Journal of Hip Preservation Surgery Vol. 6, No. 3, pp. 284–288
doi: 10.1093/jhps/hnz037
Advance Access Publication 11 October 2019
Technical Tips

OXFORD

A combined endoscopic and open surgical approach for chronic retracted proximal hamstring avulsion

Ran Atzmon[1], Eyal Amar[2], Dror Maor[2] and Ehud Rath[2]*

[1]Department of Orthopaedic Surgery, Assuta Medical Center, Faculty of Medicine and Ben Gurion University, Ha-Refu'a St 7, Ashdod 7747629, Israel and
[2]Department of Orthopaedic Surgery, Tel Aviv Medical Center, Sackler Faculty of Medicine and Tel Aviv University, Weizmann St 6, Tel Aviv 6423906 Israel.
*Correspondence to: E. Rath. E-mail: udirath@gmail.com
Submitted 2 April 2019; revised version accepted 13 August 2019

ABSTRACT

Proximal hamstring avulsion is an uncommon injury which usually requires surgical intervention. When possible, primary surgical fixation is recommended. In chronic hamstring avulsion with significant retraction of the tendon, hamstring reconstructions using an autograft or allograft are required in order to bridge the gap. This is mainly performed using an open surgical technique. We describe a combined endoscopic and open surgical approach to hamstring reconstruction surgery.

INTRODUCTION

Hamstring injuries are most prevalent in the young athlete population [1]. The injury typically occurs with an eccentric muscle contraction of simultaneous hip flexion and ipsilateral knee extension as in trying to prevent an unexpected movement of falling forward [1, 2]. The hamstring is formed by three different muscles: semitendinosus, biceps femoris and the semimembranosus, which apart from the short head of biceps femoris, all originate as a common tendon from the ischial tuberosity (IT) [3]. Complete avulsion of the proximal hamstring generally requires surgical intervention due to poor functional results with non-operative treatment [4–6]. The indications for surgical treatment are evolving and include involvement of all three tendons, retraction of 2 cm or more, displaced bony avulsion and chronic pain associated with functional impairment [1]. Acute surgical treatment within the first 4 weeks has shown to have superior results over delayed surgical treatment [1, 2, 7].

In cases when the gap between the hamstring stump and its footprint is too large to bridge, or the quality of the tendon is poor, hamstring reconstruction using an allograft or autograft is recommended [2, 6, 7]. The purpose of this surgical technique is to describe a combined surgical approach for reconstruction of chronic hamstring proximal avulsion, using a proximal endoscopic and distal mini-open repair.

SURGICAL TECHNIQUE

Pre-operative assessment

Physical examination of chronic tears often reveals limping and a 'stiff-legged' gait. Palpation may elicit deep focal tenderness at the IT and along the proximal hamstring. Furthermore, hamstring weakness might be noticed especially with running and sprinting, and can be examined with provocation tests such as bent knee stretch test, Puranen-Orava test and resisted active knee flexion with an eccentric loading [2]. Magnetic resonance imaging (MRI) of a chronic tear will demonstrate the injury location and extent, number of involved tendons and the degree of retraction. The amount of muscle atrophy and fatty infiltration, which is usually accompanied with scar tissue formation shown as a low signal on all pulse sequences will be seen. Hemorrhage, edema and fluid collection will often resolve by 2–4 weeks after the acute event [2, 3] (Figs 1 and 2).

Positioning and preparation

Surgery is performed under general anesthesia with the patient in a prone position with IV antibiotics. All bony

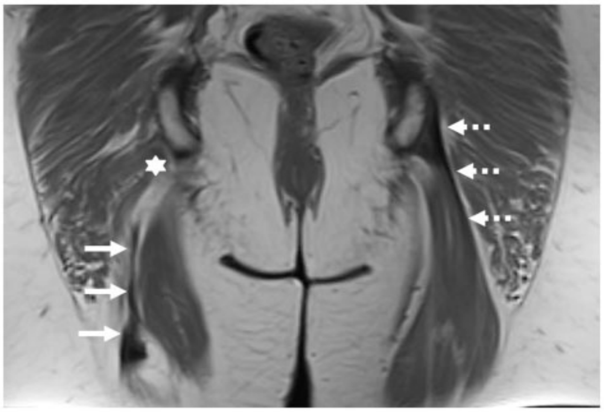

Fig. 1. Coronal MRI with T2 sequence showing complete avulsion of the right proximal hamstrings with retraction and associated edema (three full white arrow), the 6-points star marks the normal attachment site at the IT. The contralateral normal attachment and course of the hamstring is outlined with three dashed white arrow

