Association of Cerebral Oximetry with Brain Ischemic Lesions and Neurological Outcomes following Aortic Arch Repair with Unilateral Cerebral Perfusion: A Sub-analysis of the ACE CardioLink-3 Trial

Objective
Cerebral oximetry using near infrared spectroscopy is used to monitor cerebral perfusion in aortic surgery. In this sub-analysis of the randomized controlled ACE CardioLink-3 trial that compared innominate vs axillary artery cannulation for elective proximal aortic arch repair, we investigated the relationship of cerebral oximetry with adverse neurological outcomes.

Methods
A total of 102 patients were included in the trial and regional cerebral oximetry was used according to local protocol. All patients had pre- and postoperative diffusion-weighted imaging (DWI) brain MRI and assessment of clinical outcomes, including neurological functional status. In this sub-analysis, we first compared cerebral oximetry results between the study allocation groups, and second, examined association of MRI and neurological functional outcomes with cerebral oximetry findings.

Results
There was no difference in the total number of desaturations (below 20% of baseline) (4.9±16.9 vs 2.1±3.0, p=0.75, in innominate and axillary artery cannulation group), lowest absolute saturation value (right; 52.1±10.3% vs 50.6±11.3%, p=0.65, left;48.7±11.7% vs 47.7±11.4%, p=0.68), and total area under the saturation curve (AUC) with cerebral oximetry (688±1366min% vs 1415±3896min%, p=0.84) between the two trial allocation groups. On DWI, 71 (70%) patients had new ischemic lesions, amongst whom 6 (8.5%) had stroke with a modified Rankin Scale of 2.3±1.2. There was no difference in the ipsilateral and contralateral values of either cerebral oximetry desaturation parameter (total number and total AUC of desaturation) in those with or without new ischemic lesions on DWI in the territories of right or left anterior cerebral artery, anterior circulation, hemisphere, and border zone (anterior or hemilateral). When comparing patients with and without desaturation event, those with left-side desaturation event demonstrated a decrease in Montreal Cognitive Assessment score compared to those without (1.0±2.8 vs -0.9±2.0, p=0.007), while right-side desaturation event showed no significant difference (p=0.63).

Conclusions
In patients who underwent elective proximal aortic arch repair patients with unilateral antegrade cerebral perfusion, cerebral oximetry desaturation was not predictive of new ischemic brain lesions on MRI. Left-side desaturation during right side cerebral perfusion may be associated with adverse cognitive outcome.

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