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Trigeminal Artery Connection to the Posterior Inferior Cerebellar Arteries

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Summary. An example of the internal carotid artery supplying the posterior inferior cerebellar artery directly is reported. The direct PICA supply comes from a trigeminal trunk. There was no basilar artery opacification. An embryological explanation is given.

Anastomose entre une artère trijeminee et les arterès cérébelleuses postéro-inférieures

Résumé. Présentation d'un cas d'artère carotide interne alimentant directement l'artère cérébelleuse postéro-inférieure. L'alimentation directe de l'artère cérébelleuse postéro-inférieure se fait à travers un tronc trijéminé. Il n'y avait aucune opacification de l'artère basilaire. Les auteurs donnent une explication embryologique.

Verbindung der A. trigemina primitiva zur A. cerebelli posterior inferior (PICA)

Zusammenfassung. Fallbeschreibung mit klinischer und röntgenologischer Symptomatik einer Patientin, bei der die A. cerebelli posterior inferior über die A. trigemina primitiva von der A. carotis interna versorgt wurde.

The primitive trigeminal artery is the most frequent persistent carotidbasilar anastomosis. Teal [1] recently reported a case where the internal carotid supplied the ipsilateral superior cerebellar distribution through a persisting trigeminal trunk. The case reported here is an example of the internal carotid directly supplying the ipsilateral posterior inferior cerebellar artery (PICA) distribution through a persistent trigeminal trunk.

Case Report

Case 1. A 59 year old caucasian woman presented with a complaint of "thumping" in her left ear of two years duration. This could be abolished by left carotid artery compression. The left tympanic membrane had a bluish discoloration. An audiogram showed mild mixed hearing loss but the patient was not cooperative enough to rely on these results. Skull and mastoid X-rays were normal. Polytomography of the ears showed a hazy spur and ossicles on the left with water density in the middle ear. A direct puncture left carotid arteriogram (Fig. 1) showed no definite stain in the region of the ear. Further angiography was not done. By exploratory tympanotomy thick material was removed from the middle ear. The ossicular chain and middle ear were structurally normal. The postoperative diagnosis was secretory otitis media. A year later thumping in the ear persisted with some improvement. The ear has a normal appearance on examination.

Discussion

The vertebral artery ends in PICA about 5% of the time. PICA is normally absent 20% of the time and hypoplastic in 5% of cases. The anterior inferior cerebellar artery (AICA) supplies PICA distribution in these cases. AICA and PICA have in inverse relationship and in the 5% of cases where AICA is absent a large PICA supplies AICA distribution. In 2% of the cases when PICA is absent the superior cerebellar artery supplies the PICA distribution [2]. It is rare for a cerebellar artery to arise from the internal carotid artery. One case identical to ours (Newton and Potts p. 1218) and a somewhat similar case reported by Teal are the only previous examples of this.

Padget's studies form the basis for understanding trigeminal artery development and involution (Fig. 2) [3]. The cerebral arterial loops are cranial extensions of the paired aortic arches. Each cerebral arterial loop consists of three segments. The first segment is the carotid artery which runs to the region of the optic vesicle. The hindbrain division of the carotid artery is the second segment of the loop. In the adult, this segment becomes the posterior communicating artery, but in the 5.5 mm embryo it connects the carotids with the third segment, the dorsal neural arteries. The paired dorsal neural arteries supply the developing hindbrain and later fuse as a midline basilar artery. In the 5.5 mm embryo the dorsal neural arteries appear as patches of vascular tissue parallel to one another.

