Inferior Medial Geniculate Artery Branch as an Anatomical Landmark for Hamstring Harvest During Anterior Cruciate Ligament Reconstruction

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Abstract: Graft harvesting is often a challenging step of anterior cruciate ligament reconstructions. Accurate isolation of the hamstring tendons at the pes anserinus is crucial to successful graft harvesting. We describe a technique of using a branch of the inferior medial geniculate artery overlying the pes anserinus insertion as an anatomical landmark to localize the hamstring tendons for harvest. By using this vessel as an anatomical landmark, the incision length was decreased and the time required to harvest reduced. This is a highly reproducible technique and will be beneficial for soft tissue harvesting surgeons to ease hamstring graft harvesting.

Anterior cruciate ligament (ACL) reconstruction is one of the most commonly performed orthopaedic procedures. ACL reconstructions involve the harvesting of a tendon graft, of which the most commonly used is the hamstring tendon autograft.

Graft harvesting is often a challenging step of ACL reconstructions. Inaccurate isolation of hamstring tendons can damage structures adjacent to the pes anserinus insertion, such as the infrapatellar branch of the saphenous nerve, or cause greater soft-tissue injury due to inappropriate incision location.[1,2] Flexor tendons can be compromised, and tendons may subsequently need to be harvested from a second donor site. Indeed, the semitendinosus and gracilis tendon are covered by a fibrotic cap formed by the tendon of the sartorius fascia that may make access to the hamstrings more challenging.[2]

Importantly, the size and quality of the graft have been shown to affect the outcome[3,4] where a minimum graft diameter of 8 mm is recommended to replicate the native ACL diameter.[3] Hence, accurate isolation of the hamstring tendons at the pes anserinus is crucial to successful graft harvesting.

We describe a technique of using a well-defined blood vessel overlying the pes anserinus insertion, a branch of the inferior medial geniculate artery (bIMGA),[5] as an anatomical landmark to localize the hamstring tendons for harvest.

We have found that by using the bIMGA as an anatomical landmark, the length of our incision for graft harvesting was decreased and the time required to harvest was reduced. This is a highly reproducible technique and will be beneficial for other soft-tissue harvesting surgeons.

Surgical Technique (With Video Illustration)

Patient Positioning

The procedure is performed with the patient supine on the table with the knee flexed at 90°. A high tourniquet is applied, and the patient undergoes a combination of regional and general anesthetic. An examination under anesthesia is performed to confirm the diagnosis of ACL rupture. Osseous landmarks of the joint line and tibial tubercle are marked on the skin using a skin marker pen.

Graft Harvesting

After appropriate preparation and draping, a 2-cm vertical surgical incision is made 2 finger breadths below the medial tibial plateau, medial to the tibial

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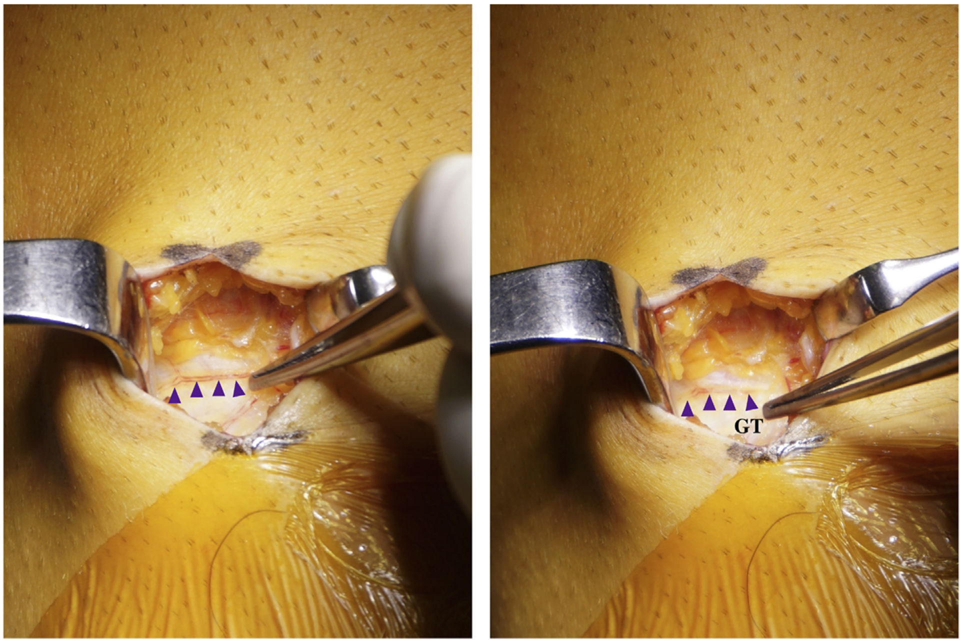

Fig 1. The bIMGA, demarked by purple arrowheads, as seen from the anterior aspect at the site of surgical incision made 2 finger breadths below the medial tibial plateau at the level of the tibial tubercle as the patient is positioned supine with left knee flexed at 90°. The gracilis tendon (GT) can be seen passing directly inferiorly. The bIMGA lies deep to skin, adipose tissue, and sartorius fascia that has been swept aside and restrained by retractors. (bIMGA, branch of the inferior medial geniculate artery.)

