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Case Study

Incidental Finding of Complete Bilateral Persistent Sciatic Arteries in a Gunshot Victim: A Case Report

Sofia M. Ramos,[1]* Reinhardt G. Dreyer[1], and Thandi E. Buthelezi[2]

Abstract

Bilateral persistent sciatic artery (PSA) is a rare vascular anomaly. We report an exceptionally rare case of complete bilateral PSAs, diagnosed on computed tomography angiography (CTA) in a patient who sustained a gunshot wound to the lower limb. Incidental PSAs are unlikely to have clinical significance, however, the unusual anatomy and higher incidence of complications requires accurate reporting of such variants. In this case, the anomaly paradoxically proved beneficial given the proximity of the gunshot wound to the femoral vessels. The embryology, clinical and imaging findings, potential complications, and treatment options regarding PSA are discussed.

Introduction

Persistent sciatic artery (PSA) represents an unusual congenital vascular anomaly found in approximately 0.025-0.04% of the population (1). The sciatic artery is an embryological continuation of the internal iliac artery, providing the major blood supply to the lower limb and then involuting during normal fetal development. Persistence of bilateral sciatic arteries is exceptionally rare, occurring in 12-32% of cases (1). The PSA anomaly was first described as a post-mortem finding by Green in 1832 (2) and has since been reported in fewer than 200 cases (3). The majority of cases are asymptomatic and found incidentally, particularly in young patients, but may later go on to present with symptoms of claudication and rarely, sciatica (4,5). PSA may be associated with numerous complications such as aneurysm, stenosis and occlusion, leading to ischaemia and potential amputation (6). We report a case of a 26-year-old female patient with bilateral PSA discovered incidentally on computed tomography (CT) angiography of the lower limbs following a gunshot wound.

[1] Department of Diagnostic Radiology, Faculty of Health Sciences, University of the Witwatersrand, Johannesburg, South Africa
[2] Department of Diagnostic Radiology, Thelle Mogoerane Regional Hospital, Vosloorus, University of the Witwatersrand, Johannesburg, South Africa.
***Author correspondence**: smmramos@live.com
Ramos ORCID: 0000-0002-4864-6834
Buthelezi ORCID: 0000 0003 2016 6334

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Case presentation

A 26-year-old female patient, with no known co-morbidities, presented to the Emergency Department (ED) at Thelle Mogoerane Regional Hospital, Vosloorus, Gauteng, South Africa, with a gunshot wound to the right thigh. The patient was clinically stable with normal vital signs and intact neurovascular system. A small bullet entry wound was noted in the right mid-thigh with no exit wound visualised. The right thigh was moderately swollen and tender, with soft compartments. The distal right lower limb was cold to the touch with a faint dorsalis pedis pulse. Subsequently, a CT angiogram (CTA) of the lower limbs was performed to exclude vascular injury.

CTA was performed from the abdominal aorta to the feet using a Philips Brilliance 54 Ingenuity Core 64-slice CT scanner (Philips Medical Systems (Cleveland), Inc.) with the following technical parameters: 150 mAs, 120 kVp, 64 × 0.625 collimation, 0.9 mm slice thickness. A 120 mL bolus of omnipaque 350 was injected at a rate of 4 mL/s.

CTA demonstrated no significant arterial injury and an undisplaced unilateral cortical fracture of the distal third of the right femur. An incidental finding of bilateral sciatic persistent arteries was made upon further assessment, serving as a fortunate variant given the proximity of the gunshot wound to the right superficial femoral artery. The patient was treated conservatively.

