

Complete persistence of the hyoido-stapedial artery in man

Case report

Intra-petrous origin of the maxillary artery from ICA

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Summary. The authors report a case of total persistence of the hyoido-stapedial artery (HSA) discovered fortuitously in an adult. The external carotid artery terminated as the superficial temporal, middle deep temporal and transverse facial arteries; the HSA arose from the intrapetrous internal carotid artery, coursed within the middle ear and the middle cranial fossa where it gave off the middle meningeal artery before leaving the skull via the foramen spinosum to become the maxillary artery.

Persistence complète de l'artère hyoïdo-stapédienne chez l'homme : à propos d'un cas (origine carotidienne intrapétreuse de l'artère maxillaire)

Résumé. Les auteurs rapportent un cas de persistance totale de l'artère hyoïdo-stapédienne (AHS) de découverte fortuite chez un adulte. L'artère carotide externe se termine

en artère temporale superficielle, temporale moyenne profonde et transverse de la face; l'AHS naît de la carotide interne intrapétreuse, chemine à l'intérieur de l'oreille moyenne et de la fosse cérébrale moyenne où elle abandonne l'artère méningée moyenne avant de quitter le crâne en passant par le trou petit rond pour devenir l'artère maxillaire.

Key words : Stapedial artery — Maxillary artery — Embryology — Internal carotid

The appearance and regression of the hyoido stapedial a. (HSA) represents an important step in the embryonic development of the arterial pattern of the cranio facial region. It usually regresses after the 16 mm stage; its vestiges constitute part of the arterial supply to the middle ear whereas its main trunk becomes the maxillary system (internal max. a.) (MA). Only partial persistence of the stapedial a. in man has been described [1, 2, 3]; we report the first case of complete HSA in vivo.

Case report

During diagnostic angiogram performed for suspicion of intracavernous aneurysm, an origin of the maxillary a. (MA) from the intrapetrous internal carotid a. (ICA) was noted (Fig. 1). Opacification of the external carotid a. (ECA) (Fig. 2) demonstrated all the remaining branches of the ECA but not its conventional termination. This disposition corresponds to the persistence of the 20-40 mm stage of the cranial arterial system, with a complete HSA.

Discussion

At the 9 mm stage [5], the proximal second aortic arch is the hyoid a. It arises from the future intrapetrous ICA. At the 16 mm stage it gives off the stapedial a. that ascends within the future tympanic cavity, through the crus of the stapes. It courses cranially into the facial canal and penetrates the middle cranial fossa with the petrosal nerves where it divides into two arteries: the supraorbital a. [future middle meningeal a. (MMA)] that remains endocranial, and the maxillo-mandibular a. (future MA). The latter leaves the skull through the

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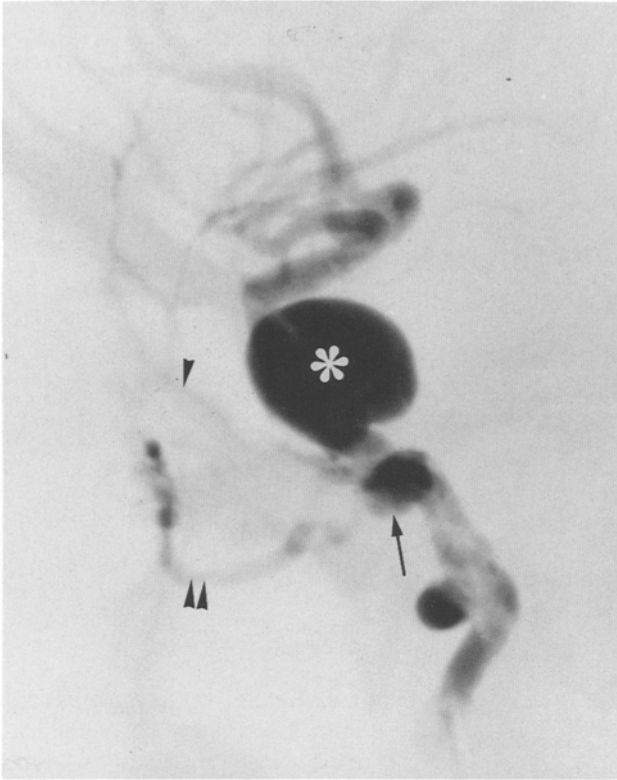


Fig. 1

Internal carotid angiogram. Lateral view. The ICA gives off the HSA which divides into MA *double arrowhead* and MMA *arrowhead*. An intracavernous aneurysm is detected (*)

Artériographie carotidienne interne. Vue de profil. L'a. carotide interne abandonne l'a. hyoïdo-stapédienne qui se divise en a. maxillaire *double tête de flèche* et a. méningée moyenne *tête de flèche*. Un anévrisme intra caverneux est détecté (*)

