Technical Note

Ultrasound-Guided Posteromedial Semitendinosus Tendon Harvest

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Abstract: Hamstring tendon autografts have emerged as the graft of choice by over 50% of sports surgeons worldwide performing anterior cruciate ligament reconstruction. A more recent technique in harvesting the semitendinosus tendon, the posteromedial approach, afforded multiple benefits compared with the anteromedial approach. However, for the inexperienced surgeon, the current techniques may not be as simple because of decreased tendon tension after general anesthesia induction and subcutaneous layer dissection, making it difficult to palpate the semitendinosus tendon. By utilizing ultrasound to assist us during our harvest, we can perform the procedure with increased accuracy and efficiency, which leads to a safer, more proficient, and less invasive procedure.

Hamstring tendon autografts have emerged as the graft of choice by over 50% of sports surgeons worldwide performing anterior cruciate ligament reconstruction.[1] This is mainly because of the advantages they offer: lesser risk of disease transmission,[2] preservation of the integrity of the knee extensor mechanism,[3] and a lower rate of anterior knee pain.[4]

Semitendinosus (ST) grafts were traditionally harvested through the anteromedial approach.[5] However, a more recent technique, the posteromedial approach, resulted in easier identification, shorter harvest time, better cosmesis, and less postoperative pain, and it avoided accidental amputation of the graft.[5,6] But for the inexperienced surgeon, the current techniques in posteromedial harvesting may not be as simple because after induction of general anesthesia, muscle and tendon tension decreases, making it difficult to palpate the ST tendon.[7]

The purpose of this article is to describe our technique for ultrasound-assisted ST tendon harvest through a posteromedial approach. This technique may aid the less experienced surgeon in performing a reproducible, safe, and efficient posterior tendon harvest.

Surgical Technique

The procedure starts with the induction of general anesthesia. The supine position is maintained, a tourniquet cuff is attached to the upper thigh, and then a clean adhesive plastic drape is applied. Skin antisepsis with betadine solution and sterile draping to the whole lower extremity is performed.

The knee is flexed to 70°, and the hip is externally rotated to 40° and abducted to 30° (figure-4 position). The surgeon palpates the ST tendon by sliding 1 finger starting from the midline of the popliteal fossa directed medially, as described by Wilson and Lubowitz.[8] The first tendon palpated is the ST tendon. An ultrasound is used to confirm the ST tendon location (Fig 1 A and B), and a mark is placed at the most palpable part of the tendon. We then trace and mark the tendon up 1 cm proximally and 1 cm distally.

A transverse skin incision of approximately 2 cm is made over the most palpable area of the tendon, and then blunt dissection is carried down to the subcutaneous layer. Palpating the ST tendon becomes difficult at this point due to less tension of the tendon. Utilization of ultrasound to confirm the location of the ST tendon is essential at this point. A mosquito forceps is used to catch the tendon, and then before completely pulling it out, we visualize the tendon on ultrasound and tug the tendon to confirm accurate catching of the tendon (Fig 2 A and B). Once the tendon is pulled out

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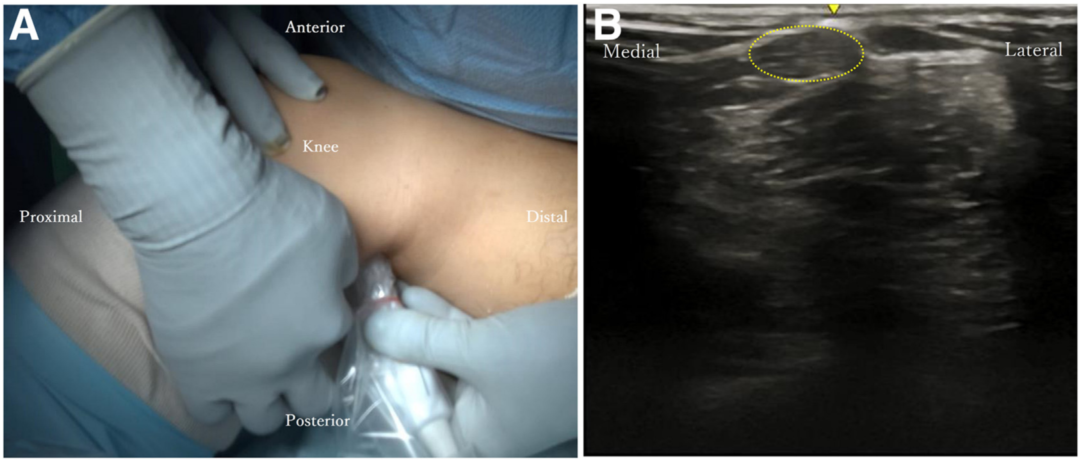

