26 Proximal Hamstring Repair/ Reinsertion: Open Surgery Technique

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26.1 Introduction

Hamstring injuries can occur in various sports activities, but are also common among regular people, for example, while falling down. These injuries can be highly disabling and they can lead to substantial time loss from sports [1]. Some of the hamstring injuries require surgical treatment for optimal recovery [2]. Various open surgery techniques have been presented in literature [3–9]. The goal of the proximal hamstring rupture repair is to restore the anatomy of the injured structures so that athlete's rapid recovery and safe return to sports is possible with the low rate of recurrent hamstring injuries. Without adequate treatment, proximal hamstring rupture can result in permanent loss of hamstring function and strength and also lead to chronic pain [1, 10].

26.2 Surgical Indications

Most hamstring injuries are strains and can be treated conservatively with good results. However, there are cases in which surgery should be considered already in the acute phase. Also, there are cases in which surgery should be considered later if non-operative treatment appears to be unsuccessful.

The physician uses clinical findings (posterior thigh hematoma, pain and decreased strength in hip extension/knee flexion) and MRI imaging to determine whether the athlete has complete (Figs 26.1 and 26.2) or incomplete proximal hamstring rupture (Figs. 26.3 and 26.4).

26.2.1 Absolute Indications for Surgery

In an athlete, a proximal one-tendon avulsion or rupture with a clear retraction should be treated surgically regardless of the hamstring tendon biceps femoris (BF), semimembranosus (SM) or semitendinosus (ST) (Figs. 26.3 and 26.4). If two or all three of the hamstring muscles are avulsed, surgery should be considered in all patients if there are not contraindications to surgery. Suture anchors are typically used to reattach the tendon to the ischial tuberosity.

Apophyseal avulsions of the ischial tuberosity occur occasionally in adolescent athletes [11]. Surgical repair is traditionally recommended if the avulsed fragment is displaced by more than 10–15 mm.

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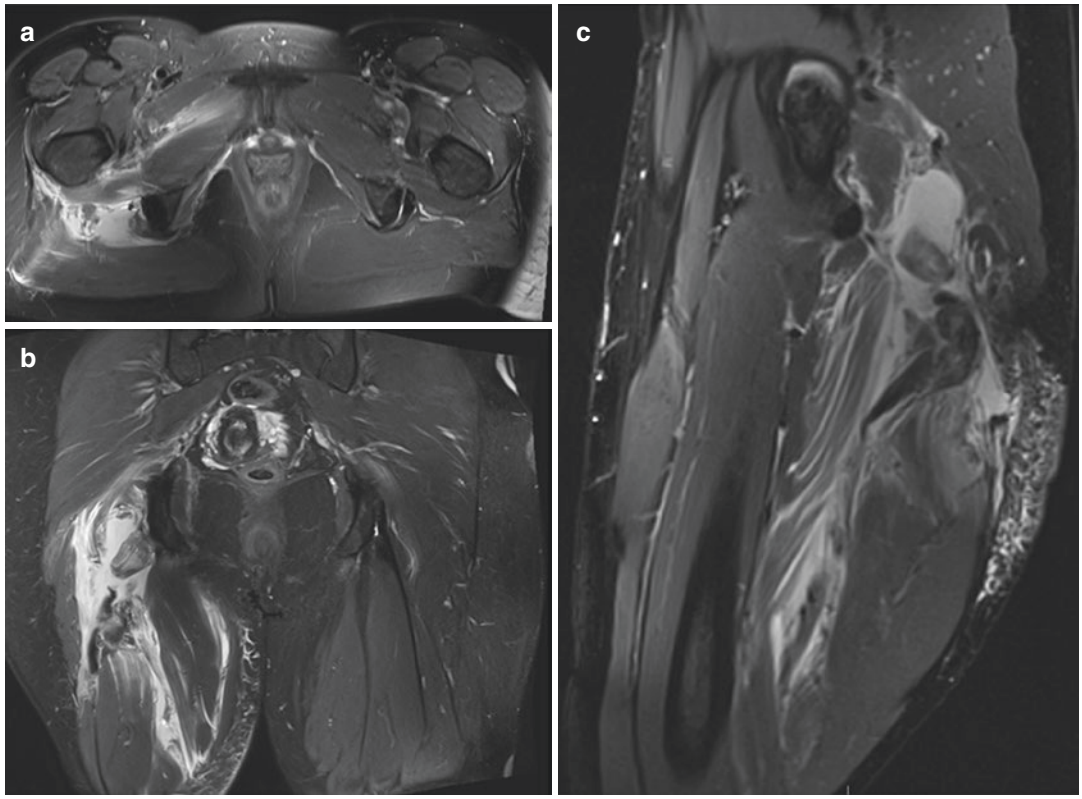

