

See Article page 1.



Commentary: Cerebrospinal fluid drainage: One component of a successful distal aortic surgery program

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Spinal cord injury (SCI) remains the most devastating complication following descending thoracic and thoracoabdominal aortic aneurysm repair (DT/TAAA). Cerebrospinal fluid drainage (CSFD), along with other protective adjuncts, have reduced the rate of permanent SCI to 5% to 8%.¹⁻⁴

In this issue of the *Journal*, Abdelbaky and colleagues⁵ present a retrospective review of 100 patients who underwent open DT/TAAA repair with CSFD as a routine adjunct, with excellent outcomes, including a permanent paraplegia rate of 2% and an in-hospital mortality rate of 6%. This success is likely secondary to several factors, including surgical expertise, routine use of other protective adjuncts, and case mix; nearly one-half of the population underwent lower-risk DT rather than TAAA repair, and the proportion of emergent patients was low. Notwithstanding the excellent results, the lack of a comparator group precludes this article from offering evidence to support or discourage the use of CSFD for SCI prevention.

RATIONALE FOR CSFD USE

Acute changes in the spinal cord occur in response to ischemia/reperfusion during distal aortic repair, resulting in edema and increased CSF pressure.⁶ CSFD works by

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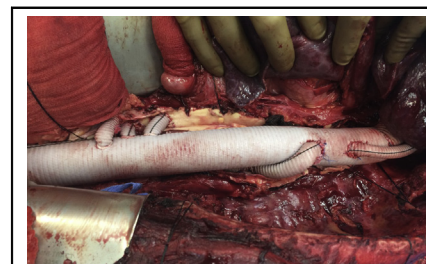
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Operative photo of repair of a thoracoabdominal aortic aneurysm.

CENTRAL MESSAGE

Cerebrospinal fluid drainage, together with other adjuncts, are important strategies to protect against spinal cord injury during open descending and thoracoabdominal aneurysm repair.

lowering the intrathecal pressure and augmenting spinal cord perfusion. The effectiveness of CSFD in reducing SCI has been demonstrated in multiple observational series^{2,6-10} and a randomized trial.¹¹ Both the American Heart Association¹² and the European Association for Cardiothoracic Surgery¹³ guidelines recommend CSFD for patients at high risk of SCI undergoing open and endovascular TAAA repair.

MANAGEMENT OF CSF DRAINS

Although guidelines provide consensus on the use of CSF drains,¹²⁻¹⁴ the protocols for CSFD, including timing, duration, and drainage protocols, are based on institutional experience and expert opinion. Most recommend maintaining CSF pressure <10 mmHg with continuous monitoring, limiting drainage to 10-15 mL/hour, early removal within 24 to 48 hours after surgery (in the absence of SCI), and cautious use of anticoagulation therapy even after drain removal.^{13,15-18} One important learning point from the Yale series is that routine CSFD is safe, with a low incidence of serious complications.

CURRENT AND NOVEL ADJUNCTS TO SPINAL CORD PROTECTION

Over the past decade, various adjunctive strategies have been introduced to minimize SCI, including distal aortic perfusion, neurophysiological monitoring, segmental artery reattachment, and aggressive blood pressure management.^{13,15,19} With advances in endovascular surgery, newer

techniques have been proposed to increase spinal cord tolerance to hypoperfusion. Staging of aortic coverage has been suggested to stimulate the development of the collateral network for perfusion of the cord.²⁰ Minimally invasive segmental artery coil embolization of intercostal arteries before thoracoabdominal aortic repair has been suggested to provoke collateral flow and reduce SCI and is currently being evaluated in a randomized trial.^{21,22}

In summary, CSFD along with other adjuncts are important strategies to protect against SCI during open descending and thoracoabdominal aneurysm repair. As with most complex aortic surgeries, it is difficult to attribute a team's success to a single factor. Rather, it is likely a combination of surgical judgment, experience, attention to management details, and a mature team that can lead to such excellent results.

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