

Persistent Axis Vessels of the Lower Limb: A Rare Anomaly

KOMALA NANJUNDAIAH, SHESHGIRI CHOWDAPURKAR, RAHE RAJAN

ABSTRACT

Introduction: The persistent axis artery is a rare embryological remnant of the axis artery which supplies the limb bud. It develops as a dorsal root of the umbilical artery and supplies the lower limb. It normally involutes when the femoral artery starts developing.

Observation: We encountered a large, incomplete, persistent axis artery during routine dissection in a male cadaver which was aged approximately 70-years. The artery entered the gluteal

region through the greater sciatic notch, below the piriformis muscle. It gave off the inferior gluteal branches, the branches to the hip joint, the biceps femoris muscle, the sciatic nerve and the tibial nerve (high division of the sciatic nerve was noted). Throughout its course, it was accompanied by a vein which anastomosed with the tributaries of the femoral vein.

Conclusion: Such a persistent axis artery is prone for aneurysm, thrombosis and embolism.

Key Words: Axis artery, Persistent sciatic artery, neurysm.

INTRODUCTION

The persistent axis artery is a rare embryological abnormality. The first description of a persistent axis artery of the lower limb was published by Green in the Lancet in 1832 [1]. This anomaly results from the lack of regression of the embryonic axial artery of the developing lower limb bud. The axis artery is a continuation of the internal iliac artery which communicates with the popliteal artery and the tibial arteries distally [2]. The femoral artery is the artery of the ventral aspect of the developing limb. Once the femoral artery starts developing, the axis artery involutes, and this is completed by the third week of gestation, leaving behind the branches which supply the gluteus maximus muscle, which is called the inferior gluteal artery [3]. The abnormal persistence of this artery can be accompanied by the hypoplastic femoral artery.

The axis artery is also called the sciatic artery or the ischiopopliteal artery. The incidence of the persistent sciatic artery has been estimated to be 0.025% to 0.04% [4]. According to the literature, till 2004, only 88 cases of the persistent sciatic artery had been reported [2]. The complete persistence of the axis artery is much more common i.e. 80%, than the incomplete persistent axis artery [2]. The literature says that 14.3% to 44% of the patients with the persistent axis artery develop aneurysms by 45 years of age, with an equal sex incidence.

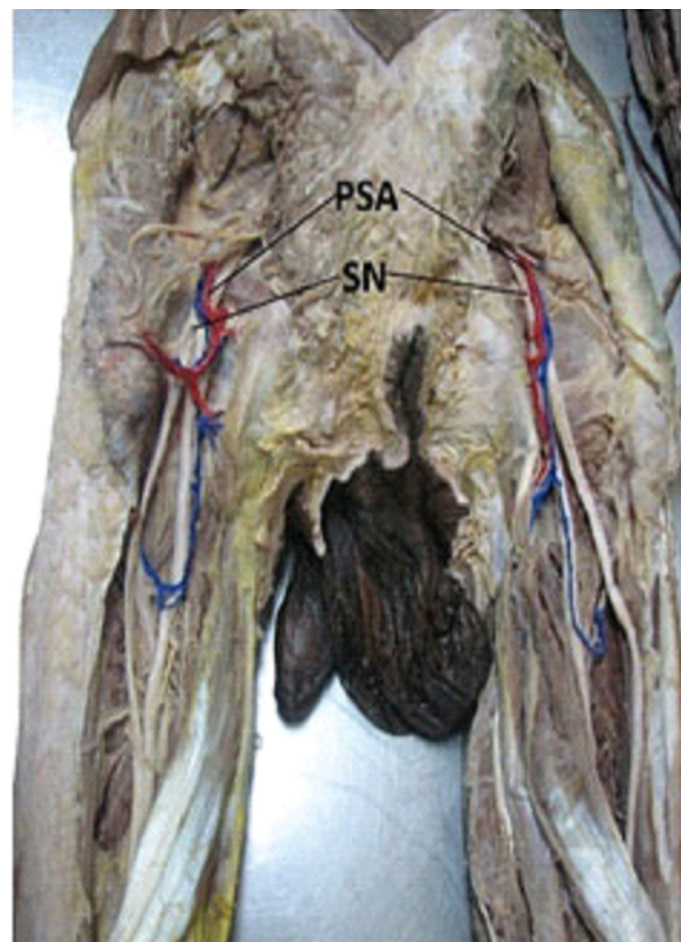
We are reporting here, a case of a large incomplete axis artery in a male cadaver, which extended to the back of the thigh.

