Peterson. Trauma Cases Rev 2016, 2:044
Volume 2 | Issue 3
ISSN: 2469-5777

Trauma Cases and Reviews

Case Report: Open Access

Free Flap Coverage of a Medial Ankle Wound in a Patient with Arteria Peronea Magna

Steven L Peterson* and Tuan A Nguyen

Operative Care Division, VA Portland Healthcare System, USA

***Corresponding author:** *Steven L Peterson, MD, DVM, Hand and Plastic Surgery Service, Operative Care Division, VA Portland Healthcare System, Mail Stop P3, OCD, 3710 SW US Veterans Hospital Road, Portland, Oregon, USA 97239, Tel: 406-531-0500, E-mail: steven.peterson3@va.gov*

Abstract

While the vascular anatomy to the lower extremity is fairly consistent, anatomical variants do exist. One such variant is the arteria peronea magna. This anatomic variant results in single vessel arterial flow to the foot through an enlarged peroneal artery with unique distal branching. The focus of interest in this vascular pattern in microsurgery has been increased risk of lower extremity devascularization during harvest of a free fibular flap for reconstruction at other anatomical sites. This altered anatomy, however, also alters the availability of target vessels during microsurgical reconstruction of an injured lower extremity with this vascular pattern. To date only one successful free flap to a lower extremity with arteria peronea magna has been reported. Here we report a second successful reconstruction of an injured lower extremity with this vascular anatomy.

Introduction

Free tissue transfer has become an established component of lower extremity salvage for trauma below the knee with critical soft tissue loss. In the absence of severe trauma or peripheral vascular disease the choice of recipient vessels is felt to be anatomically consistent; with the posterior tibial artery and dorsalis pedis artery present as easily accessible targets and the peroneal artery presenting a deep consistent third source of flow to the foot.

Rare, anatomic variants of this three artery perfusion pattern do exist [1-5]. One such variant is the arteria peronea magna (APM), which has been classified by Lippert and Pabst as a III-C pattern of arterial branching (Table 1) [1,5]. In APM dependent limbs, arterial circulation below the popliteal artery is characterized by hypoplastic or aplastic anterior and posterior tibial arteries, and a hyperplastic peroneal artery. The incidence of this variant is reported as 0.2% to 8.3% in the general population, with 50% of affected individuals having this anomaly bilaterally.

The focus on this arterial variant in microsurgical reconstruction has been concern over lower extremity devascularization following free fibula harvest [3]. However, this anatomical variation can also present challenges in lower extremity reconstruction because of altered target vessels. In addition to altered targets, the presence of anAPM may also present risk of distal ischemia if an end-to-end anastomosis to the APM is performed because of the single vessel nature of the limb.

Multiple reports exist of APM detection during free fibula preoperative planning, and of complications associated with missed detection. However, only one case report of a successful free flap to a limb dependent on APM circulation exists [6]. In this report we describe a second case of lower extremity free flap coverage where the injured limb's circulation consisted solely of an APM.

Case Report

A 63-year-old male was accepted in transfer for coverage of a medial ankle wound associated with a bimalleolar fracture (lateral

Table 1: Classification of popliteal artery branching patterns in the leg.

Class	Vascular Pattern
I-A	Usual pattern
I-B	Trifurcation: AT, PT and PER arise below knee within 0.5 cm of each other
I-C	Anterior tibioperoneal trunk: PT is first branch, then TPT bifurcates into PER AND AT
II-A1	AT arises at or above the knee joint, with normal course in its proximal segment
II-A2	AT arises at or above the knee joint, with medial curve in its proximal segment
II-B	PT arises at or above the knee joint, common trunk of AT and PER
II-C	PER arises at or above the knee joint, common trunk of AT and PT
III-A	Hypoplastic or aplastic PT, distally replaced by PER
III-B	Hypoplastic or aplastic AT, DP replaced by PER
III-C	**Hypoplastic or aplastic AT and PT, DP and PT replaced by PER (Arteria Peronea Magna)**
III-D	Hypoplastic or aplastic PER

AT: Anterior Tibial artery, DP: Dorsalis Pedis artery, PT: Posterior Tibial artery, PER: Peroneal Artery, TPT: Tibioperoneal Trunk.

ClinMed International Library

Citation: Peterson SL, Nguyen TA (2016) Free Flap Coverage of a Medial Ankle Wound in a Patient with Arteria Peronea Magna. Trauma Cases Rev 2:044

Received: July 25, 2016: **Accepted:** November 24, 2016: **Published:** November 28, 2016

Figure 1: Preoperative view of right medial ankle wound.

