DHCA IN A PATIENT WITH KNOWN COLD AGGLUTININ ANTIBODIES

Elizabeth Lucci
What is it?

- A type of autoimmune hemolytic anemia
- Cold-reactive antibodies are directed against erythrocytes
- Usually IgM immunoglobulins
- Binding of the antigen-antibody complexes causes the red cells to “clump” (agglutinate)
- Diagnosed with a positive Direct Coombs Test (DAT)
- 0.02%-0.3% incidence rate
Complications

- Once red cells agglutinate:
  - Hemolysis*
  - Anemia*
  - Vessel obstruction*
  - Hemoglobinuremia
  - Renal dysfunction
  - Cardiac dysfunction
  - Etc...
Patient History

Parameters

- 65-year-old male
- 102.1 kg and 175.9 cm (BSA = 2.23 m²)
  - No history of cold agglutinin antibodies at previous cardiac surgery
- Oropharyngeal cancer treated with chemoradiation (2017**)
  - Evidence of anemia and agglutination

Presentation upon coming to CCF

- Aortic root dilation
- Proximal descending aneurysm beginning right after the previous graft
  - Arch and descending
- 2+ Tricuspid regurgitation
Suspected agglutination

- Patient was anemic when undergoing chemoradiation
  - *Due to radiation > hemolysis*
  - *Agglutination suspected*

- Blood tests and titers were done upon arrival to Cleveland Clinic

- Direct antiglobulin (Coombs) test positive for 2+ complement (C3) and negative for IgG

- Slightly elevated levels of IgM

- 22C (Critical temperature) and 4C at titers of 64 and 256 respectively
  - *Weak reactivity at 37C*
Proposed Surgery....

- REDO
- ARCH REPLACEMENT
- FET
- ASCENDING GRAFT REPLACEMENT w/ ROOT REPAIR
- TRICUSPID VALVE REPAIR

HOW DO WE CIRC ARREST ON A PATIENT WITH COLD AGGLUTININ ANTIBODIES ACTIVE AT 22C???
Preparation is key!

- Patient: Plasmapheresis
- Surgeon: Experienced, quick
- Perfusion: Knowledge of procedure, team work with surgeon
Temperature Management

- Normal DHCA temperature: 16-20°C
- Critical temperature: 22°C
- Stayed at 24-25°C for the duration of the case
  - Arterial and venous blood temperature*
  - Nasopharyngeal
  - Bladder
  - Swan
- Monitor temperature, did not pack head with ice, blood products if given needed to be put through a warmer
Cardioplegia Management

- Microplegia with syringe pump (Medfusion 3500)

- Continuous-moderately hypothermic antegrade infusion (25C)

- 280 mL/hr: induction

- 15-40 mL/hr: maint.

  - Cardioplegia pump flow:
    - ~350 mL/min induction
    - ~100 mL/min maint.
DHCA Management

- Axillary arterial and bicaval venous cannulation

- Antegrade cerebral perfusion through an axillary graft at ~1LPM
  - Adjusted accordingly to cerebral oximetry
  - Targeted flow 10mL/kg is guideline

- Normal DHCA temperature: 16-20C

- “Deep” hypothermic circulatory arrest
  - 24-25C
Procedure

- Cannulated, initiated bypass, and began cooling
- X-clamped; asystole was achieved through antegrade microplegia
- Secured FET graft
- Stent LSCA
- Replace arch
- Recannulate arterial cannula into side graft to restore flow to body and rewarming began
- Replaced the ascending graft
- Continuous microplegia was stopped
- Remodel root
- Retrograde microplegia given to help deair the aorta
- X-clamp taken off to help rewarm and restore cardiac activity while tricuspid ring was put in place
Procedure Times

- Cooling: 40 min
- Circ arrest w/ antegrade cerebral perfusion: 55 min
- Rewarming: >60 min
- Total x-clamp time: 145 min
- Total pump time: 208 min
Important Lab Values

- K+ stayed below 6 mEq/L

- Lactate reached 6.1 mmol/L immediately following DHCA, but was reduced to 3.5 mmol/L before weaning from bypass

- Cerebral oximetry was above baseline for the duration of DHCA
  - (40% SO2 for the left side and 35% SO2 for the right side)

- pO2 dropped <200 mmHg immediately following DHCA but increased with reperfusion and washout of body
  - pCO2 also increased but was quickly managed with sweep
Post-operative Outcome

- The patient was kept intubated and taken to the ICU
- Slight AKI with a mildly elevated serum creatine levels which was treated with Lasix
- Extubated POD 1
- Started on warfarin POD 8
- Discharged POD 11 with no other complications
Conclusion

- Cold agglutinins might not be as difficult to manage with proper preparation

- Is 18C necessary?

- Protocols, experience, pre-operative diagnosis, and knowledge of disease significantly increase good outcomes of patients with cold agglutinins undergoing cardiac surgery
Resources


- Sigbjørn Berentsen, Klaus Beiske & Geir E. Tjønnfjord (2007) Primary chronic cold agglutinin disease: An update on pathogenesis, clinical features and therapy, Hematology, 12:5, 361-370, DOI: 10.1080/10245330701445392