CASE REPORT

Eur. J. Anat. 19 (3): 295-298 (2015)

Bilateral aberrant infratentorial vasculature: a rare cadaveric encounter

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SUMMARY

During a cadaveric dissection course, abnormalities of the infratentorial vasculature were noted. Following removal of the brain, the posterior cranial fossa showed the left labyrinthine artery splitting into two branches: one entered the internal auditory meatus (IAM) with the eighth cranial nerve, and the other pierced the petrous temporal bone just posterior to the IAM in the region of the subarcuate fossa. On the right side, the anterior inferior cerebellar artery formed a loop that was embedded in the dura just posterior to the IAM, but no vessels were seen entering the IAM. Further dissection into the petrous temporal bone showed the loop directed towards the region of the subarcuate fossa, and the injection of coloured latex confirmed fine arterial distribution of the latex on the surface of the deep part of the eighth cranial nerve. Eight other cadavers dissected in the same course did not show any such anomalies. Knowledge of these vascular variations is important for surgical exposure of the posterior cranial fossa.

Key words: Labyrinthine artery – Anterior inferior cerebellar artery – Posterior cranial fossa surgery – Vascular anomalies – Internal auditory meatus – Acoustic neuroma – Petrous temporal bone – Subarcuate fossa

INTRODUCTION

The labyrinthine artery in most cases (Samaltino et al., 1971; Martin et al., 1980; Zhang et al., 2002) originates from the anterior inferior cerebellar artery (AICA), and enters the internal auditory meatus (IAM), where it supplies structures in the inner ear. Isolated infarction of the labyrinthine artery can cause neural deafness and vertigo, with degenerative changes in the cochlea and vestibule (Kim et al., 1999; Choi et al., 2006). The AICA usually arises from the junction of the middle and lower thirds of the basilar artery (Atkinson, 1949). Also AICA infarction has been associated with combined loss of both auditory and vestibular functions (Lee et al., 2009; Renard et al., 2010). Surgical treatment to remove acoustic neuroma or meningioma near the IAM commonly involves removal of the adjacent bone (Kanzaki et al., 1980; Brookler, 1981). Thus the anatomy of this region and detailed knowledge of the blood supply of the internal ear are essential to reduce hearing deficits and post-surgery complications. The current case reports bilateral anomalies of the labyrinthine artery and the AICA.

CASE REPORT

During dissection of a male cadaver and removal of the brain, as part of an elective course on applied anatomy of the cranial nerves for second year medical students at the University of Adelaide, bilateral aberrant vasculature was noted in the posterior cranial fossa. All dissections were carried out under ethical approval as stated in the Body Donation Program and the Anatomy Act South Australia. On the left side, an arterial stem was seen dividing into two vessels: one entered the IAM with the facial and vestibulocochlear

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Submitted: 9 April, 2015. *Accepted:* 19 May, 2015.

