Journal of Plastic, Reconstructive & Aesthetic Surgery (2016) 69, 351–358

JPRAS
An International Journal of Surgical Reconstruction
www.JPRASurg.com

The first perforating branch of the deep femoral artery: A reliable recipient vessel for vascularized fibular grafts: An anatomical study

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Received 13 June 2015; accepted 19 October 2015

KEYWORDS
Osteonecrosis of the femoral head;
Vascularized fibular graft;
Deep femoral artery;
Perforating branch;
Anatomical study

Summary *Introduction:* Although the perforating branches of the deep femoral artery have been introduced as recipient vessels for vascularized fibular grafts in the treatment of osteonecrosis of the femoral head, comprehensive knowledge of the related anatomy is deficient. The aims of this study were to provide detailed anatomical data for the perforating branches of the deep femoral artery and validate their usefulness as recipient vessels for vascularized fibular grafts.
Materials and methods: Anatomical dissection was performed on 11 fresh human cadaveric lower extremities. The number, locations, and diameters of the perforating branches were documented. The topographic relationships with the vastus ridge and the tendinous insertion of the gluteus maximus were clarified. The diameters of the perforating branches were compared with those of the ascending branch of the lateral circumflex femoral and the peroneal arteries.
Results: The mean number of perforating branches was 3.5. The mean distances from the vastus ridge to the first, second, and third perforating branches were 8.1, 13.7, and 20.4 cm,

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http://dx.doi.org/10.1016/j.bjps.2015.10.024

respectively. The first perforating branch was always located medial to the tendinous insertion of the gluteus maximus, whereas the second perforating branch was always located distal to the gluteus maximus. The mean diameters of the first, second, third, and fourth perforating branches were 3.1, 2.3, 1.6, and 1.2 mm, respectively. The mean diameters of the ascending branch of the lateral circumflex femoral and the peroneal arteries were 2.0 and 3.6 mm, respectively.

Conclusion: The first perforating branch of the deep femoral artery is an appropriate alternative recipient vessel for vascularized fibular grafts in the treatment of osteonecrosis of the femoral head. It has a very consistent anatomy with a suitable location and diameter for anastomosis of the peroneal artery.

Introduction

Osteonecrosis of the femoral head is a potentially disabling disease that usually affects active, young individuals in their third and fourth decades of life.[1] Because the natural history of osteonecrosis of the femoral head is unsatisfactory with a high prevalence of progression to symptomatic subchondral fracture, collapse, and eventual arthrosis, the optimal goals of treatment are to facilitate an early diagnosis, halt disease progression, and revitalize the femoral head.[2] A wide range of nonoperative and operative treatments have been suggested, and variable, inconsistent results have been reported for each method.[1] The existence of a large number of procedures indicates that none of them is entirely effective, nor do they offer predictable results.[3] However, the vascularized fibular graft has been consistently successful compared with any other joint-preserving method.[3–14] Although the vascularized fibular graft is technically demanding and requires a motivated patient because of the extensive recovery period, it is generally accepted that this procedure is likely to result in hip preservation when performed before radiographic collapse of the femoral head.[5,6,10] To supply blood to avascular areas of the femoral head, the vascularized fibular graft requires anastomosis between peroneal and recipient vessels. The ascending branch of the lateral circumflex femoral artery is the most commonly used recipient vessel.[3–7,13–15] However, the ascending branch of the lateral circumflex femoral artery often has a small diameter and a limited pedicle length, and it is located in a deep confined anatomical area. These factors make anastomosis of the ascending branch of the lateral circumflex femoral artery more challenging.[12,17,18,23] For these reasons, several modifications of the anastomosis technique and alternative recipient vessels have been introduced.[8–12,16–23] The perforating branch of the deep femoral artery is one of the alternative recipient vessels, and several studies using this vessel have been reported.[8,9,20–22] However, sufficient information about the related anatomy is missing, and this lack of comprehensive knowledge has been an obstacle to its widespread use. Thorough knowledge of the vascular anatomy of the perforating branches of the deep femoral artery is essential for the use of these vessels as recipient vessels for vascularized fibular grafts. The aims of this study were to provide detailed anatomical data about the perforating branches of the deep femoral artery in a practical manner and validate their relevance as recipient vessels for vascularized fibular grafts in the treatment of osteonecrosis of the femoral head.

Materials and methods

Anatomical dissection was performed on 11 fresh human cadaveric lower extremities. There were six male and five female specimens, with their mean age being 78.2 years (range, 60–90 years). The cadavers were acquired for this study within 48 h from the time of death and were kept refrigerated. All dissections were performed under loupe magnification of 3.5X. Institutional review board approval was obtained for this study (IRB 14-006022).

Cadaver dissection

Anatomical dissections were performed on both sides of the thigh, anteromedial and posterolateral, to expose the perforating branches of the deep femoral artery. First, the anteromedial dissection was performed to expose the deep femoral artery and its branches. A linear skin incision was made from the mid-inguinal point extending inferiorly to the medial border of the patella. The subcutaneous tissue and the superficial fascia were divided, and the femoral triangle was identified. The common femoral artery and veins were exposed by opening their perivascular sheath, and then dissection was continued along the vessels. With careful dissection, the superficial femoral, deep femoral, medial circumflex femoral, and lateral circumflex femoral arteries were identified. The sartorius was mobilized and cut transversely near the lower apex of the femoral triangle. The proximal portion of the sartorius was reflected cephalad to expose the lateral circumflex femoral artery and its ascending, transverse, and descending branches. The ascending branch of the lateral circumflex femoral artery was traced to the undersurface of the rectus femoris. Distally, dissection was continued to expose the deep femoral artery and its branches. Distal exposure of the deep femoral artery was facilitated by medial retraction of