*Short report*

# Incidental intima-media wall changes in the lower-limb arteries: a case series in habitual distance runners

**B Roos**[1]; **W Derman**,[2,3] MBChB, BSc (Med) (Hons), PhD

[1] *Sonographer, Musculoskeletal Ultrasound Department, Centre for Orthopaedics, Johannesburg, South Africa*

[2] *Institute for Sport & Exercise Medicine, Division of Orthopaedic Surgery, Faculty of Medicine and Health Science, Stellenbosch University, South Africa*

[3] *International Olympic Committee (IOC) Research Centre, South Africa*

***Corresponding author:*** *W Derman (ewderman@sun.ac.za)*

This case series describes the observed presence of echogenic circular "beads" identified by high-resolution ultrasound imaging in the peripheral arterial walls of the lower limbs of three vascularly asymptomatic runners. The aetiology, mechanisms and clinical implications of these observations remain uncertain.

**Keywords:** ultrasound, calcification, beads, endurance runners, arterial wall

*S Afr J Sports Med* 2016;28(1):30-32. DOI:10.17159/2078-516X/2016/v28i1a689

High-resolution ultrasound is a popular and cost effective imaging modality used in the practice of sport and exercise medicine for the evaluation of soft tissue injury. Indeed, this modality is the imaging investigation of choice in the evaluation of skeletal muscle injury, aponeurotic tears, ligament injuries, tendinopathy and evaluation of soft tissue swelling. It is also an important diagnostic modality in the evaluation of vascular conditions including deep venous thrombosis and peripheral arterial disease.

A number of clinical ultrasonographers including the first author of this report have (during musculoskeletal ultrasound conducted for reasons of injury evaluation) noticed the presence of echogenic circular "bead" shaped calcifications in the arterial wall (intima-media space) of the peripheral lower limb arteries in runners. The vessels identified with this phenomenon include the posterior tibial, anterior tibial, popliteal and (to a lesser extent) the superficial femoral arteries. Discussions with colleagues in the radiology, orthopaedic and vascular fields have failed to explain this finding.

It has been suggested that this phenomenon might be a variant of Mönckeberg's medial sclerosis which might be exacerbated by running, however literature searches targeting this phenomenon have failed to yield many results.[1] It is of interest that a literature search did identify a study of the mechanical stress effects on the cardiovascular adaptations of peripheral arterial calcifications among athletes.[6]

## Methods

This case series describes the appearance observed in the lower limb vasculature of three runners who underwent ultrasound evaluation of the lower limb due to musculoskeletal injury. All three athletes were in a similar age group (49-52 years), of similar build and have similar histories of many years of road-running. Two of the athletes are brothers, the third athlete is unrelated.

All athletes underwent ultrasound scanning of the lower limb for either ankle sprain or calf strain. A Philips Epiq 5 ultrasound scanner (Philips, Netherlands) using an 18 MHz transducer with harmonic imaging was used in the imaging evaluations. All athletes described in this study provided written consent for their clinical material to be used in this publication.

Images captured from ultrasound scanning of the three athletes described in Table 1 are shown in Figures 2 to 6. As a control image, an asymptomatic 50-year-old male underwent ultrasound scanning as a means to demonstrate the normal anatomy and provide a "control". The image from this individual is shown in Figure 1.

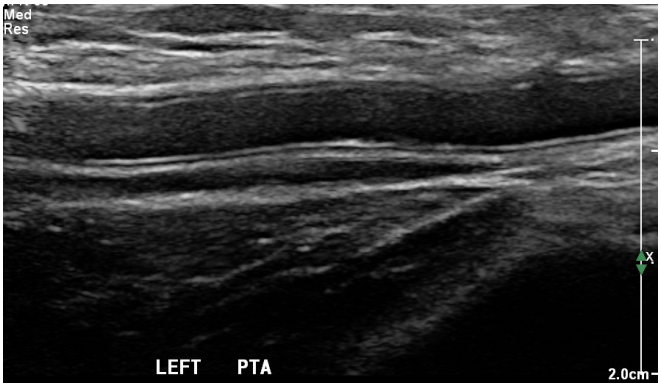


*Fig. 1. Normal smooth intima of the posterior tibial artery of a 50-year-old physically inactive individual*