Table 1. Pearls and Pitfalls for Tendon Harvesting

Pearls	Pitfalls
• Identify the bIMGA vessel at the superior border of the gracilis tendon • Incise sartorius fascia in line with the fibers • Harvest the tendons from “inside out” or by initially maintaining the tibial attachment of the tendons, using right-sided forceps • Ensure proper identification and release of all vinculae particularly large vinculae from the semi-tendinosus tendon to medial gastrocnemius muscle • Use a closed tendon harvester such as a Conmed Linvatec tendon harvester	• Avoid harvesting the tendons prior to dissection and release of all vinculae or soft-tissue attachments

bIMGA, branch of the inferior medial geniculate artery.

Table 2. Step-by-step Guide

Surgical Step	Description
1.	Patient is positioned supine with knee flexed at 90°. Osseous landmarks are drawn out including the pes anserinus and tibial tubercle (Fig 2A)
2.	A 2-cm vertical incision is made 2 finger breadths below the medial tibial plateau at the level of the tibial tubercle (Fig 2B)
3.	Adipose tissue is dissected with diathermy (Fig 2C)
4.	Gauze is used to sweep the adipose off the underlying sartorius fascia at which point the bIMGA can be seen running 1-2 mm over the superior border of the pes anserinus (Fig 2D)
5.	The sartorius fascia is sharply incised with a no. 15 scalpel in line with the fibers of the fascia, before a right angle is passed under to identify the individual tendons (Fig 2E)
6.	Each tendon is successively dissected from the sartorius fascia using tissue forceps and Metzenbaum scissors, ensuring proper identification and release of surrounding vinculae.
7.	A closed tendon harvester is used to individually release the tendons from their proximal muscle attachments in a standard fashion (Fig 2F)

bIMGA, branch of the inferior medial geniculate artery.

