Bilateral Absence of the Arcuate Artery on the Dorsum of the Foot

With anomalous origin of dorsal metatarsal arteries

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Numerous variations of the arterial anatomy of the foot and toes have been described.1, 2, 3, 4 Awareness of the anatomical variations in arteries of the foot and toes is important for angiographers, vascular surgeons and reconstructive surgeons to deal with diagnosis and treatment of arterial occlusive diseases. The dorsal artery of the foot, arteria dorsalis pedis, dorsalis pedis artery, is the continuation of the anterior tibial artery distal to the ankle. It courses distally along the dorsum of the foot to the proximal end of the 1st intermetatarsal space, where it turns into the sole to complete the plantar arch. The branches of the dorsalis pedis include the lateral and medial tarsal, 1st dorsal metatarsal arteries, deep plantar and arcuate arteries. The arcuate artery arises near the medial cuneiform, passes laterally over the metatarsal bases deep to the digital extensor tendons and gives rise to the 2nd to 4th dorsal metatarsal arteries (DMAs) before anastomosing with the lateral tarsal artery.5 The DMAs are important as they are responsible for the blood sup-
ply to the toes through their digital branches. Also, free transfer of flaps from the web spaces of toes containing DMAs are used for micro-vascular anastomosis in reconstruction of the hand.6

The following is a report of bilateral absence of the arcuate artery with variations in origin of the 2nd, 3rd, and 4th dorsal metatarsal arteries found during routine gross anatomy dissection at the College of Medicine and Health Sciences, Sultan Qaboos University, Sultanate of Oman

CASE REPORT

During routine dissection of the lower limbs of a 60-year-old male cadaver, it was observed that the arcuate artery on the dorsum of the foot was absent bilaterally [Figs. 1 & 2]. After reflection of the tendons of the extensor digitorum longus (EDL) and extensor digitorum brevis (EDB) muscles, the dorsalis pedis artery was cleaned, along with accompanying veins and traced distally. It entered the 1st intermetatarsal space where it gave rise to the 1st DMA. In both lower limbs, the artery was also found to give rise to the 2nd dorsal metatarsal artery (DMA) opposite the intermediate cuneiform bone (the usual point of origin of the arcuate artery) [Figure 1]. The 2nd DMA passed forward between the 2nd and 3rd metatarsal bones resting on the belly of the 2nd dorsal interosseous muscle. The 3rd and 4th DMA were found to arise from the lateral tarsal artery opposite the lateral cuneiform and cuboid bones [Figure 1]. The 2nd through 4th DMAs originated much more proximally than their usual textbook description of origin at the bases of the metatarsals. Similarly, the lateral tarsal artery also arose much more proximally and laterally over the dorsal aspect of the calcaneus. In the absence of the arcuate artery, it ended anteriorly by dividing into the 3rd and 4th DMAs. A muscular branch from the lateral tarsal artery was found, as usual, joining to the EDB, and a lateral branch joined the lateral malleolar network.

DISCUSSION

Anomalies of the dorsalis pedis artery and its branches on the dorsum of the foot have been mostly reported in cadaveric dissections1,4,5,7,8,9. Out of these studies, Yamada et al.2 and DiLandro et al.4 reported variations in the arcuate artery. Dissection, arteriographic and corrosion cast studies by Yamada et al.2 involving 30 limbs from 17 cadavers revealed that the arcuate artery was absent in 33% of feet and the dorsalis pedis artery was absent in 6.7% of feet. In our case, we report bilateral absence of the arcuate artery in a male cadaver. Yamada et al. (1993) found no strong association between the right and left feet of the same person for the presence of the arcuate artery. DiLandro et al.4 reported the absence of the arcuate artery in 83.3% of cases.

Variations in dorsal metatarsal arteries have been reported in several studies.1,4,5,8,9 The 1st dorsal metatarsal artery was found to originate from its usual origin, the dorsalis pedis artery, in 90.6%1,4,5,8,9 and 86% of cases.5 Lee and Dauber8 reported anomalous origin of the 1st dorsal metatarsal artery from the lateral tarsal artery in only 9.4% cases and it was also found to arise from the plantar network in 10% of cases.7 Our study found no variation in origin of the 1st dorsal metatarsal artery.

The arcuate artery is classically described as giving rise to the 2nd to 4th dorsal metatarsal arteries.5 In the study by Gabrielli and Olave5 the 2nd DMA originated from the arcuate artery exclusively in 10% of cases, the 3rd DMA in 6% of cases and the 4th DMA in 10% of cases. In its absence (48%), the lateral tarsal arteries and the proximal perforating branches were respon-
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The anatomical variation in this report describes the 2nd DMA as originating from the dorsalis pedis artery when the arcuate artery was found to be absent. To the best of our knowledge, this variation is distinct and has not yet been reported. Even studies by Gabrielli and Olave found that in the absence of the arcuate artery, the lateral tarsal arteries (52% of cases) and proximal perforating arteries (90% of cases) were responsible for the origin of the 2nd DMA. Documentation of anomalous origins of the 2nd, 3rd, and 4th dorsal metatarsal arteries, such as reported in this case study, is important to clinicians doing reconstructive surgeries of the foot.

CONCLUSION

The anatomical variation in this report describes the 2nd DMA as originating from the dorsalis pedis artery when the arcuate artery was found to be absent. To the best of our knowledge, this variation is distinct and has not yet been reported. Even studies by Gabrielli and Olave found that in the absence of the arcuate artery, the lateral tarsal arteries (52% of cases) and proximal perforating arteries (90% of cases) were responsible for the origin of the 2nd DMA. Documentation of anomalous origins of the 2nd, 3rd, and 4th dorsal metatarsal arteries, such as reported in this case study, is important to clinicians doing reconstructive surgeries of the foot.

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REFERENCES