Does High Resolution Magnetic Angiography Detect Changes in the Middle Meningeal Artery during Migraine Attacks?

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The trigemino-cerebrovascular system plays an important role in the pathophysiology of migraine headache (1); a concept known as the trigemino-cerebrovascular theory. It has been proposed that vasodilation of meningeal blood vessels, which is one of the causes of neurogenic pain, could be a key component of the inflammatory process involved in migraine headache. This view is supported by the high jugular plasma levels of calcitonin gene-related peptide (CGRP), a potent vasodilator, during headache, and their normalization following successful treatment with sumatriptan (2). On the other hand, Schoonman et al (3) observed vasodilatation only during nitroglycerin infusion-induced migraine with high resolution MRI (3.0-Tesla), and reported that migraine attacks were not associated with vasodilatation. Based on these findings, they concluded that migraine attacks are not associated with vasodilatation of cerebral or middle meningeal arteries (MMA) but rather with neuropeptide release, e.g., CGRP, from trigeminal neurons. Their report describes interesting data; however, there are at least two points that are not supported by sufficient data for the following reasons. First, the study did not evaluate the changes in MMA in spontaneous migraine attacks, but nitroglycerin infusion-induced migraine. Second, it is not known whether other parts of the MMA were more dilated or whether other cerebral arteries were dilated or not. There is evidence for the dilatation of cranial extracerebral arteriovenous anastomoses in migraine (4) and these shunt vessels, which were not studied here, selectively and strongly constrict in response to ergot alkaloids as well as triptans in experimental animals (5). In this regard, Van Den Brink et al (6) reported that the method used in their studies does not detect distal regions of the MMA or dilatation of cranial extracerebral arteriovenous anastomoses in migraine.

In migraine, the clinically pulsating headache, which originates from vessels, is an important diagnostic criterion of ICHD-II. Villalón et al (7) indicated that cranial vasodilatation is associated with increased blood volume after each cardiac stroke, with subsequent augmentation of vascular pulsations, which may be sensed by stretch receptors in the vessel wall. The resultant increase in trigeminal sensory nerve activity in the perivascular area can provoke headache and other migraine symptoms.

Nagata et al (8) examined such changes not in nitroglycerin infusion-induced migraine but in spontaneous migraine attacks. They concluded that the vasodilation of MMA they found was not significant in spontaneous migraine attacks, as pointed out by Schoonman et al (3). Nagata et al also showed that subcutaneous injection of sumatriptan resulted in vasoconstriction of MMA and the resolution of the headache after the injection. To observe these changes in the vasoconstriction of MMA before and after injection of sumatriptan in spontaneous migraine attacks must be very important in order to determine the pathophysiological mechanism of migraine.

However, their study has several limitations with regard to the detection of changes in the vasculature. First, as mentioned above, the authors did not examine changes in blood flow in cranial extracerebral arteriovenous anastomoses and shunt vessels. Second, although they concluded that they did not find significant vasodilation during migraine, they did not examine these changes soon after the appearance of migraine.

Evaluation of blood flow changes in the distal regions of the MMA and cranial extracerebral arteriovenous anastomoses in migraine is best achieved today by using near-infrared spectroscopy (NIRS), which is designed to monitor changes in oxygenated hemoglobin (oxy-Hb), and simultaneous skin laser flow (SLF) recording, which measure directly and con-
continuously cortical and scalp surface blood flow (9).

In conclusion, although the study has several limitations, this is the first report which showed vasoconstriction of MMA after subcutaneous injection of triptan resulted in the resolution of the spontaneous migraine in humans.

References


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