Getting a Handle on the Challenge of Sternotomy Pain

Thomas M Hemmerling, MD, DEAA, MSc
Depts of Anesthesiology (McGill) & Biomedical Engineering (UdM)
Montreal, Canada

Learning objectives
- Efficient pain treatment as a pre-requisite for fast track techniques
- Modalities of intra-and postoperative pain management
- Different forms of regional/local anesthesia
- Example multimodal pain strategies

Efficient postoperative pain management after cardiac surgery
- Efficient postoperative analgesia is one of the most important milestones for achieving fast track cardiac surgery.
- Several analgesic techniques are available.
- Multimodal pain treatment is also the key to successful analgesia after cardiac surgery.

From acute po. pain to chronic pain after sternotomy
- Few studies have investigated the relationship between acute postoperative pain and chronic post-sternotomy pain; so far, results are inconclusive.
- However, chronic po. pain occurs in 10-25% of patients.
- Good po. pain control is still the key to uneventful recovery and might actually help to avoid some complications, e.g. respiratory.

Recent developments in cardiac surgery I
- Minimal Surgery: minimally invasive direct coronary artery bypass surgery, robotic surgery, or endovascular valve surgery
- ‘Physiological’ techniques – e.g. normothermic CPB as routine
- OPCAB
- Approaches other than via sternotomy (thoracotomy, port surgery etc.)

Recent developments in cardiac surgery II
- Fast track an ultra fast track anesthetic techniques
- Increased costs, need for early discharge from ICU
- Increasing age of patients with specific postoperative problems and need for early mobilization
- Multimodal pain strategy as routine in anesthesia
- ‘Arsenal’ of different regional approaches
Specific risks in old age

- Neurological complications:
  - Delirium
  - Post Operative Cognitive Dysfunction
- Malnutrition
- Loss of function and independence

Recent reviews – meta-analysis

- Ronald et al.
  - Intrathecal and Epidural Anaesthesia and Analgesia for Cardiac Surgery.
  - Anesth Analg 2006;102:457–68. (Aberdeen, UK)

- Chaney M.
  - Intrathecal and Epidural Anaesthesia and Analgesia for Cardiac Surgery.
  - Anesth Analg 2006;102:457–68. (Chicago, USA)

- Djaiiani et al.
  - Regional Anesthesia in Cardiac Surgery: A Friend or A Foe?
  - (Toronto, Canada)

Regional techniques – justification?

TEA and outcome

- Superior postoperative analgesia
- Shorter postoperative ventilation
- Reduced incidence of supraventricular arrhythmia
- Lower rates of perioperative myocardial infarction.
  - “The results of this analysis suggest that for each episode of neurologic complication, 20 myocardial infarctions and 76 episodes of atrial fibrillation would be prevented.”
- TEA: effective strategy that improves perioperative morbidity.

- Djaiiani et al. 2005

Risk of epidural hematoma

- Early or immediate extubation after cardiac surgery are only possible if efficient po. analgesia is achieved.
- As in other types of surgery, efficient postoperative analgesia accelerates the transfer from ICU to regular wards and ultimately LOS.

Fast track anesthesia protocols

- Djaiani et al. 2005
**Proposed Pathways in Cardiac Surgery**

- **Pathway 1**
  - High Thoracic Epidural installed immediately before surgery, T2-3, Naropin 2mg/ml at 6-10 ml/h for 2-3 days
- **Pathway 2**
  - Continuous Bilateral Paravertebral Blocks, T3/4 bilateral, Naropin 2mg/ml at 6 ml/h (each side) for 4 days
- **Pathway 3**
  - PCA morphine (1 mg; lockout 7 min) for 3 days

**Key message**

- Efficient analgesia after cardiac surgery necessitates a multimodal strategy, similar to other major types of surgery.
- The key period is the first 48h after surgery.
- Efficient analgesia facilitates fast track and ultra fast track strategies, early mobilization and might help to prevent complications.
- Efficient analgesia might also help to avoid the development of chronic postoperative sternotomy pain, but more studies are needed.
### Cardiac Surgery
**Without regional anesthesia (intravital)**

- **Induction**
  - Sufentanil 20-40 μg, propofol 1-2 mg/kg, rocuronium 0.9 mg/kg
- **Maintenance**
  - SEVO (BIS-titrated) in 50% oxygen/air
  - Sufentanil maintenance according to hemodynamics (0.1-0.5 μg/kg/h)
- **Extubation at the end of surgery or with 4h**
  - bolus of morphine 1.5 mg iv PRN, initiate PCA morphine