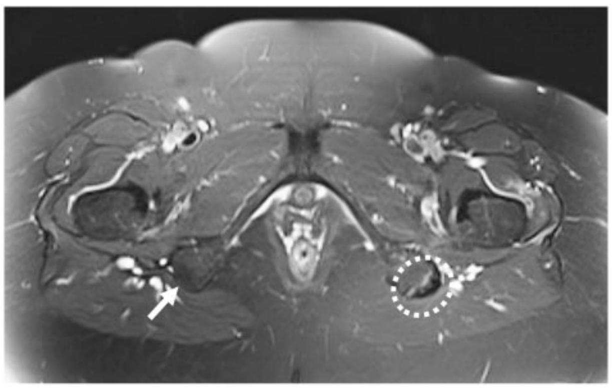

Fig. 2. Axial MRI with T2 sequence showing complete avulsion of the right proximal hamstring with edema (full white arrow) and the contralateral normal hamstring origin (dashed white circle)

and soft tissue prominences are padded, and both arms placed in 70 degrees of abduction.

Arthroscopic portals and initial evaluation

Three portal incision sites and anatomic structures are marked by palpating and identifying the IT. When palpation is difficult, it is advisable to use fluoroscopic guidance. The first central viewing portal (Fig. 3) is created in line and distal to the IT adjacent to the gluteal crease. A surgical plane is developed under the gluteus maximus with gentle medial and lateral motions of the scope sheath superficial to the IT. Care is taken not to slide the scope too lateral due to the proximity to the sciatic nerve. The scope sheath is positioned at the tip of the IT, the blunt

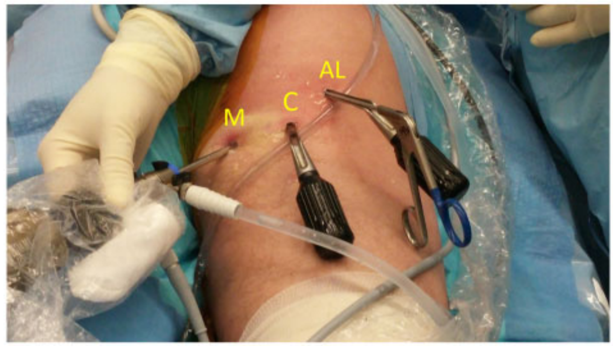

Fig. 3. Arthoscopic portals: central viewing portal (C), accessory lateral working portal (AL) and medial working portal (M)

obturator is removed and a 30 degree scope is inserted to a space created between the IT and the avulsed tendons. A spinal needle is used to ensure optimal access to the IT prior to establishing an accessory lateral working portal. The sciatic nerve that lies lateral and anterior to the IT along with its branches and the posterior femoral cutaneous nerve (PFCN) are identified with careful soft tissue dissection using a switching stick. The sciatic nerve is carefully released from adhesions proximally and distally. An additional medial working portal is often used to aid suture management (Fig. 3).

Preparation of the IT and anchor placement

Slotted hip canulas are used for safe instrument and anchor insertion. The hamstring footprint on the ischium (i.e. 'bald' ischium) is debrided using a 3.5 mm full radius resector (Smith and Nephew, Andover, MA) and the bone is exposed with a 5.5 mm round burr. Two or three double-loaded suture anchors (FASTIN® RC DePuy Mitec, Synthes) are inserted to the hamstring bed, with 5–10 mm gap separating each one.

Preparation of the hamstring stump

The proximal stump of the hamstring tendon is then palpated. A midline longitudinal incision is performed over the posterior thigh at the palpable area. Blunt dissection is performed toward the stump. The course of the PFCN is identified and protected. The fascia is then released and adhesions and scar tissue are debrided to allow mobilization of the hamstring tendon and muscle. The sciatic nerve is then identified and protected. After the tendon is released from the scar tissue, two to three number 5 Ethibond (Ethicon, Johnson and Johnson Medical N.V. Belgium) sutures are passed as whip stiches. Assessing the tendon quality and gap between its footprint at the IT and the distally retracted tendon stump, is measured by pulling

