this point. Muscle strengthening work is encouraged. The patient may undertake fast walk or jogging.
- Weeks 15–16 Isokinetic testing may be considered and further progress in rehabilitation is based on these measurements. Heavy weight training may be undertaken and running is permitted.
- Weeks 24–38 Full return to sport is usually allowed in the majority of patients.

All patients were followed-up to monitor return to normal activities and sports. This was used as the functional measure of the outcome of surgical repair.

In addition, a Cybex dynamometer (Cybex International, Ronkonkoma, NY) was used for isokinetic muscle testing measuring maximum hamstring and quadriceps torque and peak torque ratio of hamstring to quadriceps at an isokinetic velocity of 60° per second.

Results

No evidence of ischial tuberosity avulsion was noted on plain radiographs and MRI confirmed the diagnosis in all cases. The immediate postoperative recovery was unremarkable in all ten cases with average hospital stay of two

days. There were no instances of sciatic nerve injury. The three patients who underwent haematoma evacuation and release of the sciatic nerve for preoperative paresthesia confirmed immediate relief of their neural symptoms postoperatively. Four other patients reported new onset transient posterior thigh numbness, which improved between one and eight weeks. The authors believe that this was a result of neuropraxia to the posterior cutaneous nerve of the thigh. No other complications were noted in any patients.

Gauging the outcome of intervention as return to preinjury level of sports, we noted an excellent functional result by 12 months in all ten patients (average 25 weeks, range 18–65 weeks). Nine patients returned to their previous level of semiprofessional or professional sports within six to nine months after injury. One person, despite a very good recovery, opted out of top level sports. This was a personal choice made prior to the procedure and was not influenced by the surgical outcome. All patients were content with the final outcome of the reconstruction.

The Cybex dynamometer (Cybex International, Ronkonkoma, NY) graphs comparing injured versus uninjured quadriceps muscles and corresponding hamstring muscles are depicted in Figs. 5 and 6 respectively. Almost comparable readings were recorded for the operated versus the nonoperated side. An average peak torque of the operated hamstring muscles of 82.78% (range 47.16–117.88%), compared to the contralateral leg, was noted at six months. The peak torque ratio of the injured hamstring to quadriceps muscle strength was on average 0.56 (range 0.33–0.84) versus 0.66 (range 0.61–0.72) for the contralateral leg.

Discussion

Recent reports in the literature suggest successful outcomes for complete proximal hamstring tears following acute and

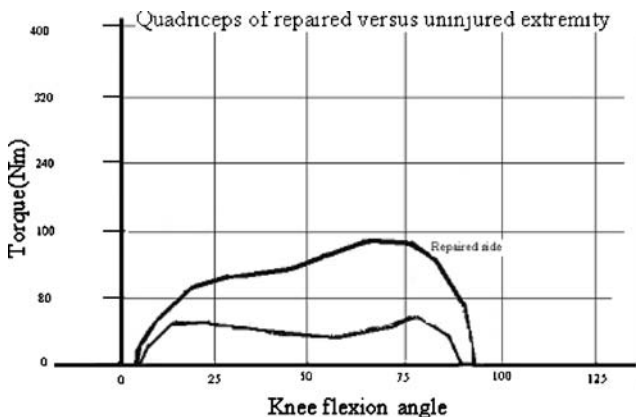


Fig. 5 Isokinetic muscle testing with analysis of average torque at 0, 25, 50, 75, 100 and 120 degrees of knee flexion

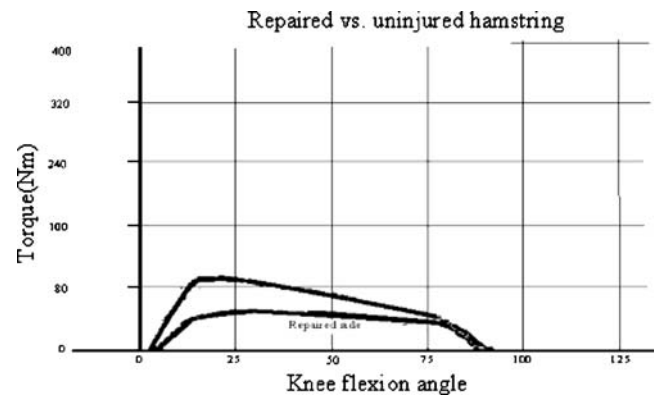


Fig. 6 Isokinetic muscle testing with analysis of average torque at 0, 25, 50, 75, 100 and 120 degrees of knee flexion

chronic repair [4, 5, 8]. Nonoperative management is associated with poor outcomes and low rate of return to sports [9, 11]. Delayed repair of tears may need larger incisions and extensive surgical exploration to identify the retracted ends of the severed musculo-tendinous region.

With delay in surgical exploration, the sciatic nerve often becomes trapped in the extensive scar tissue that forms at the site of the tear. This may pose a considerable surgical challenge compared to acute primary repair. We found explorations within the first three weeks of injury technically easier, and even within that time frame have noted nerve scarring.

Our series demonstrates further evidence for early operative intervention in complete proximal hamstring tendon tears. Due to the rare nature of the injury it is not possible to standardise the type of sport and activity levels when comparing the results of our surgical procedure. One other drawback of our study may be the lack of a comparison group where the same injury was managed conservatively. However, we believe that in view of the successful rehabilitation we noted after surgery and the poor outcome from conservative management noted in literature, such a study would not be ethical or feasible.

In conclusion, a tear of the origin of hamstring muscles is a significant injury. It can be a very frustrating and often a career-threatening injury in competitive sports. Early surgical repair and physiotherapy is associated with a good outcome and enables an early return to high level sports.

Conflict of interest No conflicts of interest or disclosures.

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