Etiology of Paraplegia after TEVAR

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Disclosures

• I have no conflicts of interest
Paraplegia after TEVAR

• Paraplegia
  ➢ Crawford reported a 30% incidence of paraplegia for open repair of Type II aneurysms with no intercostal reimplantation
• Paraplegia

Since extensive endografting of the thoracic aorta necessarily covers multiple intercostal arteries, one might expect to see paraplegia with a similarly high frequency.
**Paraplegia after TEVAR**

• **Paraplegia**
  
  ➢ Our experience, and that of others, does not reflect the same high incidence of paralysis as reported by Crawford, despite extensive coverage of the thoracic aorta
Paraplegia after TEVAR

• Etiology
  ➢ Acute paraplegia
    • Coverage of critical intercostal artery
    • Left subclavian
    • Intercostals
    • Hypogastric
    • Embolization
Intercostal reimplantation
Paraplegia after TEVAR

Acute Onset
Embolization
Paraplegia after TEVAR

Delayed onset paraplegia

- Decreased perfusion
  - Hypotension intra-op or post-op
  - Marginal collaterals
  - Delayed closure of endoleak

- Cytokine activation with secondary neuronal injury
Paraplegia after TEVAR

- 127 patients
- 3 of 127 pts (2.4%) developed spinal cord ischemia
  - No acute paraplegia
  - All delayed onset – PO day 1, 3 days, 6 weeks
Paraplegia after TEVAR

Patient #1

- Etiology - Hypoperfusion
  - Excessive anti-hypertensive medication
Patient #1

- 76 y/o male with previous AAA repair
- Underwent TEVAR
- 32 cm length covered
- Neurologically normal post-op
- 6 weeks later developed paraplegia
- CSF Drainage, BP elevation
- Return of neurologic function
Paraplegia after TEVAR

Patient #1

- Returned again 6 weeks later, 3 days after onset of paraplegia
- No response to CSF drainage
- Remained with permanent paraplegia
Patient #2

- Etiology - Delayed occlusion of critical intercostal artery
  - Closure of endoleak with thrombosis of collateral artery
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Patient #2

- 72 y/o male with previous AAA repair
- Underwent TEVAR of thoracic aneurysm
- Type II endoleak noted on completion angiography
- Discharged PO day #1 with normal neurologic exam
Paraplegia after TEVAR

Patient #2 – Post-op

Type II endoleak
Patient #2

- 3 days post-op had sudden onset of back pain
- Presented to ER and CT scan obtained
- No endoleak
- No expansion of aneurysm
- TEVAR intact without migration
- Discharged from ER
- Developed paralysis as he walked away
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**Patient #2**

CT Scan after Emergency Room visit

Endoleak has closed
Paraplegia after TEVAR

**Patient #2**

Interpretation:

- Endoleak maintained collateral flow to cord
- Back pain due to paraspinous myalgia when endoleak closed caused muscle ischemia
- Collateral flow insufficient to maintain adequate spinal cord perfusion
Patient #3

- Etiology – Reperfusion injury from activated cytokines
Patient #3

- 78 y/o female
- TAA: 8cm diameter, 16 cm length
- Coexisting 4cm AAA
- Comorbidity: COPD
- 2 devices needed for complete TAA exclusion
Gore Thoracic Excluder

Deployment Knob
(unscrew / steady pull)
Paraplegia after TEVAR

**Patient #3**

Misdeployment of the 2\textsuperscript{nd} device across the visceral segment of aorta

Wire in celiac artery
Paraplegia after TEVAR

**Patient #3**

- Device extracted via infra-renal aorta (40 minute visceral ischemia time)
- Tube graft repair of AAA
- Deployment of 2nd TEVAR in appropriate location
Paraplegia after TEVAR

*Patient #3*

*After awakening from anesthesia, neurological examination was normal*
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Patient #3

• Day after operation, left leg paralysis, right leg weakness noted
• Lumbar CSF drain inserted
• Dexamethasone IV
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**Patient #3**

- Complete resolution of neurologic sequellae by POD #3
- Discharged home POD #8, asymptomatic
- Normal examination at 18 mo follow-up
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Patient #3

- Delayed-onset Paraplegia
  - Prolonged gut ischemia with intra-operative activation of cytokines can result in secondary spinal cord injury (cord edema, apoptosis, direct cytokine injury, non-reflow phenomenon)
Thoracic Endografts

Tarlov Scores

- Aorta 12 mins.: 3.6 +/- 0.84 (p=.003)
- Aorta 12 mins. + SMA 10 mins.: 1.7 +/- 1.3 (p=.001)
- Aorta 12 mins. + SMA 12 mins.: 0.67 +/- 1.4 (p=.0009)

Legend:
- Blue: Aorta 12 mins.
- Green: Aorta 12 mins. + SMA 10 mins.
- Red: Aorta 12 mins. + SMA 12 mins.
Paraplegia after TEVAR

Etiology

- **Acute paraplegia**
  - Coverage of critical intercostal artery
  - Embolization

- **Delayed onset paraplegia**
  - Decreased perfusion (hypotension)
  - Delayed closure of endoleak
  - Cytokine activation with secondary neuronal injury
Paraplegia after TEVAR

Summary

- The use of CSF drainage is helpful in reversing neurologic symptoms in some patients
- We recommend routine CSF drainage as a precaution in patients with prior thoracic or abdominal aortic replacement
Paraplegia after TEVAR

Summary

➢ Since gut ischemia can increase the risk of paraplegia, we recommend against simultaneous “debranching” procedures at the time of TEVAR
Thank You
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