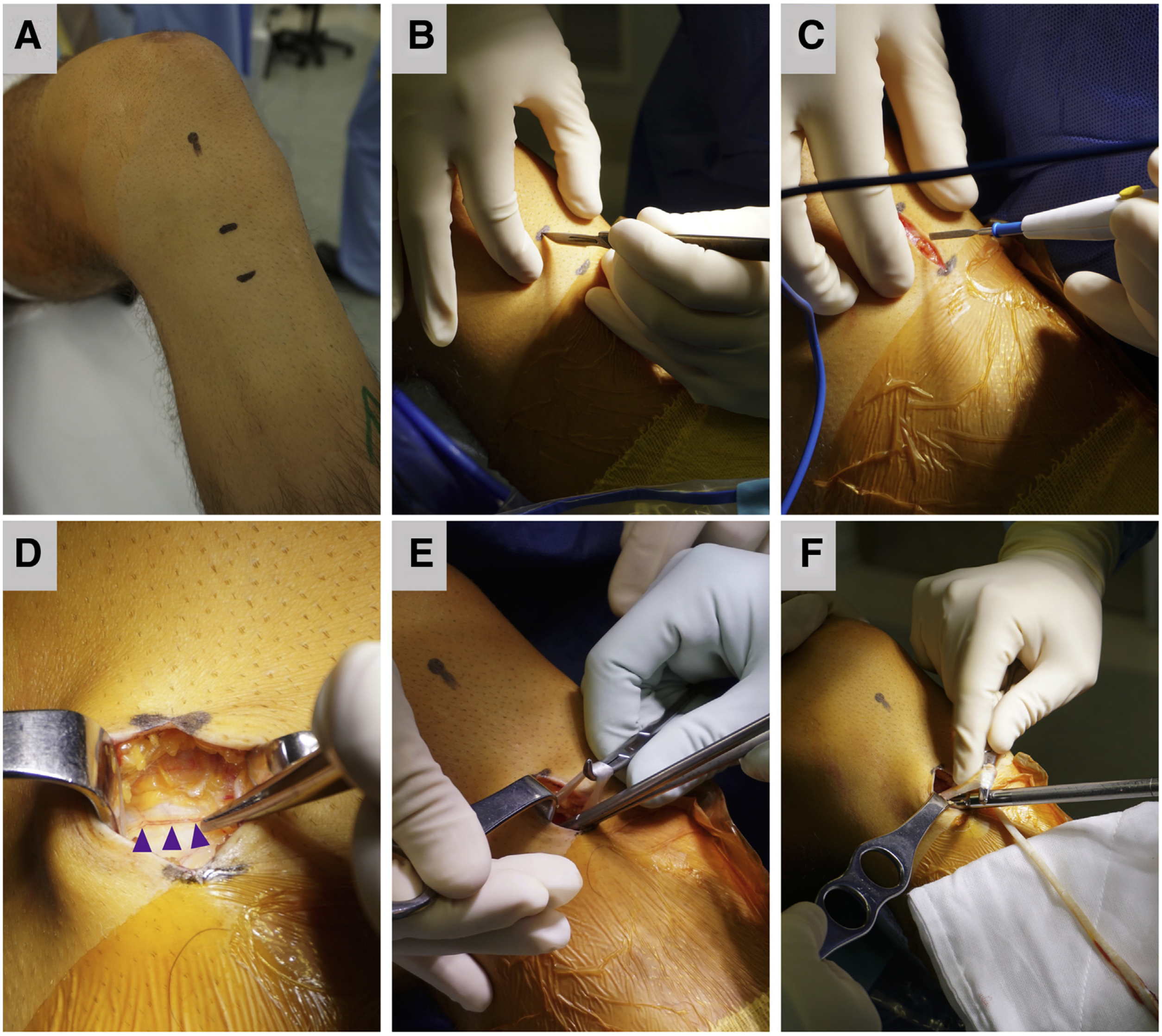

Fig 2. The surgical technique to localize the pes anserinus hamstring insertion and harvest the hamstring graft using the visualization of the bIMGA as an anatomical landmark, shown from the anterior aspect. (A) Patient is positioned supine with the left knee flexed at 90° and osseous landmarks are marked. (B) A surgical incision is made. (C) Adipose tissue is dissected with diathermy. (D) Purple arrowheads denote the bIMGA. (E) The sartorius fascia is incised and a right angle used to identify the individual tendons. (F) Tendons are individually released from their proximal muscle attachments using a closed tendon harvester. (bIMGA, branch of the inferior medial geniculate artery.)

tubercle. Cats claws are used to elevate and provide traction before adipose tissue is dissected with diathermy. Gauze is used to sweep the adipose tissue off the underlying sartorius fascia.

At this point, a vessel (bIMGA) can be seen running 1-2 mm above the superior border of the pes anserinus. This bIMGA passes horizontally in the sartorius fascia superficial to the pes anserinus insertion (Fig 1A). The gracilis tendon can often be palpated directly inferior to the bIMGA (Fig 1B).

The sartorius fascia is then sharply incised with a no. 15 scalpel before a right angle is passed under the fascia

Table 3. Advantages and Limitations

Advantages	Limitations
• Almost universally present regardless of sex, age or ethnicity • Highly reproducible • Easily and quickly located • Easily dissected and cauterized once graft harvesting location is determined	• Can be narrowed or absent in a minority of patients

to identify the individual tendons. Each tendon is successively dissected from the sartorius fascia using tissue forceps and Metzenbaum scissors. A closed tendon harvester such as a Conmed Linvatec tendon harvester is used to individually release the tendons from their proximal muscle attachments, while taking care to identify and release all vinculae prior to tendon harvesting to avoid premature amputation of the tendon graft. Please see Table 1 for further pearls and pitfalls of the tendon harvesting technique.

This surgical technique using the bIMGA as an anatomical landmark for the hamstring tendon insertion is further described in Video 1, Table 2, and Fig 2. Please see Table 2 for a step-by-step guide on performing this technique.

Discussion

This surgical technique of using a blood vessel as an anatomical landmark of the hamstring insertion has not been described in a technical journal previously. The blood vessel described is likely a tributary of the vascular arch that surrounds the pes anserinus and is supplied by the inferior medial genicular artery, inferior lateral genicular artery, and anterior tibial recurrent artery.[6] Lopes et al.[7] have recognized previously this vascular arch network as a reference point for hamstring tendon harvesting. Similarly, Babu et al.[8] noted a "sentinel" blood vessel with anatomical relevance to aid identification of the hamstrings and proposed it to be a periosteal artery. We concur with these aforementioned studies to highlight the anatomical significance and technical aide that recognizing this blood vessel provides to assisting hamstring graft harvesting.

Hamstring graft harvest is technically challenging, with graft size and quality affecting the outcome. Graft harvesting also incurs several risks to the patient where the infra-patellar and sartorial branches of the saphenous nerve can be damaged, and the surrounding fascial bands or medial collateral ligament can be mistaken for the hamstring tendons. Subsequently, many different graft-harvesting techniques are available, and there is no universally accepted consensus on hamstring graft harvesting methodology. The technical difficulty and donor-site morbidity may be why allograft is preferred by some surgeons, even though autograft has a lower graft rupture rate.

While in a minority of patients this vessel may be narrowed or absent, this technique has several advantages applicable to the vast majority of patients (Table 3). Using this technique is practical intraoperatively and highly reproducible, decreasing the difficulty in locating the hamstrings for harvest, resulting in decreased operative time and incision length. The bIMGA is almost universally present regardless of sex, age, or ethnicity and is reliably within 1-3 mm of the hamstring tendons. It is easy to locate and can be dissected and cauterized easily for access to the hamstring tendons. By using this technique, the time for graft harvesting can be shortened and hamstring tendons can be harvested with greater confidence.

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