Intraoperative microvascular Doppler sonography

IOMD constitutes a safe, accurate, and low-cost imaging modality for evaluating blood flow velocities and for optimal stepwise AVM elimination without unnecessary sacrifice of veins. PI and RI are reliable parameters in diagnosing cerebrovascular malformations, but systolic and diastolic flow velocities may vary to a greater extent. This phenomenon has never been elucidated previously and therefore needs to be emphasized when using this technique intraoperatively [1].

The intraoperative microvascular Doppler sonography (iMDS) is a well-established tool in vascular neurosurgery for blood flow velocity (BFV) monitoring, capable of detecting vessel occlusion. However, identification of subtotal vessel compromise is more difficult, since the measured BFV may substantially vary with changing insonation angles and insonated vessel segments. To keep these parameters constant Malinova et al. combined neuronavigation with iMDS (niMDS). The question was if niMDS allows the detection of subtotal vessel compromise in aneurysm surgery.

During surgery, the 3-dimensional reconstruction of the CT-angiography, which was obtained routinely prior to surgery, was displayed by the neuronavigational system. Prior to clipping, neuronavigation was used to define target point and trajectory, which, by coupling the neuronavigational pointer with the Doppler probe, correspond to the insonated vessel segment and the insonation angle. After clipping, for each vessel segment, the same trajectory was used for all consecutive measurements. The mean BFVs pre- and post-clipping were documented.

Malinova et al. performed 82 BFV-measurements in 39 aneurysm surgeries. Mean deviation between pre- and post-clipping BFV values was 2.12cm/s. There was a significant correlation between the mean BFV values before and after clipping (r=0.45 [95% CI 17-66%]; p=0.002). One patient experienced new neurological deficits due to occlusion of a perforating vessel that was not insonated.

The study could not answer the question if niMDS can detect BFV changes after clipping indicating vessel compromise, as no subtotal vessel occlusion occurred in the 39 operations. However, they proofed that niMDS-measured BFVs only varied minimally in uncompromised vessels pre- and post-clipping, suggesting that vessel compromises might be easily detected during aneurysm surgery [2].

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2)
Malinova V, von Eckardstein K, Rohde V, Mielke D. Neuronavigated microvascular Doppler sonography for intraoperative monitoring of blood flow velocity changes during aneurysm surgery - A feasible monitoring technique. Clin Neurol Neurosurg. 2015 Jul 2;137:79-82. doi: 10.1016/j.clineuro.2015.06.021. [Epub ahead of print] PubMed PMID: 26164348.