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ORIGINAL RESEARCH ARTICLE

ANATOMICAL VARIATIONS IN DORSALIS PEDIS ARTERY AND ITS BRANCHES WITH CLINICAL CORRRELATIONS

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ABSTRACT

50 feet were dissected to see the course and branching pattern of dorsalis pedis artery. The following variations of the artery were seen. The dorsalis pedis artery was deviated laterally in 4% of feet. It was continuation of perforating branch of peroneal artery in 4% of feet. Arcuate artery was absent in 40% of feet. In 8% feet the medial tarsal artery was absent. In 12% feet there were two medial tarsal arteries. There were two lateral tarsal arteries in 14% of feet and three lateral tarsal arteries in 8% of feet. Knowledge of these variations can help the radiologists in diagnosing peripheral vascular diseases by colour Doppler. Awareness about the arterial variations in the foot can help microvascular surgeons to do infrapopliteal interventions in critical limb ishaemia and also in reconstructive surgeries.

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INTRODUCTION

To diagnose patients with peripheral arterial disease, palpation of peripheral arterial pulse is one of the simplest screening test. In lower extremity, pulsations of dorsalis pedis artery are taken to evaluate the arteriosclerotic diseases. In the era of microvascular surgery the dorsalis pedis artery is used as stem for myocutaneous flap in reconstructive and plastic surgeries (Mir Wajahath Ali *et al*., 1996). Knowing the normal anatomy and anatomical variations in the origin, course and branching pattern of the dorsalis pedis artery can increase success rate of these all surgeries. With increasing incidence of diabetic foot, peripheral arterial diseases and accidental injuries to foot a need may arise for a vascular surgery. A detailed anatomical knowledge about the arteries of the foot and its variations is needed in such situations. The main artery to supply dorsum of the foot is dorsalis pedis artery as it also contributes to plantar arch (Rajeshwari *et al*., 2013). Hence this study is undertaken to trace the course of Dorsalis pedis artery, its branching pattern and variations if any.

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Dorsalis Pedis Artery (DPA) is the continuation of the anterior tibial artery. The dorsalis pedis artery starts midway between the malleoli and runs anteromedially till it reaches the proximal end of 1st interosseous space where it gives out the first metatarsal artery and continues on plantar aspect.

Branches of Dorsalis pedis artery

The two tarsal arteries lateral (LTA) and medial (MTA) arise as the dorsalis pedis artery crosses navicular. The lateral runs laterally under the extensor digitorum brevis and supplies it. Lateral tarsal artery anastomoses with branches of arcuate, anterior lateral malleolar and lateral plantar arteries. Two or three medial tarsal arteries can be found on the medial border of foot and join the medial malleolar network (Keith *et al*., 2005). The arcuate artery (AA) runs laterally across the bases of the lateral four metatarsal, deep to the extensor tendons on the dorsum of the foot. The arcuate artery gives rise to 2nd, 3rd & 4th dorsal metatarsal arteries (Gray, 2008). Knowledge of normal anatomy and variations in these arteries can help the radiologists in diagnosing peripheral vascular diseases by colour Doppler. Awareness about the arterial variations in foot can help microvascular surgeons to increase clinical

effectiveness in infrapopliteal interventions in critical limb ishaemia.

MATERIALS AND METHODS

50 lower limbs from 7 female and 18 male cadavers were procured from the department of Anatomy of Dr. D Y Patil Medical College and Research centre, Pimpri, Pune, Maharashtra, India. These cadavers were embalmed with 10% formalin and fixed. Dorsum of foot was dissected as per dissection procedure in Cunningham's manual-I, Fifteenth edition.

This is a descriptive type of study

Skin of dorsum of the foot was reflected. After reflecting the deep fascia and extensor retinaculum the dorsalis pedis artery was dissected and cleaned. Variations in origin of dorsalis pedis artery were noted. Branches of dorsalis pedis artery were exposed after reflecting the extensor digitorum brevis muscle. Any variations in course of Dorsalis Pedis Artery were noted. Any variations in origin and number of medial tarsal, lateral tarsal and arcuate arteries were noted.

RESULTS

Lower limbs of 7 female and 18 male cadavers were dissected to study the dorsalis pedis artery and its branches. Observations were noted separately for male and female as well as for left and right sides.

DISCUSSION

In all lower limbs dorsalis pedis artery was present but the artery itself and its branches showed lot of variations.

