AJNR

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AJNR Am J Neuroradiol 1989, 10 (3) 569-573
http://www.ajnr.org/content/10/3/569

Accessory Meningeal Artery:
An Anatomic Misnomer

Jiri J. Vitek[1]

The accessory meningeal artery is misnamed in view of the territory the artery supplies. The name implies that the vessel is an important addition to the middle meningeal artery in supplying the meninges. This is incorrect, because no more than approximately 10% of the blood flow of the accessory meningeal artery reaches the intracranial territory; 90% of the blood is carried to the extracranial structures.

After reviewing the anatomy of the accessory meningeal artery we support the notion that the proper name of the vessel should be arteria pterygomeningica, or pterygomeningeal artery.

An erroneous and abbreviated description of the accessory meningeal artery (AMA) is well established and perpetuated in the anatomic and neuroradiologic literature. The name of the artery overlooks the basic fact that the distribution of the AMA is predominantly extracranial. In 1961 Baumel and Beard [1] published the anatomic account of the AMA and noted the discrepancy between the name of the artery and its supplying territory. The stereotyped version exaggerates the part of the artery that enters intracranially and gives no proper emphasis to the extracranial portion of the vessel despite the fact that on average only 10% of the blood carried by the AMA supplies structures intracranially [1].

Anatomy and Discussion

The AMA is almost always present (96%); it has an inconsistent origin and variable course. According to Baumel and Beard [1] the AMA arises about equally from the internal maxillary artery or the middle meningeal artery. When the AMA originates from the internal maxillary artery (Fig. 1), about 60% of the time it arises very close to the origin of the middle meningeal artery. The other 40% of the time it comes off the mid portion of the pterygoid segment of the internal maxillary artery. In 24% of cases, the AMA is represented by more than one vessel. This happens more frequently if the vessel originates from the internal maxillary artery rather than the middle meningeal artery. There is a definite relationship between the course of the internal maxillary artery and the origin of the AMA [1–6]. In the deep variety (internal maxillary artery medial to the lateral pterygoid muscle), the AMA stems directly from the internal maxillary artery (Fig. 2). In the superficial variation (internal maxillary artery lateral to the lateral pterygoid muscle), the AMA originates from the middle meningeal artery (Fig. 3). In approximately 13% of cases this rule does not apply.

The AMA, after originating from either the internal maxillary or middle meningeal artery, courses parallel to the superior boundary of the medial pterygoid muscle in a fascial plane, which separates the medial and lateral pterygoid muscles. The AMA ascends through the interaponeurotic space, and just below the skull base it divides into its terminal branches. For simplicity, the branches are divided into ascending, descending, and recurrent rami [1] (Fig. 4). There are three ascending

Received May 26, 1988; accepted after revision September 10, 1988.

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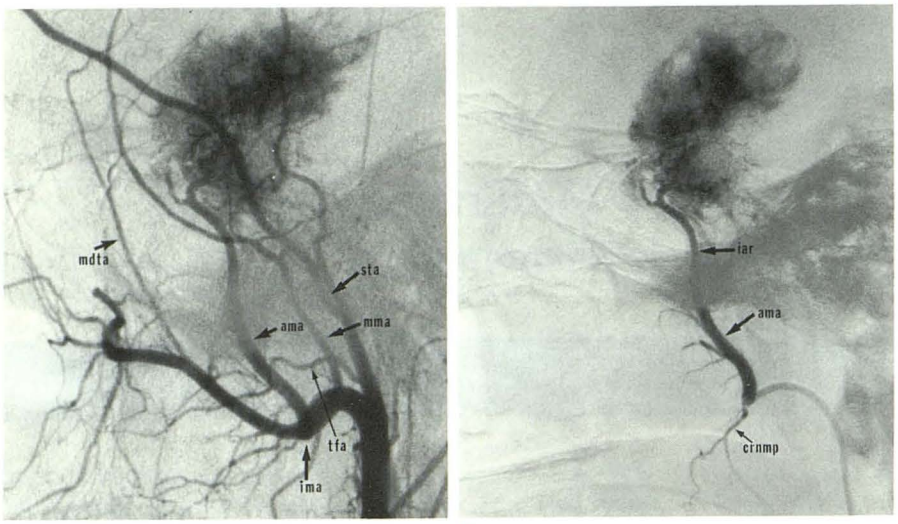
AJNR **10:569–573, May/June 1989**
0195–6108/89/1003–0569