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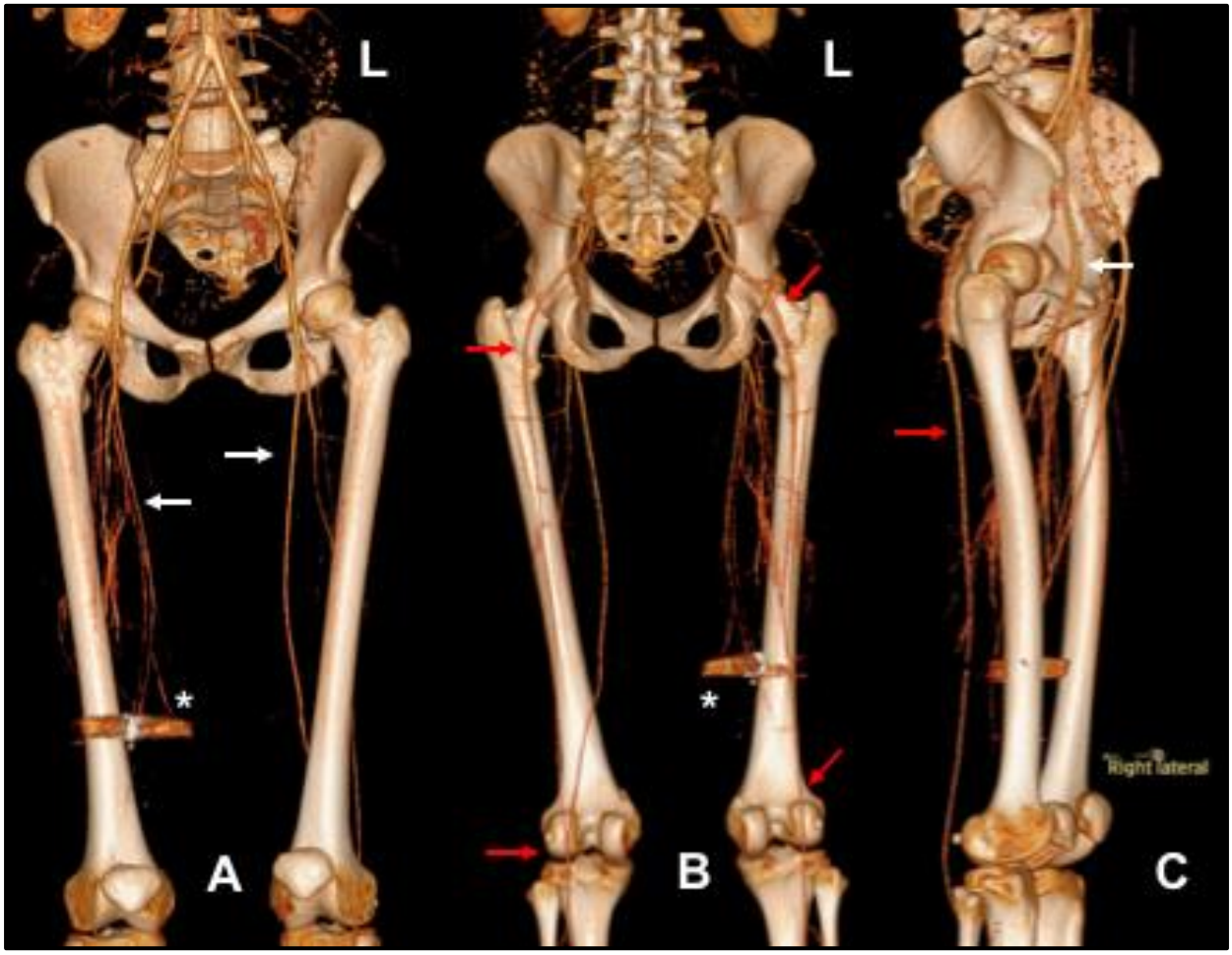

Figure 1 | (**A**) Anterior coronal CTA 3D volume reconstruction demonstrating normal origin and course of the SFAs (white arrows), from the common femoral arteries. The SFAs were found to be hypoplastic, particularly within the right thigh, and demonstrated poor continuation to the popliteal arteries. Bullet fragment denoted by the asterisk (*). (**B**) Posterior coronal CTA 3D volume reconstruction demonstrating the bilateral PSAs originating from the internal iliac arteries, continuing as the popliteal arteries (red arrows). (**C**) Lateral oblique 3D volume reconstruction shows the relationship of the posteriorly orientated PSA (red arrow) relative to the anteriorly located SFA (white arrow).
[CTA, computed tomography angiography; SFAs, superficial femoral arteries; PSAs, persistent sciatic arteries.]

The bullet fragment was left in situ and the patient was discharged in a stable condition.

The superficial femoral arteries (SFAs) were found to be hypoplastic, particularly within the right thigh, and demonstrated poor continuation to the popliteal arteries (Figure 1. A). The PSAs originated from the internal iliac arteries, each continuing into the posterior thigh, through the greater sciatic foramen, below the gluteus maximus and along the sciatic nerve in the posterior compartment (Figure 1 & 2). The PSAs provided the majority of blood supply to the popliteal arteries (Pillet & Gauffre Type 2a configuration) (Table 1).

The bullet fragment was lodged within the deep tissues, alongside the medial femoral cortex of the right distal thigh. The gunshot tract was intimately associated with the superficial femoral vessels of the right anteromedial thigh (Figure 1. A, B), highlighting the potential benefit of the complete PSA anomaly in this case. There was no significant injury to the right SFA despite the proximity of the gunshot wound.