- **Induction**
  - Remifentanil 0.1-0.25 μg/kg/min, propofol 1-2 mg/kg, rocuronium 0.9 mg/kg
- **Maintenance**
  - SEVO (BIS-titrated) in 50% oxygen/air
  - Remifentanil maintenance according to hemodynamics (0.05-0.5 μg/kg/min)
- **Extubation at the end of surgery or with 4h**
  - bolus of morphine 1.5 mg iv PRN, initiate PCA morphine

### Cardiac Surgery
**With paravertebral blocks (intravital Opioid, dosage as described below)**

- **Induction**
  - Opioid, propofol 1-2 mg/kg, rocuronium 0.9 mg/kg
  - SEVO (BIS-titrated) in 50% oxygen/air
  - Opioid maintenance according to hemodynamics
- **Extubation at the end of surgery or within 4h**
  - Immediately after extubation
    - bolus of morphine 1.5 mg iv PRN, initiate PCA morphine
    - + Continuous Bilateral Paravertebral Blocks, T3/4 bilateral, Naropin 2 mg/ml at 4 ml/h (each side) for 3 days

### Simple strategies
- Multimodal strategies as basis of postoperative analgesia
- Intensive and efficient analgesia should be achieved for the first 48h – ‘main target period’
- NSAIDs, such as paracetamol, can safely be given during the immediate postoperative period (e.g. 1 g per day)
- All thoracic drain sites should be locally infiltrated during surgery.
- If TEA is used, it can be used solely for intraoperative and postoperative pain treatment.
- If SA is used, then intraoperative opioids might be necessary, but in a lower dose.
- Paravertebral or parasternal blocks provide additional analgesia but have little impact on intraoperative opioid consumption.

### Simple postoperative strategies
- All patients other than TEA-treated patients should have PCA-morphine or equivalent to auto-control their pain after extubation.
- Until extubation, short acting opioids, such as fentanyl, are preferable for fast track protocols.
- Continuous infusions of sufentanil or remifentanil po. Are described for the immediate ICU period, but might be less practical than conventional methods (nurse-controlled morphine or fentanyl followed by PCA)
Annexe

• Multimodal analgesic principles in cardiac surgery depend on good communication between all the health care providers, starting with the anesthesiologist in the operating room; this is especially important when regional techniques are used.

• Next slide shows an example of a communication sheet to be filled out by the anesthesiologist in the OR.

Appendix 1

Transfer sheet

<table>
<thead>
<tr>
<th>Attending regional cardiac anesthesiologist -&gt; ICU or PACU</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of anesthesia</td>
</tr>
<tr>
<td>IV fluids</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Regional/technique</th>
<th>Spinal anaesthesia</th>
<th>Local anaesthetic agent</th>
<th>\underline{ml}</th>
<th>\underline{%}</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Needle</th>
<th>Level</th>
<th>\underline{G}</th>
<th>\underline{G}</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Thoracic epidural anaesthesia</th>
<th>\underline{Test dose} \underline{ml}</th>
<th>\underline{%}</th>
<th>\underline{Catheter depth (skl level)}</th>
<th>TNA \underline{level}</th>
<th>\underline{Local anaesthetic agent} \underline{ml}</th>
<th>\underline{%}</th>
<th>\underline{Needle}</th>
<th>\underline{G}</th>
<th>\underline{Level}</th>
<th>\underline{Comments}</th>
</tr>
</thead>
</table>

| \underline{Catheter depth (skin level)} | \underline{TNA \underline{level}} | \underline{Local anaesthetic agent} | \underline{ml} | \underline{%} | \underline{Needle} | \underline{G} | \underline{Level} | \underline{Comments} |
|----------------------------------------|-------------------------------|----------------|----------------|----------------|----------------|----------------|------------------|

<table>
<thead>
<tr>
<th>Intermediate block</th>
<th>\underline{Unilateral}</th>
<th>\underline{Bilateral}</th>
<th>\underline{ml}</th>
<th>\underline{%}</th>
<th>\underline{Needle}</th>
<th>\underline{G}</th>
<th>\underline{Level}</th>
<th>\underline{Comments}</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Continuous infusion</th>
<th>\underline{ml/h}</th>
<th>\underline{at}</th>
<th>\underline{ml/h}</th>
<th>\underline{Start time}</th>
<th>\underline{End time}</th>
<th>\underline{Comments}</th>
</tr>
</thead>
</table>

Sinha et Hemmerling, 2008