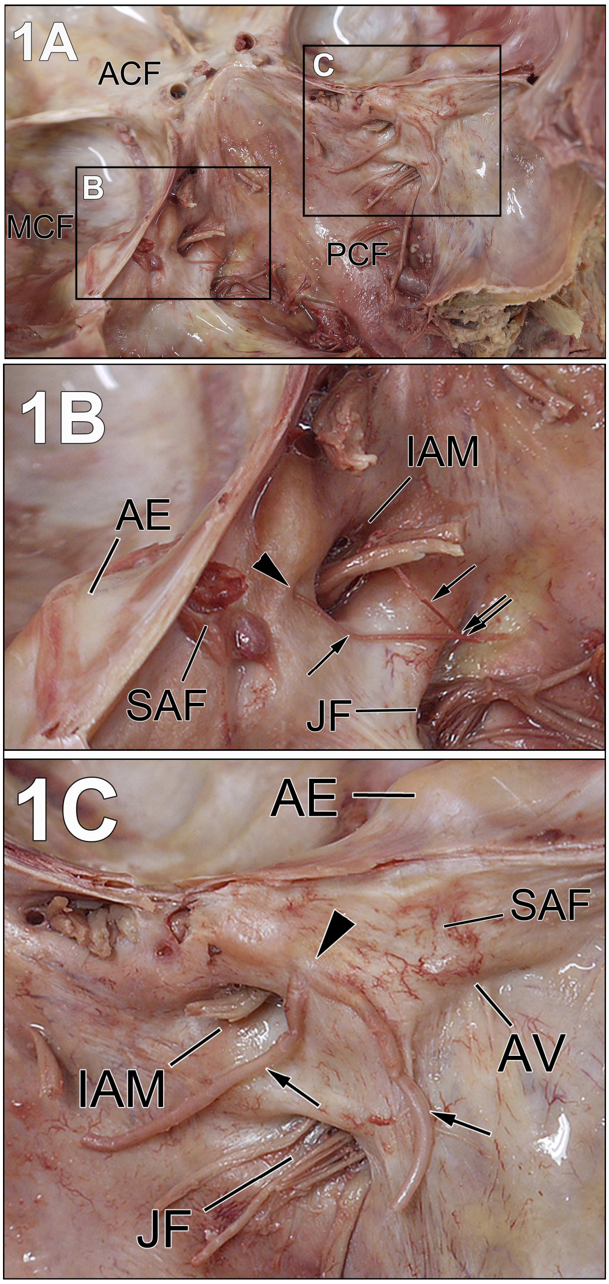

Fig. 1. (A) Dissection of the cranial cavity showing parts of the anterior (ACF), middle (MCF) and posterior (PCF) cranial fossae. The areas B and C defined by two rectangles are enlarged in (B,C). **(B)** A higher magnification of the rectangle "B" in Fig. 1A showing aberrant left labyrinthine artery, the stem of which is dividing (double arrows) into two branches (single arrows). One branch is entering the internal auditory meatus (IAM) with the facial and vestibulocochlear nerves and the other is entering the petrous temporal bone through a small foramen (arrowhead) located immediately posterior to the IAM in the region of the subarcuate fossa (SAF) where venous arrangement is also seen piercing the dura mater. The arcuate eminence (AE) is seen in the middle cranial fossa. Jugular foramen, JF. **(C)** A higher magnification of the rectangular area "C" in Fig.1A, showing two arteries (arrows) entering the petrous temporal bone (arrowhead) under cover of the dura mater just posterior to the internal auditory meatus (IAM) in the region of the subarcuate fossa (SAF). The arcuate eminence (AE) is seen in the middle cranial fossa. A small depression marks the position of the aqueduct of the vestibule (AV) inferior to the subarcuate fossa (SAF). No arteries are seen entering the IAM as on the left side (Fig. 1B). Jugular foramen, JF.

nerves, and the other entered the petrous temporal bone just posterior to the IAM (Figs. 1A and 1B).

On the right side, no arteries where seen entering the IAM (Figs. 1A and 1C), but two vessels were seen entering the petrous temporal bone close together at a point just posterior to the IAM under cover of the dura mater (Figs. 1A and 1C). One of the arteries was cannulated, and coloured latex was injected slowly through the vessels. The dye immediately returned via the other artery (Fig. 2A).

The dura mater was then peeled off and the petrous temporal bone was excavated using a dental drill at the point of entry of the two arteries (Fig. 2B). A loop was noted linking the two vessels just few mm deep to the surface, and the head of the loop was directed towards the subarcuate fossa (Fig. 2B). The IAM was also widened to expose the deep parts of the contained nerves. Fine injected vessels were seen on the surface of the nerves, and appeared to branch in a central direction (Fig. 2C). A comparison was made with eight other heads being dissected in the same course; none of the variations described in the current case were present in the other eight specimens.

DISCUSSION

In the current case two vessels were seen entering the petrous temporal bone on the left side, one at the IAM and the other just posterior to the meatus. The vessel entering the IAM represents the labyrinthine artery, as it is the commonest route for supplying structures in the internal ear. Double and triple labyrinthine arteries have been described (Mazzoni, 1970; Mazzoni and Hansen, 1970; Zhang et al., 2002), but in our case the second artery entered the petrous temporal bone. The second vessel entering the petrous temporal bone is likely to be the subarcuate artery that entered the petrous temporal bone in the region of the subarcuate fossa just posterior to the IAM.

The AICA upon approaching the IAM turns sharply thereby forming a well-defined arterial loop with its convexity directed laterally (Gerald et al., 1973). Arterial loops of the AICA have been seen near and inside the IAM (Zhang et al., 2002). After giving off the labyrinthine artery, the AICA travels on to supply the cerebellar cortex below the horizontal cerebellar fissure (Perneczky, 1981). In the current case, on the right side an arterial loop was seen embedded in the dura and petrous temporal bone. This is likely to be the AICA that has become embedded during formation of the skull bones. A previous report described an AICA being

