The effects of surgery, anesthesia, and cardiopulmonary bypass (CPB) can have drastic effects on the pulmonary system, making postoperative respiratory events some of the most prevalent complications after cardiac surgery. Because of the immaturity of their respiratory system, infants with critical congenital heart disease (CHD) requiring surgery within their first year of life are at an even higher risk. Two potential avenues for prognosticating patients most at risk for post-CPB respiratory dysfunction is that of assessing MCC in patients with cystic fibrosis that is of functional nuclear imaging. Using nebulized radiolabeled particles, serial imaging with a gamma camera can be used to measure MCC. We hypothesized that poor mucociliary clearance would be associated with worse postoperative outcomes in infants with CHD patients undergoing cardiac surgery with CPB.

**INTRODUCTION**

Mucociliary clearance in infants undergoing congenital cardiac surgery

**KEY BACKGROUND POINTS**

- Pulmonary complications remain highly prevalent after congenital cardiac surgery and have even resulted in death.
- Functional nuclear imaging has been used to quantitatively investigate respiratory mucociliary clearance in patients with cystic fibrosis.

**METHODS**

- We enrolled 19 newborns admitted to the CICU
- Patients received nebulized technetium sulfur colloid
- MCC scan performed using Digirad Ergo™ portable gamma camera (Poway, CA) by continuous imaging for 30 minutes
- Pre-, intra- and postoperative variables were collected for each infant from the values obtained just prior to surgery through those obtained right up until discharge from their initial CICU postoperative admission.

**RESULTS**

Figure 1. MCC scan conducted pre- or postoperatively in CHD patients undergoing cardiac surgery with CPB. (A) Aerosolized technetium sulfur colloid imaged over 30 mins. (B) Higher clearance observed in preop vs. postop scans. (C) Composite retention curves show clearance is observed in the preoperative scans but not in the postoperative scans.

Figure 2. Relationship between preoperative MCC and several postoperative variables. (A) Preoperative MCC showed the strongest relationship with the CICU LOS (r = -0.965, p = 0.008). Also significantly negatively correlated were (B) postoperative days requiring milrinone (r = -0.95, p = 0.013) and (C) dexamethasone (r = -0.903, p = 0.036) infusions, (D) duration of open chest (r = -0.894, p = 0.041), and (E) drain output for the first 24 postoperative hours (r = -0.917, p = 0.029).

Figure 3. Picture showing inhaled radioactive technetium immediately after administration of the nebulized technetium-99m tracer via hand ventilation. Minimal interruption of mechanical ventilation for administration of the nebulized technetium-99m tracer via hand ventilation. Otherwise, all routine care progresses uninterrupted.

**SUMMARY**

- There were significantly strong correlations between preoperative mucociliary clearance and several postoperative variables, most notably initial CICU LOS.
- Functional nuclear imaging can safely be implemented in critically ill neonates at the bedside in the ICU setting.

**LIMITATIONS**

- Small sample size
- Heterogeneous sample with a wide spectrum of congenital heart defects

**APPLICATIONS**

- Preoperative MCC scanning may help to prognosticate infants most at risk for postoperative pulmonary complications.
- Identifying at-risk infants prior to congenital cardiac surgery can facilitate earlier implementation of pulmonary interventions and improve perioperative outcomes.

**REFERENCES**


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