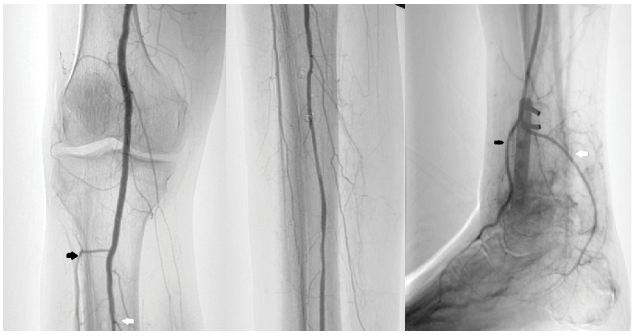

Figure 2: Preoperative angiogram.

(Left) Anterior posterior view demonstrating hypoplastic takeoff of anterior tibial artery (black arrow), and hypoplastic takeoff of posterior tibial artery (white arrow).

(Center) More distal anterior posterior view demonstrating dominant arteria peronea magna.

(Right) Lateral ankle view showing dorsal (black arrow) and medial (white arrow) terminal branches of the arteria peronea magna.

Figure 3: Anterior posterior postoperative radiograph of right ankle showing level of fibular resection osteotomy nine cm proximal to tip of lateral malleolus.

Figure 4: Anterolateral thigh flap in place on right medial ankle.

and posterior) of the right ankle. Wound care at the referring institution, where open reduction internal fixation was accomplished, consisted of Negative Pressure Wound Therapy (NWPT) application followed by skin grafting. When the skin graft was lost NWPT application continued and the decision was made to transfer the patient for possible free flap coverage of the medial ankle wound (Figure 1). Durable flap coverage was felt to be critical for infection control and to provide a better soft tissue envelope for planned future ankle fusion.

Preoperative physical exam demonstrated a palpable and Dopplerable dorsalis pedis artery. However, a posterior tibial artery could not be located by palpation or Doppler proximal to the wound; although a medial plantar artery was detectable by Doppler. An angiogram was performed which demonstrate the right popliteal artery branching into a hypoplastic anterior tibial artery and a tibioperoneal trunk which more distally gave off a hypoplastic posterior tibial artery and then continued as an APM (Figure 2). The APM terminated in a medial and dorsal branch which took distal courses similar to a normal medial plantar artery and dorsalis pedis artery (after penetrating the interosseous membrane); respectively, to develop a pedal arch.

For soft tissue coverage a free anterolateral thigh flap was harvested and anastomosed end-to-side directly to the APM and its two vena commitans 12 cm proximal to the tibiotarsal joint line. Access to the APM vascular bundle was obtained by segmental resection osteotomy of the fibula 9 cm proximal to the tip of the lateral malleolus (Figure 3) and tunneling of the vascular pedicle of the flap behind the tibia. There was no postoperative compromise in vascularity to the foot or flap; and the flap provided durable closure of the wound (Figure 4).

Two years following surgery the patient ambulated with assisted weight bearing on the foot and declined formal fusion, feeling that the limited motion afforded by ankyloses of the joint adequately controlled his pain.

Discussion

The arterial supply to the lower limb has been studied extensively and multiple anomalies have been defined and classified by the Lippert and Pabst system (Table 1) [1,5]. The incidence of these anomalies remains low, with approximately 90% of humans having a standard pattern of the popliteal artery dividing just distal to the popliteus muscle into the anterior tibial artery and the tibioperoneal arterial trunk. The tibioperoneal arterial trunk then divides approximately 4 cm below the origin of the anterior tibial artery into the posterior tibial artery and the peroneal artery. Terminal branches of the tibial anterior artery are the deep plantar and arcuate artery. Terminal branches of the posterior tibial artery are the medial and lateral plantar arteries. The deep plantar artery and the lateral plantar artery form the plantar arch. Communicating branches connect the arcuate artery and the medial plantar artery with the deep plantar arch. These

communications between the anterior and posterior tibial arteries allow the foot to be perfused adequately by either artery alone. The peroneal artery is connected to the anterior and posterior tibial arteries by means of two communicating branches above the ankle.

