Watershed cerebral infarction

see Watershed Shift Phenomenon.

A watershed stroke or watershed cerebral infarction is defined as an ischemia that is localized to the border zones between the territories of two major arteries in the brain. (Note that the actual blood stream blockage/restriction site can be located far away from the infarcts.) Watershed locations are those border-zone regions in the brain supplied by the major cerebral arteries where blood supply is decreased. Watershed strokes are a concern because they comprise approximately 10% of all ischemic stroke cases.

The reason for the infarct is that the watershed zone requires perfusion from both cerebral arteries simultaneously and reduction in either will result in ischemia. In effect, the two arteries do not function as collateral perfusion to the watershed area.

Watershed strokes are localized to two primary regions of the brain, and are termed cortical watersheds (CWS) and internal watersheds (IWS).

Patients with many different cardiovascular diseases have a higher likelihood of experiencing a blood clot or loss of blood flow in border-zone regions of the brain. The resulting symptoms differ based on the affected area of the brain.

A CT scan and MRI are used for diagnosis, and afterward several treatment options are available, including the removal of atherosclerotic plaque and a physical widening of the clogged blood vessel. Long-term care is focused around three areas: rehabilitative therapy, surgical interventions, and prevention of future watershed strokes. Going forward, research to combat watershed strokes is focusing on various topics, such as stem cell research.

The revascularization technique, including bypass created using the external carotid artery (ECA), radial artery (RA), and M2 portion of middle cerebral artery (MCA), has remained indispensable for treatment of complex aneurysms.

It remains unknown whether diameters of the RA, superficial temporal artery (STA), and C2 portion of the internal carotid artery (ICA) and intraoperative MCA blood pressure have influences on the outcome and the symptomatic watershed cerebral infarction (WI).

The aim of a study was to evaluate the factors for the symptomatic WI and neurological worsening in patients treated by ECA-RA-M2 bypass for complex ICA aneurysm with therapeutic ICA occlusion.

Matsukawa et al., measured the sizes of vessels (RA, C2, M2, and STA) and intraoperative MCA blood pressure (initial, after ICA occlusion, and after releasing the RA graft bypass) in 37 patients. Symptomatic WI was defined as presence of the following: postoperative new neurological deficits, WI on postoperative diffusion-weighted imaging, and ipsilateral cerebral blood flow reduction on SPECT. Neurological worsening was defined as the increase in 1 or more modified Rankin Scale scores. First, the authors performed receiver operating characteristic curve analysis for continuous variables and the binary end point of the symptomatic WI. The clinical, radiological, and physiological characteristics of patients with and without the symptomatic WI were compared using the log-rank test. Then, the authors compared the variables between patients with and without neurological

worsening at discharge and at the 12-month follow-up examination or last hospital visit.

Symptomatic WI was observed in 2 (5.4%) patients. The mean MCA pressure after releasing the RA graft (< 55 mm Hg; p = 0.017), mean (MCA pressure after releasing the RA graft)/(initial MCA pressure) (< 0.70 mm Hg; p = 0.032), and mean cross-sectional area ratio ([RA/C2 diameter]2 < 0.40 mm [p < 0.0001] and [STA/C2 diameter]2 < 0.044 mm [p < 0.0001]) were related to the symptomatic WI. All preoperatively independent patients remained independent (modified Rankin Scale score < 3). After adjusting for age and sex, left operative side (p = 0.0090 and 0.038) and perforating artery ischemia (p = 0.0050 and 0.022) were related to neurological worsening at discharge (11 [29%] patients) and at the 12-month follow-up or last hospital visit (8 [22%] patients).

Results of the present study showed that the vessel diameter and intraoperative MCA pressure had impacts on the symptomatic WI and that operative side and perforating artery ischemia were related to neurological worsening in patients with complex ICA aneurysms treated by ECA-RA-M2 bypass [1].

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Matsukawa H, Tanikawa R, Kamiyama H, Tsuboi T, Noda K, Ota N, Miyata S, Oda J, Takeda R, Tokuda S, Kamada K. Risk factors for neurological worsening and symptomatic watershed cerebral infarction in internal carotid artery aneurysm treated by extracranial-intracranial bypass using radial artery graft. J Neurosurg. 2015 Nov 13:1-8. [Epub ahead of print] PubMed PMID: 26566202.

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Steingart A, Hachinski VC, Lau C, et al. Cognitive and Neurologic Findings in Subjects With Diffuse White Matter Lucencies on Computed Tomographic Scan (Leuko-Araiosis). Arch Neurol. 1987; 44:32–35