Case Report

Persistent sciatic artery found incidentally on hip MRI: report of 4 cases

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A B S T R A C T

The persistent sciatic artery is a rare anatomical variant, representing the persistence of the sciatic artery in adult life that is responsible for the major blood supply to the lower limb in early embryologic development. Such persistence may be bilateral and can remain asymptomatic for many years. However, aneurysmal degeneration has been described as a complication of the persistent sciatic artery, which may cause critical limb ischemia resulting from thrombosis or embolization of aneurysm thrombus. Digital subtraction angiography, Doppler ultrasound, computed tomography angiography and magnetic resonance angiography are the most frequently used diagnostic tools to detect, classify and determine the presence of complications of a PSA. Early detection of this vascular abnormality on imaging studies can avoid life-threatening complications. We describe 4 patients with PSA that were diagnosed as an incidental finding in magnetic resonance imaging of the hip and demonstrate its characteristic imaging appearance.

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Introduction

The persistent sciatic artery (PSA) is a rare embryologic abnormality consisting in the lack of regression of the embryonic dorsal axial artery associated with a hypoplastic superficial femoral artery (SFA) [1]. The reasons for an incomplete or absent development of the femoral artery are unknown [2].

In early embryologic development, the sciatic artery (SA) is a continuation of the internal iliac artery into the popliteal-tibial vessels and represents the major blood supply to the lower limb bud. With the development of the femoral arteries, the SA normally involutes [3].

The prevalence of this phenomenon is estimated to be 0.025%-0.04% and can be bilateral in 22%-25% of the patients [4,5].

The first description of a PSA was published by Green in the Lancet in 1832 [3,6,7].

Traditionally, diagnosis of PSA is made with invasive or contrast imaging studies, such as digital subtraction angiography, computed tomography angiography (CTA), and
magnetic resonance angiography (MRA). The cases of 4 patients with PSA that were diagnosed as an incidental finding in a standard magnetic resonance imaging (MRI) protocol of hip, without gadolinium or angiographic techniques, are discussed.

Case presentation

Four patients with persistence of the SA diagnosed as an incidental finding of MRI of the hip are reported. The patients were submitted to the standard 1.5-Tesla (T) MRI protocol of hip without intravenous gadolinium injection (T1, T2 fat suppression and proton density-weighted spin-echo pulse sequences). CTA was performed in 2 cases to better evaluate the vascular anomaly.

Case 1

A 31-year-old woman was referred to MRI scan with a history of the right hip pain, without trauma. The MRI of the right hip demonstrated a prominent tubular structure crossing the major sciatic foramen, following the course of the sciatic nerve in the proximal thigh, coursing inferior to the gluteus maximus muscle, posterior to the greater trochanter of the femur. This structure demonstrated low signal in T1- and T2-weighted sequences with a thin T2 hyperintense wall, characterizing an arterial blood vessel with fast blood flow (flow void). Additionally, there was a marked reduction in the diameter of the common femoral artery and SFA and absence of associated musculoskeletal abnormalities (Fig. 1). CTA was performed 10 days later and confirmed the PSA originated from the internal iliac artery, passing through the popliteal fossa where it becomes the popliteal artery. The common femoral artery and the SFA were hypoplastic (Fig. 2).

Case 2

A 28-year-old man was referred to the MRI center with complaint of left hip pain after trauma in a soccer game 2 months earlier. MRI scan of the left hip demonstrated a partial...
torn of the proximal myotendinous junction of the rectus femoris muscle with a small hematoma in the intermuscular plane. As an incidental finding, a vascular structure with the course adjacent to the sciatic nerve corresponding to a PSA was found, showing pulsation artifacts as ghost images in the phase encoding direction (Fig. 3), characterizing the arterial blood flow.