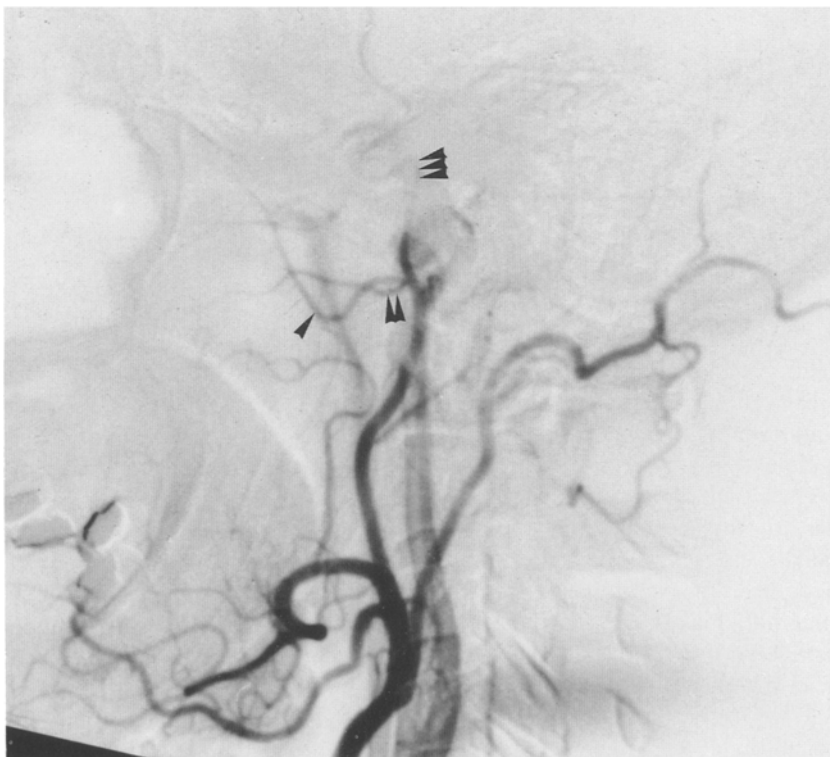


Fig. 2

Global ECA angiogram. Lateral view. The distal ECA ends in the superficial temporal a. *triple arrowhead*, transverse facial a. *double arrowhead* and middle deep temporal a. *arrowhead*. The MA is not opacified

Artériographie carotidienne externe globale. Vue de profil. La carotide externe distale se termine en a. temporale superficielle *triple tête de flèche*, transverse de la face *double tête de flèche* et temporale profonde moyenne *tête de flèche*. L'a. maxillaire n'est pas opacifiée

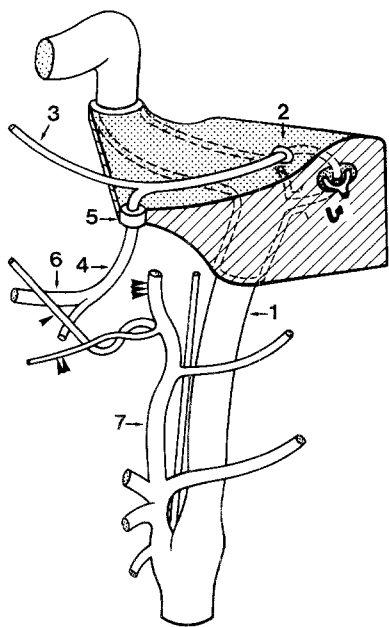


Fig. 3

Schematic representation of the total HSA persistence. The intra-petrous ICA 1 gives off the HSA that penetrates into the middle ear *curved arrow*. It courses through the crus of the stapes and penetrates intracranially through the petrous n. hiatus 2. It divides into MMA 3 and maxillo-mandibular a. 4 that leaves the cranial cavity through the foramen spinosum 5 to become MA 6. External carotid a. 7 Superficial temporal a. *triple arrowhead* Transverse facial a. *double arrowhead* Middle deep temporal a. *arrowhead*

Représentation schématique de la persistance totale de l'a. hyoïdo-stapédienne. L'a. carotide interne intra pétreuse 1 abandonne l'a. hyoïdo-stapédienne qui pénètre dans l'oreille moyenne *flèche courbe*. Elle passe au travers du stapes (étrier) et pénètre en intra crânien en accompagnant les nn. pétreux 2. Elle se divise alors en a. méningée moyenne 3 et maxillo-mandibulaire 4 qui va quitter la cavité crânienne en passant par le trou petit rond 5 pour devenir l'a. maxillaire 6 A. carotide externe 7 A. temporale superficielle *triple tête de flèche* A. transverse de la face *double tête de flèche* A. temporale moyenne *profonde tête de flèche*.

foramen spinosum. Ventrally the ventral pharyngeal a. represents the primitive ECA stem. At the 20-24 mm stage, the maxillomandibular a. is annexed by the ventral pharyngeal a. The subsequent reversal of flow into the trans cranial portion leads to proximal regression of the HSA [5]. The tympanic portion of the artery then regresses (40 mm stage). The superior tympanic a. constitutes the distal vestige of the system, while its proximal vestige is the caroticotympanic a. of the intrapetrous ICA. The definitive vascular cartography of the cranio-encephalic area is then installed. The maxillomandibular a. becomes the MA "arising" from the ECA.

In animals the HSA exists as an "adult" either complete (Hamster) or partial (birds) [1].

Until now in man, only partial persistences have been reported: the persisting "stapedial a.", arising from the intrapetrous ICA. In these reports the stapedial a. only supplied the MMA territory, which includes part of the orbital contents. In fact it only corresponds to the persistence of the supra orbital division of the embryonic vessel. In these instances, the MA (maxillo-mandibular division) arises from the ECA. Therefore partial persistence corresponds to the regression of the transcranial portion of the maxillo-mandibular a. following the reversal of flow, following the ventral pharyngeal (ECA) annexation [4].

In our case no annexation at all has occurred, thus no regression took place and the full HSA remained from the intrapetrous ICA.

Conclusion

This extremely rare disposition illustrates the peculiar constitution of the ECA, that is embryologically a purely digestive a. (pharyngeal) which becomes the classic artery that we know, only after it gathers the territories of the branchial arteries (neural crest). Similar annexations probably apply to the hypoglossal and pro-atlantal aa. that become the posterior division of the ascending pharyngeal and the proximal occipital aa. respectively. The middle deep temporal a. origin from the ECA in our case, points to the late muscular arterial supply differentiation, grafted on the pattern determined after the 40 mm stage.

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