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NON-INVASIVE MONITORING OF BRAIN OXYGEN SATURATION DURING TEMPORARY CLIPPING APPLIED FOR COMPLEX CEREBRAL ANEURYSM SURGERY (FORE-SIGHT TECHNOLOGY)

C. De Deyne, J. Wuyts, V. Desloovere, F. Jans, D. Peuskens, T. Daenekindt, R. Heylen

Depts of Anesthesia and Neurosurgery*. Ziekenhuis Oost-Limburg Genk (Belgium) ; Faculty of Medicine, Universiteit Hasselt (B)

Complex cerebral aneurysm surgery carries a high risk for intra-operative ischemic insults, especially if multiple periods of temporary clipping seem necessary to allow final aneurysm clipping. Optimal intra-operative cerebral protection remains an open and controversial question. The use of non-invasive neuromonitoring, applied during aneurysm surgery, could guide an optimal (and maximal) intra-operative neuroprotective strategy.

In 12 pts, scheduled for elective complex cerebral aneurysm surgery by supra-orbital incision, non-invasive cerebral oximetry was applied over the patient's forehead, enabling bilateral brain saturation monitoring. The Fore-Sight monitor is a continuous wave, spatially resolved, near-infrared spectrometer that measures absolute cerebral tissue oxygen saturation (SctO2 %). The disposable sensor provides fiberoptic light guided from the monitor with a prism and 2 light detectors (scalp and brain) at fixed distances (1.5 and 5 cm) from the light source. The scalp detector samples returning light from the extracranial tissue, whereas the brain detector samples returning light signals from both the brain and the extracranial tissue. The signal from the scalp detector is used to cancel the extracerebral interference from the signal of the brain detector to obtain information that mostly comes from the brain. Laser light at an FDA-deemed safe level (class I laser) is projected into the brain in 4 precise (bandwith < 1 nm) wavelengths (690, 780, 805 and 850 nm) to capture information needed for the algorithm to calculate the absolute value of SctO2. Validation studies proved a stable correlation between SctO2 and jugular bulb saturation (SjO2) with SctO2 10% higher than SjO2. As it is clinically accepted that SjO2 has a normal safe limit of 45%, the absolute Fore-Sight SctO2 threshold is estimated to be approximately 55%.

In 3 of 12 pts, excessive ambient light interfered with SctO2 monitoring and no SctO2 data could be obtained. In 7 of 9 remaining pts, multiple periods of temporary clipping were applied. Before the first temporary clip, barbiturates (thiopental) were administered in order to obtain a Burst Suppression Ratio (EEG cerebral function monitoring) in the range of 20 to 40%. In all pts, a small, nonsignificant decrease in ipsilateral SctO2 was observed during temporary clipping, but in all periods, SctO2 values remained above 55%. After release of the temporary clip, an immediate, shortlasting (3-5min) and significant increase in ipsilateral SctO2 was observed in 3 pts. In one of these 3 pts, 4 periods of temporary clipping were necessary and all 4 periods resulted in the same phenomenon. After release of the temporary clip, ipsilateral SctO2 immediately increased by a mean of 8.4% (range 7-11%) with return to baseline values after a mean of 4min. These observations could point to a local and important hyperperfusion occurring after the release of the temporary clip and could indicate the presence of a time window not suitable for re-application of a temporary clip.

This first report reveals the feasibility of intra-operative non-invasive cerebral oxygenation monitoring, using absolute SctO2 monitoring, during complex cerebral aneurysm surgery. The surgical approach by minimal invasive supra-orbital incision plays a major role in enabling this forehead non-invasive monitoring technique. However, further studies will have to reveal the clinical implications of this new information.