CASE REPORT

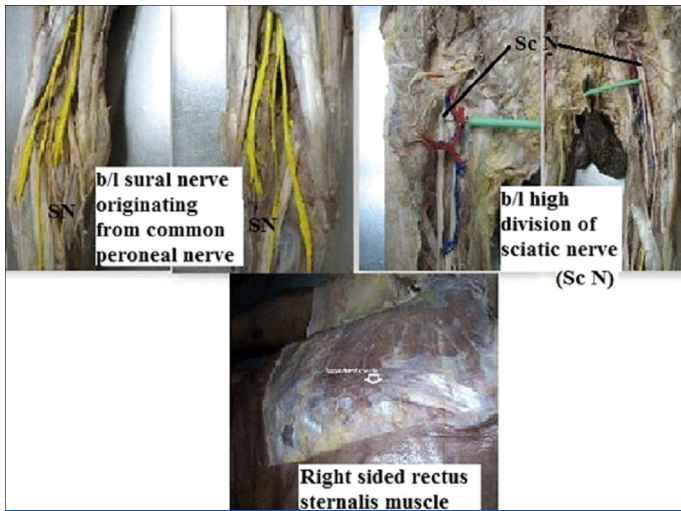
During a routine dissection study in the Anatomy Department, MSRMC, Bangalore, we found a bilateral incomplete persistent axis artery in an adult male formalin preserved cadaver, which was approximately aged 70-years.

The artery was as a continuation of the internal iliac artery. It en-

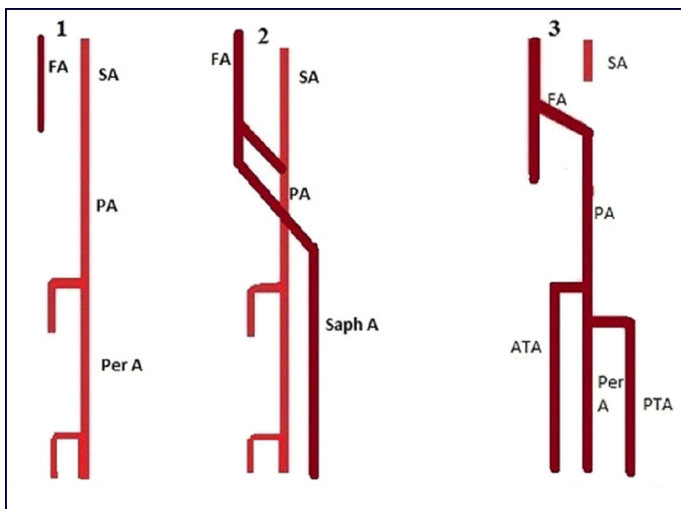
tered the gluteal region through the greater sciatic foramen, below the piriformis muscle, on both the sides. The artery was 4mm thick on both the sides at the point of entry and it gave off the inferior



[Table/Fig-1]: Bilateral persistent sciatic artery. PSA-Persistent sciatic artery. SN-sciatic nerve



[Table/Fig-2]: Other variations observed in the same cadaver



[Table/Fig-3]: Development of arteries of lower limb (1,2,3). SA-Sciatic artery, PA-popliteal artery, FA-Femoral artery, Saph A-Saphenous artery, ATA-Anterior tibial artery, PTA-Posterior tibial artery.

gluteal artery. Then the artery coursed distally in the thigh for 15 cm on the left and 22cm on the right, giving three branches to the hip joint, and it ended by giving multiple branches to the biceps femoris muscle. On the left side, one branch was given to the gluteus maximus muscle. [Table/Fig-1]. Along its course, few small branches to the sciatic and the tibial nerves (high division of the sciatic nerve was observed) were given off. However, the sciatic artery did not continue distally to communicate with the popliteal or the tibial arteries. The femoral artery was normal in calibre and the popliteal artery was found to be a continuation of the femoral artery.

Throughout its course, the artery was accompanied by a vein, which anastomosed with the femoral perforating vein, at the level of the mid thigh. It received tributaries from the inferior gluteal vein, veins draining biceps femoris and the hip joint.

