See Article page 552.

Commentary: Spinal cord protection in thoracoabdominal aortic surgery: Jumping into the deep end of the pool

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Spinal cord injury (SCI) is the most feared morbid complication following operative treatment of descending thoracic aortic aneurysm (DTAA) and thoracoabdominal aortic aneurysm (TAAA). The landmark study from Svensson and colleagues¹ identified the duration of aortic clamping and extent of aortic replacement as key factors related to the development of SCI. Consistent with ischemia as the basis for SCI, Safi and colleagues^{2,3} have defined the cornerstones of surgical prophylaxis as distal aortic perfusion and cerebrospinal fluid (CSF) drainage. Coselli and colleagues⁴ definitively validated these concepts in their randomized controlled trial of CSF drainage.

The aforementioned studies were of open surgical repair. Endovascular approaches (ie, thoracic endovascular aortic repair [TEVAR]) for DTAA and TAAA have since been developed. SCI also may occur following TEVAR, and as would be expected, is related to the extent of aortic coverage.⁵ However, TEVAR differs from open repair in certain aspects that may impact upon SCI, positively or negatively. First, intercostal artery reimplantation can be performed in open repair but not in TEVAR. Second, proximal aortic occlusion or hypothermic circulatory arrest is required for open repair, whereas TEVAR typically entails

From left to right, Drs Cheema, Omer, and Rajagopal

CENTRAL MESSAGE

Spinal cord injury remains a challenge in thoracoabdominal aortic surgery. Pooled data analyses may lack sufficient granularity.

very brief periods of endo-aortic occlusion. Third, distal aortic perfusion can be performed during open surgical repair.

In their article in this issue of the *Journal*, Gaudino and colleagues⁶ take on the herculean task of characterizing the modern incidence of and risk factors for SCI via a meta-analysis for both open repair and TEVAR, thereby permitting comparison between the 2 surgical approaches. In brief, they found the following: (1) the incidence of SCI was greater with open repair than with TEVAR (5.7% vs 3.9%); (2) SCI was more common in TAAA than in DTAA (7.6% vs 3.5%), particularly with extent II, III, and V TAAA; (3) related to (1) and (2), the difference between open repair and TEVAR with respect to SCI was driven exclusively by differential incidences in patients with DTAA; and (4) neither CSF drainage nor intercostal artery reimplantation appeared to influence SCI.

The scope of this study is vast, and there is “strength in numbers.” Perhaps the strongest conclusion that can be drawn is that with respect to SCI, specifically in patients with DTAA, TEVAR is superior to open repair. TAAA continues to have a substantial incidence of SCI regardless of operative approach; however, “clamp-and-sew” studies were included in this meta-analysis. In addition, CSF drainage was not associated with a lower incidence of SCI.

When findings run counter to conventional wisdom, but particularly when that conventional wisdom is built on a foundation of both physiologically sound concepts and rigorously conducted previous studies, skepticism is warranted. Most importantly, this work used pooled analytic techniques. Conceptually unsound conclusions can be

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drawn using these approaches, often because confounding variables might not be distributed within the population in the same fashion as the independent and dependent variables. These issues may be amplified with meta-analyses. In this study, a large number of constituent studies had missing data, some missing data with respect to a particular set of variables and others missing data with respect to another set of variables.

There is no substitute for tracking individuals, and pooled approaches definitionally do not do so. If individual patient data were available, then only those patients with complete data for all variables of interest could be included, and more rigorous analyses could be performed. Interpreting these pooled data is much like jumping into the deep end of the pool; there is a hazard of sinking if one is not skillful.

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See Article page 552.

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Commentary: Rates of spinal cord ischemic injury after aortic surgery: One size does not fit all

Nicholas T. Kouchoukos, MD

Spinal cord ischemic injury (SCI) is a major complication after open or endovascular procedures on the descending thoracic (DTA) or thoracoabdominal (TAAA) aorta and is associated with substantial mortality and morbidity. Despite modifications in operative technique and introduction of interventions such as drainage of cerebral spinal fluid and monitoring of motor- and sensory-evoked potentials, the risk of SCI, manifested primarily by paraplegia or

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CENTRAL MESSAGE

Pooled rates of permanent postoperative spinal cord ischemic injury that include patients with both thoracic and thoracoabdominal aortic aneurysms do not tell the whole story.

paraparesis, has not been substantially reduced over the past 3 decades, especially in patients with TAAAs.¹⁻³

In this issue of the *Journal*, Gaudino and colleagues⁴ present an extensive meta-analysis of the contemporary (2008-2018) experience with open and endovascular repair of thoracic and thoracoabdominal aortic aneurysms involving 169 studies and 22,634 patients. The primary outcome examined was the prevalence of permanent SCI (paraplegia

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