Variations in Dorsalis pedis artery

The dorsalis pedis artery was seen deviated laterally in 4% of feet. In 2008, Ebrahim M. El. Saeed *et al* found that in 5% cases there was lateral deviation of dorsalis pedis artery (Ebrahim *et al*., 2008). Present study correlates with the study of Ebrahim M. El. Saeed *et al*. (2008) regarding the deviation of dorsalis pedis artery laterally. Knowledge of this variation will be useful in deciding whether the absence of pulse in dorsalis pedis artery is due to thrombosis of the artery of abnormal course. Non palpable dorsalis pedis pulse with impaired blood flow as visualized by arteriography is one of

Table 1. Variations in Dorsalis pedis artery

Name	Variation if any	Incidence	Leg (Right or Left)	Sex
Dorsalis pedis artery	Deviated laterally (fig.1)	4%	Both	Female
	Perforating branch of Peroneal artery continues as dorsalis pedis artery (fig.2)	4%	Left	Both

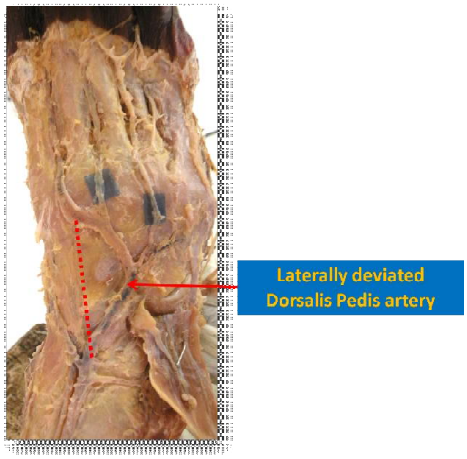

Figure 1. Abnormal course of Dorsalis pedis artery

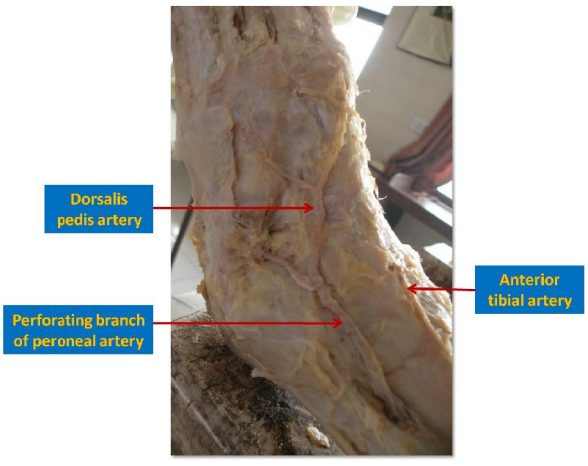

Figure 2. Abnormal origin of Dorsalis pedis artery

Table 2. Variations in medial tarsal artery

Name	Variation if any	Incidence	Leg (Right or Left)	Sex
Medial tarsal artery	Absent (fig.3)	8%	Both	Both
	Two Medial tarsal arteries (fig.4)	12%		

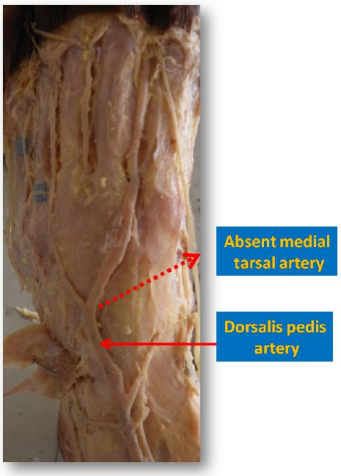

Figure 3. Absent Medial tarsal artery

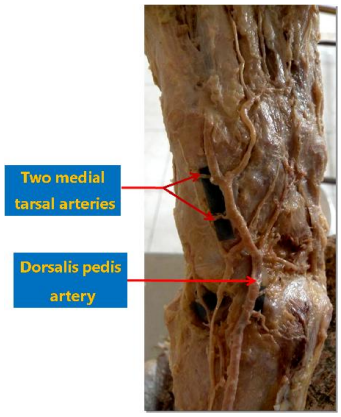

Figure 4. Variation in number of Medial tarsal artery

Table 3. Variations noted in the lateral tarsal artery

Name	Variation if any	Incidence	Leg (Right or Left)	Sex
Lateral tarsal artery	Two lateral tarsal arteries (fig.5)	14%	Both	Both
	Three lateral tarsal arteries (fig.6)	8%		