Associated variations like the presence of the right rectus sternalis muscle, a bilateral high division of the sciatic nerve, a bilateral origin of the sural nerve from the common peroneal nerve, the bilateral sural communicating nerve from the tibial nerve and the right sural communicating nerve joining with the sural nerve in the popliteal fossa were noted in the same cadaver. [Table/Fig-2].

DISCUSSION

During the embryological development, the tip of the limb bud has a terminal arterial plexus which constantly gets renewed in the

distal direction as the limb grows. Later, one main vessel supplies the limb and the terminal plexus is called the axis artery. The axis artery of the lower limb arises from the dorsal root of the umbilical artery and courses along the dorsal surface of the thigh, the knee and the leg. The femoral artery courses along the ventral surface [5]. [Table/Fig 3].

There have been various reports of the persistent axis artery [1,2,3, 4,6,7,8,9,10], which may lead to the realisation that the numerous forms of the persistent axis artery correspond to various embryological developments of the lower limb arteries. A male predominance is noted in most of the studies [3]. In a majority of cases, the sciatic artery was complete [4].

George Paraskevas et al gave the following classification for the various types of the Persistent axis artery [2]

- Type I: A complete axial artery and a normal femoral artery.
- Type II: A complete axial artery and an incomplete femoral artery
- Type IIa: A superficial femoral artery which does not, however, reach the popliteal artery.
- Type IIb: no superficial femoral artery.
- Type III: An incomplete axial artery; only the upper half of the artery can be found with a normal femoral network.
- Type IV: An incomplete axial artery in which only the lower half can be found, with the co-existence of a normal femoral network.
- Type V: A sciatic artery branching from the medial sacral artery, with an existing superficial femoral artery.

The persistent sciatic artery in our cadaver fell into type III.

The axis artery can remain asymptomatic. In around 14.3% to 44% cadavers, it undergoes aneurysmal dilatation. The pre-disposing factors for aneurysm are, a congenital hypoplastic vessel wall with reduced elastic elements and exposure of the artery to repeated trauma in the gluteal region. The aneurysm of the persistent axis artery presents as a pulsating mass in the buttock. Arterial insufficiency as a result of thrombosis of the aneurysm or the distal embolization of the mural thrombus from the aneurysm is also a common clinical presentation, and it is associated with a high incidence of limb loss. Other patients may experience sciatica, which is manifested by pain, numbness or motor impairment as a result of compression of the sciatic nerve by the aneurysm at the level of the sciatic notch [6]. Failure to recognize a persistent axis artery as the major blood supply to the lower extremity may lead to an incorrect diagnosis of superficial femoral artery occlusive disease and inappropriate surgical revascularization [8]. The persistent axis artery can be diagnosed by using Doppler studies, angiography, computed topography or magnetic resonance imaging of the pelvis and the lower extremities. However, magnetic resonance angiography may be considered as the first line imaging modality due to its non-invasiveness and ability to generate 3- dimensional vascular images without using an iodinated contrast [6].

The treatment included aneurysmal exclusion and a femoro-popliteal by-pass with an inverted autologous saphenous vein in the case of a complete persistent sciatic artery, or else, ligation or balloon embolization [2,10].

The persistent axis artery has occasionally been associated with other anomalies which include, mullerian and left renal agenesis,

arterio-venous fistula formation, multiple haemangiomas, neurofibromatosis or anomalies of the leg arteries. The persistent axis artery may thus be accompanied by a superficial brachial artery, a right retro-oesophageal subclavian artery, accessory renal arteries, a left accessory hepatic artery branching off from the left gastric artery and an intermesenteric arterial anastomosis [2].

CONCLUSION

The persistent axis artery can undergo aneurysmal dilatation. Arterial insufficiency as a result of thrombosis of the aneurysm or distal embolization of the mural thrombus from the aneurysm is a common clinical presentation, and it is associated with a high incidence of limb loss. Arterial variations are also important for clinicians for angiographic interpretation and surgical procedures. The abnormal arteries are vulnerable in both orthopaedic and vascular surgeries. Reports of such variations will enhance the anatomical knowledge and remove the ambiguity during diagnostic interventions and surgical procedures.

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