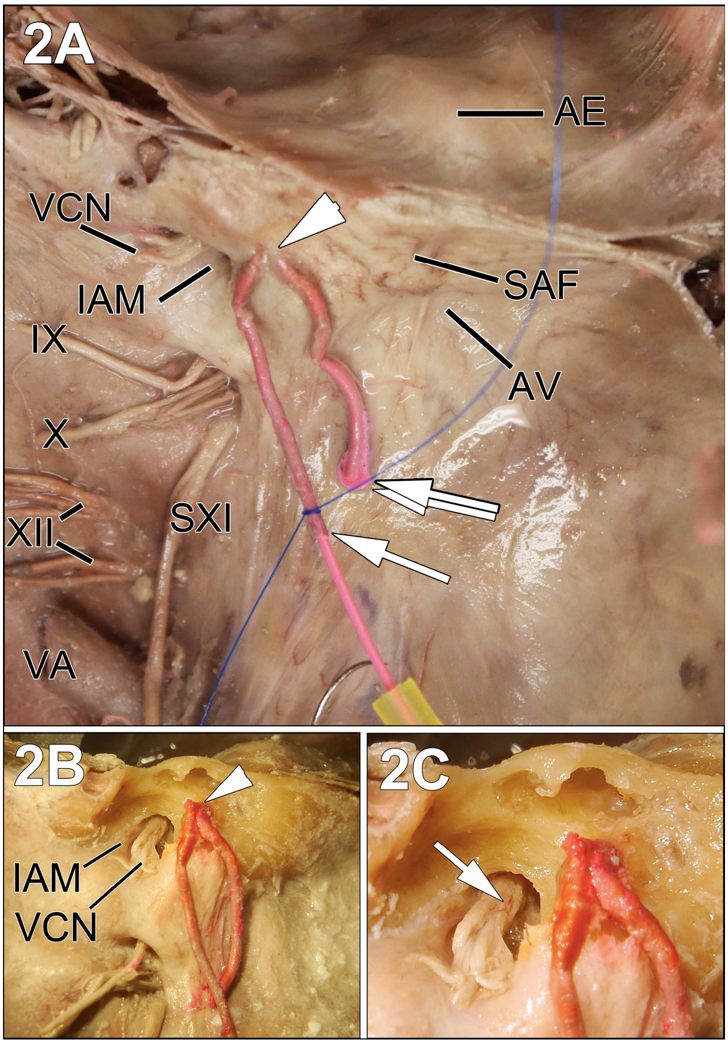

Fig. 2. (A) The right posterior cranial fossa showing the facial and vestibulocochlear nerves (VCN) within the internal auditory meatus (IAM). The glossopharyngeal (IX), vagus (X) and spinal accessory (SXI) nerves are seen grouping towards the jugular foramen (JF). The hypoglossal nerve (XII) is piercing the dura as two separate bundles anterior and superior to the vertebral artery (VA). Two arteries are seen entering the petrous temporal bone through the dura mater (arrowhead) just posterior to the IAM in the region of the subarcuate fossa (SAF). One of the arteries is cannulated (single arrow) and when injected with coloured latex the dye returned via the other artery (double arrow). A small depression in the dura marks the position of the aqueduct of the vestibule (AV) inferior to the subarcuate fossa (SAF). The arcuate eminence (AE) is seen in the middle cranial fossa. **(B)** The petrous temporal bone drilled, showing a loop (arrowhead) connecting the two arteries that entered the bone posterior to the internal auditory meatus (IAM) and being directed towards the subarcuate fossa. The meatus (IAM) is also drilled widely and showing the deep parts of the facial and vestibulocochlear nerve (VCN). **2C:** A higher magnification of fig. 2B showing fine injected vessels (arrow) on the surface of the vestibulocochlear nerve, which appear to branch in a central direction towards the cranial cavity.

embedded in the dura and bone of the subarcuate fossa (Tanriover and Rhoton, 2005), and the senior author (ALR) of that report observed such anomaly in four surgical cases and in three cadaveric dissections. The subarcuate fossa is the site where the subarcuate artery enters the petrous temporal bone and supplies the area of the mastoid antrum, mastoid air cells and semicircular canals (Mazzoni, 1970; Akyol et al., 2011). In the current case although the arterial loop entered the dura closer to the IAM (Fig. 2A), further dissection and drilling of the bone followed the loop in the direction of the subarcuate fossa (Fig. 2B).

Injection of the arterial loop with coloured latex resulted in the appearance of fine injected vessels on the surface of the vestibulocochlear nerve. Despite the use of a magnifying dissecting microscope, limitations did not allow the display of a direct branch from the arterial loop to the nerve. The appearance of coloured vessels ramifying on the surface of the nerve provides evidence that the loop contributed to the arterial supply of the labyrinth deep through the petrous temporal bone.

In instances where the AICA is embedded in the petrous temporal bone (Tanriover and Rhoton, 2005) it was noted that removal of the posterior bony wall of the IAM may place the AICA at a great risk. Therefore, in patients with acoustic neuroma, if an AICA was seen embedded in the dura or bone, extra care should be exercised in drilling the bony wall of the IAM and in reflecting the dura with the artery medially (Tanriover and Rhoton, 2005). Severance of the labyrinthine artery during surgery leads to acute cochlear dysfunction (Mom et al., 2014) while irritation of the labyrinthine artery may lead to spasm with cochlear dysfunction if the spasm is not reversed intraoperatively (Mom et al., 2014). It is worth noting here that this is the first time to report the above anomalies in the South Australian population. In posterior cranial fossa exposures it is important for surgeons to be aware of the anatomical variations detailed above.

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