

Redesign Cardiac Surgery to Reduce Neurological Injury

Scope of the Problem: Neurologic injuries are frequent and devastating complications following cardiac surgery. Current work by our group has identified that the causes (thrombotic/lipid emboli, cerebral hypoperfusion & hypotension, and gaseous emboli) of these injuries are byproducts of processes of surgical and perfusion care.

Goal: Our goal is to identify modifiable clinical strategies and techniques of surgical and cardiopulmonary bypass (CPB) care associated with the causes of neurologic injury secondary to coronary artery bypass graft (CABG) surgery, and subsequently to redesign these processes to reduce a patient's risk of a neurologic injury.

Strategies/Activities:

1. Determine the effectiveness of redesigning CPB in reducing microemboli (Maine Medical Center)
 - Strategy
 - i. Link in real-time processes of clinical care with mechanisms of brain injury
 - Activities
 - i. Our initiatives have resulted in an 87.9% reduction in microemboli detected in the outflow of the CPB circuit, and a 75.8% reduction in microemboli detected in the cerebral arteries.
 - ii. Changes in the CPB circuit have lowered the CPB outflow count presently to below the cerebral microemboli count.
2. Determine the association between surgical aortic management strategies and microemboli (Catholic Medical Center)
 - Strategy
 - i. Identify opportunities to prevent microembolic activity, especially during proximal anastomotic techniques during off-pump surgery
 - Activities
 - i. Preliminary findings suggest microemboli occur during discrete processes of clinical care associated with the use of proximal anastomotic device usage
3. Determine the association between perfusionist interventions and gaseous microemboli (Dartmouth-Hitchcock Medical Center)
 - Strategy
 - i. Identify alternative strategies for blood sampling and medication injection
 - Activities
 - i. Preliminary findings suggest that CPB equipment eliminates most microemboli ≥ 40 microns in size, thereby reducing their likelihood of being delivered to the patient.

Progress:

1. Disseminate more broadly the findings from Maine Medical Center.
2. Create quality improvement working groups at Catholic Medical Center and Dartmouth-Hitchcock Medical Center to understand better the opportunity for disseminating generalizable knowledge to other NNECDSG medical centers.
3. Apply and secure funding to support current work, as well as conduct neuroimaging and neurobehavioral testing.