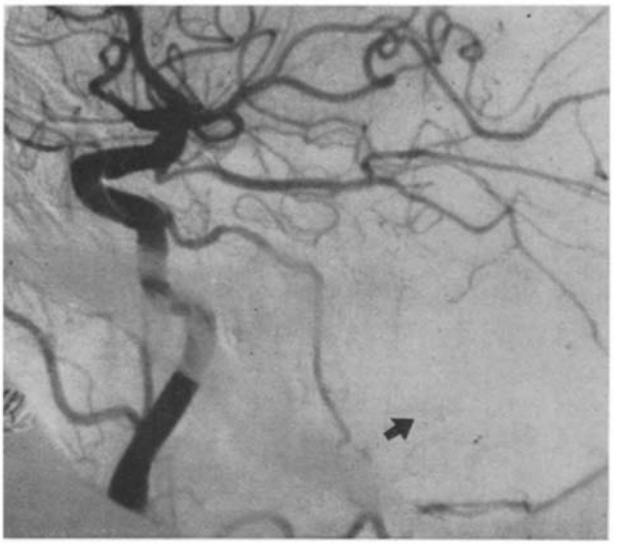


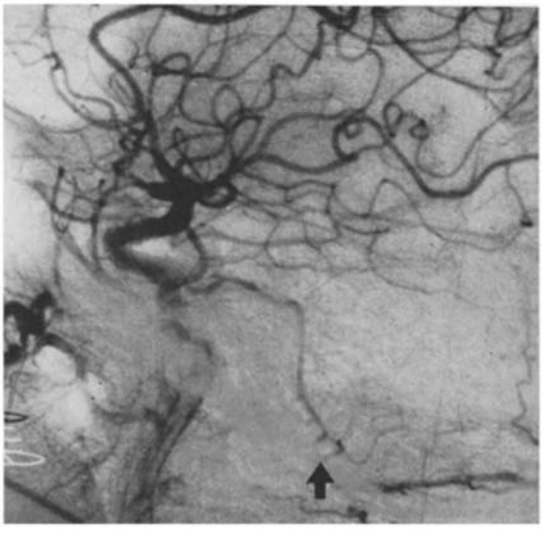
Fig. 1. a) Left carotid arteriogram, lateral view, shows a trigeminal artery feeding a large trunk running into the posterior fossa (arrow)

In rare cases the dorsal neural arteries fail to fuse. This may result in duplication of the basilar artery. In cases of incomplete fusion, septation or fenestration of the basilar artery results [2, 4].

There are several anastomotic channels between the carotid and the dorsal neural arteries [5]. The trigeminal, the otic, and the hypoglossal arteries connect the carotid with the dorsal parts of the cerebral vascular loops. These three intracranial anastomotic channels usually involute and the vertebrobasilar system is the dominant source of blood to the cerebellum and pons. The trigeminal artery is the most prominent anastomotic channel in the embryo and most frequently persists into adult life.

The commonest radiographic manifestation of primitive carotidbasilar anastomosis is filling of the basilar and its branches from a carotid injection. Saltzman's Cases 6 and 7 show that the trigeminal artery may supply only the superior cerebellar arteries through an interposed segment of basilar artery [6]. Teal's Case 1 and the case reported in Newton and Pott's text (p. 1218) are the only previously reported examples of the internal carotid supplying a specific ipsilateral cerebellar bed through a persisting trigeminal trunk. Although the basilar artery did opacify in Teal's case it did not appear to be interposed as in Saltzman's Cases 6 and 7. Our case shows internal carotid supply to the PICA distribution through a persisting trigeminal trunk. No basilar artery opacification occurred.

b



c

Fig. 1. b and c) AP and lateral views shortly after 1a show further opacification of the cerebellar trunk ramifying in an inferior cerebellar hemispheric distribution. The trunk originates from the precavernous internal carotid artery. It courses laterally (arrow 1b) around the upper brain stem, then descends along the lateral aspect of the pons. At the level of the lower brain stem (arrow 1c) the vessel courses posteriorly. Ramification posteriorly occurs just beyond this point. Because of overlying vessels, it is difficult to see whether this ramification occurs medially supplying vermis or laterally supplying the cerebellar hemisphere

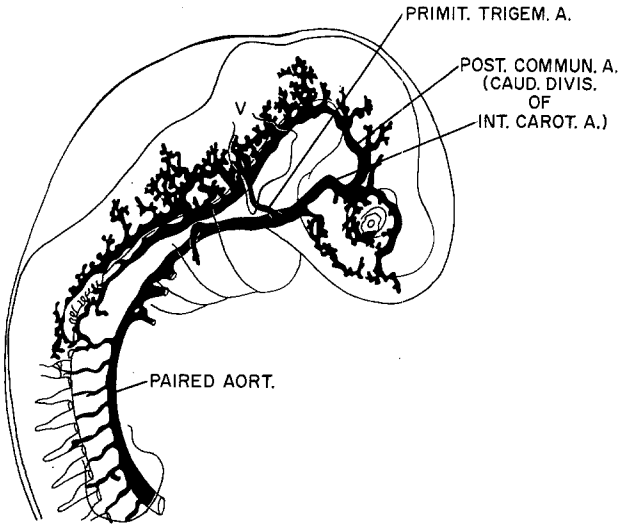


Fig. 2. A diagram of the cerebral circulation in the 5.5 mm embryo (redrawn from Padget) shows the trigeminal anastomosis and the undifferentiated dorsal neural vascular patches it feeds

Involution of the anastomotic branches and differentiation of the cerebellar and pontine arterial supply may vary from the usual pattern. This case and the cases referred to above show that the internal carotid may provide the entire supply to any of the three main cerebellar arteries through a persisting trigeminal trunk. The trigeminal artery may furnish the dominant supply to an undifferentiated group of vascular patches along the paired dorsal neural arteries. The dorsal neural vascular patches then differentiate to form a superior or inferior cerebellar artery and the trigeminal artery retains its primitive connection. The remaining dorsal neural arterial tissue fuses in the midline as a basilar artery with little (as in Teal's case) or no connection with the cerebellar artery fed from the internal carotid artery.

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