New Concepts in Paraplegia after TEVAR
What Role Does Spinal Cord Injury Edema Play? What Causes It and How Can It Be Prevented?

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Objective

- Zenith TX2 Low Profile Study (2015) yielded zero paralysis
- Changing the guidelines in USA (2010) and Europe (2015)
- Spinal cord edema
- We developed 2 animal models to answer the clinical question
- Future direction: drug-induced fasciotomy to prevent paralysis in TEVAR

Conclusion:

'Rather than the low-profile graft itself leading to reduced spinal cord complications, we would conclude from these data that aggressive use of spinal cord drainage should be encouraged.' Illig et al. J Vasc Surg 2015

Disclosures

- None

One-year outcomes from the international multicenter study of the Zenith Alpha Thoracic Endovascular Graft for thoracic endovascular repair

Karl A. Illig, MD, Troy Choo, MD, Li, Chenghui, MD, Negash Beyene, MD, Hidetoshi Watanuki, MD, Yutaka Hirose, MD, Tatsuhiko Fujita, MD, PhD, an behalf of Zenith TX2 Low Profile study investigators, Tottenham, Ilia, Minamino, Osaka, Japan, Denver, CO, and Indianapoils and New York, NY

Conclusion:

'We lack the ability to make any judgements as to the issues surrounding this argument at all.'

Vs.

The original conclusion:

'That aggressive use of spinal cord drainage should be encouraged'
References for 2010 Guidelines

22.5. Recommendations for Spinal Cord Protection During Descending Aortic Open Surgical and Endovascular Repairs

1. Cerebrospinal fluid drainage is recommended as a spinal cord protective strategy in open and endovascular thoracic aortic repair for patients at high risk of spinal cord ischemic injury (188–190). (Level of Evidence: B)

References for 2010 Guidelines


Spinal Drainage in TEVAR

Etz et al. downgraded the level of evidence from \( \text{Ib} \) to \( \text{IIaC} \)

No Randomized Controlled Trials

MRI findings following Open TAAA Repair

- Spinal drain for 48 hours
- Drainage stopped on POD 3
- Catheter removed on POD 4
- Patient developed paralysis on POD 4 after catheter removal
- The patient completely recovered

Correlation does not imply Causation.

Spinal Cord Edema in the Mouse Model

Canine Model 2008

Mouse Model 2010

Spinal Cord Edema in the Canine Model

First: CSF Drainage through an intrathecal Catheter

Second: Aortic cross clamping and ligation of 3 pairs of intercostal arteries
The ischemic change is evident by Edema, Neuronal Loss and Endothelial Cell Swelling/Recruitment of Inflammatory Cells in the blood vessels.

H&E Staining of the spinal cord tissue

Control Dog                              Aortic Cross Clamp Dog

The lateral horn

Pyruvate Dehydrogenase Staining
(Key protein in aerobic cell metabolism)

Control Dog                              Aortic Cross Clamp Dog

Ventral column                           Ventral column

Dorsal column                           Dorsal column

Ventral horn                            Dorsal horn

lateral horn                            dorsal horn

• Marked disruption of lateral horn
• Relative sparing of ventral horn

MRI of the Spinal cord in the canine model

T1W post-contrast images (Multihance) showing high signal intensity lesions in the spinal cord after ACC.

Future Directions:
• Thoracic Endovascular Placement (TEVAR) in the canine model and assessment of histological damage in the spinal cord.
• Assessment of CSF markers in open and endovascular repair after spinal cord injury.

Thank You! Go Bucks!