ICU Management of Minimally Invasive Cardiac Surgery

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Disclosure(s)

- None financial
Agenda

- In patients who have undergone minimally invasive cardiac surgery:
  - How do they look different upon arrival to the ICU
  - What are ICU goals and how do they differ from other CTS patients?
  - How does strategy for pain management differ in ICU
  - What are some of the particular emergencies for which these patients are at risk
Is care for these patients just “mini” (or less)?

- Yes (and no....)
- Patients expect:
  - Shorter hospital stay (faster recovery)
  - Less pain
  - Earlier mobility and quicker return to preop fxn
  - Less complications

Picture credit: Salil Shah, MD
Are outcomes predicated on a faster procedure?

Right anterior minithoracotomy versus conventional aortic valve replacement: A propensity score matched study

Mattia Glauber, MD, Antonio Miceli, MD, PhD, Daniyar Gilmanov, MD, Matteo Ferrarini, MD, Stefano Bevilacqua, MD, Pier A. Farneti, MD, and Marco Solinas, MD

JTCVS 2013; 145(5):1222-6

• Retrospective, observational, propensity matched

• AVR via right minithoracotomy vs full sternotomy
Why do these patients recover faster?

<table>
<thead>
<tr>
<th>Outcome</th>
<th>RT (n = 138)</th>
<th>FS (n = 138)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mortality (n)</td>
<td>1 (0.7)</td>
<td>1 (0.7)</td>
<td>1</td>
</tr>
<tr>
<td>Stroke (n)</td>
<td>1 (0.7)</td>
<td>2 (1.5)</td>
<td>1</td>
</tr>
<tr>
<td>Reexploration for bleeding (n)</td>
<td>9 (6.5)</td>
<td>6 (4.3)</td>
<td>.6</td>
</tr>
<tr>
<td>New-onset postoperative AF (n)</td>
<td>25 (18.1)</td>
<td>41 (27.9)</td>
<td>.03</td>
</tr>
<tr>
<td>Blood transfusions (n)</td>
<td>26 (18.8)</td>
<td>47 (34.1)</td>
<td>.006</td>
</tr>
<tr>
<td>Wound infection (n)</td>
<td>0</td>
<td>1 (0.7)</td>
<td>1</td>
</tr>
<tr>
<td>Ventilation time (h)</td>
<td></td>
<td></td>
<td>.004</td>
</tr>
<tr>
<td>Median</td>
<td>6</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>Range</td>
<td>5–9</td>
<td>6–11</td>
<td></td>
</tr>
<tr>
<td>Hospital stay (d)</td>
<td></td>
<td></td>
<td>.02</td>
</tr>
<tr>
<td>Median</td>
<td>5</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Range</td>
<td>4–6</td>
<td>5–7</td>
<td></td>
</tr>
</tbody>
</table>
Why do these patients recover faster?

Better outcomes are predicated on a team approach:
- Surgeon
- Anesthesia
- Periop support
- ICU management

Maybe that’s just true for younger patients.....
Minimally Invasive Versus Sternotomy Approach for Mitral Valve Surgery in Patients Greater Than 70 Years Old: A Propensity-Matched Comparison

David M. Holzhey, MD, William Shi, Michael A. Borger, MD, PhD, Joerg Seeburger, MD, Jens Garbade, MD, PhD, Bettina Pfannmüller, MD, and Friedrich W. Mohr, MD, PhD

- Retrospective, observational, propensity-matched
- 1,027 patients (> 70 years)
  - Propensity-matched 143 vs 143

<table>
<thead>
<tr>
<th>Variables</th>
<th>Minimally Invasive (n = 143)</th>
<th>Sternotomy (n = 143)</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intraoperative results:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Length of surgery (minutes)</td>
<td>186 ± 61</td>
<td>169 ± 59</td>
<td>0.01</td>
</tr>
<tr>
<td>Cardiopulmonary bypass time (minutes)</td>
<td>142 ± 54</td>
<td>102 ± 45</td>
<td>0.00001</td>
</tr>
<tr>
<td>Cross-clamp time (minutes)</td>
<td>74 ± 44</td>
<td>64 ± 28</td>
<td>0.015</td>
</tr>
<tr>
<td>Minimum temperature (°C)</td>
<td>32 ± 3.7</td>
<td>32 ± 4.2</td>
<td>0.20</td>
</tr>
</tbody>
</table>

Ann Thorac Surg 2011; 91:401-5
Minimally Invasive Versus Sternotomy Approach for Mitral Valve Surgery in Patients Greater Than 70 Years Old: A Propensity-Matched Comparison

David M. Holzhey, MD, William Shi, Michael A. Borger, MD, PhD, Joerg Seeburger, MD, Jens Garbade, MD, PhD, Bettina Pfannmüller, MD, and Friedrich W. Mohr, MD, PhD

Cox regression: HR 1.8 (95%CI 0.42-7.9), p=0.43
Good outcomes in cardiac surgery require a team approach
How do minimally invasive patients differ from standard cardiac surgery patients on arrival to the ICU?

