Medical Management of Neuropsychological Issues Associated with Mechanical Circulatory Support

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Disclosures
• Site Co-investigator for North American Berlin Heart Trial
• No financial compensation

Objectives
• Define incidence of neurological complications of mechanical circulatory support
• Discuss management/outcomes of neurological complications
• Discuss psychological impact of circulatory support in pediatrics

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Neurological Complications of MCS

- Incidence/Risk
  - Patient/Disease Factors
  - Device Dependent

Neurological Complications of MCS

- Patient/Disease Factors
  - Size
  - Age
  - Physiology
  - Prior Surgeries
  - Inflammation/coagulation

Neurological Complications of MCS

- Device Dependent
  - Paracorporeal/Intracorporeal
  - Pulsatile/Continuous flow
Neurological Complications of MCS

• Paracorporeal vs. Intracorporeal

• Paracorporeal Pulsatile Devices
  • 1st generation assist devices
  • Long cannulas
  • Inlet/outlet valves
  • Only device available for small children (<5 yo)

Neurological Complications of MCS

• Pulsatile Devices - Adult Outcomes (early 2000's)
  › 16-25% incidence of stroke, 0.44-0.88 events/patient year
  › 0.05 events/patient year in medical arm
  › 44% reduction in stroke or death with VAD

Kaplan-Meier analysis of stroke-free survival in LVAD group and group that received optimal medical therapy (OMT). Follow-up took place for 672 days. Circles depict censored patients whose follow-up was <672 days.
Neurological Complications of MCS

- Pulsatile Devices-Pediatric Outcomes (2000’s)
  - Neurologic dysfunction in 29%, 0.5 events/100 days supported (1.8 events/patient year)

Lazar et al. Circulation 2004

- Are we getting better?


- Continuous Flow Devices-Adult Data
  - Heartmate II trial
    - 0.13 vs. 0.22 events/patient year
  - Heartware HVAD trial
    - 14.8% with stroke; 0.18 events/patient year
    - After change in protocol (increased aspirin dose)
      - 9.4% with stroke; 0.13 events/patient year

Slaughter et al. NEJM 2009

Neurological Complications of MCS

- Continuous Flow Devices-Pediatric Data

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Treatment and Outcomes

- Neurologic Critical Care
  - Prevent extension of injury
    - Brain swelling in closed compartment
    - Maintain cerebral blood flow
      - CPP = MAP - ICP
      - ICP \( \geq \) CVP
    - Seizures
    - Pump change??

- Hemorrhagic Conversion
  - Dreaded complication
  - Delicate balance
    - Clot vs. Bleed
Treatment and Outcomes

- Hemorrhagic Conversion - Management
  - Neurosurgical consultation
  - Consideration for intervention
  - Hold all anticoagulation
  - Transfusion support
  - Change pump as needed
  - Careful re-initiation of anticoagulation

- Thrombolytic Therapy
  - One pediatric case report - successful
  - Adult data focuses on pump thrombosis
    - Case reports/series - mostly positive
  - Adult post-cardiac surgery stroke
    - One small series
    - 5 of 13 (38%) showed improvement
    - One hemotorax, two others needed transfusion

- Maximize recovery - Rehabilitation

- Outcomes
  - Adult VAD trials: 25-50% mortality with stroke
    - Hemorrhagic doubles mortality
  - Berlin Heart Trial
    - 33% of deaths attributed to neurologic insult
    - 29% mortality in patient with neurologic insult
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Psychological Impact of MCS

- Depression
- Anxiety
- Self-image
- Constant Waiting

Reynard et al. Am J Cardiol 2014

Psychological Impact of MCS

- Depression/Anxiety—Adult Data
- Improves with implant
- Stable for 1 year
- Mirrors QOL scores

Reynard et al. Am J Cardiol 2014
Psychological Impact of MCS

- Depression/Anxiety
  - 5/8 with psychiatric disorder at 1-2 months
    - 2 Adjustment with depressive/anxiety, 1 anxiety, 2 major depressive disorders
  - Slight improvement at 6 months
  - No symptoms in 2 pre-school children

Reynard et al. Am J Cardiol 2014

Ozbaran et al. Psychosomatic Medicine 2012
Psychological Impact of MCS

- Treatment
  - High use of psychotropic medications
    - 28.8% on antidepressants
    - 19.7% on anxiolytics
    - 1.5% on atypical antipsychotics
  - Standardized counseling can help

- Caregivers (spouse)
  - PTSD in 23% of partners (average of 6 years later)

- Mothers
  - BDI score 20.7 to 14.4 from 1 to 6 months
  - 6 of 8 > 17 → high depressive symptoms
  - Down to 1 of 8 at 6 months
  - Similar trend in anxiety scores
    - 8/8 moderate at 1 month, 3/8 severe

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