Fig. 26.1 Complete proximal three-tendon avulsion: (**a**) axial, (**b**) coronal and (**c**) sagittal planes

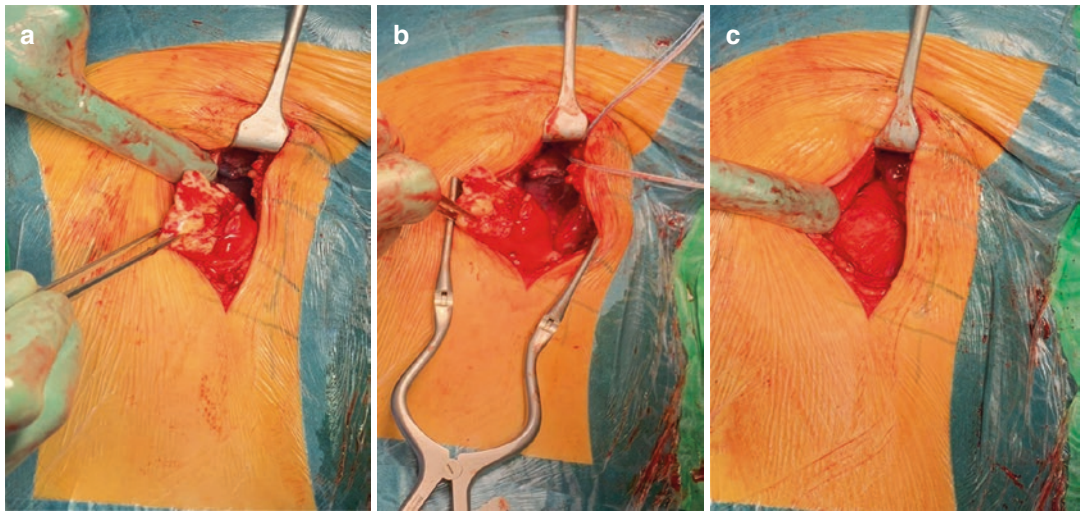

Fig. 26.2 Surgical approach and anatomy: (**a**) Retracted complete proximal three-tendon avulsion identified using vertical skin incision; (**b**) suture anchors placed anatomically to ischial tuberosity; and (**c**) prepared and suture-loaded tendons are secured to the footprint