Fig 1. (A) Identification of the semitendinosus tendon. Left leg in a figure-4 position with the patient supine. Before making an incision, we confirm the location of the semitendinosus tendon by placing an ultrasound probe over the palpated tendon at the posteromedial aspect of the popliteal fossa. (B) Short-axis ultrasound image of the semitendinosus tendon (encircled).

of the wound, it is inserted into an open tendon harvester (Linvatec Conmed), and the harvester is advanced retrograde while pulling the tendon distally to apply countertraction (Fig 3A). We make sure the harvester is directed in line with the tendon and toward the ischial tuberosity. Once the proximal ST is released, it is pulled out from the wound. To release the distal tendon from the pes anserinus, we utilize a closed tendon stripper (Arthrex), advancing it distally (Fig 3B) until the whole ST attachment along with some periosteum is peeled off. The ST tendon is then retrieved out of the incision site.

The wound is irrigated with normal saline solution before closing the subcutaneous layer with interrupted 3-0 vicryl sutures. The skin is then apposed with interrupted, vertical mattress suturing using 3-0 nylon sutures. The wound is then covered with a sterile dressing (Video 1).

Discussion

The ST tendon is joined by the tendons of the gracilis and sartorius to form the pes anserinus, which inserts into the proximal anteromedial tibia.[9] These tendons were traditionally harvested through an anteromedial approach, which is complicated by premature graft amputation, inability to separate hamstrings due to conjoint tendon insertion, and medial saphenous nerve infrapatellar branch injury.[8] Although multiple assistants are necessary and there is a potential for poor wound healing in the posteromedial approach, this approach avoided the complications encountered through an anteromedial approach (Table 1).[10]

Tendon stripper deviation is a frequent cause of premature graft amputation in the anteromedial approach due to the presence of fascial bands.[11] These bands have an acute angle of attachment between the ST tendon and the distal fascia. With this orientation, harvesting

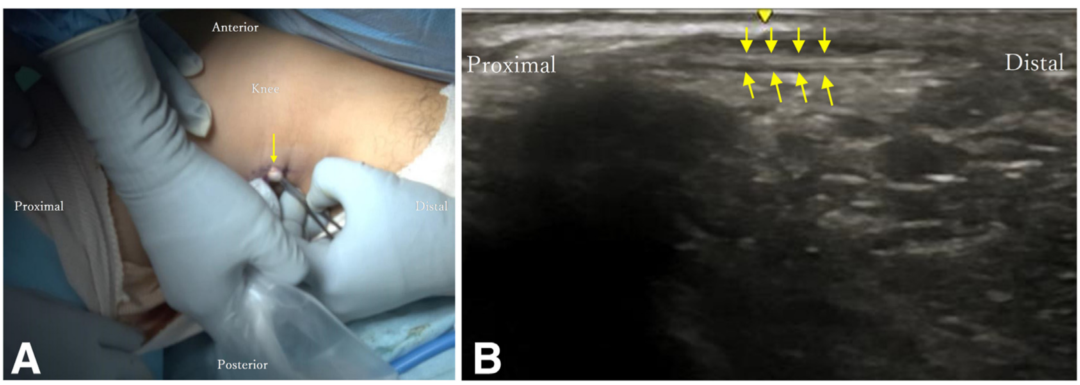

Fig 2. (A) Confirmation of the semitendinosus tendon. Left leg in a figure-4 position with the patient supine. Ultrasound is used to confirm that the structure caught with the mosquito forceps is a tendon (arrow) before completely pulling it out. (B) Long-axis ultrasound image of the semitendinosus tendon (arrows).