Case 3

A 40-year-old woman presented to MRI center with right iliac crest pain for 2 months, without trauma. The MRI scan of the right hip revealed proximal iliotibial band syndrome, characterized by a small partial tear of the proximal iliotibial band at the iliac tubercle surrounded by soft tissue edema. A PSA was
found as an incidental finding, with low signal in T1- and T2-weighted sequences due to flow void, coursing in proximity to the sciatic nerve. The common femoral artery and the SFA were hypoplastic. Retrospective analysis of a MRI scan of the pelvis with intravenous gadolinium injection confirmed the anatomic variant (Fig. 4).

Case 4

A 36-year-old woman underwent MRI of the right hip due to sciatica symptoms. The examination was normal except for the presence of a vascular structure with flow void coursing adjacent to the sciatic nerve (Fig. 5). Abdominal computed tomography angiography performed a month later confirmed the PSA originating from the internal iliac artery. The SFA was hypoplastic (Fig. 6).

Discussion

The SA arises as a branch of the dorsal root of the umbilical artery, supplying the main vascularization of the lower limbs in the early embryo. From the sixth week until the third month of pregnancy, the development of the femoral arterial system and the progressive involution of the SA occurs [1,7–9]. As part of this process, the blood flow of the popliteal artery is provided from both the SA and the SFA, during a period of embryonic development. Normally, there is a progressive and almost complete involution of the SA after the development of the femoral arteries [2,4]. Remnants of the SA typically persist in the adult, the proximal part gives rise to the inferior gluteal artery, and the distal part forms the popliteal and peroneal arteries (Fig. 7) [1,3,7].

When persistent into adulthood, the SA is a continuation of the internal iliac artery. This ectatic vessel takes the path of the inferior gluteal artery, courses deep to the gluteus maximus muscle, posterior to the greater trochanter of the femur, and along the posterior aspect of the adductor magnus muscle into the popliteal fossa where it becomes the popliteal artery. The PSA may lie in close proximity to the sciatic nerve or it may accompany the posterior cutaneous nerve [3,7].

The PSA may be complete or incomplete. The complete PSA constitutes approximately 63%-79% of reported cases [3,4,10]. In this form, the SFA is hypoplastic, and the PSA is the continuation of a large internal iliac artery, which is accompanied by the sciatic nerve and continues as the popliteal...
Fig. 4 – Case 3. A 40-year-old female with persistent sciatic artery on the right side. (A) and (B) Sagittal and coronal T2-weighted fat saturated MR images demonstrating small partial tear of the proximal iliotibial band surrounded by soft tissue edema (white arrows). (C) and (D) Consecutive pelvic axial T1-weighted fat saturated MR images with gadolinium at the level of the greater femoral trochanter demonstrating the PSA on the right side (red arrow) and normal neurovascular bundle sciatic nerve on the left side (yellow arrow). The common femoral artery (white arrows) and the superficial femoral artery (green arrows) were hypoplastic on the right side.
artery. In the incomplete type, PSA is discontinuous between the pelvis and the popliteal fossa, and the femoral system is the dominant arterial supply to the lower extremity [3,10–12].

Pillet et al. [13] proposed a classification of PSA into 4 categories, considering the partial or total absence of the femoral vasculature. Type I: complete PSA and normal femoral artery. Type II: complete PSA and incomplete femoral artery; type IIa: a SFA which does not, however, reach the popliteal artery; type IIb: no SFA; type III: incomplete axial artery; only the upper half of the artery can be found with a normal femoral network; type IV: incomplete axial artery in which only the lower half can be found with the coexistence of a normal femoral network. Gauffre et al. [14] added a fifth type: SA branching from the medial sacral artery with an existing SFA.

Such classification cannot be adopted in MRI scan of the hip due to the small field of view.

