

Pain Management After CABG

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- *Pain following cardiac surgery is common
- *moderate to severe in up to 75% of patients
- *prolong hospital stays
- *significant morbidity
- *psychology distress
- *chronic pain

Mechanisms of pain

- * Acute pain following cardiac surgery is
- * multifactorial in etiology
- * Skin incision
- * Dissection
- * sternal retraction
- * Preparation of the internal mammary artery graft
- * placement of chest drains
- * Endotracheal Intubation
- * Sternal wires
- * Release Pro-inflammatory mediators

- * Including nitric oxide & Cytokines
- * Mediators activate afferent nociceptive fibres
- Cause **nociceptive pain**

Nociceptive pain exaggerated

- * With cardiopulmonary bypass
- * Anaesthetic drugs
- * Sternal retraction
- * Harvesting of the internal
- * Mammary artery
- * Fracture ribs
- * Musculoskeletal pain
- * Costochondritis
- Pleuritic pain

Chronic pain most Inflammatory nerve injury **Neuropathic pain**

Adverse effects of pain

- *High levels of post-operative pain
- *Detrimental to recovery
- *Inhibits satisfactory coughing
- *Deep breathing
- *Mucus accumulation
- *Increased risk of atelectasis Pneumonia
- Pneumonia
- *prolonged hospital stays
- *mechanical ventilation
- *Antibiotics
- *less likely to be mobile
- *Sit upright
- *Comply with their physiotherapy
- *Muscle atrophy
- * increases heart rate elevates blood pressure
- *Hyperglycaemic state
- *Promote arrhythmias
- *Atrial
- *Fibrillation (AF)
- *Increase myocardial oxygen consumption

- ***ischaemic events**

- *Postoperative AF ranges from 29% to 63%

- * Anxiety

- * Worsening sleep

- * Exhaustion

- * low mood.

- * Severe or prolonged acute pain is a risk factor for the

- *Development

- *Of chronic pain, with 21–55% of patients developing

- *Chronic pain syndromes after cardiac surgery

- *Depression 30% of patients with chronic pain

- * Developing depression

Management of pain

- *Importance of using multi-modal analgesia in treating post-operative pain
 - * Combination of analgesics
 - *neuropathic Agents opioids paracetamol and/or non-steroidal drugs (NSAIDs)
- Antiinflammatory

Opioids

- *Initial primary analgesia Following cardiac surgery
- * Adverse effects in higher doses
- * Nausea, vomiting, pruritus, constipation and urinary retention
- * Respiratory complications
- * Decreased mobility
- * Increased drowsiness

- *Addiction
- *Exacerbate renal failure
- *Post-operative ileus
- *Patient controlled analgesia (PCA)

NSAIDs

- *Increased risk of post-operative bleeding
- *Acute kidney injury

Paracetamol

- *First few days
- *Neuropathic agents, Gabapentin, Pregabalin
- *Adjuvant analgesic when started pre-operatively

High-risk patients

*History of opioid abuse

- previous chronic pain Conditions

*long term analgesic

King's College Hospital Cardiac Surgical Pain Management Protocol.

	High-risk Defined as: previous IVDU, chronic pain or long-term analgesic use	Low-risk Defined as: all non-high-risk patients
Pre-operative		
Gabapentin	600 mg STAT	
Intra-operative		
Opioid infusion (morphine or fentanyl as per patient profile)	Yes	Yes
Post-operative		
Opioids tramadol	Morphine infusion until extubation?convert to	
Paracetamol + codeine	Regularly or as necessary	
Patient controlled analgesia	Yes	No
Call acute pain team	If pain score 8	

Chronic Post sternotomy Pain

- *Chronic pain following median sternotomy is
 - *common after cardiac surgery
 - *Pain can reduce quality
 - *Of life, affecting sleep, mood, activity level
 - *Overall satisfaction
 - * Chronic sternal pain Reported incidence of 11% to 56% at 1 year after surgery

- * Chronic postoperative pain following median sternotomy is
 - Defined as any nonanginal postoperative pain lasting more than **3 months**.
- * May present
- * Numbness
- * Allodynia
- * Palpation tenderness
- * Constant pain

Chronic post sternotomy pain has

A variable presentation, impacting 1 or multiple sites

- * Most frequently affecting the thorax

may also involve

- *Upper and lower extremities

- *Neck

- * Back

Thoracic pain following coronary artery bypass grafting

- (1) anterior chest wall pain on the left side
- (2) midline scar pain
- (3) right-sided chest wall pain

Pathophysiology

After any surgical procedure, the up-regulation , activation, and neural sensitization during the acute pain phase are important contributors to the development of chronic pain

*Neuropathy from anterior intercostal nerve entrapment or injury during internal mammary harvest, arthritis or hypersensitivity associated with sternal wire placement, musculoskeletal Injury from surgical incision Manipulation Sternal fracture or incomplete bone healing Sternal wound infections Myofascial component

Impact

- *incidence of chronic pain following median
- *sternotomy varies widely between 11% and 56% at 1 year following
- *surgery

- *Most patients with chronic poststernotomy pain report their pain as mild or moderate
- *approximately 15% report severe pain (>7 on visual analog scale).