Key to Abbreviations in Figure 1

mma	= middle meningeal artery
sta	= superficial temporal artery
ama	= accessory meningeal artery
tfa	= transverse facial artery
ima	= internal maxillary artery
mdta	= middle deep temporal artery
iar	= intracranial ascending ramus
crnmp	= companion ramus of the medial pterygoid nerve

Fig. 1.—Enlarged intracranial ramus of accessory meningeal artery in a meningioma of the cavernous sinus. Note deep course of internal maxillary artery.
***A*, Lateral arteriogram of external carotid artery.**
***B*, Lateral arteriogram of accessory meningeal artery.**

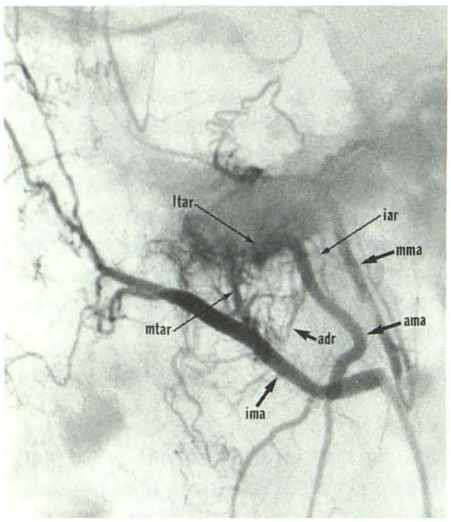


Fig. 2.—Enlarged extracranial portion of accessory meningeal artery in juvenile angiofibroma. Lateral external carotid artery arteriogram shows deep course of internal maxillary artery. Angiofibroma was previously embolized.

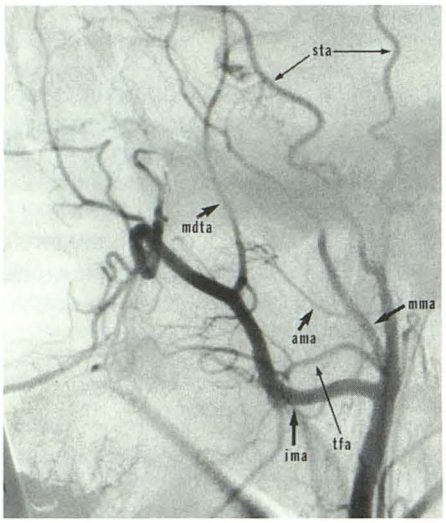


Fig. 3.—Normal accessory meningeal artery. Lateral external carotid artery arteriogram shows superficial course of internal maxillary artery. Note occlusion of internal carotid artery.

Key to Abbreviations in Figures 2 and 3

ltar	= lateral territory ascending ramus
mtar	= medial territory ascending ramus
ima	= internal maxillary artery
adr	= anterior descending ramus
ama	= accessory meningeal artery
mma	= middle meningeal artery
iar	= intracranial ascending ramus
mdta	= middle deep temporal artery
sta	= superficial temporal artery
tfa	= transverse facial artery

branches of the AMA: the lateral territory ascending ramus, the medial territory ascending ramus, and the intracranial ascending ramus. There are two constant descending rami: one descends between the tensor veli palatini and medial pterygoid muscles along the medial pterygoid nerve (companion ramus of the medial pterygoid nerve); the other, which is the anterior descending ramus, occasionally supplies the upper surface of the soft palate. The recurrent rami usually remain in the interaponeurotic space and supply the trigeminal (mandibular) nerve.

The greatest part of the distribution of the AMA supplies structures outside the cranial cavity (Fig. 5). Near the infratemporal surface of the greater wing of the sphenoidal bone, the AMA gives off its major terminal branches. These supply both pterygoid muscles, the tensor veli palatini muscle, and adjacent nerves. One of the smallest branches of all is the meningeal twig, which usually enters intracranially through the foramen ovale (Fig. 5).

