Spinal cord protection for thoracoabdominal aortic surgery

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No disclosures

"Twenty years in politics, Charlie, and no conflicts of interest. I feel I've missed the boat somehow."
Lesson 1

Geography & Points of Interest
Now
Tomorrow

Cambridge University Hospitals
The risk of paraplegia
Crawford classification n: 1509

15%  31%  7%  4%

Time

Just blame the Adamkiewick artery!
Location, location, location.....

Paraplegia

The collateral network

The collateral network

The collateral network

Native  48hs  120hs

Geisbusch et al. Imaging of vascular remodeling after simulated thoracoabdominal aneurysm repair. April 2012
The collateral network

simulated thoracoabdominal aneurysm repair. April 2012
The collateral network

Postoperative SCPP

Geisbusch et al. Imaging of vascular remodeling after simulated thoracoabdominal aneurysm repair. April 2012

47 hybrid thoracoabdominals
4.3% paraplegia
Open surgery does exist...

### Conditions Associated With Aortic Media Abnormalities

**Genetic**
- Marfan syndrome
- Ehlers-Danlos syndrome, vascular form
- Bicuspid aortic valve (including prior aortic valve replacement)
- Turner syndrome
- Loeys-Dietz syndrome
- Familial thoracic aortic aneurysm and dissection syndrome

**Inflammatory vasculitides**
- Takayasu arteritis
- Giant cell arteritis
- Behçet arteritis

**Other**
- Pregnancy
- Polycystic kidney disease
- Chronic corticosteroid or immunosuppression agent administration
- Infections involving the aortic wall either from bacteremia or extension of adjacent infection

ACCF/AHA/AATS/ ACR/ASA/SCA/SCAI/SIR/STS/SVM. Guidelines for the Diagnosis and Management of Patients With Thoracic Aortic Disease. March 2010
Known knowns

15%
31%
7%
4%

The facts

- Intraoperative ischemia
- Interruption of blood supply
- Long segments of unperfused aorta
- Cross clamp without distal perfusion
The facts

- Long segments of unperfused aorta
- Intraoperative ischemia - Interruption of blood supply
- Cross clamp without distal perfusion
- Oclusion of collateral supply
- Oclusion of segmental vessels
- Permanent interruption of cord blood supply

MAP
Keep it **complex**
• Spinal drain
  • Patient selection
  • Keep it clean!
  • Target CSF pressure before cross clamp (10-12 mmhg)
  • Continuous drainage vs intermittent drainage
  • Maintain SCPP > 60 mmhg
  • Remove after 48-72 hs
MEPS

- Highly sensitive (high negative predictive value)
- Limited specificity
- Help to detect flow stealing, cannula malposition, test collateral network
- Facilitate planning of segments preservation
Lower body perfusion

- Use your TEE skills / epiaortic
- Maintain MAP 60 mmHg? - SCPP 60 mmHg?
  Maintain the BP than you can!
- Repeat MEPs
- Maintain CSF pressure low during Xclamp
- Cool down a few degrees (33-34°)
- Communicate with perfusionist
Lower body perfusion

- Use your TEE skills / epiaortic
- Maintain MAP 60mmhg? - SCPP 60 mmhg?
  Maintain the BP than you can!
- Repeat MEPs
- Maintain CSF pressure low during Xclamp
- Cool down a few degrees (33-34°)
- Communicate with perfusionist
Perioperative care

• Aggressive correction of coagulopathy
• Maintain MAP > 70-80 mmhg (NA - ADH - AD)
• Keep MEPs as much as possible
• Maintain CSF drainage
• Sedation break
• Engage with critical care team
Maximisation of spinal cord protection

- Hypothermia
- Haemodynamic stability
- Preservation of collateral network (subclavian, hypogastric)
- CSF drainage
- MEPS/SSEP
- Perioperative risk awareness

- Exploitation of collateral network
- Two stage procedures (even for hybrid)
- Lower body perfusion
- Prevention of flow stealing
Gender Classification
Known unknown/ Aortic Arch surgery

- Cool down to 18-20°
- DHCA
- 20-40’
- Reperfuse
- Correct coagulopathy
Global warming

New suspects

1. Antegrade cerebral perfusion (400-1200 ml/min)
2. Heart perfusion 300-800 ml/min
3. Lower body ischemia
New suspects

1. Antegrade cerebral perfusion
2. Heart perfusion
3. Lower body perfusion

Aneurysm Replaced with Prosthesis
The facts

- Intraoperative ischemia
  - Interruption of blood supply
    - Long segments of unperfused aorta
    - Cross clamp without distal perfusion

- Permanenent interruption of cord blood supply
- Oclusion of collateral supply
- Oclusion of segmental vessels

MAP (Mean Arterial Pressure)
How warm is too warm..?

How warm is too warm..?

Ischemic Spinal Cord Damage After SCP @ 28C

Keep it cool..!

Propensity score (@ 28°):

- Risk of paraplegia up to 2.1% (8/377)
- As high as 18% if lower body ischemia > than 90 minutes

Symptoms:
- Imperceptible Muscular Weakness
- Clinical deficit
- Paraplegia

Known unknowns

- **AAR**
  - Sub-lethal ischemia
  - Intact collateral network
  - Uncomplicated anatomy
  - 24-28°
  - **AAR**
    - Sub-lethal ischemia
    - Intact collateral network
    - Complicated anatomy
    - 20-24°
  - **AAR**
    - Sub-lethal ischemia
    - Disable collateral network
    - Complicated anatomy
    - 18-20°

Aorta working group guideline - Papworth Hospital 2013
Known unknowns

**AAR**
- Sub-lethal ischemia
- Intact collateral network
- Uncomplicated anatomy

Aorta working group guideline - Papworth Hospital 2013
Medico legal issues

• Multidisciplinary team approach for patient selection and intra-operative care
• Discuss with the patient the risk of spinal injury: paraplegia, paraparesis, nerve damage
• Risk associated to anaesthetic approach: spinal drain complications.
• Document spinal core protection strategy and information shared with patient
• Zero tolerance with MEPs (surgeon has to investigate!)
• Documentation, documentation, documentation!
Conclusion

• Risk assessment - Make a plan for cord protection (MDT discussion)
• Perfuse all “perfusable” tissue
• Advance end organ monitoring (NIRS, MEPs, SCP, Femoral pressure)
• Adapt to dynamic changes
• Maintain standards postoperatively for 48-72 hs.
• Manage patients expectation / Good documentation
Temporal Length & It's Aphorisms
Thank you
The List

- Anatomy
  - segmental perfusion / spinal collateral network
- Know knowns - known unknowns
  - DTAAr / AArch rep / TEVAR
- Monitoring
  - MEPs / cerebral oxymetry
- Bundle of care for spinal protection
  - Spinal drainage / distal perfusion / T°
- Peri-operative care
- Medicolegal implications
Adamkiewick artery