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An Anatomical Study on Dorsalis Pedis Artery

Vengadesan .B[1], Dr. Pushpalatha .K[2]

[1]Tutor, Department of Anatomy, Chamarajanagar Institute of Medical Science, Chamarajanagara, Karnataka, India
[2]Professor & HOD, Department of Anatomy, JSS Medical, College Mysuru-15, Karnataka, India

Abstract: ***Background: The study of Dorsalis pedis artery and variations in its branching pattern has been reported sporadically. The purpose of this study was to evaluate the arterial. Supply on the dorsum of the foot. Materials and Methods: The study was carried out of forty dissected limbs of unknown sex and age from the department of Anatomy, JSS Medical College Mysuru. Results and Discussion: The incidence of classical text book description was found to be very less in present study. In 5% of cases the dorsalis pedis artery was replaced by the peroneal artery. In 5% of cases the anterior tibial artery was found on lateral side of leg, dorsalis pedis artery is a continuation of the anterior tibial artery seen passing above lateral malleolus and then it passes forwards along the lateral side of the dorsum of the foot. Conclusion: The findings suggest that the lateral aspect of the dorsum of the foot has a poor nourishment.***

Keywords: Dorsalis Pedis Artery, Vascular Anatomy, Flap Reconstruction

1. Introduction

Dorsalis pedis artery is the chief artery of the foot and is the continuation of the anterior tibial artery distal to the ankle. It passes to the proximal end of the first intermetatarsal space where it turns into the sole between the heads of the first dorsal interosseous to complete the plantar arch[1].

Branches of dorsalis pedis artery
1. Lateral and medial tarsal arteries
2. Arcuate artery
3. First dorsal metatarsal artery
4. Cutaneous branches.

The chief artery of the dorsum of foot is the dorsalis pedis artery. Reconstruction of the arteries of the foot in patients with severe chronic arterial occlusive disease has become a routine and valuable procedure. However, it is frequently difficult to select the optimal site for the distal arterial anastomosis. Awareness of the anatomical variations of the foot arteries is important for angiographers, vascular surgeons and reconstructive surgeons who operate upon the foot region. The dorsalis pedis artery is excellent for pedal revascularization, since it is the largest artery distal to the ankle joint. Fasciocutaneous flaps have been shown to be very reliable and versatile for covering defects of the foot.

The anatomical study of the arteries of the foot is necessary for further advances in arterial reconstruction. Such reconstruction often avoids amputation in cases of arterial trauma resulting from industrial and automobile accidents, as well as in patients with diabetes and severe ischemia of the lower limbs .The dorsalis pedis flap is one of the most common used foot flaps. There is still little detailed information on the arterial supply of the dorsum of the foot. Knowledge of the vascular anatomy is key to ensuring the safety and reliability of the flap surgery. To evaluate patients with arterial disease, palpation of peripheral arterial pulse is commonly used .In lower limb, palpation of dorsalis pedis artery is used to evaluate the arteriosclerotic diseases. Dorsalis pedis artery is the main source of blood supply to the dorsum of the foot. Knowledge about the origin, course and branching pattern of this artery is essential, as it forms the stem for one of the major myocutaneous flaps, used for ankle surgeries in plastic and reconstructive surgeries.

As variation in dorsalis pedis artery is uncommon, it is essential to have a sound knowledge about the artery it is advisable to have preoperative angiography for any abnormality, to prevent risks during surgical intervention. Hence the present work was undertaken to study in detail the abovementioned parameters and compare with the other worker

2. Materials and Methods

40 lower limbs of unknown sex and age were obtained in a span of two years from the Department of Anatomy JSS Medical College Mysuru, Karnataka, India. The limbs were dissected carefully to explore the dorsalis pedis artery, and its branches was traced and painted and marked for clear view and photographed. They variations were observed were studied in details.

3. Observation & Results

1) Normal course and branches of dorsalis pedis artery
In the present study in 90% of cases the anterior tibial artery continued as the dorsalis pedis artery and gave the lateral tarsal artery, medial tarsal artery, arcuate artery and first dorsal metatarsal artery and continued as the deep plantar artery after piercing the first dorsal interoesseous muscle.

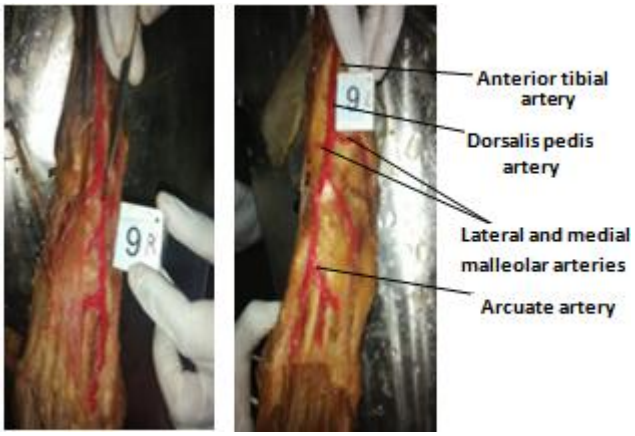

Figure 1: Normal course and branching pattern of Dorsalis pedis artery

2) Dorsalis pedis artery was replaced by the peroneal artery :

In specimens number 5RF and 5LF.The DPA was replaced by the peroneal artery and perforating branch which passes through the opening in the interoesseous membrane descended under cover of the extensor digitorum longus and peroneus tertius and anastomosed with anterior malleolar branch of anterior tibial artery.