Anatomically, four regions of distribution are recognized: the lateral, medial, intracranial, and interpterygoid territories [1]. The lateral territory is located superficially (laterally) to the interpterygoid aponeurosis. The approximate share to this territory is 30%, and the main recipient is the lateral pterygoid muscle [1]. It also supplies the greater wing of the sphenoid

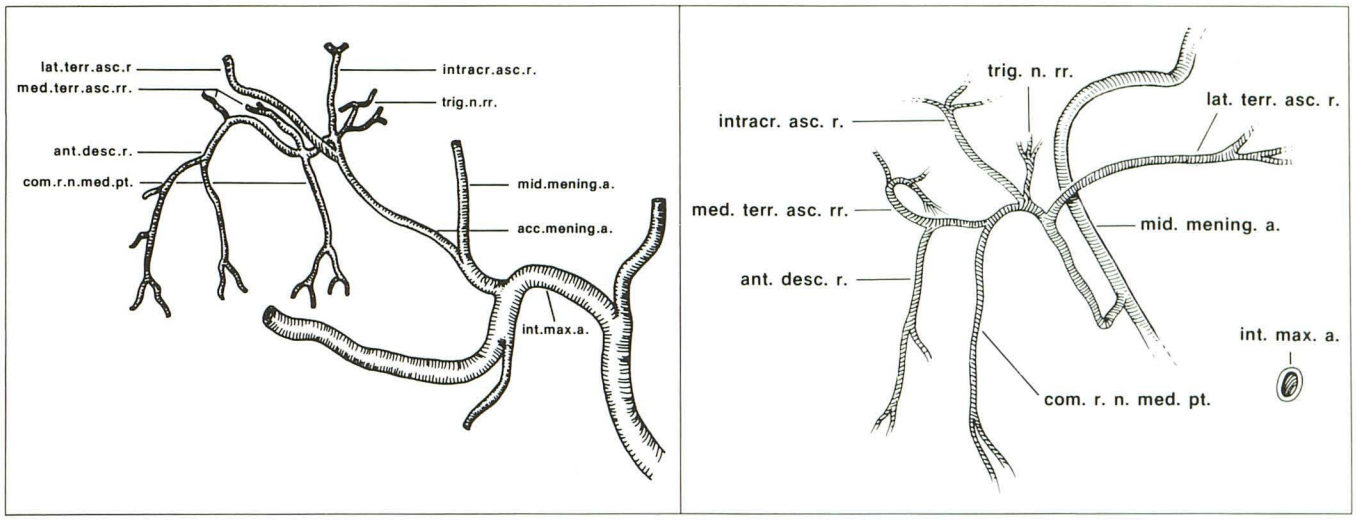


Fig. 4.—Schematic of "typical" accessory meningeal artery. *A*, Lateral view. *B*, Anteroposterior view. (Modified from [1] with permission of the Cambridge University Press.)

Key to Abbreviations in Figure 4

mid. mening. a.	= middle meningeal artery
int. max. a.	= internal maxillary artery
acc. mening. a.	= accessory meningeal artery
trig. n. rr.	= trigeminal nerve rami
intracr. asc. r.	= intracranial ascending ramus
lat. terr. asc. r.	= lateral territory ascending ramus
med. terr. asc. rr.	= medial territory ascending rami
ant. desc. r.	= anterior descending ramus
com. r. n. med. pt.	= companion ramus of the medial pterygoid nerve

Key to Abbreviations in Figures 5, 6, and 7

ama	= accessory meningeal artery
mma	= middle meningeal artery
tnr	= trigeminal nerve ramus
iar	= intracranial ascending ramus
ltar	= lateral territory ascending ramus
mtar	= medial territory ascending ramus
adr	= anterior descending ramus
crnmp	= companion ramus of the medial pterygoid nerve
ima	= internal maxillary artery

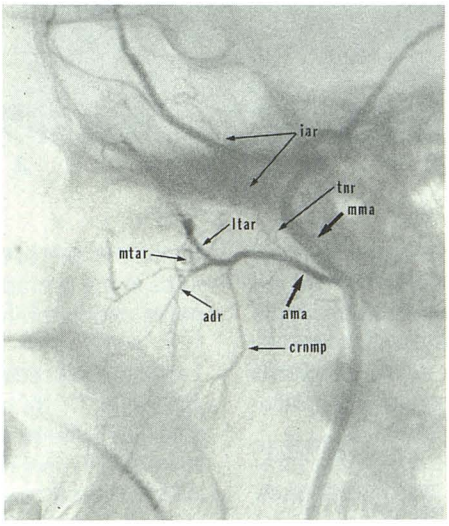


Fig. 5.—Normal accessory meningeal artery. Lateral arteriogram shows injection into middle meningeal artery. Superficial course of internal maxillary artery.