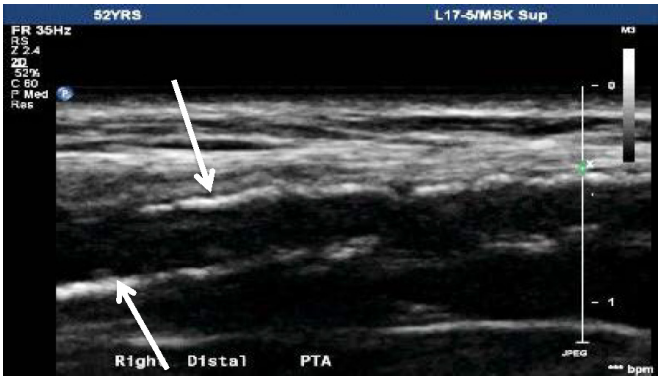


*Fig. 2. Ultrasound conducted for ankle sprain of Athlete 1 [Note arrows show echogenic intima-media thickening (beads) in the distal posterior tibial artery]*

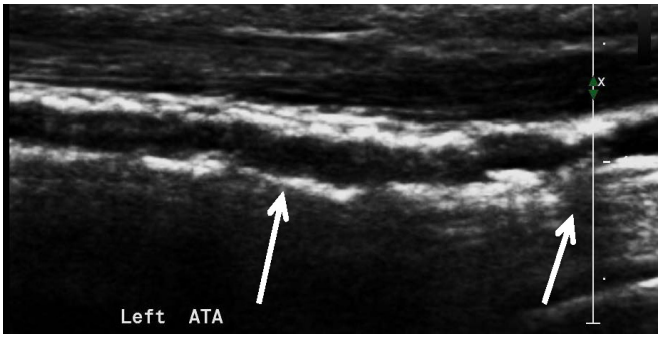


*Fig. 3. Ultrasound conducted for ankle sprain of Athlete 2. Arrows indicate echogenic intima-media calcification (beads) in the left anterior tibial artery [Note posterior shadowing in sections as the deposits become denser]*

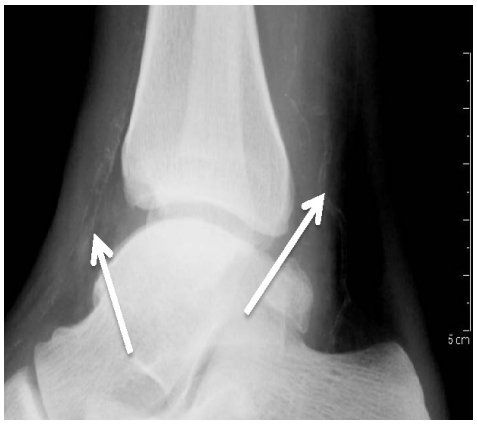

*Fig. 4. Left lateral ankle X-ray post injury in Athlete 2 [Note incidental arterial calcifications visible]*

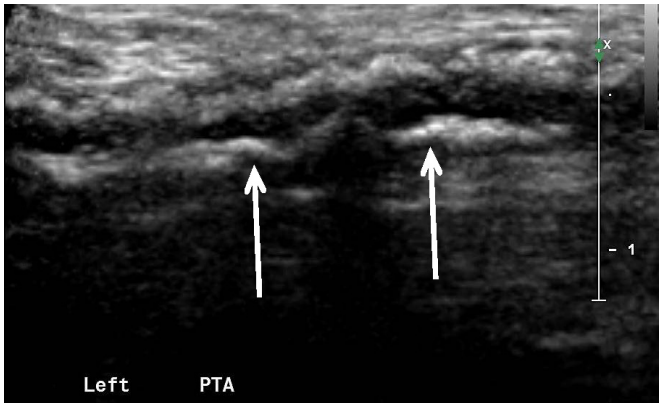


*Fig. 5. Intimal-medial calcific bead-like deposits in the left posterior tibial artery of Athlete 3*

