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Cerebral near-infrared spectroscopy monitoring during transcatheter aortic valve implantation

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Introduction: Stroke and transient ischemic attack (TIA) are important periprocedural cerebrovascular complications of transcatheter aortic valve implantation (TAVI). Regional cerebral O₂ saturation is an indicator for cerebral perfusion and can be measured in real-time and noninvasively by near-infrared spectroscopy (NIRS). In this pilot study we evaluated the feasibility and utility of NIRS during TAVI.

Methods: Regional cerebral O₂ saturation (rScO₂, bihemispheric) was measured by near-infrared spectroscopy during 32 transfemoral TAVI procedures (female 56.3%, mean age 81.8 years). All patients received conscious sedation and O₂-supplement if peripheral oxygen saturation (SpO₂) was below 95%. Baseline rScO₂ was measured at the beginning of the procedure, as well as before, during and 5min after rapid pacing for valve deployment.

Results: Mean preoperative mini mental state examination score was 26.5 points (theoretically max. 30 points, >24 points no severe cognitive impairment). Two-third of the patients (n=21) required oxygen supply (mean 4.0 l/min) during the TAVI procedure. Mean baseline rScO₂ was 59.3% with no differences between both cerebral hemispheres (left 60.3% vs. right

58.7% p=0.23). Compared to baseline rScO₂ and rScO₂ assessed immediately before rapid passing, rScO₂ dropped significantly during rapid pacing (59.3% vs. 51.8%, p<0.01 and 60.9% vs. 51.8%, p<0.01 respectively). Five minutes after rapid pacing rScO₂ values had normalized again (post rapid pacing 60.9% vs. 51.8% during rapid pacing, p<0.01; baseline 59.3% vs. post rapid pacing 60.9%, p=0.51). Intraprocedural cerebrovascular events were observed in two cases. One patient developed a left-sided hemiplegia (stroke, later verified by cerebral CT scan) and one patient a transient tremor of the left upper extremity (TIA, new hemorrhagic or ischemic event ruled out by cerebral CT scan). In both cases we observed an abnormal sudden rScO₂ decrement by the corresponding right hemispheric NIRS sensor (left-right hemisphere sensor: 60% vs. 44% and 63% vs. 48% respectively).

Conclusion: Regional cerebral O₂ saturation, an indicator for cerebral perfusion, decreases significantly during rapid pacing of TAVI procedure. Furthermore, rScO₂ measurement by NIRS may be helpful to detect cerebrovascular complications early during TAVI procedure.