Normal and Pathological Findings of the Angiographic Examination of the Internal Auditory Artery

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Summary. The authors have made a full anatomical description and roentgenological study of the internal auditory or labyrinthine artery. The internal auditory artery seldom arises from the basilar trunk and reaches the inner ear without giving off collateral branches to the cerebellum; more often it originates as a branch of the cerebello-labyrinthine artery near to the internal auditory meatus. The first segment of the internal auditory artery goes through the ponto-cerebellar cistern (precanalear or cisternal segment) ending with a slight angle close to the internal auditory meatus; at this level the intracanalicular segment arises and follows the inferior wall of the internal auditory canal with a fluctuating path.

Angiographic studies made on a group of patients affected by lesions of different nature affecting the petrous portion of temporal bone have shown that the roentgenological visualization of the internal auditory artery offers greater accuracy in diagnosing expanding processes in the region of the ponto-cerebellar angle and opens new horizons for the study of those diseases of the ear, in the pathogenesis of which a vascular factor plays an important role.

Etude angiographique normale et pathologique de l'artère auditive interne

Resume. Les auteurs presentent une etude anatomique et radiographique de l'artere auditive interne. Rarement elle se detache du tronne basilaire pour atteindre l'oreille interne sans abandonner de collatérales pour le cerelet; plus souvent elle est une branche de l'artère cérébello-labyrinthisque dont elle naît non loin du conduit auditif interne. Le premier segment ou segment cisternal ou précanalaire traverse la citerne ponto-cérébelleuse. Le segment intracanaliciare circule le long du plancher du conduit auditif interne. L'étude de l'artère auditive interne s'avère intéressante dans les cas de processus expansifs de l'angle ponto-cérébelleux et de troubles de l'oreille interne dont l'origine est vasculaire.

The radiologic study of some arterial branches of the posterior fossa is complicated by the frequent variation in origin and course, the small dimensions and the peculiar anatomy of this region surrounded as it is by thick bony structures. The aim of this paper is to draw attention to a small artery, the internal auditory or labyrinthine artery, not as yet sufficiently described in the radiological literature although some anatomical studies have described the different origins and course.

Cavatorti (1908) on 100 autopsy specimens noticed that the left internal auditory artery (i. a. a.) originated from the basilar trunk in 70 cases, from the vertebral artery in 21, from the anterior inferior cerebellar artery in 8 and was absent in 1. The right i. a. a. was a branch of the basilar artery in 67, of the anterior-inferior cerebellar artery in 26, of the vertebral artery in 5 and was absent in 2.

Luna (1915) classified the cerebellar arteries into: anterior, posterior and vertebro-cerebellar. From the posterior cerebellar artery, which corresponds to the anterior-inferior cerebellar artery of the present nomenclature, would constantly arise 2 arterioles called by the author, the internal auditory arteries.

Stopford (1916) showed that the i.a.a. originates directly from the anterior-inferior cerebellar artery in over 60% of cases and from the basilar artery in less than 40%.

Adachi (1928) noticed that the i.a.a. did not arise from the basilar trunk but from one of the cerebellar arteries and more often from the anterior-inferior cerebellar artery.

Bozzi (1935) found in 105 autopsies that the i.a.a. of both sides arose from the basilar trunk in 47 and from the anterior-inferior cerebellar artery in 19 cases. In 23 specimens the right i.a.a. arose from the basilar artery and the left one from the anterior-inferior cerebellar artery; in the remaining 16 cases the right i.a.a. originated from the anterior-inferior cerebellar artery and the left one from the basilar trunk.

Brunetti and Caramagna (1938) after examining 70 autopsy specimens arrived at the conclusion that the labyrinthic blood supply is usually provided by one or two arterial branches of constant lumen, arising by a loop from the anterior-inferior cerebellar artery close to the internal auditory meatus.

Ferrari-Lelli (1939) examining 38 i.a. a. noticed that the antero-inferior cerebellar artery makes a
loop at the level of the internal auditory meatus, situated usually above the superior surface of the acoustic nerve, then beneath it, crossing it perpendicularly. At the level of this loop arises the i.a.a., usually double in the foetus (55.5%) and single in the adult (85%).

According to Atkinson (1949) the anterior-inferior cerebellar artery arises constantly at the union of the middle with the inferior third of the basilar trunk and runs laterally and caudal across the region of the ponto-cerebellar angle and the acoustic nerve. From this point the i.a.a. usually arises and enters the internal acoustic canal. The author described 7 cases: in the first one the i.a.a. arose from the anterior-inferior cerebellar arteries were smaller than average; in the second case the left i.a.a. arose from the anterior-inferior cerebellar artery and the right one from the basilar trunk, with hypoplasia of the ipsilateral anterior-inferior cerebellar artery; in the remaining 5 cases the i.a.a. branched off from the anterior-inferior or posterior-inferior cerebellar artery, after this had gained the previous one.

According to Guerrier and Villacqqué (1949) the middle cerebellar artery and the i.a.a. form the "cerebello-labyrinthine system". This is made by one vessel (middle cerebellar) or by two vessels (middle cerebellar and labyrinthine-cerebellar) which originate from the basilar trunk and constantly, in a second division, form four branches namely, from front to back: the labyrinthine, the anterior, middle and posterior cerebellar arteries. They never observed the labyrinthine artery originating from the basilar trunk itself, completely separate from a cerebellar component.

According to Lazorthes et al. (1950) the i.a.a. arises almost always from the middle cerebellar artery. Only twice have they seen it originate directly from the basilar trunk, beneath this artery.

Walker (1955) attempted the angiographic visualization of the i.a.a. in the dog and was able to show only the portion outside the internal auditory meatus, whereas the part inside could not be seen due to the very reduced lumen and to the density of the petrous portion of the temporal bone. The author believes that a better angiographic visualisation of the i.a.a. in Man might be obtained by using tomography while injecting the contrast medium.

Castaingne et al. reported in 1967 one case of arterial aneurysm that occurred at the level of the internal acoustic canal. At vertebral angiography it seemed to be related to a single arterial trunk, originating from the middle portion of the basilar trunk. At surgery the small arterial vessels were found to be multiple.

In 1968 Takahashi et al. found that the i.a.a. was difficult to visualize even in radiograms submitted to a good subtraction technique, but in a few cases small arteries could be shown directed toward the internal auditory meatus.

Material and methods

The i.a.a. has been studied anatomically and radiologically. The anatomic study1 was made on autopsy specimens of 10 adults and 20 newborn babies, injecting the vertebral artery from both sides with coloured neoprene. After removing the cerebral hemispheres and the cerebellar mass, the pons and medulla were removed by slow maceration and the final result was a cast of the vertebrobasilar arterial system, maintaining its relations to the bony structures of the posterior fossa.

The angiographic study of the vertebro-basilar system has been carried out on 30 subjects free from posterior fossa lesions and 25 patients affected by lesions of different nature (15 tumours of the ponto-cerebellar angle, 3 cases of idiopathic sudden deafness, 3 cases of chronic petromastoiditis, 2 cases of Menière's syndromes and 2 cases of deafness due to malformation).

The angiographic examinations were carried out via the percutaneous brachial route, a method which allows more freedom of lateral movement of the head and therefore better selection of the radiographic projections. The possibility of obtaining angiograms at short time intervals (two seriograms per second) and the use of the photographic technique of subtraction of the images enabled us to show the artery in a large percentage of cases.

Results

Anatomical findings. The study of 30 casts of the vertebrobasilar system permits us to offer diagramatically 3 methods of origin of the arteries of the "cerebello-labyrinthine system" (Fig. 1).

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