

Section 4: Operative Strategies

Translating Strategies to Protect the Brain

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Types & incidence of neurological injury in cardiac surgery

- Stroke

Major focal injury

Incidence: 1.5 - 4% or higher. **Mortality increases x3**

- Encephalopathy

Global injury: spectrum from coma to general dysfunction

Incidence: 5% or higher. **Mortality increases x2 or more**

- Delirium

Transient confusion, without detectable new CNS injury

Incidence: 10 - 20% or higher. **Increased morbidity**

- Cognitive Dysfunction

Also transient, but persistent new dysfunction uncommon

Incidence: about one-third of patients. **Increased anxiety.**

Risk factors for neurological injury in cardiac surgery

- Patient-specific risk factors
 - Older age, extent of atherosclerosis, prior CVA, hypertension, diabetes, LV dysfunction, neurodegenerative disease
- Procedure-related risk factors
 - Time on CPB, hyperglycemia, hypoperfusion, microemboli, hyperthermia, severe anemia, CPB-induced systemic inflammatory cascade
- Procedure-specific risk factors
 - Manipulation of atheromatous aorta, percutaneous catheters, circulatory arrest, VADs

Current mitigation strategies to reduce neurological injury in cardiac surgery

- Before surgery

Identify patient's risk profile for CNS injury; utilize cerebrovascular and CNS imaging; alter surgical procedure as needed; pretreat with drug therapy

- During surgery

Optimize aortic manipulation (epi-aortic US); single clamp; maintain higher perfusion pressure & hematocrit; avoid hyperglycemia & hyperthermia; employ alpha-stat pH management; avoid cardiotomy blood; use arterial line filters

- After surgery

Maintain adequate blood pressure-perfusion pressures; maintain hematocrit; avoid hyperthermia; treat atrial fibrillation; be early to obtain MRI diffusion and perfusion-weighted imaging studies

Notable knowledge gaps in causes, prevention & treatment of neurological injury in cardiac surgery

- Causes

Mechanisms of 2^o ischemic brain injury and/or impaired post-ischemic recovery; nature of the increased susceptibility of the aging brain; role of micro emboli

- Prevention

Effective neuro-protective drugs; more accurate patient risk assessments, including pre op MRI; even safer CPB; better CBF & brain oxygenation management perioperatively; effective deflection or exclusion of emboli

- Treatment

Lack of reliable biomarkers of CNS injury; role of early MRI imaging; benefits of neurovascular interventional Rx post-op; role of reperfusion strategies

Most compelling scientific gaps re neurological injury in cardiac surgery

- **Basic Scientific Discovery**

 - Effective neuroprotective agent or drug**

- **Translational Science**

 - Strategies to mitigate cerebral embolization**

- **Clinical & Population Science**

 - Clinical trials in elderly & high risk patients to assess optimal management strategies**