Commentary: Neurophysiologic monitoring during aortic arch surgery: Preventing rather than treating

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Aortic arch surgery, both in acute and elective settings, remains one of the most complex cardiac procedures. Despite the efforts that have been undertaken to reduce complications, high mortality and morbidity are still associated with this kind of surgery, as reported by the largest international registries. Particularly, neurologic injury has historically been the most-feared complication. Strategies for improving mortality and preventing neurologic events have developed over time. In a contemporary practice, hypothermic circulatory arrest with antegrade or retrograde cerebral perfusion, neurophysiologic intraoperative monitoring, and pharmacologic strategies have become ways to reduce the incidence of neurologic injury of aortic arch surgery.

With regards to intraoperative neuromonitoring (IONM), electroencephalography (EEG) and somatosensory-evoked potentials (SSEP), as well as cerebral oximetry by near-infrared spectroscopy, have been used to support cerebral perfusion strategies during aortic surgery. However, despite the rapid spread of these methods, poor data examining IONM in the setting of aortic arch reconstruction are available.

In the present issue of the Journal, Sultan and colleagues present a series of 563 patients undergoing aortic arch surgery who were intraoperatively monitored with both SSEP and EEG. Among them, 119 patients had either SSEP changes or accompanying EEG changes. This group was compared with 444 patients with no evidence of changes. Baseline characteristics were similar between groups except for a greater body mass index in those patients with intraoperative neural changes. The type of aortic etiology was similar between the groups, with an equal distribution of dissection and aneurysmal disease. However, patients with IONM changes were more likely to undergo total aortic arch replacement versus hemiarch and included more patients with the classification of emergency. Breaking down the intraoperative changes, 102 patients had significant SSEP changes, with 62 patients having EEG changes. Of the 102 patients with SSEP changes, 53 were permanent. In total, 16 patients had temperature-related SSEP changes, 9 of which were permanent. The patients with permanent neurologic changes intraoperatively had longer cardiopulmonary bypass times as well as circulatory arrest intervals. Intuitively, permanent neurologic changes translated into greater operative mortality, adverse neurologic events, and longer intensive care stays with greater need for mechanical ventilation and dialysis. Unfortunately, the results are limited by the inability to meaningfully risk adjust, given small a sample size and the paucity of modifiable factors identified. Of note, 20 patients without IONM changes developed adverse neurologic events documented in the postoperative period.

We congratulate the authors for the study project and results and advocate for more studies like this to better understand the predicting factors of adverse neurologic events in this complex subset of patients. In our opinion, this study emphasizes the need of routine IONM when such complex aortic surgery is performed, and to reduce the incidence of...
adverse neurologic events, optimal perfusion and surgical strategies are imperative. Undoubtedly, this complex approach requires a well-established organization that takes in account all the different “actors,” such as surgeons, anesthetists, perfusionists, nurses, and neurophysiologists, once more underlining the contemporary idea of specialized centers with a high volume of aortic surgery to treat both chronic and acute aortic syndromes. There is a large consensus that patients affected by complex aortic syndromes may benefit from treatment at dedicated specialized aortic centers with significantly improved outcomes and decreased mortality. At high-volume centers, excellent outcomes are possible. Several series by recognized aortic centers have reported a less than 2% stroke rate. We do think that the future treatment of aortic arch disease is going toward a total arch approach with standardized cerebral protection techniques, delivered by specialist high-volume aortic centers with expertise in this technique.

Correctly, the authors highlight the continued opportunity to optimize strategies for reversing neurologic insult during aortic arch surgery once IONM changes occur, with the aim of reducing operative mortality and postoperative adverse neurologic events. However, we believe that a standardized surgical and perfusion approach should aim to prevent any neurologic insult during aortic arch surgery.

Our own experience, favoring hypothermic circulatory arrest complemented by complete trivascular cerebral perfusion for extended arch operations using bispectral index and regional cerebral oximetry, reflects a stroke rate of 1.4% in the elective setting and 2.4% in the emergency setting. In this sense, to prevent is definitively better than to treat.

References