Discussion

Embryology, Anatomy and Classification

The embryonic sciatic artery develops as a continuation of the internal iliac artery (branch of the umbilical artery) at the 6 mm stage and is responsible for the major

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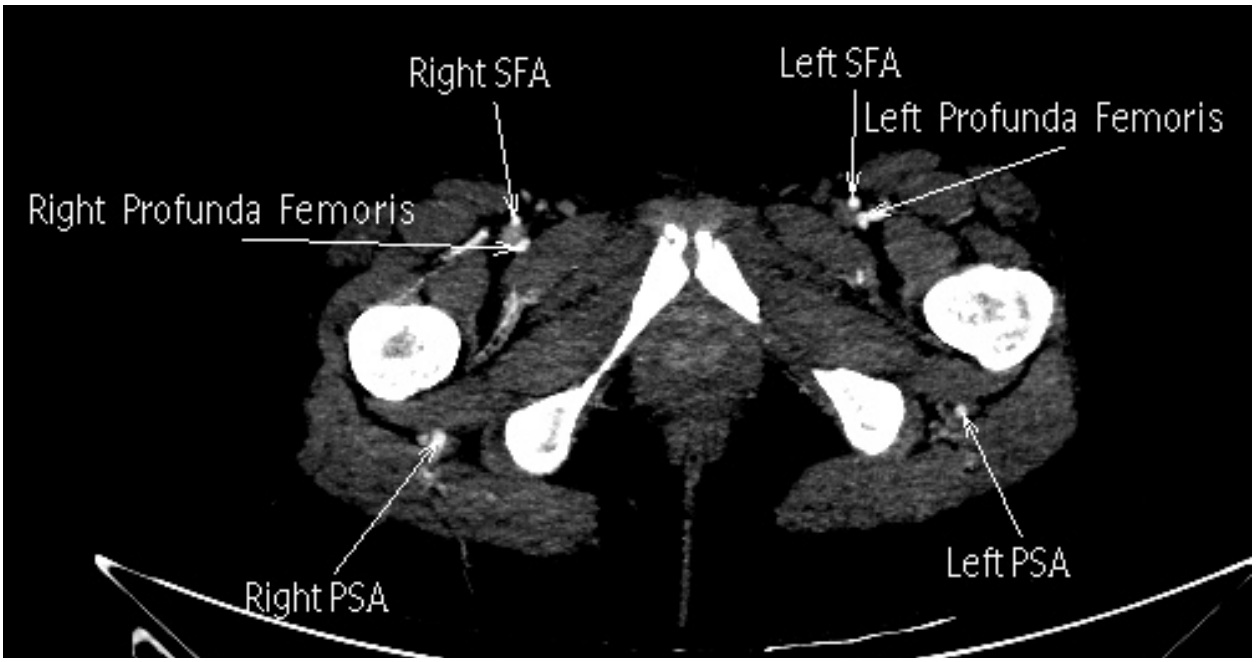

Figure 2 | Axial CTA maximum intensity projection (MIP) reconstruction with bone structures demonstrating the relation of the PSAs with the pelvis and proximal femurs.
[CTA, computed tomography angiography; PSAs, persistent sciatic arteries.]

blood supply of the lower limb bud during the 6-9 mm stage of development (7). The femoral artery begins to form at the 10 mm stage, as a continuation of the external iliac artery. At the 12 mm stage, the superficial and deep femoral arteries are formed and become the main vascular supply to the lower limb. Normally, the sciatic artery involutes by the 22 mm stage (6). The proximal remnants of the involuted sciatic artery give rise to the inferior and superior gluteal arteries. This distal portion of the involuted sciatic artery develops into the peroneal and popliteal arteries (8). The SFA continues to develop and eventually establishes continuity with the popliteal artery (6). The PSA is due to failure of regression and may be associated with hypoplasia of the femoral arterial system in some cases (7). Some authors have postulated that the sciatic artery persists in cases when the femoral arteries do not develop completely, however, the reasons for abnormal development are unknown (3). A genetic mutation or vascular event triggered by the in utero environment has been suggested as a possible cause (6).

Anatomically, the course of the PSA differs from that of the femoral arteries. The sciatic artery runs from the internal iliac artery, through the sciatic foramen, alongside the sciatic nerve, however, this relationship may not be found universally (6). The artery then lies deep to the gluteus major muscle and travels distally along the adductor magnus, eventually exiting via the popliteal fossa.

PSAs are commonly tortuous and enlarged. The internal iliac artery may also have a larger calibre than the external iliac artery, as it supplies blood to the lower limb via the PSA. As mentioned previously, the SFA may be normal in calibre, hypoplastic or completely absent (7). The classification system described by Pillet et al. and modified by Gauffre et al. is widely used to define the 5 different types of PSA (6,9,10) (Table 1). The majority of cases, approximately 80%, are complete with the PSA continuing as the popliteal artery, as seen in our patient's case.