Risk Factors

- *Surgical Techniques
- *Internal mammary harvesting can be
- *Associated with an increase in acute pain
- *Tissue trauma
- *Intercostal nerve injury
- *Damage
- *From Retraction

Rib fractures occur in up to 5% of patients following median sternotomy.

Fractures of the first rib account for approximately one-third of poststernotomy

Rib fractures and if displaced posteriorly may injure The brachial Plexus.

Brachial plexus injury following median Sternotomy primarily

Affects the C8–T1 nerve roots and is associated with Pain, Dysesthesia, and hand weakness. Dysesthesia, and hand weakness.

* Brachial plexus injury may also occur in the absence of rib fractures

- ***Sternal wound** infections seem to
- *Exhibit an increased incidence of chronic pain
- *Wound complications
- *Including infection
- *Mediastinitis
- *Keloid formation
- *Wound dehiscence
- *Poor sternal healing may contribute to the
Development
Of chronic pain.
- *Sternal pseudoarthrosis and sternal nonunion
- *Occur in up to 1% of patients following median
- *Sternotomy

***Patient factors** linked to sternal nonunion include diabetes

*Chronic obstructive pulmonary disease
Of steroids

*History of radiation

*poor nutritional status

***Surgical factors**

*technical errors in sternotomy off-midline

*sternotomy

*osteoporotic bone

*multiple fracture lines fracture gap

*decreased vascularity of the bony segments

*Instability of the sternal closure

- ***Cardiopulmonary bypass** time does not seem to impact
- *The development of chronic pain, procedures performed with
- *Cardiopulmonary bypass may also be associated with increased
- *Pain compared with procedures

Acute Pain Severity and Treatment

- *The presence of persistent acute and severe pain
- *largest risk factors associated with the development of chronic pain

Risk Factors for Development of Poststernotomy Chronic Pain

Risk Factors for Development of Poststernotomy Chronic Pain

Perioperative/Surgical Factors	Perioperative/Surgical Factors Patient Factors
Emergent surgery +++	Depression and anxiety ++
Persistent acute pain requiring opioids ++	Higher NYHA class ++
Wound complications (superficial and deep infection, sternal nonunion) ++	Hypothyroidism ++
Improper sternal retraction +	Large chest circumference ++
Rib fractures +	Preexisting chronic pain diagnosis ++
Cardiopulmonary bypass +/-	Genetic predisposition to chronic pain +
Internal mammary artery harvest +/-	Low socioeconomic status +
<ul style="list-style-type: none"> • Pedicled grafts + • Bilateral harvest + Prior sternotomy -	Age ≈70 y +/-

+ = Increased risk; - = no increased risk.
 NYHA indicates New York Heart Association.

Treatment of Chronic Pain

- *multiple treatment modalities
- *Medications
 - *Nonsteroidal anti-inflammatory
 - *Drugs (NSAIDs)
 - *Opioids
 - *Tricyclic antidepressants
 - *Serotonin and
 - *Norepinephrine reuptake inhibitors
 - (GABA)
 - *Muscle relaxants
 - *Benzodiazepines
- *Topical agents Including lidocaine NSAIDs, and capsaicin

Prevention Modalities

A meta-analysis by Chaparro et al⁶³ of 40 randomized controlled trials evaluated various treatment modalities including N-methyl-D-aspartate (NMDA) antagonists, NSAIDs, GABA analogs, local anesthetics, steroids, and serotonin-norepinephrine reuptake inhibitors.

TABLE 2. Medication Treatment Options for Chronic Poststernotomy Pain

Medication Treatment Options for Chronic Poststernotomy Pain

Agent	Mechanism of Action
Acetaminophen	Inhibits prostaglandin synthesis
Gabapentin	GABA analog; binds to $\alpha 2$-δ site of voltage-dependent calcium channels
Pregabalin	GABA analog
Ketamine	Noncompetitive antagonist at NMDA receptors, decreases inflammatory markers
Dexmedetomidine	$\alpha 2$-Agonist with analgesic, anxiolytic, and sympatholytic effects

TABLE 3. Modalities to Treat/Prevent Poststernotomy Pain

Modalities to Treat/Prevent Poststernotomy Pain	
Technique	Purported Benefit
Thoracic epidural anesthesia	Benefit for acute postoperative pain; no known impact on chronic pain
Intrathecal opioid injection	Improved analgesia and decreased opioid consumption in acute postoperative period; no known benefit in the long term
Paravertebral block	Trend toward improved acute pain control as compared with thoracic epidural anesthesia; no known role for chronic pain prevention
Intrapleural local anesthetic injection	Improved early postoperative pain control (first postoperative day)
Continuous wound catheter for prolonged local anesthetic delivery	Improved acute postoperative pain; no data on chronic pain
Transcutaneous electrical nerve stimulation	Improved pain scores and reduced opioid consumption, but no long-term data
Sternal wire removal	Effective for pain that is related to sternal wires once healing has occurred and pain not associated with mediastinitis
Psychotherapy	Improved pain scores in patients with postoperative depression