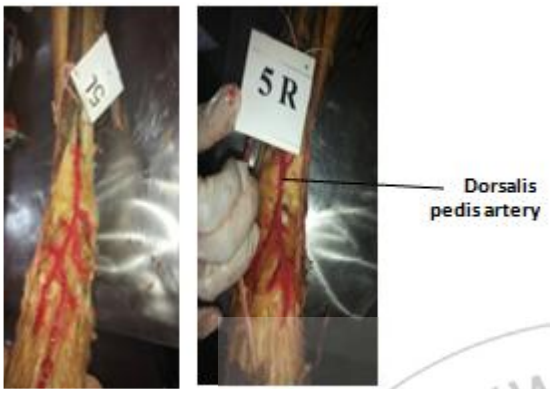

Figure 2: Dorsalis pedis artery was replaced by perforating branch of peroneal artery

3) Anterior tibial artery was found on lateral side of leg:

In specimen number 11RF and 11LF.Variation was observed, that is anterior tibial artery was found on lateral side of leg, dorsalis pedis artery is a continuation of the anterior tibial artery seen passing above lateral malleolus and then it passes forwards along the lateral side of the dorsum of the foot. It crossed inferior extensor retinaculum, below extensor digitorum longus and finally reached the proximal end of the intermetatarsal space.

Figure 3: Anterior tibial artery was found on lateral side of leg

4. Discussion

Variations in the blood vessel and their anomalous course can be attributed to their development. Tiny blood vessels derived from the blood islands in the 3rd or 4th week of development, merge with each other and form continuous network, from which buds grow out, canalize and form new vessels. New vessels of neighborhood areas form a closed network depending on the functional dominance, some vessels regress and others diverge in the mode of origin and course from the principal vessel. The dorsalis pedis artery is noted for its variations[2].

The dorsalis pedis artery which is the continuation of anterior tibial artery is the main and prime arterial supply to the foot. It terminates at the proximal part of the first intermetatarsal space, where it divides into two branches, the first dorsal metatarsal artery and the deep planter artery and passes to it dips into the sole, between the head of first dorsal interoesseous muscle to complete the planter arch[3]. The present study was undertaken to study in details variation in the origin, course, and branching pattern of DPA in 40 specimens by dissection method.

Bailleul.JP et al reported that dorsalis pedis artery was replaced by perforating branch of peroneal artery in 8% of cases. Similar variation was observed in 12% of cases by Mestdagh.H.B et al, in their study. In the present study, the dorsalis pedis artery was replaced by perforating branch of peroneal artery in two specimen's (5%) bilaterally[4].

These variant patterns are clinically very significant because it may be confused for vein and dye may be injected which may result in the necrosis of the lower limb.

Kesabi D, Keerti Singh et al, Lateral deviation of dorsalis pedis artery and higher bifurcation of anterior artery tibial artery to form dorsalis pedis at junction of upper 3/4th and lower 1/4th of leg . In the present study found that dorsalis pedis artery begins in front of the ankle between the two malleoli was in all specimens, expect 10% of specimen[5].

Study done by Dilandro.AC et al, revealed that dorsalis pedis artery was absent in 6.7% of case, the arcuate artery was absent in 33%.The dorsalis pedis artery crossed under the extensor hallucis tendon at the ankle in 54%, above the ankle in 43% and below the ankle in 3%, suggesting the optimal site of dorsalis pedis artery anastomosis on the foot is the segment distal to the ankle. In the present study found that the dorsalis pedis artery and the arcuate artery was present in all specimens[6]

Nilesh .K. Mitra et al, reported in 14.29% of cases the second dorsal metatarsal artery originated from the dorsalis pedis artery which is not infrequent. In the present study, this variation was observed the second dorsal metatarsal artery originated normally from arcuate artery in all 40 specimens[7].

The significance of the above discussed variation of the dorsalis pedis artery are extremely important for cardiologists, Interventional Radiologists, Plastic Surgeons, Traumatological surgeons these days. This artery is used to record peripheral arterial pulsation. Also the musculo-cataneous flaps based on dorsalis pedis artery are commonly used for reconstructive surgeries.

These days' radiologists prefer dorsalis pedis artery to femoral artery for performing angiographic studies because of easy approachability and less complications. The added advantage is the patient can be ambulant very early when compared with femoral artery approach. Hemostasis can be obtained easily in the dorsalis pedis artery.

Tortuosity and high level of bifurcation are of great importance for radiologists because the chances of perforation are more in tortuous arteries. Branches of the arteries can be mistaken for vein.

Harvesting dorsalis pedis artery along with fascio cutaneous dorsum of foot flap is very common procedure used by the plastic surgeons and Traumatological Surgeons.

The present work was undertaken to study the variations of the dorsalis pedis artery regarding origin, variation, branching pattern. Because dorsalis pedis artery and surrounding flap have great clinical applications. Very frequently they are approached and, used by cardiologists, Interventional Radiologists, Plastic Surgeons, and Traumatological Surgeons.

5. Conclusion

In the present work, recording the dorsalis pedis artery variation, out of 40 specimens, 36 were normal in their origin, course, branching pattern and termination. In 5% the dorsalis pedis artery was replaced by perforating branch of the peroneal artery. The perforating branch which passes through the opening in the interoesseous membrane and descended under cover of extensor digitorum longus and peroneus tertius and anastomosed with the anterior malleolar branch of anterior tibial artery. In 5% the anterior tibial artery runs along lateral side of the leg and continues as dorsalis pedis artery passes above lateral malleolus, and then passes forward along the lateral side of the dorsum of the foot.

The knowledge of dorsalis pedis artery origin, variations, branching pattern are indispensable for clinicians. Dorsalis pedis artery and fascio-cutaneous dorsum of foot flap are used as graft. Dorsalis pedis arteries are approached by cardiac Surgeons, Interventional Radiologists, Plastic Surgeons and Traumatological Surgeons. Hence the present work has great relevance clinically.

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