Surg Radiol Anat (2017) 39:581–584
DOI 10.1007/s00276-016-1753-3

ANATOMIC VARIATIONS

Fenestration of the supraclinoid internal carotid artery arising from the paraclinoid aneurysmal dilatation and fusing with the origin of the posterior communicating artery: a case report

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Received: 3 August 2016 / Accepted: 26 September 2016 / Published online: 30 September 2016

Abstract We report an extremely rare case of fenestration of the supraclinoid internal carotid artery (ICA) diagnosed by magnetic resonance (MR) angiography. The smaller channel arose from the paraclinoid ICA aneurysmal dilatation, and the posterior communicating artery arose from the distal end of the fenestration. Careful observation of MR angiographic images, including source images, is important to detect rare arterial variations, and their identification on MR angiography is aided by the creation of partial maximum-intensity-projection images and partial volume-rendering images.

Keywords Cerebral aneurysm · Fenestration · Internal carotid artery · Magnetic resonance angiography · Posterior communicating artery

Introduction

Fenestrations of the intracranial arteries are not rare and are most prevalent in the vertebrobasilar system, especially at the proximal segment of the basilar artery [11, 13, 16]. However, the fenestration of the supraclinoid internal carotid artery (ICA) is rare and frequently associated with an aneurysm at the fenestrated segment [4, 6, 7, 9, 16]. We present a case of the left supraclinoid ICA fenestration diagnosed by magnetic resonance (MR) angiography, in which the smaller channel of the fenestrated segment arose from an aneurysmal dilatation of the paraclinoid ICA and fused with the origin of the posterior communicating artery (PCoA).

Case report

A 73-year-old woman with headache visited our hospital and underwent cerebral MR imaging and MR angiography for the evaluation of cerebrovascular disease. She was examined using a 1.5-Tesla scanner (Magnetom Symphony, Siemens Medical Systems, Erlangen, Germany) and standard three-dimensional time-of-flight MR angiography protocol. We evaluated routinely obtained maximum-intensity-projection (MIP) images using the SYNAPSE® (Fujifilm Medical Company, Tokyo, Japan) picture archiving and communication system (PACS) and created partial MIP images and partial volume-rendering (VR) images to confirm the anomalous artery.

Cerebral MR imaging revealed no significant abnormality, and MR angiography showed an aneurysmal dilatation at the medial side of the paraclinoid segment of the left ICA and a large left PCoA that so-called fetal-type posterior cerebral artery (PCA). Clear demonstration on partial MIP (Fig. 1) and VR (Fig. 2) images of a small channel connecting the aneurysmal dilatation and origin of the fetal-type PCA indicated the fenestration of the supraclinoid ICA. MR angiographic source images and

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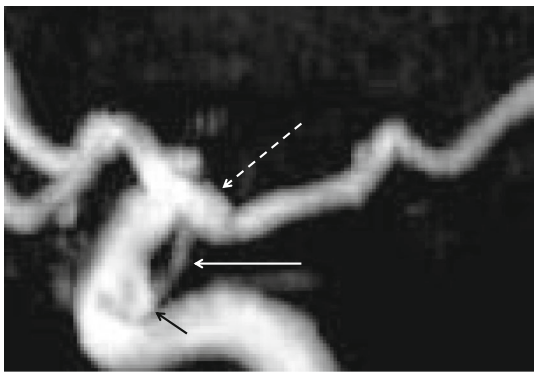

Fig. 1 Magnetic resonance (MR) angiography obtained using a 1.5-Tesla scanner. Partial maximum-intensity-projection MR angiographic image of the left carotid system, including the posterior cerebral artery (PCA). *Left lateral projection image* shows aneurysmal dilatation of the left paraclinoid internal carotid artery (ICA) (*short arrow*) and left fetal-type PCA with infundibular dilatation (*dotted arrow*). Between the aneurysmal dilatation and the origin of the fetal-type PCA, an artery of small caliber (*long arrow*) suggests fenestration of the supraclinoid ICA

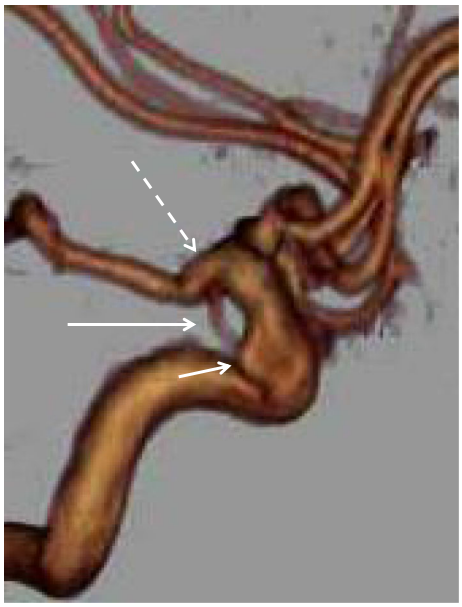

Fig. 2 Partial volume-rendering MR angiographic image of the left carotid system. *Right lateral projection image* clearly demonstrates the relationship among the aneurysmal dilatation (*short arrow*), fetal-type posterior cerebral artery with infundibular dilatation (*dotted arrow*), and anastomotic channel (*long arrow*)

their oblique sagittal reconstructed images (Fig. 3) were useful to identify both the origin and end of the smaller channel. The small size and wide neck of the aneurysmal dilatation allowed its observation without intervention. Neither computed tomography (CT) angiography nor catheter angiography was performed.