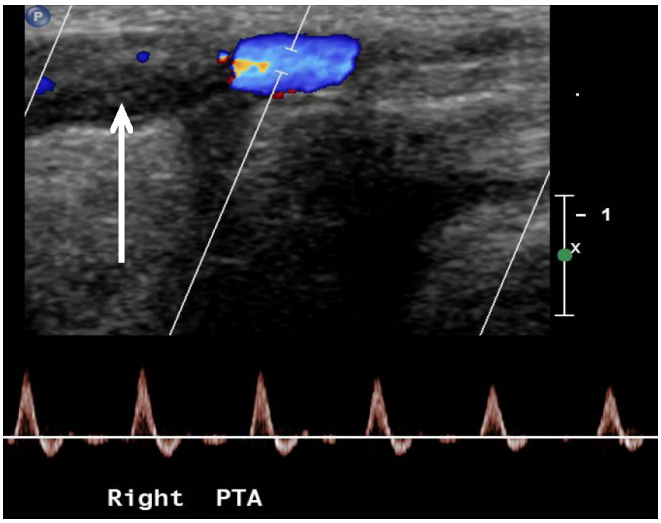


*Fig. 6. Calcific deposits in right posterior tibial artery deposits of Athlete 3 [Note deposits cause shadowing, resulting in only partial visualisation of the colour Doppler flow. The Doppler spectral trace of flow is, however, normal.]*

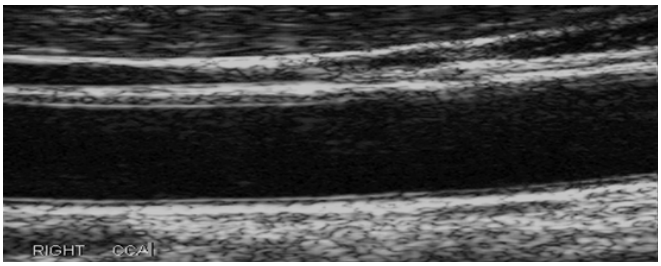

*Fig. 7. Ultrasound scan of the carotid artery of Athlete 3 [Note the smooth non-calcified vascular wall]*

The clinical and sporting characteristics of the three runners are shown in Table 1.

## Discussion

This case series describes vascular beadlike calcifications as an incidental finding in the intima-media layers of the lower limb vasculature in three endurance runners who underwent musculoskeletal ultrasound scanning for lower limb soft tissue injury. Many practicing ultrasonographers have observed this phenomenon in endurance runners.

It is assumed that the nature of the hyperechoic regions described above are calcific in origin.[2] In the early stages of these lesions in younger runners, the deposits do not cause any posterior shadowing to suggest calcium as a component. It is therefore possible that the lesions seen might represent lipid or fibrotic deposits. Over time, however, the deposits do cause marked shadowing on ultrasound, to the point of preventing visualisation of sections of the vessel lumen (Figure 6).

Most of the literature describing vascular ultrasound investigations in the athletic and non-athletic populations show that they were performed as diagnostic tests secondary to the presence of vascular symptoms. For example, iliac artery stenosis in cyclists has been well researched and involves endofibrosis, a pathological process characterised by thickening of the vessel intima, causing progressive stenosis of the lumen and impaired blood flow.[3] Fibromuscular dysplasia is a further disorder that has been described but predominantly affects the medial or adventitial layers of the arterial wall and typically involves the renal or extracranial cerebrovascular arteries.[4] The condition described in this series is also clearly different from cystic adventitial disease, in which mucoid cysts develop within the adventitial layer of typically the popliteal artery, increasing adventitial thickness and compromising flow.[5]

Mönckeberg's sclerosis has some similar features to the cases described in this series, but tends to result in a stiffening of the elastic layer of the arterial wall. In addition, it is usually observed in the major lower limb arteries of the elderly, but can occur in the head, neck and pelvis. It is important to note that the vascular calcifications described in this series were only noted in the arteries of the lower limb and not in the carotid vessels (Figure 7). It is also important to note that increased calcium and calcium scores in the coronary arteries of endurance runners has recently been described.[6] The clinical relevance of these findings is yet to be determined.