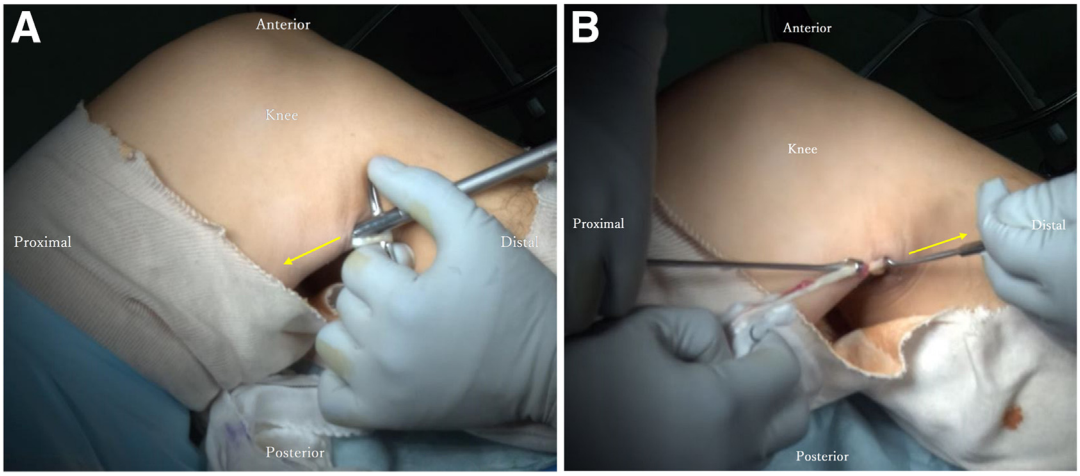

Fig 3. (A) Harvesting of the semitendinosus tendon graft from proximal attachment. Left knee flexed at 90°. The open tendon harvester is advanced retrograde (arrow) to release the semitendinosus tendon from its musculotendinous junction. (B) Harvesting of the semitendinosus tendon graft from distal attachment. Left knee flexed to 90°. A closed tendon stripper is advanced distally to release its distal attachment at the pes anserinus.

Table 1. Advantages and Disadvantages of Posteromedial Approach Technique Compared with Anteromedial Approach

Advantages	Disadvantages
Lesser premature graft amputation	Multiple assistant necessary for field visualization
Easier to identify tendons for harvest	Potential wound-healing complications
Lower rate of neurologic complications	

Table 2. Advantages and Limitations of Ultrasound Use in the Posteromedial Approach of Semitendinosus Tendon Harvest

Advantages	Limitations
Accurate placement of incision	Availability of high-frequency ultrasound device
Easier identification during harvesting of tendon	Surgeon must be familiar with ultrasound use
Confirmation of tendon	
Less invasive harvesting technique	

from the anteromedial approach would catch and redirect the stripper to cause impingement of the ST tendon and subsequent premature amputation. Approaching these bands from the other side, as with the posteromedial approach, would cause the stripper to slide past these bands with no risk of entanglement.[12]

The ST and gracilis tendons have a conjoint insertion at the pes anserinus, located in the anteromedial aspect of the tibia.[13] This makes identification of the individual tendons difficult with an anteromedial approach, leading to a more complex harvest.[6] These tendons separate, become distinct structures, and are subcutaneously located proximally, thus making the posteromedial approach less complicated.[11]

A study by Roussignol et al.[14] showed that saphenous nerve injury is rare in a posteromedial approach because the sartorius muscle and fascia protect the subcutaneously located nerve from the path of the tendon stripper during harvesting. Whereas in the anteromedial approach, the saphenous nerve lies in close approximation to the hamstring tendons, and a slight deviation of the stripper due to catching by the fascial bands leads to nerve damage.[15]

After dissection of the subcutaneous layer, the ST tendon is released and loses its tension. This makes it difficult to locate the ST tendon on palpation and may at times lead to inadvertent harvest of the gracilis tendon, which is approximately 12.8 mm medially.[14] By using ultrasound, we can accurately harvest the ST tendon through visualization. This leads to a precisely placed skin incision over the ST tendon, resulting in a less invasive harvesting technique and preventing unnecessary dissection (Table 2).

This technique is not without its limitations. Not all institutions have a high-frequency ultrasound device available for use inside the operating room. Furthermore, this technique requires the surgeon to be familiar with ultrasound use. The technique presented used ultrasound to confirm the tendon being harvested and increased the accuracy and efficiency of the posteromedial harvesting technique. With this method, the less experienced surgeon may be able to harvest the ST tendon in a less invasive manner that is safer and more proficient.

Disclosures

All authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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