- Neurologic
- Pulmonary
- Cardiovascular
Arrival from the O.R.: Neurologic

- Less intraop sedation/NMB
  - Fentanyl equivalent approx. 10 mcg/kg
  - No (or minimal) re-dose of NMB post CPB
  - Inhalational agent just prior to OR departure (no continuous sedation)
  - Minimize benzodiazepines

*Prepare for rapid wake-up*
Arrival from the O.R.: Cardiovascular

- Arterial line, CVC
- +/- PAC
- +/- Intraoperative TEE
- Rapidity of vasopressor/inotrope wean dependent on post-CPB function (and degree of vasoplegia)
- Often hypovolemic out of OR
Arrival from the O.R.: Pulmonary

- ETT (may have exchanged DLT). May be none (MIDCAB)
- Lung protective ventilation
- Reversal of NMB (after clear CXR)
- Close follow-up CT output

Prepare for rapid extubation
What are the ICU goals for the minimally invasive patient?

Neurologic  Pulmonary  Cardiovascular

Other
ICU Goals: Neurologic

- Early (POD 0)
  - Minimize sedation
  - Reversal of NMB

- Late (POD 1→)
  - Multimodal pain therapy (TBD)
  - Early mobility (POD-1)
  - Focus on minimizing delirium (pharm and non-pharm)
ICU Goals: Cardiovascular

• Early (POD 0)
  • Minimize HD lability
  • Volume replete as necessary
  • Electrolyte repletion

• Late (POD 1 →)
  • Removal of CTs
  • Anti-platelet (CABG), anticoagulation (afib, MVR)
  • Beta-blocker, statin
  • ACE-i (if low LVEF or on preop)
ICU Goals: Pulmonary

• Early (POD 0)
  • Minimize atelectasis
  • Extubate
  • Incentive spirometry
  • Avoidance of hypoxia/hypercarbia

• Late (POD 1→)
  • Early mobility
  • Chest PT
  • Diuresis
ICU Goals: Other

• Glycemic control
• Maintenance of normothermia
• De-escalation of therapy
• Removal of lines/foley
• Early nutrition
• Mobility, mobility, mobility.....
TAVR Specific Concerns in ICU

- Monitor limb perfusion (from access catheters)
- Renal function (intraop contrast)
- Conduction/Arrhythmias (up to 20% require PPM)
- Close neurologic monitoring
- Careful volume mgmt (typically very vol sensitive)
Pain management strategies in minimally invasive cardiac surgery
Assessment of pain: MIDCAB v OPCAB

Comparison of early and late quality of life between left anterior thoracotomy and median sternotomy off-pump coronary artery bypass surgery

Julian J. Nesbitt,1,2 George Mori3, Charlotte Mason-Apps2 and George Asimakopoulos2,4

<table>
<thead>
<tr>
<th>Table 1. Patient characteristics.</th>
<th>MIDCABG (n=17)</th>
<th>OPCAB (n=49)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>17 (100%)</td>
<td>42 (86%)</td>
<td>ns</td>
</tr>
<tr>
<td>Age (years)</td>
<td>65±12</td>
<td>65±9</td>
<td>ns</td>
</tr>
<tr>
<td>Elective</td>
<td>17 (100%)</td>
<td>45 (92%)</td>
<td>ns</td>
</tr>
<tr>
<td>Angina III or IV</td>
<td>2 (12%)</td>
<td>10 (20%)</td>
<td>P&lt;0.05</td>
</tr>
<tr>
<td>NYHA III or IV</td>
<td>3 (18%)</td>
<td>9 (18%)</td>
<td>ns</td>
</tr>
<tr>
<td>Good LV</td>
<td>16 (94%)</td>
<td>44 (90%)</td>
<td>ns</td>
</tr>
<tr>
<td>Add. EuroSCORE</td>
<td>3.8±2.6</td>
<td>3.7±2</td>
<td>ns</td>
</tr>
<tr>
<td>Mean Graft no</td>
<td>1.07±0.2</td>
<td>1.9±0.4</td>
<td>P&lt;0.05</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 2. (Oral analgesia at 3 weeks and 3 months).</th>
<th></th>
<th></th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analgesia</td>
<td>MIDCABG</td>
<td>OPCAB</td>
<td></td>
</tr>
<tr>
<td>3 Weeks</td>
<td>50%</td>
<td>82%</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>3 Months</td>
<td>8%</td>
<td>21%</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

Perfusion 2017; 32(1):50-6
Multimodal Analgesia

- Non-opioid adjuncts
  - Intravenous acetaminophen
  - Intravenous lidocaine
  - Gabapentin
  - $\alpha_2$-adrenergic agonists (e.g. clonidine)
  - Toradol (careful with CKD)
  - Bowel regimen with opioids
Other modalities (not as well studied in CTS)

- Intercostal blocks (sequential)
  - Approximately 4 mL of 0.5% bupivacaine per nerve
  - Infiltration of the inferior border of the rib near the proximal intercostal nerve
  - Can be performed under direct vision by the surgeon
  - Provides analgesia for approximately 12 hours
  - Requires supplemental analgesics because of the miss block of the posterior and visceral rami of the intercostal nerve
Other modalities (not as well studied in CTS)

- Paravertebral blocks
- Intrathecal
- Epidural
ICU emergencies for minimally invasive cardiac surgery
ICU Emergencies

• **Bleeding +/- tamponade** (sternal saw immediately available)

• Pulmonary edema (often unilateral)

• Arrhythmias (eval mA threshold of PWs from OR- may need TV pacer)

• TIA/Stroke

• Ischemia

• Respiratory failure (often pain related)

• Retroperitoneal hemorrhage (groin access)
Conclusion

• A smaller incision does not equal less care

• ICU management = team approach

• Expedite extubation, mobility, nutrition, etc- but be aware of common emergencies and **high-alert** for tamponade

• Multimodal analgesia is key for fast recovery
Thank You