Discussion

According to Padget [8], most adult arteries in the head region are recognizable in a Stage 5 embryo of 16–18-mm length. Arterial fenestrations result from fusion failure or persistence of the primitive arterial network during the early embryonic stages. The prevalence of fenestration in the vertebrobasilar system is well known [11, 13]; nevertheless, Bharatha et al. [1] reported the greatest prevalence of intracranial arterial fenestrations in the region of the anterior communicating artery (ACoA). However, true ACoA fenestration is extremely rare [15].

Fenestration of the supraclinoid ICA is rare and either tiny, mimicking an aneurysm [2], or relatively large, such as that of our patient. When the fenestration is large, an aneurysm is frequently seen at the proximal end of the fenestrated segment [4, 6, 7, 9, 16]. In our patient, the smaller channel arose from the aneurysmal dilatation of the paraclinoid ICA and fused with the origin of the fetal-type PCA (Fig. 4). Despite extensive literature review, we found no similar case. Chen et al. [3] reported a case of bilateral supraclinoid ICA fenestrations, but we believe the catheter angiography images that they presented do not allow for the exclusion of arterial dissection with patent pseudolumen. Fenestration of the terminal segment of the ICA may be confused with duplicate origin of the middle cerebral artery (MCA), such as a case reported by Rennert's group [10] in which the point of distal fusion was located at the MCA and not the ICA [14]. Plumb et al. [9] reported a case in which the PCoA arose from the fenestration of the supraclinoid ICA.

ICA fenestrations can be seen outside the supraclinoid segment, but intracavernous ICA fenestration is extremely rare [12]. Cervical ICA fenestration may be confused with arterial dissection with patent pseudolumen (pseudofenestration) [5].

Supraclinoid ICA fenestration is clinically significant because of its frequent association with an aneurysm at the proximal end of the fenestrated segment. Thus, when paraclinoid or proximal supraclinoid ICA aneurysm is found on MR angiography, the presence of fenestration should be carefully investigated. Some tiny channel may not be imaged on routine MR angiography, as was the case in our patient. It is important to recognize any arterial variation relating to the aneurysm during CT angiography or catheter angiography work-up prior to coiling or clipping to prevent complication during surgery.

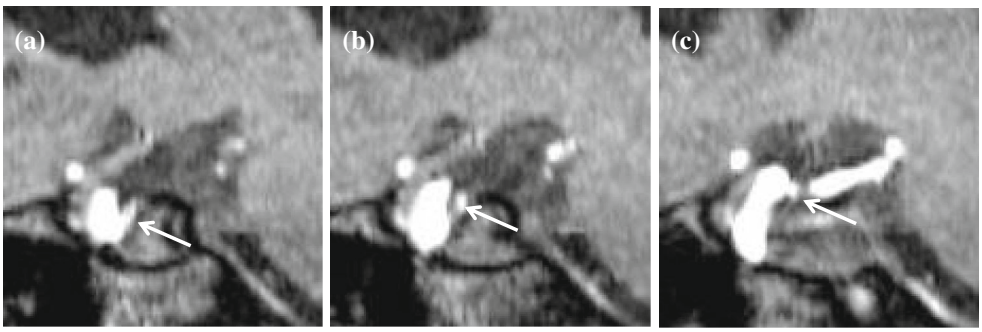

Fig. 3 Oblique sagittal reconstructed source images of MR angiography. *Arrows* indicate small connecting artery between the aneurysmal dilatation and the origin of the fetal-type posterior cerebral artery with infundibular dilatation

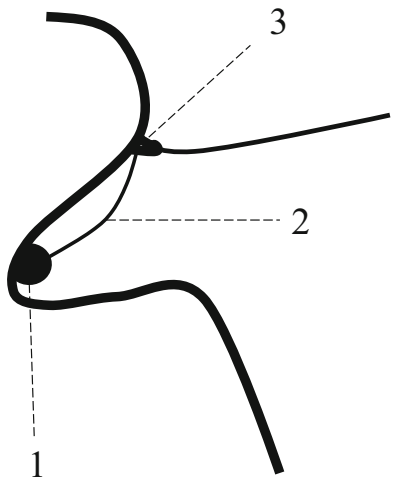

Fig. 4 Schematic illustration of the left carotid system of this patient in the left lateral projection: *1* paraclinoid aneurysmal dilatation; *2* fenestration of the supraclinoid internal carotid artery; *3* fetal-type posterior cerebral artery with infundibular dilatation

Conclusions

We reported an extremely rare case diagnosed by MR angiography of fenestration of the supraclinoid ICA arising from the paraclinoid aneurysmal dilatation and fusing with the origin of a fetal-type PCA. We found both partial MIP and partial VR images useful in identifying rare cerebral arterial variations when interpreting MR angiography.

Acknowledgments We thank Rosalyn Uhrig, M.A. for editorial assistance in the preparation of this manuscript.

Compliance with ethical standards

Conflict of interest The authors declare no conflict of interest.

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