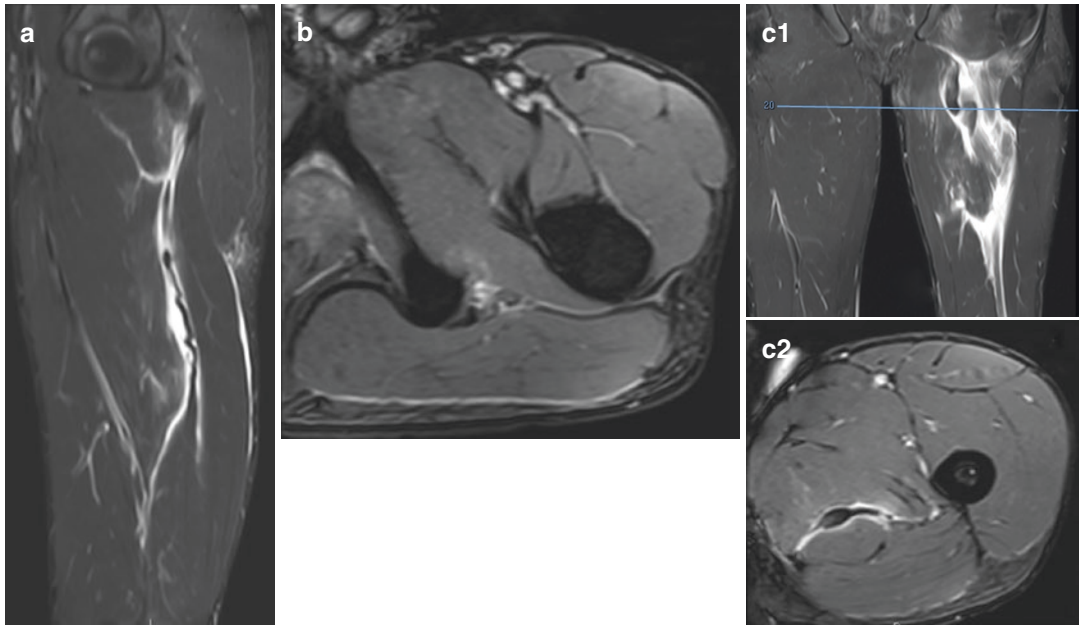

Fig. 26.3 Complete proximal one-tendon avulsion (semimembranosus): (**a**) sagittal, (**b**) axial, and (**c**) coronal (*1*) with subsequent axial view (*2*)

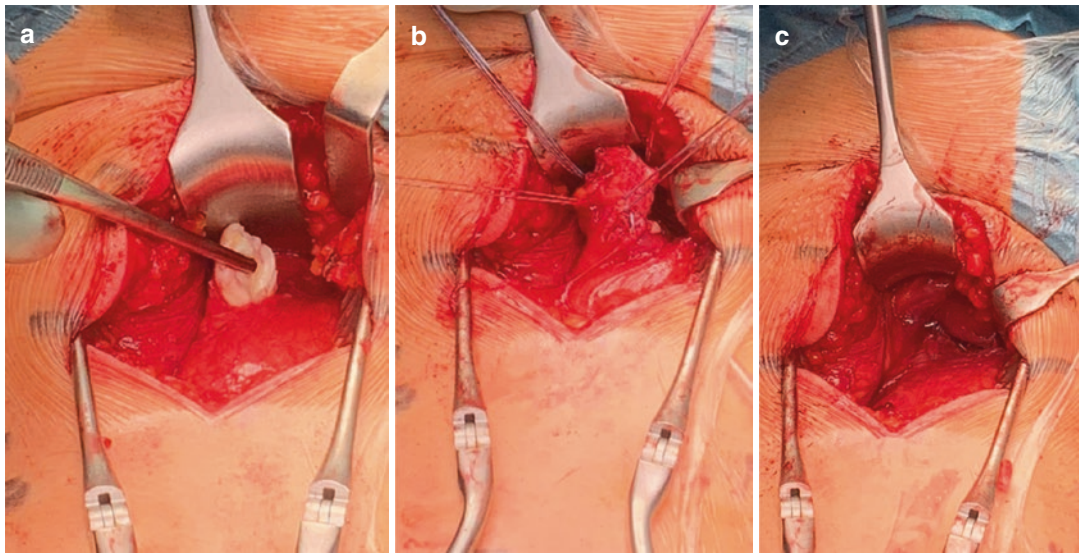

Fig. 26.4 (**a**) Retracted single tendon (biceps femoris) avulsion identified using vertical skin incision; (**b**) suture anchors placed anatomically to ischial tuberosity; and (**c**) prepared and suture-loaded tendon is secured to the footprint

26.2.2 Relative Indications for Surgery

Occasionally incomplete tears especially when recurrent form scar tissue and adhesions that cause persistent symptoms and are non-responsive to conservative treatment. This can occur in the proximal interface or in the proximal tendinous part or in the central tendon area. In proximal incomplete avulsions that remain symptomatic, the MRI may show liquid between the bone and the tendon which is a sign of incomplete healing. In those cases, surgery gives often a good result.

