To MUF or Not to MUF: What is the Data Showing Us?

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Is there any difference in data when comparing conventional ultrafiltration (CUF) to modified ultrafiltration (MUF) in pediatrics?

That is the question!

Modified Ultrafiltration After Pediatric Cardiac Surgery: A Systematic Review
Systematic literature review of randomized control trials on pediatric patients comparing results between Modified Ultrafiltration (MUF) to Conventional Ultrafiltration (CUF)

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Study Criteria

**Inclusion**

- Randomized Clinical Trials that had two separate arms comparing MUF vs. CUF
- Patients under 18 years old undergoing cardiopulmonary bypass

**Exclusion**

- Observational studies
- Case studies
- Cross over trials
- Quasi-randomized trials

Study Characteristics

- Conventional Ultrafiltration (CUF)
  - 387 randomized patients CUF only
  - Age range of 2-76 months

- Modified Ultrafiltration (MUF)
  - 509 randomized patients MUF only
  - Age range of 2-73 months

- 896 patients in 15 accepted publications
- Patient sample size ranged from 19-261 patients with average of 28 patients per study
- Study publications ranged from 1991-2008
- Meta-analysis could not be done due to significant cross study heterogeneity
11/15 Studies Reported ICU Length of Stay (LOS)

- Decrease in LOS with MUF: 8
- No significant difference in LOS: 3

13/15 Studies Reported on Ventilator Duration

- Decrease Ventilation Time with MUF: 7
- No Significant Difference: 6

9/15 Studies Reported on Blood Transfusion

- Decreased Blood Transfusion with MUF: 3
- No Difference Between MUF and CUF: 6
**Post-Op Hematocrit**

- **7/15 Studies Reported 1 hr Post-op Hct**
  - 9 Higher Hct with MUF
  - 2 No Difference
- **3/15 Studies Reported 48 hr Post-op Hct**
  - 2 Higher Hct with MUF
  - 2 No Difference

**6/15 Studies Reported on 24hr Post-Op Blood Product Administration (FFP, Platelets)**

- 24hr Post Op Blood Product Administration
  - 1 Decreased Blood Product Administration with MUF
  - 3 No Difference Between the Studies
  - 1 Increased Blood Product Administration with MUF

**7/15 Studies Reported on 48 hr Chest Tube Drainage**

- Chest Tube Drainage in first 48hrs
  - 2 Less Chest Tube Drainage with MUF
  - 1 Increase Chest Tube Drainage with MUF
  - 4 No Difference Between Studies
Other Outcomes

- **Length of Hospital stay (HLOS)**
  5/15 studies reported - No significant HLOS difference between the two groups

- **Mortality**
  11/15 studies reported on mortality - No significant difference in mortality between the two groups

- **Cytokines (IL6, IL 8, elastase, TNF)**
  4/15 studies reported - No difference in 24 hr post surgery

- **Post-op Creatinine**
  3/15 studies reported - 1 reported higher Creatinine w/MUF, 2 reported no difference

Summary of Studies

- **Leaning Positive for MUF**
  - Chest Tube Drainage
  - Blood Transfusions
  - Post-Op Blood Products
  - 48 hr Post-Op Hct

- **No Difference MUF and CUF**
  - Hospital LOS/ ICU LOS
  - Mortality
  - Cytokines
  - Creatinine
  - 1 Hour Post-Op Hct
  - Ventilatory Duration

Herding Cats-Problems with the Study

- Significant heterogeneity between studies - could not perform meta-analysis
  - Wide variety between protocols, reporting methods, age of studies 17 year spread

- Studies focused on very different parameters. High parameter report - 13/15 ventilatory duration to low report - 3/15 on 48 hr Hct

- Sample size - Only included Randomized Control Trials - Too rigid?
Study was Influenced by Lack of Standardization in Reporting

- Pathology - Defect? Cyanotic disease? Pulmonary hypertension?
- CPB technique - CPB components, Coated circuits, Prime, I/O, Pump times, Cross clamp times, DHCA?
- Meds - Antifibrinolytics - Aprotinin, Amicar, Steroids?
- MUF technique - Time, volume in/out, type of filter, A/V or V/V MUF?

What Does This All Mean?
Inconclusive Results

To MUF or Not to MUF - What’s Next?

- Multi-center Randomized Control Trials
- Standardization in outcomes reporting
- Transparency reporting clinical practice techniques and patient data
- Longer term and patient specific outcomes
- Impact of DUF/ZBUF on outcomes
- Look at other outcomes? COP, inotrope score
- Fresh new look at MUF vs. CUF - Data based from old studies
Lurie Children’s Hospital of Chicago Non-Scientific Modified Ultrafiltration Opinion

• Maximizes Hct before anesthesia hemodilutes patient!
• Allows time for hemodynamics to stabilize post CPB
• Allows time for fine tuning of ventilation status and inotrope support (semi-support state)
• Down time - Evaluation of surgical repair via TEE

Lurie Children’s Hospital of Chicago Ultrafiltration Approach

• CUF on CPB to maintain Hct of 30%
• ZBUF during rewarming or to normalize K+
• MUF attempted on every case - 10 minutes
• Exceptions: Heavy bleeding and single ventricle cases where Hct is greater than 42%

Thank You!