

## Successful ACL reconstruction with a variant of the pes anserinus

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**Abstract** An anatomical variant of the pes anserinus encountered during anterior cruciate ligament reconstructive surgery which has not been previously described is discussed. During routine harvesting, the sartorius fascia was incised and the semitendinosus and gracilis tendons were identified. At the distal portion, it was noted that each tendon gave off an additional tendinous slip. The slip from the semitendinosus tendon had attached to the gracilis tendon and vice versa, thereby creating a double pes anserinus. This variant was used to construct the graft, and at 1 year review the patient had returned to full sporting activities with no complications encountered.

**Keywords** Pes anserinus · ACL · Reconstruction · Variant

### Introduction

Rupture of the anterior cruciate ligament (ACL) is a common sporting injury with an annual incidence of 1 in 3,000 in the USA [1]. Reconstruction is advocated in young, active patients to restore stability and function and

lessen the likelihood of late degenerative disease. Reconstruction using autografts is preferential over the use of allografts since they provide greater stability [2] and cost less [3]. The most commonly used autografts are the hamstring tendons and bone-patella-bone, although the lower morbidity associated with using the gracilis and semitendinosus hamstring tendons means that this method is becoming more popular [4]. In combination with the sartorius aponeurosis, the gracilis and semitendinosus tendons form the pes anserinus or goose's foot at their attachment to the proximal medial surface of the tibia [5]. Warren and Marshall [6] dissected 154 human knees and found that the medial side of the knee can be separated into three layers. Layer I, which is known as the crural or deep fascia, is the first fascial plane encountered after a skin incision is made over the medial side of the knee and is the layer into which the sartorius inserts. The gracilis and semitendinosus tendons meanwhile lie posterior and deep to this layer but superficial to layer II, which is composed of the superficial medial ligament and variable structures anterior to this ligament. Layer III, which is made up of the capsule of the knee joint and the deep medial ligament, is not routinely encountered in ACL surgery.

It is the senior author's experience that there is significant rarity in finding variations of the pes anserinus that affect clinical practice. We report a case of a previously undescribed anatomical variant of the pes anserinus that had implications for tendon harvesting and preparation at ACL reconstruction in a young female.

### Case report

A 25-year-old female was seen in the out-patients orthopaedic clinic following a valgus injury to the left knee

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whilst playing netball. She described symptoms of instability, and examination of knee revealed a grade II effusion with a positive pivot shift test. A rupture of the ACL was confirmed on magnetic resonance imaging. She elected to undergo ACL reconstructive surgery, and it was determined that she would be suitable for autograft hamstring graft. During routine harvesting, layer I was incised and the semitendinosus and gracilis tendons were identified. At the distal portion, it was noted that each tendon gave off an additional tendinous slip. The slip from the semitendinosus tendon had attached to the gracilis tendon and vice versa, thereby creating a double pes anserinus (Fig. 1). A stripper was placed proximal to the additional slips of tendon so that each tendon could be isolated. Careful dissection was then undertaken at the pes anserinus to dissect the distal attachment. The hamstring graft was then prepared in the standard fashion to make a single bundle incorporating the tendinous slips. An 8-mm-diameter tibial tunnel was drilled and a 7-mm-diameter femoral tunnel was drilled. The graft was passed and secured using Endobutton fixation proximally and interference screw distally. Lachman testing demonstrated a stable knee post-operatively and the patient commenced a physiotherapist-directed rehabilitation protocol. At 1 year

review, she had returned to full sporting activities with no symptomatic instability.

The patient provided informed consent for the publication of this case.