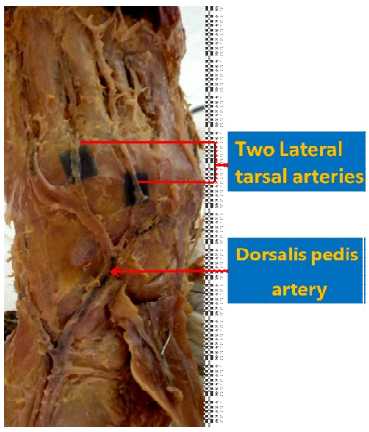

Figure 5. Variation in number of Lateral tarsal artery

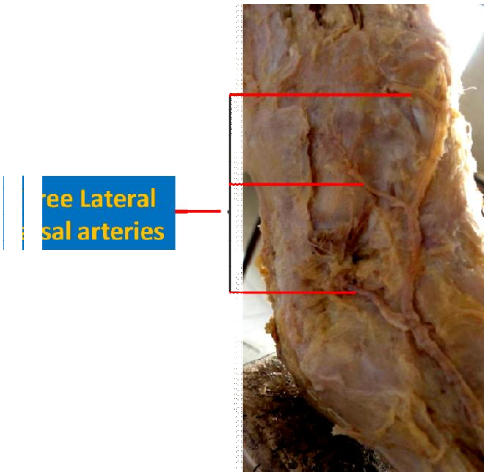

Figure 6. Variation in number of Lateral tarsal artery

Table 4. Variations noted in arcuate artery

Name	Variation if any	Incidence	Leg (Right or Left)	Sex
Arcuate artery	Absent(Fig.7)	40%	Both	Both

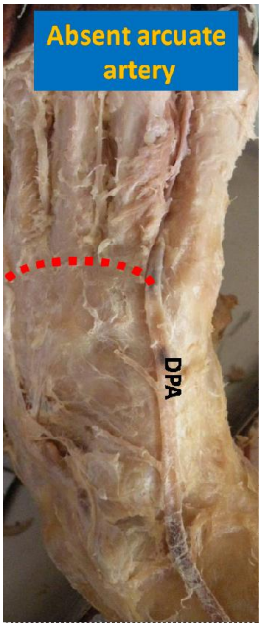

Figure 7. Absent Arcuate artery

the contraindications for flap procedure (Christen Krag and Per Riegels- Nielsen, 1982). In present study DPA was seen as continuation of perforating branch of peroneal artery in 4% of feet. The anterior tibial artery was hypoplastic and the arcuate artery was absent. The Yamada *et al*. (1993) found the same variation in 6.7% of legs and Mir Ali (1996) found it in 1% of cases. Present study correlates with the study done by Yamada *et al*. (1993) regarding the origin of dorsalis pedis artery from perforating branch of peroneal artery.

Variations in Medial tarsal artery

In 8% feet the medial tarsal artery was absent. In 12% feet there were two medial tarsal arteries. In 2008, Ebrahim M. El. Saeed *et al* found that two medial tarsal arteries were present in 90% cases (Ebrahim *et al*., 2008).The forefoot skin defect can be repaired using the flap supplied by the branch of medial tarsal artery (Tan *et al*., 2012).

Variations in lateral tarsal artery

There were two lateral tarsal arteries in 14% of feet. In 2008, Ebrahim M. El. Saeed *et al* found double lateral tarsal arteries in 70% feet (Ebrahim, 2008) There were three lateral tarsal arteries in 8% of feet. Knowledge of variation in the lateral tarsal artery will help the surgeon to choose LTA pedicled extensor digitorum brevis flap for reconstructive surgeries. The lateral tarsal artery flaps are also introduced to cover the defect in head and neck oncologic resection. Wang C, Wang Q, Li G and Yang D used this flap for hypopharyngeal reconstruction (Wang *et al*., 2015).

Variations in Arcuate artery

In present study arcuate artery was absent in 40% of feet. Yamada *et al*. (1993) found the same variation in 33%, Vijayalaxmi (1996) found in 6% and rajeshwari (2013) found in 16.67% of legs.

The perfusion to dorsum of foot in such cases was done either by enlarged lateral tarsal artery or by deep plantar arch. Hollinshead mentions about small communications between branches of lateral tarsal artery and the arcuate artery. When the arcuate artery is rudimentary or missing; lateral tarsal artery may give rise to more lateral dorsal metatarsal arteries (Hollinshead, 1958). Dorsalis pedis artery is the main artery that supplies the foot as it also contributes to the formation of deep plantar arch. In the era of microvascular surgeries, dorsalis pedis artery and its branches have got immense importance in flap surgeries. Surgeons are still trying to bring to light the full potential of dorsalis pedis artery in various reconstructive surgeries. Hence this study will definitely aid in further such endeavours.

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