It is tempting to speculate that the deposits described may be related to an inflammatory process of the arterial walls due to the repetitive jarring impact of the foot on a hard surface. However, to the knowledge of these authors, no biopsies have been performed to establish the aetiology of the deposits.

**Acknowledgements:** Ms Roos would like to acknowledge the support and enthusiasm of Dr Mark Ferguson, Prof Mike Lambert and Dr Jon Patricios who assisted with encouragement of the first author to present these observations. Thanks to the three athletes for the permission to use their data.

**Competing interests:** None.

**Table 1. Characteristics of the three runners described in this series**

| Parameters | Athlete 1 | Athlete 2 | Athlete 3 |
|---|---|---|---|
| Height (m) | 1.8 m | 1.6 m | 1.8 m |
| Weight (Kg) | 67 | 65 | 80 |
| Age (yrs.) | 52 | 51 | 49 |
| Years running | 29 | 25 | 11 constant, then intermittent |
| Short distances i.e. Track + Field | minimal | minimal | 5 yrs. : 800-5000 m |
| Long distances i.e. 10 km+ | multiple | multiple | multiple |
| Ultramarathons i.e. >42.2 km | 22 | 22 | none |
| Marathons (42.2 km) | 130 | 40 | none |
| Half marathons (21.2 km) | 400 | 150 | several |
| Triathlons | 12 ultra + 60 std | 7 ultra + several std | multiple std |
| Other sporting disciplines: | canoe/cycle | canoe/cycle/yoga | swimming, cycling, gym |
| Exercise sessions per week: | 7 to 12 | 4 | 5 to 7 |
| Major injuries/illness: | stress # alar x 2 | car/motorbike accidents | lateral ligament complexes |
| | patella tendinopathy | no major limb injuries | both ankles 1980s |
| | bilharzia x 2 | some knee + ankle issues | Maisonneuve # Left 2010 |
| | muscles tears/sprains | (arterial calcifications incidental on X-ray) | (arterial calcifications incidental on X-ray) |
| Cholesterol concentration (mmol/L) | 4.8 | 5.2 | 5.1 |
| Smoking habit | never | several years, but not for 25 years | never |

Abbreviations: m = metres km = kilometres yrs = years std = standard mmol/L = millimol per litre

## References


1. Gielen S, Schuler G, Adams V. Cardiovascular effects of exercise training: molecular mechanisms. Circulation 2010;122:1221-1238. [http://dx.doi.org/10.1161/CIRCULATIONAHA.110.939959]
2. Drůeke TB. Arterial intima and media calcification: distinct entities with different pathogenesis or all the same? Clin J Am Soc Nephrol 2008;3: 1583-1584. [http://dx.doi.org/10.2215/CJN.03250708]
3. Peach G, Schep G, Palfreeman R, et al. Endofibrosis and kinking of the iliac arteries in athletes: a systematic review. Eur J VascEndovasc Surg 2012;43:208-217. [http://dx.doi.org/10.1016/j.ejvs.2011.11.019]
4. Perdu J, Boutouyrie P, Bourgain C, et al. Inheritance of arterial lesions in renal fibromuscular dysplasia. J Hum Hypertens 2007;21:393-400. [http://dx.doi.org/10.1038/sj.jhh.1002156]
5. França M, Pinto J, Machado R, et al. Case 157: Bilateral adventitial cystic disease of the popliteal artery 1. Radiology 2010;255:655-660. [http://dx.doi.org/10.1148/radiol.10082211]
6. O'Keefe JH, Patil HR, Lavie CJ, et al. Potential adverse cardiovascular effects from excessive endurance exercise. Mayo Clinic Proc 2012;87:587-595. [http://dx.doi.org/10.1016/j.mayocp.2012.04.005]