Clinically, PSA should be suspected in case of absence of femoral pulse, however, with present popliteal and/or pedal pulses (Cowie’s sign) [1,2,8]. The most common complication of PSA is fusiform aneurysmal degeneration, with a prevalence of 48% [2]. It has been suggested that chronic trauma as a result of compression of the PSA against the sacrospinous ligament, piriformis muscle, and hip, as well as frequent stretching during flexion of the hip joint, may be a causative factor in aneurysm formation [2,3]. Others have suggested that there is a reduced amount of elastic fibers in the arterial wall [1,3]. Arterial insufficiency as a result of aneurysm thrombosis or distal embolization of mural thrombus is a common method of presentation. Rupture has rarely been reported. Aneurysms can produce compression of the sciatic nerve resulting in pain, numbness, or motor impairment [3,12].

Another potential complication of a PSA is an accidental damage in hip surgery. During a posterior approach to the hip joint, great caution must be exercised in protecting a PSA. Inappropriate trauma could either cause peripheral embolization, propagation of mural clots, or rupture [7,15,16].

The methods described in the literature for the diagnosis and assessment of complications of PSA are digital.

Fig. 5 – Case 4. A 36-year-old female with persistent sciatic artery on the right side. (A-C) Axial T1-weighted MR image (A), axial T2-weighted fat saturated MR image (B), and axial computed tomography angiography (C) demonstrating the PSA (white arrows) and the hypoplastic superficial femoral artery (yellow arrow).
subtraction angiography, CT or MRI with contrast medium, CTA, MRA, and Doppler ultrasound [2,4,8]. The classic angiographic findings are as follows: the internal iliac artery is larger in caliber than the external iliac artery; PSA courses laterally at the level of the femoral head and is recognized as posterior if oblique views are obtained; the external iliac and common femoral arteries are usually normal or small but are in their usual locations; and the SFA runs into the thigh, where it tapers gradually and bifurcates close to the level of the adductor canal [7]. CT and MR with contrast medium are less invasive and should provide the same anatomic information, allowing proper diagnosis of PSA, aneurysmal degeneration, and show its relationship with neighboring structures [8]. Doppler ultrasound can demonstrate the SA course in the posterior portion of the thigh continuing with the popliteal artery, accompanied by a sciatic vein, allowing for the identification of an aneurysmal degeneration as well as the presence of complete or partial thrombosis [8].

Some authors suggest that MRA may be considered as the first-line imaging modality due to its noninvasiveness and ability to generate 3-dimensional vascular images without using iodinated contrast [17,18].

We demonstrated that a PSA could also be found as an incidental finding in patients who have no symptoms related to PSA in a standard MRI protocol of hip without gadolinium or angiographic techniques. The typical imaging finding of PSA in MRI is a large caliber vascular structure coursing along the sciatic nerve, with signs of rapid blood flow, such as flow void, and occasionally showing pulsation artifacts, which can be seen as motion-related artifacts in the phase encoding direction.

PSA might be confused with prominent branches of the inferior gluteal artery; however, PSA has a larger caliber, courses distally into the thigh, and frequently may be associated with hypoplastic SFA and a larger internal iliac artery.
The treatment of PSA will depend on the presentation as well as the urgency of the situation. Asymptomatic patients should be monitored at regular intervals by physical examination and noninvasive imaging of the SA, with intervention recommended only if asymptomatic aneurysmal dilation is noticed. If there is aneurysmal dilation, its exclusion is fundamental to prevent embolization or rupture. Ligation of the aneurysm may be the only treatment necessary in those patients with normal superficial femoral or adequate collateral perfusion of the lower extremity. In the incomplete form, it is sufficient to ligate or embolize the PSA aneurysm. In the complete form, it is necessary to add a revascularization technique (bypass, stent, angioplasty) that will guarantee adequate perfusion of the limb [3,4,10].

In conclusion, PSA is a rare vascular embryologic abnormality that can remain asymptomatic for many years, nonetheless, with potential life-threatening complications.

Teaching point

We demonstrated that a standard MRI protocol, without intravenous contrast medium or angiographic techniques, is capable of diagnosing the presence of a PSA. When detected as an incidental finding, this anatomic variant must be described in MRI reports not only due to its potential complications, such as aneurysmal degeneration thrombosis and embolization, but also to avoid an accidental damage during a posterior approach hip surgery.

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