

# PICA mirror aneurysms: Rarest of the rare

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## Abstract

Mirror aneurysms, a subset of bilateral, symmetrically situated aneurysms occurring in corresponding intracranial vessels, are an intriguing radiological finding. They probably represent phylogenetic aberrations in the embryonic development of intracranial vasculature. The posterior circulation, particularly the posterior inferior cerebellar artery (PICA), is an infrequent site for mirror aneurysms, with only four cases being reported so far. Here we describe the fifth such case of an incidentally detected PICA aneurysm on digital subtraction angiography, with an overview of the development of intracranial vessels and possible embryological perturbations which may lead to formation of this exceedingly rare anatomic abnormality.

**Keywords:** Mirror aneurysms, PICA, embryology, posterior circulation

## INTRODUCTION

Multiple intracranial aneurysms (IAs) are a relatively common entity in literature with an incidence in general population ranging from 15-30%.<sup>1</sup> Mirror aneurysms are a subset of multiple aneurysms, occurring bilaterally in corresponding intracranial arteries, ranging from less than 5% to 36% of all IAs.<sup>2</sup> In a recent series by Lee *et al.*<sup>3</sup>, most common sites of mirror aneurysms were middle cerebral artery (MCA), followed by cavernous internal carotid artery (ICA) and posterior communicating artery (PCOM). Posterior inferior cerebellar artery (PICA) is an infrequent site of aneurysmal formation, comprising of approximately 2.5% of all IAs.<sup>2</sup> Mirror aneurysms are exceedingly rare in PICA, with only four cases having been reported so far.<sup>2,4-6</sup> Majority of PICA aneurysms arise from vertebral artery (VA)-PICA junction while only a few take origins from distal PICA segments.<sup>7,8</sup>

## CASE REPORT

A 45-year-old man, presented with acute onset “thunderclap headache” lasting 1-2 hours, accompanied by few episodes of vomiting. The pain remitted within the next 6-12 hours, leaving behind a dull aching, holo-cranial band like sensation around his scalp, without any other neurological deficit. He sought medical

attention approximately 5 days after onset of the headache. Neurological examination was uneventful apart from mild terminal neck rigidity. A plain computerized tomography (CT) scan of brain was unremarkable.

The patient was not a known diabetic or hypertensive, nor did he smoke or drink alcohol. There was no family history of cardiovascular morbidity or stroke. It was revealed that he suffered from a trivial blunt trauma to the back of his head few days prior to onset of the headache. Suspecting a possible cervical arterial dissection, a cerebral four vessel digital subtraction angiogram (DSA) study was performed. Although there was no evidence of dissection, on vertebral artery contrast injection, two symmetrical, bilateral aneurysms, mirror-like in configuration, were noted arising from bilateral posterior inferior cerebellar arteries (PICA), without evidence of rupture. The left aneurysm measured 1.2 X 1.1 mm while the right was slightly bigger, with measurements of 2.5 X 1.8 mm on anteroposterior and transverse projections. The neck was not well delineated. No other aneurysms were seen. The patient was offered endovascular coiling for the same as a therapeutic option which he declined. Since the aneurysms were asymptomatic, it was planned to follow up the patient with subsequent angiographic scan. The decision to intervene therapeutically would be guided by increase

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in the size of the aneurysms on follow-up or development of symptoms in relation to it, such as intracranial haemorrhage. However, the re-assessment could not be done as per plan since we were unable to follow-up the patient in person.

## DISCUSSION

Mirror aneurysms have no recognized predisposing factors different from conventional risk factors of aneurysm formation. However, they have been shown to be more common in elderly females.<sup>2</sup> Traditionally, hemodynamic stress, vascular risk factors and genetic factors have been implicated in predisposition towards aneurysm formation.<sup>9</sup> However, considering the remarkable anatomical symmetry of mirror aneurysms, it is prudent to consider that more subtle embryological factors may be at play.

Although the intracranial vasculature appears to be a homogenous arrangement, embryological differentiation allows for assumption of “segmental identity”. This concept as proposed by Baccin *et al.*<sup>4</sup>, visualises the development of the arteries at the base of skull from three segments: procencephalic, mesencephalic and rhombencephalic. This accounts for the selective vulnerability of segments to specific insults or triggers. Multiple aneurysms developing from the same or at least two consecutive vascular segments suggest an endothelial defect; however, aneurysms involving non-contiguous segments

are indicative of a defect prior to cephalization, i.e., a genetic or inherited disease.<sup>4</sup>