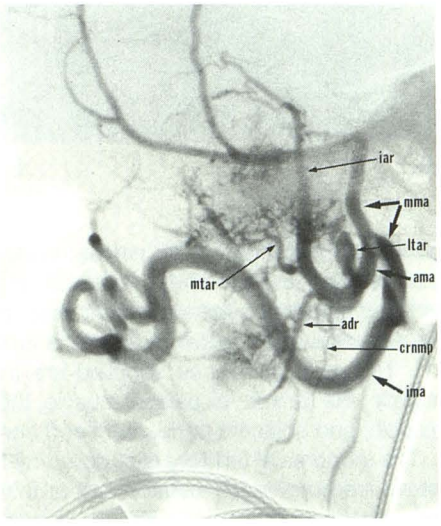


Fig. 6.—Enlarged accessory meningeal artery in juvenile angiofibroma. Lateral external carotid artery arteriogram shows superficial course of internal maxillary artery. Intracranial ramus is enlarged, and tumor penetrates into middle fossa.

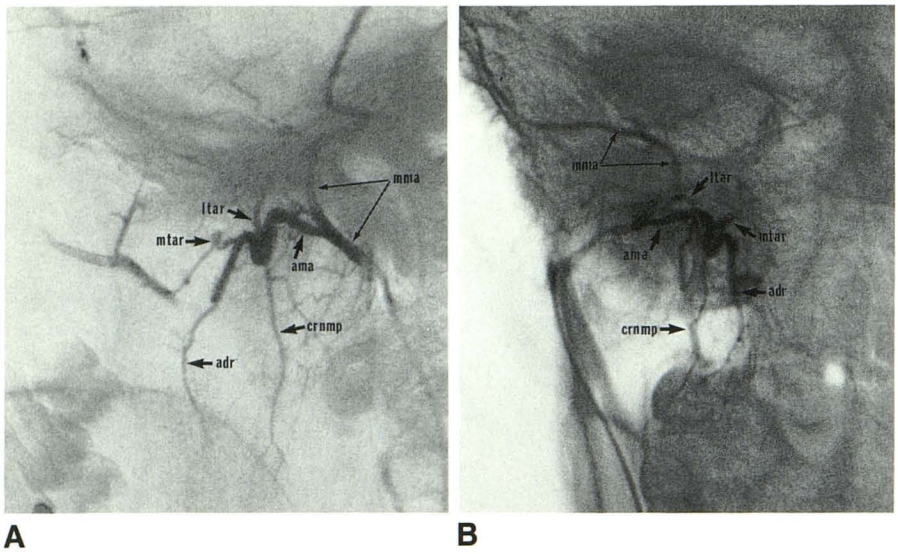


Fig. 7.—Enlarged extracranial portion of accessory meningeal artery in previously embolized juvenile angiofibroma. Arteriogram of middle meningeal artery. Superficial course of internal maxillary artery.
***A*, Lateral view.**
***B*, Anteroposterior view.**
See Key to Abbreviations in Figures 5, 6, and 7.

