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Non-Invasive Absolute Cerebral Oximetry and Intraluminal Shunting during Carotid Endarterectomy

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Introduction: During carotid endarterectomy (CEA), incidence of intra-operative stroke due to clamping-induced cerebral ischemia or embolization remains high (3-5%). The most recently introduced NIRS device (Fore Sight technology) uses 4 precise wavelengths to measure absolute cerebral tissue oxygen saturation (SctO₂). Referring to validation studies to jugular bulb oximetry, SctO₂ threshold for ongoing cerebral ischemia is estimated at 55%. In this study, we monitored SctO₂ during carotid clamping for CEA comparing pts requiring shunt insertion (S), to guarantee adequate cerebral perfusion during clamping, to pts undergoing CEA without need for shunt insertion (NS).

Patients and Methods: With IRB approval, 192 consecutive pts scheduled for CEA were included over a 24months period. In all pts, CEA was performed under general anesthesia. Bilateral SctO₂ monitoring was applied pre-operatively, but was blinded for intra-operative interpretation. Shunt insertion was guided by aEEG monitoring and/or by absence of any carotid backflow (as estimated by vascular surgeon).

Results: In 46 of 192 pts, EEG changes indicative of ongoing cerebral ischemia (21pts) and/or absence of any carotid backflow (37pts) guided a shunt insertion. Mean ipsilateral SctO₂ before clamping was not different for NS (72.2%; 62-80%) compared to S (70.3%; 64-77%). In both groups, SctO₂ decreased significantly after carotid clamping (NS: minus 6.56%; 2-20%; p0.0042 vs S: minus 9.1%; 4-29%; p: 0.0031). Significantly more S pts (12/46) revealed SctO₂ below 55% (mean duration 2.1min) after carotid clamping (compared to 6/146 NS pts). Ipsilateral mSctO₂ before shunt opening was 60.4% (50-77%) and increased significantly (p: 0.0039) to m68.3% (52-78%) after opening. In one pt, SctO₂ remained below 50% during whole shunting period (31min). This pt revealed a new neurological deficit at emergence from anesthesia. All other 191 pts experienced an uneventful neurological recovery.

Conclusions: Non-invasive absolute cerebral oximetry revealed significant ipsilateral decreases in cerebral saturation after carotid clamping. Significantly more pts requiring shunt insertion were found with SctO₂ values below the threshold of 55% after carotid clamping.

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