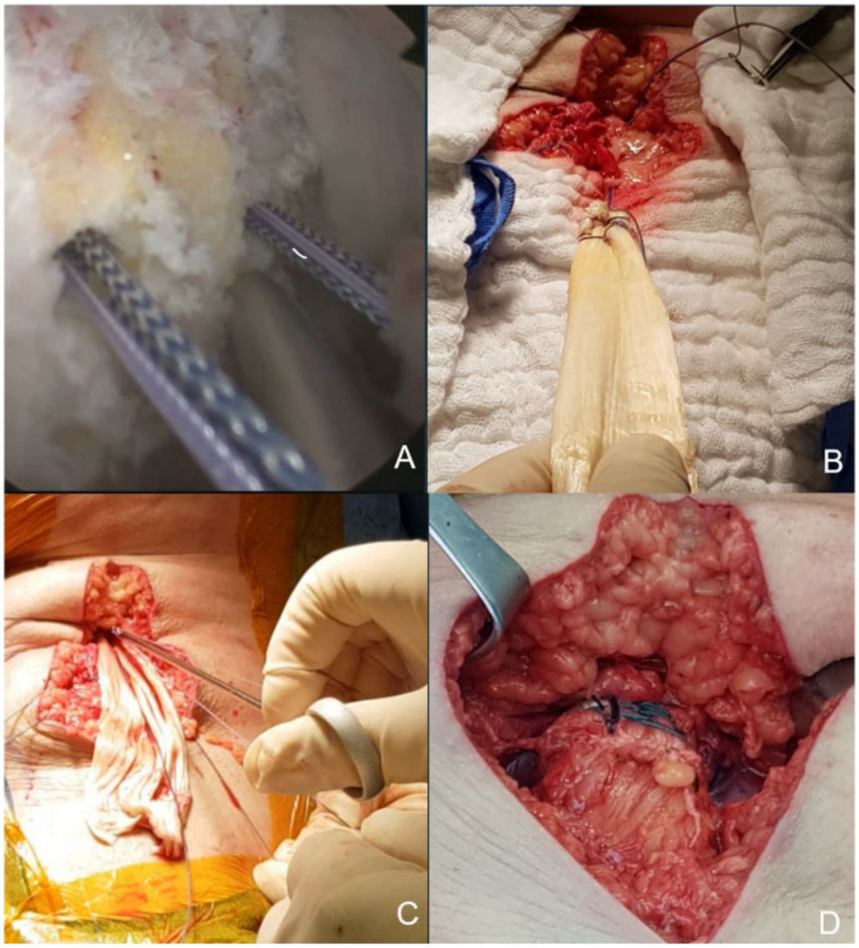

Fig. 4. Showing the different steps of the surgery, two double loaded suture anchors are inserted to the hamstring bed at the IT, with 5–10 mm gap separating each one (A). The sutures of the anchors are passed through the allograft using a lasso type knot (B), sliding the allograft up to the IT (C). Finally, the hamstring tendon is sutured to the allograft under tension with krackow sutures on each side of the tendon (D).

the tendons toward the IT, while flexing the knee. Rarely, in case of a large gap between the tendons and the IT, even a 60 degrees of flexion is required. Finally, an Achilles allograft was used to bridge the gap (Fig. 4).

Allograft bridging

The sutures of the anchors which were previously placed at the IT are passed through the allograft using a lasso type knot, sliding the allograft up to the IT followed by knot crossing between the two anchors. With the knee in 30 degrees of flexion, the hamstring tendon is sutured to the allograft under tension with krackow sutures on each side of the tendon, ensuring the tendon is firmly attached to the bone and balanced in the desired tension through the leg range of motion. The wound is then closed with absorbable 2.0 Vicryl and 3.0 Monocryl (see Supplementary Material).

Post-operative protocol

The standardized post-operative protocol included an anti-coagulation drug, toe-touch weight bearing for the first 10–14 days, proceeding with partial weight bearing for 2–5 weeks. However, instead of using hip orthotic, in order to restrict hip movement, we used a four wheel scooter as a substitute which also made the use of crutches redundant (Fig. 5).