It has been suggested that paramuscular/central tendon injuries especially in the BF may have a higher risk of poor healing with conservative treatment [12]. Also, the risk of a recurrent injury may be high. In these injuries, there is often an incomplete tear of the paramuscular tendon typically in the area of 5–20 cm from the proximal origin. Often the muscle tissue is torn off from the tendon also. When a tear like this remains symptomatic after adequate conservative treatment or there are recurrences, surgery should be considered. Full continuity of the central tendon is restored with sutures and the attachment of the muscle to the tendon is reinforced. It is important to avoid overtightening of the repaired tendon. Scar tissue may be removed. Suture anchors may be used if the tear is located close to the bony origin.

In chronic proximal hamstring ruptures and in some re-rupture cases, anatomic apposition of the retracted muscles cannot always be achieved. In those cases, fascia lata autograft augmentation or for example, Achilles allograft have been used to connect the retracted hamstrings to ischial tuberosity [13, 14]. If patient has radiating nerve pain, sciatic nerve is typically adhered to the scar tissue and it should be freed for good outcome. It seems that late reconstruction of complete proximal hamstring avulsion with fascia lata autograft augmentation or allograft can result in enhancement of muscle strength, better function of the hamstrings and improved the leg control. Also symptoms derived from retracted hamstrings causing stretching to the sciatic nerve could be alleviated.

26.3 Surgical Technique

26.3.1 Patient Positioning and Preparation

In surgery, the patient is placed in the prone position and usually spinal anaesthesia is used. The ipsilateral knee is slightly flexed (20°) to relax the hamstring muscles. The whole area of the hamstrings should be prepared especially in more chronic cases.

A vertical skin incision should be used especially when there is retraction of the ruptured tendons as they may need to be mobilized to achieve tension-free contact to the ischial tuberosity again. The incision starts at the ischial tuberosity extending distally, approximately 10–15 cm. A fasciotomy is done to the common hamstring fascia and it is continued distally, approximately 15 cm from the origin of the hamstring muscles. The lower edge of the gluteus maximus muscle is freed and careful haemostasis should be performed. The posterior cutaneous femoral nerve should be identified and spared as well. This is not always easy, especially in the chronic cases. The ischial tuberosity is exposed by retracting superiorly the inferior border of the gluteus maximus muscle. The sciatic nerve can be found lateral to the ischial tuberosity and it should be freed from adhesions in chronic cases, especially if there are sciatica type of symptoms.

In acute ruptures, hematoma or seroma is often present. In more chronic ruptures, adhesions and scarring is covering the ruptured area. In chronic cases, ruptured structures should be carefully freed and mobilized like sciatic nerve.

26.3.2 Surgical Repair

In most cases, re-attachment of the torn tendons can be done using suture anchors. When surgery is performed in the early phase, anatomical reattachment can be done. In chronic cases, the torn tendons can be reattached slightly distal and medial to the original site of the ischial tuberosity to avoid over tightening the tendons.

Anchor placement to the ischial tuberosity should be anatomical and typically 2–3 suture anchors are used to reinsert ruptured tendons back to the bone. Suture passing through tendon should be done carefully and multiple times and then the ruptured tendon is reinserted to the footprint area by pulling the gliding strand of the suture anchor. Care must be taken not to rotate or misplace tendon heads. After the repaired proximal hamstring tendons are in good contact for prepared bony cortex surface, knots can be done.

If proximal part of the tendon or central tendon is ruptured, the goal of the repair is to restore full continuity of the tendon with sutures and also the attachment of the muscle to the tendon is reinforced. It is important to avoid over tightening of the repaired tendon. Scar tissue may be removed. Suture anchors may be used if the central tendon tear is located close to the bony origin.