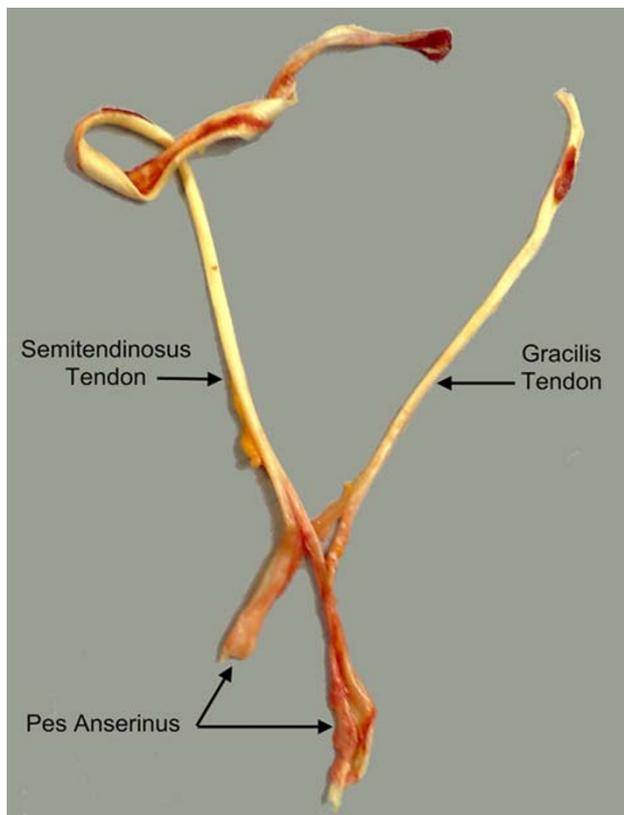
## Discussion

Surgery involving the pes anserinus has long been associated with ACL injuries. In 1939 [7], the use of the gracilis tendon for reconstruction was first described, though inconsistent results led to the development of other techniques to stabilise the knee. Transfer of the pes anserinus to a more proximal and medial position to compensate for the associated anteromedial rotator instability that accompanies ACL ruptures was described by Slocum and Larson in 1968 [8], though the outcomes of this procedure were again not universally successful. A combined graft of semitendinosus and gracilis tendons using a single-bundle technique, as employed in our case report, was described in 1986 [9]; this is currently one of the most common techniques for ACL reconstruction.

This case presented a previously undescribed variation of the pes anserinus that had clinical implications due to its need to be used as a graft in ACL reconstructive surgery. Work by Ivey and Prud'homme [10] demonstrated that close to 50% of knees have anatomical variants of the pes anserinus, which could be divided into seven groups:

- Up to three semicircular fascial slips extending from layer I to the posterior aspect of the medial collateral ligament (MCL).
- Splitting of the semitendinosus tendon with one end joining the gracilis in the normal manner and the other joining the crural fascia.
- Variable pattern of overlap between the tendons in their distal attachment.
- Thickened sartorius fascia inserting either as a separate tendon, or joining the gracilis or semitendinosus.
- Tendinous slips arising from either layer I or gracilis running perpendicular and superficial to the semitendinosus.
- A thickened band of semimembranosus running parallel to the medial collateral ligament adherent to the gracilis and semitendinosus.
- A slip of semitendinosus splitting prior to fusion with the gracilis and inserting directly into the medial collateral ligament or tibia.

Their work, however, was a cadaveric study and there are no reported variants described previously that have been found intra-operatively. Since it is unlikely that all operated knees have normal anatomy with no variants, it can be assumed that these variations as described are minor



**Fig. 1** Dissection of the hamstring tendons demonstrating a double pes anserinus

and do not have an impact on the outcome of surgery. Furthermore, although Ivey and Prud'homme describe variable pattern of overlap between the tendons in the distal attachment as one of their groups, detailed drawings in the original paper reveal the variant we describe as not being included within this group.

Our newly described variant had two implications for surgery. The first practical consideration of the discovery of this variant was in careful harvesting. The harvesting technique of the senior author involves using a stripper to isolate the tendon from the muscle belly. Without an appreciation of the additional tendinous slips, placement of the stripper distal to slips would have potentially shredded the graft, thereby compromising it and necessitating use of either an ipsilateral bone-patella-bone graft, contralateral hamstring tendons, or allograft, which are all less favourable. The second was sizing of the bony tunnels necessary in ACL reconstruction. Whilst it is customary for the graft to have a uniform diameter or 0.5 mm difference between the tibial and femoral ends, our graft through the incorporation of the tendinous slips had a 1 mm difference, though in this case at least, it did not affect clinical outcome.

This case highlights the importance of careful dissection of the hamstring tendons in ACL reconstructive surgery, whilst the presence of an anatomical variant should not faze the surgeon since it can be incorporated within the graft.

**Conflict of interest statement** The authors declare that they have no conflict of interest.

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