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CASE REPORT

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

With anomalous origin of dorsal metatarsal arteries

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غياب الشريان المقوَس من ظهر كلا القدمين مع وجود تغيرات في منابت الشرايين المشطية (العرشية) الظهرية

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الملخص: خلال التشريح الروتيني للأطراف السفلية لجثة ذكر يبلغ من العمر ستون عاماً، لوحظ غياب الشريان المقوس من ظهركلا القدمين . حيث وجد كلاهما يجتازان الناحية الظهرية للقدمين مقابل المفصل الرسغي-المشطي. كما شوهد الشريان القدمي الظهري متنحياً 2 سنتيمتر للجانب الوحشي من وتد عضلة إبهام القدم الباسطة الطويلة. وأن منبت الشريان المشطي الظهري الثاني كان من الشريان الظهري المقوس قبالة العظمة السفينية (الوتدية) المتوسطة. أما الشريانين المشطيين الظهريين الثالث والرابع فلقد كانت منابتهما من الشريان الرسغي الوحشي. وعلى الرغم من وجود الوصف المسبق لغياب الشريان المقوس فإن ما نصفه هنا من المتغيرات الشريانية لم توصف من قبل ومتميزة عن غيرها من المتغيرات التشريحية . حيث أن منبت بديل الشريان المشطي الظهري الثاني وجد مبتدئاً من الشريان القدمي الظهري. وإن معرفة المتغيرات التشريحية لشرايين الأقدام والأصابع لها أهمية سريرية وبشكل خاص في مجالات جراحة الترميم والبحث عن المتلازمات المرضية لهذه المتغيرات.

مفتاح الكلمات: تشريح، شرايين، ظهري، مشطي، قدمي، تقرير حالة، عمان.

ABSTRACT Bilateral absence of the arcuate artery was observed during routine dissection of the lower limbs of a 60-year-old male cadaver. Running distally on the dorsal aspect of both feet and opposite the tarso-metatarsal joint, the dorsalis pedis artery diverged 2cm lateral to the tendon of the extensor hallucis longus. The 2nd dorsal metatarsal artery was found originating from the dorsalis pedis artery opposite the intermediate cuneiform bone. The 3rd and 4th dorsal metatarsal arteries originated from the lateral tarsal artery. Although absence of the arcuate artery has been previously described, the arterial variant described here is thought to be distinct from those previously reported. The variant 2nd dorsal metatarsal artery was found to originate from the dorsalis pedis artery. Knowledge of anatomical variations of arteries supplying the feet and toes has important clinical significance in reconstructive surgery and in determining associated pathology.

Keywords: Anatomy, Tarsal; Dorsal; Metatarsal; Arcuate; Pedis; Arteries; Case Report; Oman.

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, 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 anastomising with the lateral tarsal artery.[5] The DMAs are important as they are responsible for the blood sup-

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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 dissections[1,2,3,4,7,8,9] 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

Figure 1: ***Photograph of the dissected right foot showing the dorsalis pedis artery giving origin to the 1st and 2nd dorsal metatarsal artery (DMA) and absence of arcuate artery. The 3rd and 4th DMA are seen to be arising from the lateral tarsal artery. Arrow shows lateral diversion of the dorsalis pedis artery 2 cm away from the tendon of EHL. 1. dorsalis pedis artery; 2. 1st DMA; 3. 2nd DMA; 4. 3rd DMA; 5. 4th DMA; 6. lateral tarsal artery; 7. medial division of the deep peroneal nerve. Extensor hallucis longus (EHL); extensor digitorum brevis (EDB); extensor digitorum longus (EDL)***

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, 8, 9] The 1st dorsal metatarsal artery was found to originate from its usual origin, the dorsalis pedis artery, in 90.6%[1, 4, 8, 9] and 86% of cases.[9] Lee and Dauber[8] 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.[9] 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 Olave[9] 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-

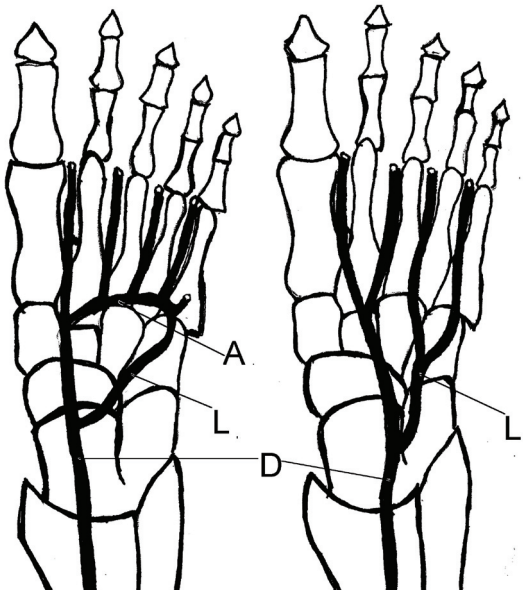

Figure 2: ***Schematic representation showing comparison between normal and anomalous origin of the DMAs (1-4). The left-sided figure shows the normal description of the 1st DMA arising from the dorsalis pedis artery and the 2nd, 3rd, and 4th DMAs arising from the arcuate artery. The right-sided figure shows the variations found in this study; normal origin of the 1st DMA arising from the dorsalis pedis artery and anomalous origins of the 2nd DMA from the dorsalis pedis artery, and the 3rd and 4th DMAs from the lateral tarsal artery. D- dorsalis pedis artery; A- arcuate artery; L- lateral tarsal artery***

sible for the formation of the second DMA in 52%, of the third DMA in 54%, and of the fourth DMA in 72% of cases. The proximal perforating branches made an important contribution to the formation of such arteries, contributing partially or totally to the second DMA in 90%, to the third DMA in 92%, and to the fourth DMA in 86%.[4, 9] in 72 cadaveric dissections, found that the lateral tarsal artery supplied the 2nd, 3rd, and 4th DMA more frequently (47.2%) than the arcuate artery. The proximal perforating arteries as well as various combinations of all three sources were also found to contribute complete blood supply to dorsal metatarsal arteries 2 through 4. In our study the 3rd and 4th DMA arose from the lateral tarsal artery.

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[9] 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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