Wound closing is done by layers; subcutaneous tissue and skin.

26.4 Post-operative Rehabilitation Protocol

- Complete proximal hamstring rupture (acute repair, no augmentation)
- Isolated proximal biceps femoris rupture/conjoint tendon (BF + ST) rupture
- Proximal semimembranosus rupture

General principles of rehabilitation and routine protocol:

- Often daily surgery; patient can leave the hospital same day.
- Post-operatively, no immobilization with casts or orthoses are needed.
- First knee slightly flexed while laying on bed.
- Wound check after 2–3 days, sutures removed after 10–12 days.
- Walking with help of two crutches during first 1–3 weeks. However, full-weight bearing is allowed immediately after operation while standing and slow walking.
- Calf and gluteus muscle activations can be started right after operation as well as isometric hamstring contractions.
- Sitting should be avoided as much as possible during first 3 weeks.
- Active stretching of the hamstrings should be avoided first 4 or weeks.
- Functional strengthening or physiotherapy starts normally at 4 weeks. Gradually increasing load of the hamstrings. It is also important to concentrate on to the gluteus, calf muscles and pelvis core training.
- Light aqua training can be started after 3–4 weeks, cross-trainer or stationary biking after 6–8 weeks, Alter-G running after 8–10 weeks, normal running after 2–3 months and return to field after 2.5–4 months from the operation.
- Return to high level of sports after 3–5 months from the operation when pain-free and safe sports–related movements are successfully performed.

26.5 Complications

Severe complications are possible relating to the hamstring surgery. One should be aware and experienced about general principles of muscle tendon surgery. Some of these complications are related to the injury itself and some to the surgical technique.

There are some cases presented in the literature in which a complete proximal hamstring rupture has caused a dysfunction of the sciatic nerve with resulting complete foot drop and numbness of the lateral calf and dorsal foot [15, 16]. Similar cases have been described occurring after partial proximal hamstring tears [17, 18]. The damage to the intramuscular nerve branches of the hamstring muscles is also a possible complication and could be seen, for example, in chronic proximal avulsion injuries. Nerve branch lesions can be also result from the surgery. If denervation of the hamstring muscles is suspected before operation, electroneuromyography (ENMG) study is recommended.

Lesion of posterior femoral cutaneous nerve is also possible and that is especially related to the cases needing reoperation. Most of these patients have some numbness around the scar area, which do not cause any harm in their activities of normal daily life.

Post-operative infections are very rare in good planned and performed operations. We use antibiotic prophylaxis routinely before operation. After operation careful wound control(s) is of course important as well. Sutures should not be kept for too long time.

Good knowledge of the anatomy and 'experienced hands' are important and essential to avoid surgery-related failures. Hamstring operations are often demanding procedures and should be done by surgeons specialized for these injuries. One should be aware how to handle sciatic nerve, how to place and insert anchors to the ischial tuberosity and how to prepare tendons and take the suture attachments from the ruptured tendons.

26.6 Conclusion

In competitive athlete, open surgical treatment for proximal hamstring tears gives good outcome [19, 20]. Indications for operative and non-operative treatment depends on the activity level of the patient, the retraction of the avulsion and the number of avulsed tendon heads [2, 5, 10, 21, 22]. The vertical incision gives good visualization to the injured tendons and neural structures. By using modern suture anchors, safe and tissue friendly reattachments are possible; ruptured tendons can be pulled to the anatomic insertion securely which enables the strength of the hamstrings be restored. After uneventful operation the athlete can return to play within one competitive season if the rehabilitation is done by well-trained lower extremity specialized physiotherapist and staged rehabilitation program [12, 20].

Few tips/tricks

- Be aware of normal hamstring anatomy; tendon insertion sites and nerve structures.
- The location of posterior femoral cutaneous nerve can vary a lot.
- While doing reinsertion of the tendons avoid excessive tightness.
- Step by step rehabilitation is important to avoid recurrent injuries.

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