Table 1 | Classification of persistent sciatic artery according to Pillet et al. (9,10) * Added by Gauffre *et al*. PSA, persistent sciatic artery; SFA, superficial femoral artery

	PSA	SFA
Type 1	Complete	Complete
Type 2a	Complete	Incomplete - no continuation to the popliteal artery
Type 2b	Complete	Absent
Type 3	Incomplete – only proximal sciatic artery present	Complete
Type 4	Incomplete – only distal sciatic artery present	Complete
Type 5a*	Origin is from the median sacral artery	Complete
Type 5b*	Origin is from the median sacral artery	Hypoplastic

Type 1 describes a complete PSA with normal femoral artery. Type 2: complete PSA with incomplete SFA development. Type 2 further subdivided into 2a: the SFA is present but narrows, with no continuation to the popliteal artery and 2b: the SFA is completely absent. Type 3 describes an incomplete PSA where only the proximal sciatic artery is present and the SFA is normal. Type 4: incomplete PSA; only the distal sciatic artery is present, with normal SFA. Type 5: PSA arises from the median sacral artery; 5a: SFA normal, 5b: hypoplastic femoral artery (1,6,9,10).

Clinical Features

PSA cases discovered incidentally at imaging are unlikely to be of clinical relevance and these asymptomatic cases may result in under-reporting of the anatomical variant (1,6). In our case, the patient did not report any symptoms related to the bilateral PSA. This anomaly proved beneficial given the proximity of the gunshot wound to the femoral vessels in the anteromedial thigh. This outcome resembles a similar scenario encountered by Shaffer et al (1).

The superficial course of the PSA, through the buttock and sciatic foramen, lying between the piriformis muscle and sacrospinous ligament, may predispose to repetitive trauma during compression in hip flexion and extension (6,11). Additionally, the relative congenital hypoplasia of the arterial wall renders the PSA susceptible to atherosclerosis and aneurysms. Aneurysmal dilatation of the PSA is a common cause for presentation, occurring in up to 43% of PSA cases (11).

Patients with symptomatic PSA present at a mean age of 44 years (1) with a range of clinical signs and symptoms: pain and pallor of the lower limb, buttock pain, claudication, poor capillary refill and cool extremities. Lower motor weakness, loss of sensation and sciatica have also been reported (1,4). Repetitive external compression results in claudication whilst seated (12). Aneurysms may present as pulsatile, painful masses in the buttock region. Arterial insufficiency from aneurysm thrombosis or embolisation is a common presenting symptom (13). The Cowie sign is considered pathognomonic for PSA. This describes the presence of a palpable popliteal pulse, in the absence of a femoral pulse, however, it may only be recognised in a minority of PSA cases (4).

Treatment of PSA will depend on the patient's symptoms, aneurysm formation and the type of PSA. Occlusion of complete type PSA will require revascularisation by surgical bypass given the high incidence of femoral artery hypoplasia whereas aneurysms will require endovascular resection, coiling or stent-graft placement (6,11).

Conclusion

Bilateral PSA is a rare vascular variant and is associated with the development of complications secondary to the relative hypoplasia of the vessel walls. This anomaly should be reported when detected, even in asymptomatic cases or as an incidental finding, given the high incidence of associated atheroma formation, ischaemia and potential aneurysm formation. Follow up of such cases would allow for early detection of complications and appropriate timeous intervention.

Additional information

Supplementary information

Supplementary Figure 1 | Scrolling Axial CTA maximum intensity projection (MIP) reconstruction with bone structures demonstrating the relation of the PSAs with the pelvis and proximal femurs. Raw data, unedited. Used in generation of Figure 2.

Ethical Considerations

This article followed all ethical standards for a research report. Ethics Clearance Certificate (M200828) issued by the Human Research Ethics Committee (Medical) of University of Witwatersrand.

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Conflict of interest statement

The authors report no conflicts of interest and declare that they have no financial or personal relationships that may have inappropriately influenced them in writing this article.

Author contributions

S.R. was responsible for the conception, design, drafting, literature review and revision of the article. R.D. made a substantial contribution to the conception and design, acquisition of data and imaging of the article.

T.B. made a substantial contribution to the design, revision and approval of the article.

Data availability statement

Data sharing is not applicable for this article.

Disclaimer

The views expressed in this article are only of the authors and do not represent the views or official policies and position of the affiliated partners of the authors.

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