Somatosensory Evoked Potentials During Temporary Arterial Occlusion for Intracranial Aneurysm Surgery: Predictive Value for Perioperative Stroke

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Introduction

Temporary arterial occlusion (TAO) is a valuable tool for minimizing intraoperative rupture risk during intracranial aneurysm microsurgery; however, it may also be associated with ischemic injury. This study aims to identify surgical and intraoperative neurophysiological monitoring (IONM) factors that predict perioperative stroke risk after TAO.

Methods

We performed a retrospective chart review of 177 intracranial aneurysm surgeries at our institution, in which TAO was performed before the placement of a permanent clip under monitoring with somatosensory evoked potentials (SSEPs) and electroencephalography (EEG). We collected temporary clip (maximum TAO episode duration, number of episodes, location) and IONM factors (type/duration/onset latency of change, duration of recovery) present for each patient. Additionally, we extracted perioperative stroke rate, which was defined as a new-onset neurological deficit that developed within 24 hours postoperatively that was correlated with hypodensity on postoperative computed tomography. Multivariate logistic regression was utilized to assess the combined effects of occlusion duration and SSEP changes on perioperative stroke rate.

Results

Ten (6%) patients developed perioperative stroke in the vascular territory of TAO. SSEP changes were observed in 50% (5/10) of patients with perioperative stroke and in 16% (26/167) of patients without SSEP changes (p=0.005). Maximum TAO episode duration experienced in patients that developed perioperative stroke was 12.6 minutes (95% confidence interval, 8.1-17.1) and that for patients without strokes was 8.0 (95% confidence interval, 7.3-8.7) minutes (p=0.026). Multimodal changes (both SSEP + EEG changes) exhibited a specificity, sensitivity, positive predictive value, and negative predictive value of 94%, 30%, 30%, and 94%, respectively. Multimodal changes were observed to increase specificity (p=0.008, chi-squared test) for stroke as compared to SSEP changes alone, without a corresponding decrease in sensitivity (p=0.650, Fisher's exact test).

Conclusions

SSEP changes and increased single-episode TAO durations are independently associated with increased stroke risk. SSEP with corresponding EEG changes are highly specific for perioperative stroke.

Learning Objectives

By the end of this session, participants should be able to:

•Understand the role of somatosensory evoked potentials in intracranial aneurysm cases.

•Identify risk factors associated with perioperative stroke during temporary arterial occlusion.

•Contextualize SSEP and EEG changes within a diagnostic framework.