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Original article

Minimally invasive posterior approach in the popliteal fossa for semitendinosus and gracilis tendon harvesting: An anatomic study

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ABSTRACT

Introduction: Harvesting the semitendinosus (ST) and gracilis (GR) tendons at the anteromedial side of the knee may be hampered by a conjoint tendon insertion on the tibial metaphysis and an accessory bundle between the ST and the medial gastrocnemius. Locating and sparing the terminal branches of the saphenous nerve are difficult on an anteromedial approach. The principal objective of the present anatomic study was to assess the feasibility of ST and GR harvesting from a minimally invasive posterior approach in the popliteal fossa. The secondary objective was to analyze the risk of saphenous nerve branch lesion during harvesting.
Method: Ten cadaver knees, free of scarring, were used. The whole body was positioned supine. The tendons were located in the popliteal fossa with the knee in 30° flexion. A mini-incision was performed in the fossa. The ST and GR tendons were located, and retrograde followed by anterograde stripping was performed. Tendon lengths and diameters were measured. The knees were then dissected to check for saphenous nerve branch lesions (anterior, infrapatellar and posterior branches).
Results: The GR and ST tendons were respectively located at 14.4 and 24 mm from the medial edge of the knee. In 90% of cases, there was an accessory ST bundle toward the medial gastrocnemius muscle, 26 mm below the posterior edge. Tendons could be harvested without deviation of the stripper. Knee dissection did not find any saphenous nerve branches, these being protected by the sartorius fascia.
Discussion: Posterior ST and GR tendon harvesting in the popliteal fossa is reliable and reproducible. It allows easy sectioning of the accessory ST bundle, without deviation during retrograde stripping. Unlike anterior harvesting, which leads to a rate of saphenous branch lesion of 50–78%, posterior harvesting protects the nerve branches by keeping away from the sartorius.
Level of evidence: Level 4.

1. Introduction

Anterior cruciate ligament reconstruction by semitendinosus (ST) and gracilis (GR) tendon autograft is, along with the bone/patellar-tendon/bone technique, the most frequent attitude in chronic anterior knee laxity. Hamstring harvesting usually involves a paramedian medial anterior incision and dissection of the distal ST and GR insertions. Such anterior harvesting incurs 3 problems:

- the GR and ST tendons have a conjoint insertion at the pes anserinus;
- there is often an accessory ST bundle toward the medial gastrocnemius muscle, which has to be sectioned to avoid stripper deviation;
- there is a risk of saphenous nerve branch lesion during the surgical approach and retrograde stripping [1].

Posterior harvesting in the popliteal fossa has been described, to get round the problems and comorbidity associated with an anterior approach. Prodromos et al. [2] recommended a primary posterior approach to guide harvesting via a reduced anterior approach, avoiding risk of premature sectioning due to adherence. Hara et al. [3] recommended harvesting via a transverse approach in the posteromedial angle of the knee, completed by an anterior counter-approach for distal insertion sectioning at the pes anserinus. Kodkani et al. [4] reported ST and GR harvesting on a single posterior popliteal approach without anterior approach, and

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in 2004 Franz [5] reported a retrospective series of 500 patients treated by autograft harvested from the popliteal fossa.

The principal objective of the present anatomic cadaver study was to analyze reproducibility of tendon harvesting on a single minimally invasive posterior approach. The secondary objective was to describe the saphenous nerve and its branches with respect to the minimally invasive popliteal approach and the stripper trajectory, to determine whether harvesting is liable to induce lesions.

2. Material and method

The present descriptive anatomic study was performed in the anatomy laboratory of the Rouen Medical School. Ten knees free of previous surgery (5 subjects, whole body, fresh) were used, with ranges of motion allowing complete extension and at least 120° flexion.

The ST and GR tendons were located in the popliteal fossa (Fig. 1) with the lower limb in external hip rotation and 30° knee flexion. A 25-mm transverse incision centered on the tendons was made in the flexion fold; it could be extended according to the difficulty of tendon location. Subcutaneous tissue was dissected by finger. The crural fascia covering the two tendons was opened using Metzenbaum's scissors.

The larger and more medial tendon was the ST (Fig. 2). Once located, it was placed on a traction suture; traction under 90° knee flexion externalized 5–6 cm of tendon, allowing distal exploration for ST and GR expansions to the medial aponeurosis of the thigh (Fig. 3) and for the accessory ST bundle toward the aponeurosis of the medial head of the gastrocnemius muscle. The GR tendon, located further in and more superficially, was externalized on traction suture in the same way (Fig. 4).

The distances of the ST and of the GR from the medial edge of the knee and between the ST and GR were measured (Fig. 5), the medial edge of the knee being located as the most posterior and medial point of the medial femoral condyle.