Because of this redundancy inblood supply to the lower extremity below the knee, controversy exists regarding the need for preoperative vascular imaging in lower extremity trauma [7,8] and prior to free fibula harvest [9,10]. In general, with a low energy mechanism of trauma, such as the patient presented in the report, physical exam findings are felt to be adequate prior to undertaking reconstruction. However, a careful exam is required since in the presence of an APM one may interpret the detection of a dorsalis pedis arterial and medial plantar artery as indicative of normal anterior and posterior tibial arteries. Careful exam, however, will show the course of the dorsal pedis artery to be more lateral in location as it originates from a perforating dorsal branch of the APM. Also, the medial plantar artery will not be traceable to its origin from the posterior tibial artery above the level of the medial malleolus since it originates instead deeply as a medial terminal branch of the APM. With any clinically detected anatomical variation an angiogram, or alternatively a magnetic resonance angiogram should be obtained to better define vascular anatomy [11].

In the previous reported case of free flap reconstruction of a lower extremity with APM the anastomosis was made end-to-end to the medial branch of the APM, at the anatomical location of the medial plantar artery, after clamping the vessel to assure adequate distal perfusion. However, in their report the authors state they were prepared to obtain access to the APM by osteotomy and resection of the fibula if flow was deemed inadequate to the distal foot after clamping or division of the target medial branch. In our case we felt more proximal anastomosis was indicated, both because of wound orientation and to maximize preservation of distal flow in this older individual.

In summary, while the lower limb is normally redundantly supplied with blood flow, severe trauma, peripheral vascular disease, or rare anatomic variation may limit this redundancy in a manner that could negatively impact outcome during microsurgical reconstruction of the lower limb. APM is one anatomical variant that impacts both the use of the lower limb as a donor and recipient during free flap surgery. While preoperative angiography may not be mandatory prior to reconstructive microsurgery where the limb in question serves as a free flap donor or recipient, the operating surgeon should have a low threshold for further testing by standard or magnetic resonance angiography if any abnormality is detected during the preoperative exam. With adequate forehand knowledge and planning risk of foot or distal limb loss can be minimized when performing microvascular reconstructive surgery even in the face of significant anatomical variation such as an APM.

References

1. Lippert H, Pabst R (1985) Arteries of the lower leg. In: Lippert H, Pabst R, Arterial variations in man: classification and frequency. Munich: Bergmann Verlag, 63-64.
2. Rosson GD, Singh NK (2005) Devascularizing complications of free fibula harvest: peronea arteria magna. J Reconstr Microsurg 21: 533-538.
3. Holzle F, Ristow O, Rau A, Mucke T, Loeffelbein DJ, et al. (2011) Evaluation of the vessels of the lower leg before microsurgical fibular transfer. Part I: anatomical variations in the arteries of the lower leg. Br J Oral Maxillofac Surg 49: 270-274.
4. Jung W, Oh CS, Won HS, Chung IH (2008) Unilateral arteria peronea magna associated with bilateral replaced dorsalis pedis arteries. Surg Radiol Anat 30: 449-452.
5. Kim D, Orron DE, Skillman JJ (1989) Surgical significance of popliteal artery variants. A unified angiographic classification. Ann Surg 210: 776-781.
6. Lutz BS, Siemers F, Shen ZL, Machens HG, Wippermann B, et al. (2000) Free flap to the arteria peronea magna for lower limb salvage. Plast Reconstr Surg 105: 684-687.
7. Lutz BS, Wei FC, Machens HG, Rhode U, Berger A (2000) Indications and limitations of angiography before free-flap transplantation to the distal lower leg after trauma: prospective study of 36 patients. J Reconstr Microsurg 16: 187-191.
8. Haddock NT, Weichman KE, Reformat DD, Kligman BE, Levine JP, et al. (2010) Lower extremity arterial injury patterns and reconstructive outcomes in patients with severe lower extremity trauma: a 26-year review. J Am Coll Surg 210: 66-72.
9. Lutz BS, Wei FC, Ng SH, Chen IH, Chen SH (1999) Routine donor leg angiography before vascularized free fibula transplantation is not necessary: a prospective study in 120 clinical cases. Plast Reconstr Surg 103: 121-127.
10. Kelly AM, Cronin P, Hussain HK, Londy FJ, Chepeha DB, et al. (2007) Preoperative MR angiography in free fibula flap transfer for head and neck cancer: clinical applications and influence on surgical decision making. AJR 188: 268-274.
11. Klein S, Van Lienden KP, Van't Veer M, Smit JM, Werker PM (2013) Evaluation of the lower limb vasculature before free fibula flap transfer. A prospective blinded comparison between magnetic resonance angiography and digital subtraction angiography. Microsurgery 33: 539-544.