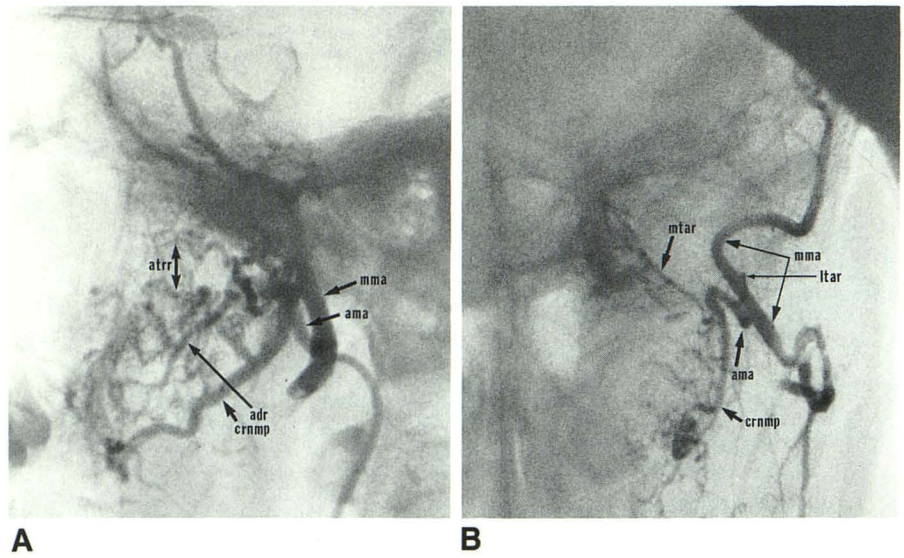


Fig. 8.—Enlarged extracranial portion of accessory meningeal artery in juvenile angiofibroma. Arteriogram of middle meningeal artery. Superficial course of internal maxillary artery.
***A*, Lateral view.**
***B*, Anteroposterior view.**
atrr = anterior territory rami. For other abbreviations, see Key to Abbreviations in Figures 5, 6, and 7.

bone, the lateral pterygoid lamina, and the proximal parts of the anterior division of the mandibular nerve. The medial territory comprises the structures deep to the interpterygoid aponeurosis. The approximate share to this territory is 55% [1]. The main structures supplied are the medial pterygoid muscle, the tensor veli palatini muscle, the levator veli palatini muscle, and adjacent periosteum and bony structures.

The intracranial territory is supplied by the ascending intracranial ramus, which usually enters into the middle fossa through the foramen ovale. In 22% of cases [1] this meningeal twig enters intracranially through the sphenoid emissary foramen (foramen of Vesalius). In 18% of cases the intracranial branch is not present. The average share to this territory is only about 10% [1]. The intracranial ramus anastomoses with the cavernous branches of the internal carotid artery and variably supplies the dura in the medial portion of the middle fossa, the semilunar cave and ganglion, and the cavernous sinus structures [6]. The consumption of the interpterygoid territory is only about 5% and carries the blood to the structures in the interaponeurotic space, mainly to the mandibular nerve and its branches and eventually to the otic ganglion [1].

In the neuroradiologic literature, the AMA is mentioned by Allen et al. [2, 3], by Salamon et al. [4], and, in much greater detail, by Dilenge and Geraud [5], who recognized the AMA as a single, well-identifiable artery on subtracted selective external carotid arteriograms in 60% of the angiograms they studied. Lasjaunias and Berenstein [6] described four branches of the AMA: the posterior branch (lateral territory ascending ramus), the inferomedial branch (medial territory ascending ramus), the intracranial branch (intracranial ascending ramus), and the inferopalatin branch (anterior descending ramus). This inferopalatin branch gives the AMA its characteristic angiographic appearance of an inverted V configuration caused by its sharp turn underneath the skull base [6]. All these authors described the AMA in normal as well as in