The first step consisted in retrograde harvesting of each tendon, using an open stripper (Biomet Inc., Warsaw, Indiana, USA). The stripper stopped in contact with the muscle body, about 20 cm from the approach (Fig. 6). The second step consisted in antegrade stripping up to contact with the medial tibial facet, stopping short of tibial detachment.

A wide approach was then performed, from the distal part of the anterior tibial tuberosity up to the mid-third of the thigh. The skin cover was lifted subdermally, sparing the terminal branches of the saphenous nerve, which were dissected. The saphenous nerve runs into the adductor canal, where it crosses to the inner side of the artery. Leaving the canal, it follows the inferior geniculate artery behind the sartorius muscle then divides into an anterior and a posterior terminal branch. The anterior branch runs superficially and subdivides into infrapatellar ramifications distributed over the superficial skin cover of the medial side of the knee. The posterior branch descends vertically to the medial side of the knee under the sartorius, then emerges between the gracilis and the distal sartorius insertion tendon, perforating its aponeurosis and to run subcutaneously along the great saphenous vein over the medial edge of the tibia. The terminal branches are distributed over the skin cover of the medial side of the lower leg and ankle [6–9]. The shortest distance between the posterior branch and the GR was measured (Fig. 7). Dissection explored for:

- lesion to the sartorius muscle and fascia, which constitute an interposition plane between the subcutaneous saphenous nerve terminal fibers and the path of the stripper during harvesting;

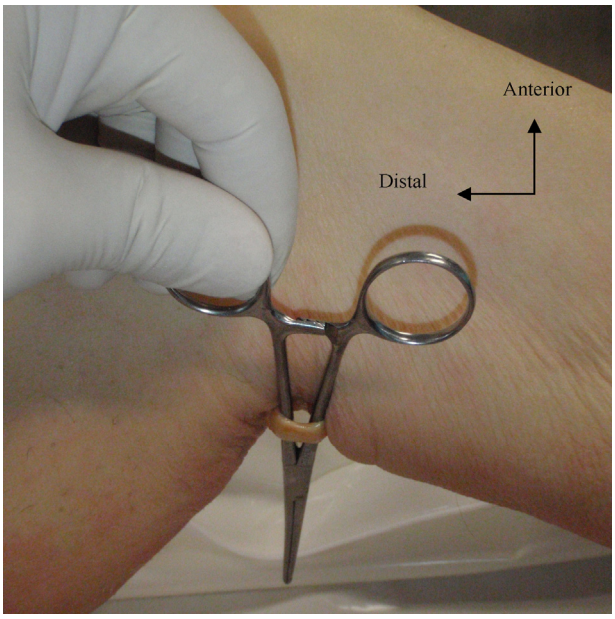

Fig. 2. Location of semitendinosus. Medial view of knee (right knee).

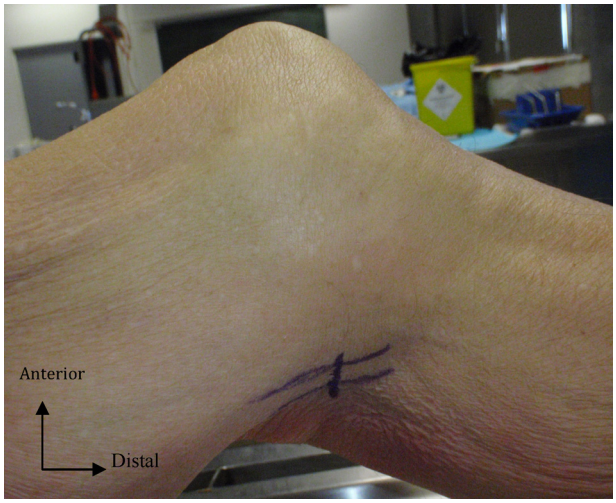

Fig. 1. Approach location. Medial view of knee (left knee).

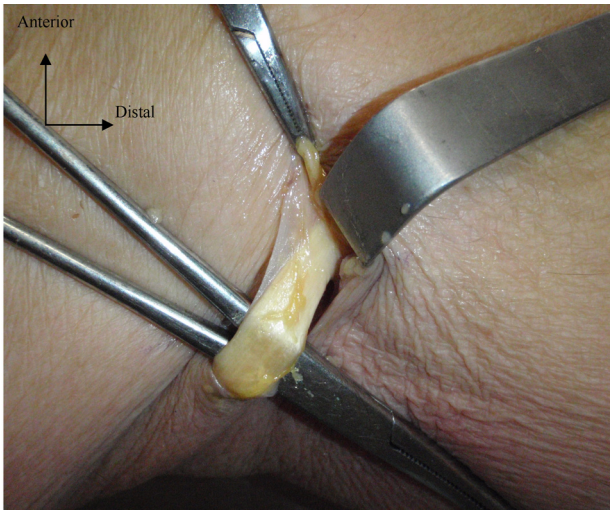

Fig. 3. Exposure of semitendinosus adherences. Medial view of knee.