

The anatomical variability and the functional role of the middle meningeal artery

Simone Mantini¹, Emiliano Bruner², Barbara Colaiacomo¹, Maurizio Ripani³

¹ Dipartimento di Scienze della Salute, Università degli Studi di Roma Foro Italico, Italy

² Centro Nacional de Investigación sobre la Evolución Humana, Paseo Sierra de Atapuerca s/n 09002, Burgos

The middle meningeal artery is one of the main component of the dural vascular networks, covering the parietal, temporal and part of the frontal meningeal regions. Usually it arises from the maxillary branch of the external carotid artery and enters the middle cranial fossa through the foramen spinosum. Here it passes into the meningeal layers and divides in two principal branches from which arise minor vessels which form a complex vascular network between the cortical brain surface and the endocranial wall. Anatomical studies suggest that the middle meningeal artery shows a high anatomical variability both in terms of origin and branching patterns. Furthermore its functional role and the relations with the other encephalic circular network are not thoroughly clear. Tri-dimensional angiogramy reconstructions can provide interesting insights in this sense. In most individuals the middle meningeal artery cannot be segmented because the contrast enters only in the basal portion of the network. As a consequence the upper and middle parts of the meningeal vessel are not visible, while the traces of the channels can be easily recognised on the endocranial wall. These results suggest a scarce, discontinuous or absent blood flow, possibly associated with functions restricted to specific physiological situations or even closure of the vessels by connective/fat tissues. When it can be visualised, the tri-dimensional reconstructions suggest punctual contacts between the middle meningeal vessels and the middle cerebral artery, which run laterally, share a short tract with the middle meningeal artery and then come back into the encephalic tissues. On the other hand it is impossible to visualize eventual connections between the meningeal network and the diploic and extra-cranial vessels. The functional role of this complex vascular network could be interpreted both in terms of metabolic and biomechanical adaptations. The former is associated with oxygenation and thermoregulation of the meningeal layers, the second with a protection role of the vessels which act as a hydrodynamic skeleton. Nevertheless, because of the lack of large anatomical comparative database and taking in account the limits of the angiogramy reconstructions, these results should be considered as preliminary. Information on the anatomical variations of these vessels is needed to support useful hypotheses in vascular biomedicine and neurosurgery, as well as in human evolution.

Key words

Angiogramy, meningeal vascular network, endocranial anatomy