Commentary: Horseshoes and hand grenades

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Central Message

Network meta-analysis enables comparisons among 3 different neuroprotection strategies; however, it is unable to elucidate optimal cerebral protection for complex cases of aortic arch repair.

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To better understand the ideal use of neuroprotection strategies during aortic arch surgery, Hameed and colleagues¹ used an innovative new study design known as network meta-analysis, which facilitates direct and indirect comparison among multiple comparative studies within a single overarching analysis. This is a dramatic departure from established meta-analyses of aortic arch repair that rely solely on direct evidence, permitting the appraisal of only 2 modalities of cerebral protection.²⁻⁶

Use of network meta-analysis enabled Hameed and colleagues¹ to simultaneously evaluate 3 approaches to cerebral protection: antegrade cerebral perfusion (ACP), retrograde cerebral perfusion (RCP), and isolated deep hypothermic circulatory arrest (DHCA).¹

The research included 26,968 patients from 68 publications, including 6 randomized controlled trials and 62 observational studies. Their findings suggest that the use ACP or RCP did not significantly influence postoperative stroke or mortality, the duration of circulatory arrest correlated with the effect of ACP and RCP, and the use of unilateral or bilateral ACP and temperature target for circulatory arrest did not influence the operative outcomes. This supports currently available data, primarily that ACP and RCP yield superior neuroprotection results to those of isolated DHCA.⁷⁻⁹ Most surgeons agree that for arch repairs with short periods of cerebral ischemia (ie, <25 minutes), the use of either ACP, RCP, or isolated DHCA provides sufficient protection. Similarly, the consensus opinion is that for arch repairs with longer ischemic times, some sort of brain perfusion, whether it be ACP or RCP, is beneficial.

The study by Hameed and colleagues,¹ although compelling, is unable to definitively determine the optimal strategy for the anticipated prolonged ischemic times necessitated by total transverse aortic arch repair. This is due to inherent limitations in the substrate data. Most publications contain a mixture of patients undergoing hemiarch and total transverse aortic arch replacement—vastly divergent procedures that often have different neurologic outcomes. The majority

of surgeons will concur that cerebral protection strategies deemed adequate for a typical hemiarch repair may not be sufficient for more complex operations. Grouping these operations together renders it difficult to elucidate the precise role of ACP, RCP, and bilateral ACP for repairs with prolonged ischemic times. In addition, standard definitions of hypothermia are frequently absent from published studies and serve as a significant confounding variable. Following the consensus developed by Yan and colleagues¹⁰ (ie, deep hypothermia defined as 14.1°C–20°C, moderate hypothermia as 20.1°C–28°C, and mild hypothermia as 28.1°C–34°C) would facilitate future investigations by creating a level playing field.

Currently, there is significant disparity worldwide in strategies used during aortic arch repair: flow rates, temperature targets, cannulation sites, cerebral perfusion (including unilateral or bilateral protection), and techniques for reattaching branching arteries. European surgeons favor ACP during elective cases and RCP for emergency cases, although the use of isolated DHCA is prevalent in the United States.^{7,11} The considerable heterogeneity in approaches emphasizes the paucity of data on the optimal cerebral protection strategy, the lack of conviction regarding the ideal approach, and the continued divergence of opinion. Despite the important contributions that Hameed and colleagues¹ bring to the surgical literature, readers remain left with a plethora of questions regarding the ideal approach to complex aortic arch repair.

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