The PICA as seen in the adult disposition is a vessel formed of various primordial channels during embryogenesis. As detailed by Macchi *et al.*<sup>11</sup>, the PICA is a recent phylogenetic acquisition in the vascular tree. The initial stimulus for the development of the posterior circulation is obtained from the growth of the brainstem and the occipital lobe.<sup>12</sup> At the 4-5mm embryonic stage, with definite vascularisation of the caudal end of the neural tube, the predominant supply of the hindbrain is from the paired longitudinal neural arteries. These channels are re-enforced by the carotid-vertebrobasilar anastomoses via the trigeminal artery (TA), the otic artery (OA), the hypoglossal artery (HA) and the pro-atlantal artery (ProA).<sup>13,14</sup> These connections eventually regress in the embryonic period following development of the VA in the 7-12 mm stage of the embryo, from transverse anastomosis between the cervical intersegmental arteries.<sup>13,15,16</sup> Thus, at this stage, the neural arteries are supplied by the major radiculo-medullary homologue in the posterior fossa, the VA.

The main vascular network of the spinal cord, derived from the anterior and posterior spinal arteries, is reinstated at the upper cervical level by a lateral longitudinal spinal axis, named the lateral spinal artery (LSA) by Lasjaunias *et al.*<sup>17</sup> The developing medulla-spinal junction as well as the developing cerebellum is supplied by a

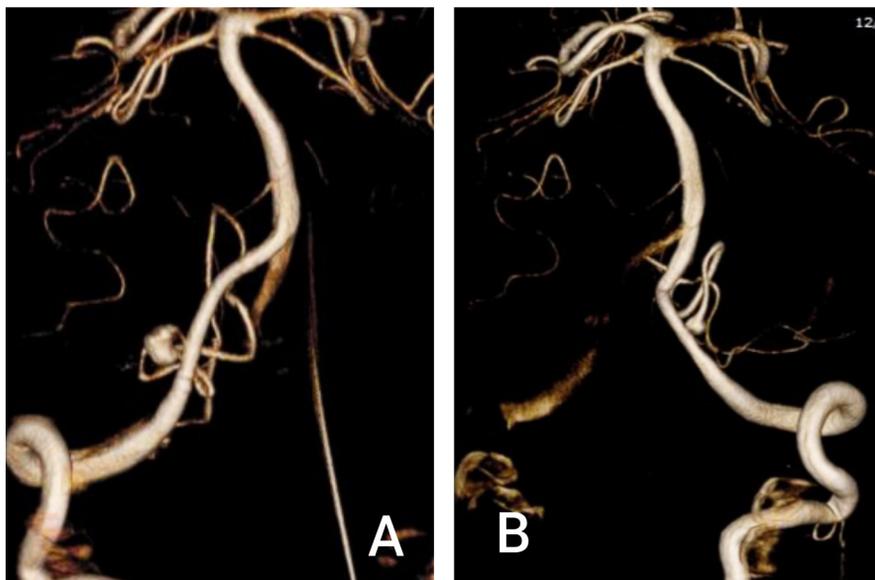


Figure 1: 3-dimensional re-constructed digital subtraction angiography (DSA) image of contrast injection of right (A) and left (B) vertebral arteries, respectively, revealing mirror aneurysms of bilateral posterior inferior cerebellar arteries (PICA)

series of small arterial channels that get attached to the LSA as well as to the VA. The progressive development of the medullary-spinal junction and the cerebellum acts as a pacemaker for the recruitment of vascular channels from the LSA and VA. Till day 35 of embryonic development, it is merely the superior cerebellar arteries (SCA) which vascularize the developing cerebellum along its inferior aspect. It is not until day 45, that the development of the PICA becomes apparent as a small vessel terminating in the choroid plexus. With further maturation of the cerebellum and acquisition of the neocerebellum, one of the branches from the LSA gains prominence and annexes these newly formed hemispheric branches.<sup>11</sup> It is interesting to note that the PICA is not predominantly a cerebellar artery but is rather a perforator destined to supply the medulla, that has a secondary function of blood supply to the neocerebellum because of its location. As opposed to mammals, the late acquisition of this third cerebellar vessel represents the latest phylogenetic acquisition in the form of the neocerebellum.<sup>11,18</sup>

Since the Proximal part of the PICA is formed because of the junction of the lateral spinal with a perforator, it is conceptually possible that during embryogenesis, an insult to the fusion process may result in a defect in the vessel wall at that area and lead on to the formation of aneurysms later in life, bilaterally.

In summary, we report the fifth case of a PICA mirror aneurysm in an otherwise asymptomatic individual. In contrast to previous reports, our patient did not present with subarachnoid haemorrhage or focal neuro-deficits. Thus, the exact course of management for such patients is uncharted territory.

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Image courtesy of GS Neuroscience, Patna, India.

## DISCLOSURE

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Conflict of interest: Nil

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