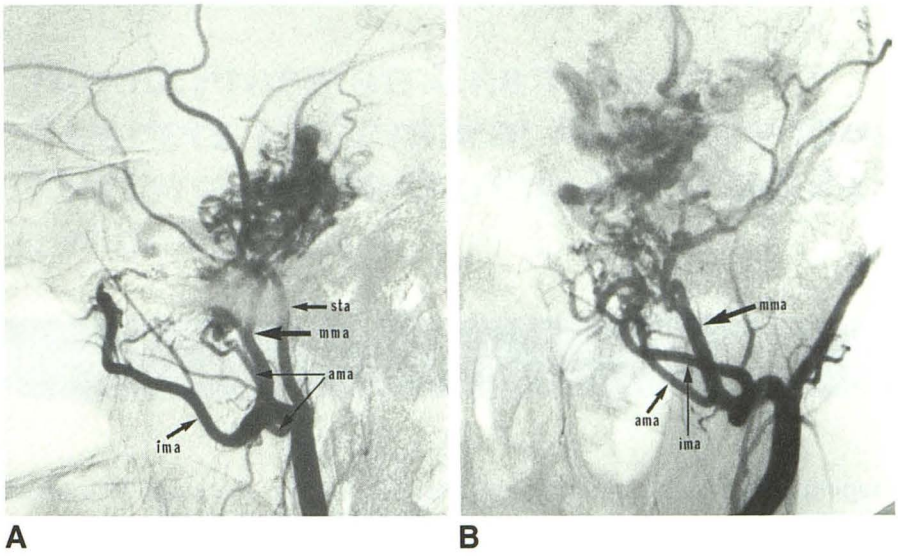


Fig. 9.—Enlarged middle meningeal artery and intracranial ramus of accessory meningeal artery, which supplies intracranial arteriovenous malformation. Superficial course of internal maxillary and accessory meningeal arteries originates from the middle meningeal artery.

***A*, Lateral view.**

***B*, Anteroposterior view.**

sta = superficial temporal artery. For other abbreviations, see Key to Abbreviations in Figures 5, 6, and 7.

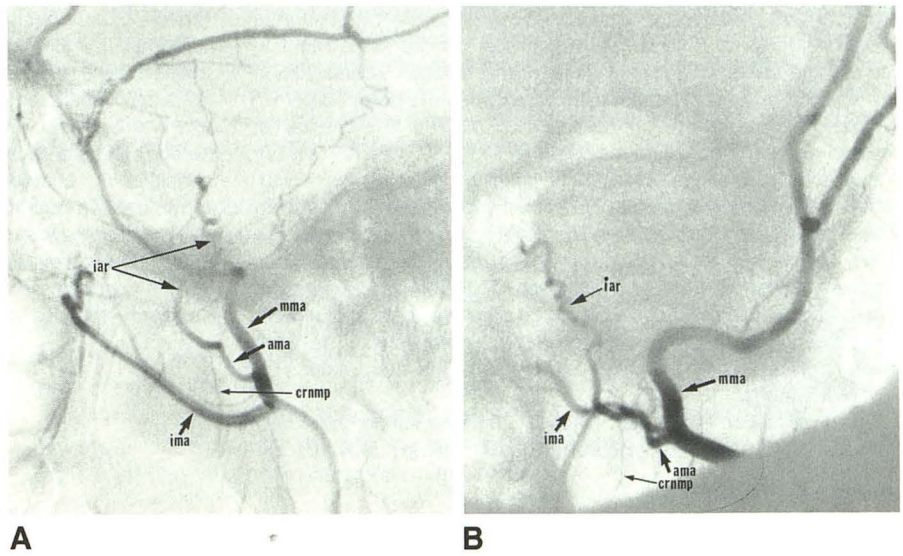


Fig. 10.—Intracranial arteriovenous malformation supplied by internal and external carotid arteries. Enlarged intracranial ramus of the accessory meningeal artery carries blood into cavernous segments of internal carotid artery. Note enlarged middle meningeal artery and superficial course of internal maxillary artery.

***A*, Lateral view.**

***B*, Anteroposterior view.**

See Key to Abbreviations in Figures 5, 6, and 7.

pathologic conditions. Lasjaunias and Berenstein [6] stressed in great detail its anastomotic channels.

Today's catheterization techniques enable routine catheterization of the internal maxillary artery and, if anatomic conditions are favorable, the middle meningeal and accessory meningeal arteries as well (Fig. 1). The AMA can play a significant role in supplying different pathologic processes located in its vascular territory, such as nasopharyngeal carcinoma, juvenile angiofibroma (Figs. 2 and 6–8), lymphoepithelioma, rhabdomyosarcoma, hemangioma, chemodectoma, carotidocavernous sinus fistula, intracranial or dural arteriovenous malformation (Figs. 9 and 10), meningeoma in the middle fossa or cavernous sinus (Fig. 1), and some other expanding lesions located in the middle cranial fossa.

Conclusions

The name accessory meningeal artery overlooks the basic fact that the distribution of the artery is predominantly extracranial within the superior pterygoid region. As proposed by Baumel and Beard [1] the proper name of the vessel should be pterygomeningeal artery (arteria pterygomeningica). This name should be used in anatomic as well as in neuroradiologic literature.

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