DISCUSSION

Chronic complete proximal hamstring avulsion, generally requires surgery due to poor outcomes with non-operative treatment, such as diminished strength and endurance, prolonged pain and decreased return to sports activities [1, 2, 5]. Chronic tears tend to be more challenging than acute tears due to adhesions and scar tissue formation

Fig. 5. Post-operative four wheel scooter using as a substitute for hip orthotic brace and crutches

which affects the retracted tendon and the ability to mobilize the sciatic nerve [2, 4]. Open hamstring reconstruction surgery for chronic avulsion has been described using a fascia lata and achilles tendon allograft or semitendinosus and gracilis tendon autograft with a relatively good results [6, 7]. Open surgery techniques require an extended skin incision with a longitudinal posterior incision starting at the IT and extending distally up to 15 cm (Table I) [1, 2, 4, 6–8]. Additionally, detachment and raising the free lower edge of the gluteus maximus muscle and a careful dissection toward the IT while avoiding the sciatic and the posterior cutaneous femoral nerves. The placement of deep blunt retractors at the IT may pose a danger to the neighboring neurovascular structures. Exploration of the sciatic nerve using endoscopic technique allows better visualization and meticulous neurolysis. Moreover, placing the anchors in an endoscopic technique allows better accuracy and minimum undermining and preparation of the boney footprint. Using the anchor suture as a shuttle relay makes the need for dissection and visualization of the ischial fixation point unnecessary.

When it is possible to achieve adequate mobilization of the hamstring stump and accomplish primary fixation, the achilles tendon can be used to augment the repair [4]. In this technical note, we used an achilles tendon allograft to bridge the gap between the ischium and the proximal stump. However, any other allograft will likely accomplish the same goal [4, 6, 7]. When a substantial gap is noticed, a relatively large graft is needed, therefore, the use of an allograft prevents donor site morbidity.

In addition to the pearls and pitfalls shown in Table II, the limitation of this technique is the combination of

Table I. Advantages of endoscopic surgery over an open hamstring repair [1, 2, 4, 6–8]

Requires a smaller skin incision
No need for inferior detachment of the gluteus maximus muscle
Reduced soft tissue undermining
Improved view and preservation of the sciatic and posterior cutaneous femoral nerves
No need for deep blunt retractors to allow ischial exposure which may put the sciatic nerve at risk

Table II. Pearls and pitfalls of endoscopic surgery

Pearls	*Pitfalls*
Accurate portal positioning to allow maneuverability and triangulation	Limited field of view
Immediate coagulation using a radiofrequency probe	Difficulty with retraction greater than 5 cm
Using a lasso type knot, the sutures of the anchors are passed through the allograft, sliding the allograft up to the IT	Prone position which requires more attention from the surgical and anesthetic team
	Technically demanding
	Proximity of the portals to the sciatic nerve

endoscopic and open approach, which are technically demanding and should be addressed as two separate procedures under the same anesthesia.

SUPPLEMENTARY DATA

Supplementary data are available at *Journal of Hip Preservation Surgery* online.

ACKNOWLEDGEMENTS

RA, ER and EA participated in the surgery. All authors participated in the writing and proofreading of the manuscript and approved the final manuscript.

FUNDING

No funding was received for this project.

CONFLICT OF INTEREST STATEMENT

None declared.

REFERENCES

1. van der Made AD, Reurink G, Gouttebarge V *et al*. Outcome after surgical repair of proximal hamstring avulsions: a systematic review. *Am J Sports Med* 2015; **43**: 2841–51.
2. Moatshe G, Chahla J, Vap AR *et al*. Repair of proximal hamstring tears: a surgical technique. *Arthrosc Tech* 2017; **6**: e311–e17.
3. Beltran L, Ghazikhanian V, Padron M *et al*. The proximal hamstring muscle-tendon-bone unit: a review of the normal anatomy, biomechanics, and pathophysiology. *Eur J Radiol* 2012; **81**: 3772–9.
4. Folsom GJ, Larson CM. Surgical treatment of acute versus chronic complete proximal hamstring ruptures: results of a new allograft technique for chronic reconstructions. *Am J Sports Med* 2008; **36**: 104–9.
5. Harvey MA, Singh H, Obopilwe E *et al*. Proximal hamstring repair strength: a biomechanical analysis at 3 hip flexion angles. *Orthop J Sports Med* 2015; **3**: 232596711557691.
6. Lempainen L, Sarimo J, Orava S. Recurrent and chronic complete ruptures of the proximal origin of the hamstring muscles repaired with fascia lata autograft augmentation. *Arthroscopy* 2007; **23**: 441.e1–5.
7. Muellner T, Kumar S, Singla A. Proximal hamstring reconstruction using semitendinosus and gracilis autograft: a novel technique. *Knee Surg Sports Traumatol Arthrosc* 2017; **25**: 112–4.
8. Benazzo F, Marullo M, Zanon G *et al*. Surgical management of chronic proximal hamstring tendinopathy in athletes: a 2 to 11 years of follow-up. *J Orthop Traumatol* 2013; **14**: 83–9.