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Minimally Invasive Cardiac Surgery—Identifying Opportunities for Further Improvement in the Quality of Postoperative Patient Recovery

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According to the American Heart Association, more than 1.5 million patients worldwide undergo cardiac surgery every year.[1] Traditional approaches to these cardiac surgeries include incisions, such as median sternotomy or thoracotomy, which provide excellent surgical exposure. Unfortunately, each of these traditional incisions produces its own pattern of postoperative pain that may become chronic.[2,3] Furthermore, patients often may have additional incisions to facilitate vascular access and/or vascular conduit harvesting, as well as chest tubes that may exacerbate an already painful procedure.[4] In addition to postoperative pain, nausea and vomiting also remain common after cardiac surgery, despite the advent of fast-track cardiac surgery.[5,6]

The development of minimally invasive cardiac surgery has continued the search for multimodal- enhanced recovery after cardiac surgery, with attention to better analgesic and antiemetic interventions.[7] In this issue of the *Journal of Cardiothoracic and Vascular Anesthesia*, Burtoft et al. from the Mayo Clinic reported the incidence of severe pain, as well as nausea and vomiting, after robotic-assisted mitral valve repair (n = 124: May 2018 to September 2019).[8] Despite a minimally invasive surgical approach, as well as multimodal analgesic and antiemetic measures, the incidence of these selected endpoints remained high at 77% (95% confidence interval [CI] 69%-84%) and 67% (95% CI 58%-75%).[8] These investigators also noted that intraoperative exposure to methadone was associated with a reduced risk for severe pain (odds ratio 0.40; 95% CI 0.16-0.99; p = 0.04) and reduced opioid requirement in the first 24 postoperative hours (p = 0.006).[8]

Methadone, a longer-acting opioid, has emerged as an analgesic option in the armamentarium for contemporary cardiac anesthesia.[9] The beneficial analgesic effects of methadone have been noted in adult and pediatric cardiac surgery.[10–12] Murphy et al. have demonstrated, in a prospective randomized trial (n = 156: adult cardiac surgery with cardiopulmonary bypass), that intraoperative methadone significantly reduced postoperative pain and rescue opioid requirements, with enhanced patient-perceived quality of pain management.[10] A recent meta-analysis confirmed the superior analgesic and opioid-sparing properties of methadone for acute postoperative pain due to its potent analgesic effects,

Conflict of Interest

None.

including N-methyl-D-aspartate receptor antagonism, as well as inhibition of serotonin and noradrenaline uptake.[12] The cumulative literature, together with the findings from Burtoft et al., suggested that methadone could be considered more often for enhanced recovery after cardiac surgery, including minimally invasive cardiac surgery.[8–12]

Beyond methadone, what are further options to reduce the high incidence of severe postoperative pain and improve the quality of recovery in this setting? A clear message from the literature is to consider multimodal perioperative protocols that include regional analgesic techniques.[13,14] The multimodal analgesic approach in the trial by Burtoft et al. included nonopioid options, such as acetaminophen, ketorolac, and/or ketamine, although there was significant heterogeneity in their perioperative utilization.[8] The regional anesthetic options included paravertebral blockade, pectoral blocks, and robotic port-site infiltration with local anesthetic. The variation in choice and conduct of regional anesthetic blockade in the study by Burtoft et al. also has confounded the impact on postoperative recovery, as outlined by the investigators in their discussion of the trial limitations.[8]

Although the benefits of epidural analgesia for cardiac surgery have been evaluated recently in detail, the risks of neuraxial hematoma have invigorated the search for alternative regional anesthetic techniques to enhance the quality of recovery and offer further tangible benefits to patients and their families.[14,15] Fascial plane blocks with ultrasound guidance have emerged recently as effective opioid-sparing options for analgesia after cardiac surgery, including minimally invasive approaches.[16–18] These blocks also offer the option to extend effective analgesia well into the postoperative period, with placement of a catheter for continued delivery of local anesthetic to maintain the sensory block even in anticoagulated patients.[19–21] As part of an embedded postoperative protocol to enhance the quality of recovery after cardiac surgery, these blocks can provide superior analgesia, lower perioperative analgesic requirements, enhanced patient mobilization and satisfaction, and improved respiratory mechanics to allow prompt chest tube removal.[17–21] An alternative option to extend the benefits of these newer regional blocks is the addition of liposomal bupivacaine.[22] Future trials should evaluate these analgesic options in minimally invasive cardiac surgery to further decrease the incidence of postoperative pain and enhance the quality of recovery.

Postoperative nausea and vomiting remain common after cardiac surgery, with a reported incidence in the 40% to 70% range, although the incidence may be lower in the setting of fast-track cardiac surgery.[5,6] Despite their multimodal approach, Burtoft et al. reported an incidence of 67% (95% CI 58%-75%), consistent with the literature.[5–8] The pathophysiology for this high incidence was likely multifactorial, including significant exposure to opioids and volatile anesthetics.[23,24] The investigators also have speculated about the possibility of widespread stimulation of vagal receptors in the surgical field.[8]

Regardless of the exact mechanisms, the high incidence merits further attention. Similar to the distress of postoperative pain, postoperative nausea and vomiting can affect multiple organ systems. The gastrointestinal discomfort may prevent patients from tolerating important oral medications. Severe vomiting may lead to electrolyte abnormalities, volume shifts, and associated abdominal or chest pain. The pulmonary system may be compromised in the event of aspiration pneumonia. Pain, stress, and active vomiting may adversely affect

myocardial demand, with increased sympathetic tone. Patients experiencing nausea and vomiting likely will not be able to participate effectively in their postoperative mobilization programs.

The approach to the management of postoperative nausea and vomiting after cardiac surgery therefore requires further investigation and development. Recent trials confirmed the ongoing high incidence of nausea and vomiting, especially in the setting of risk factors such as female sex.[25,26] Newer techniques, such as the fascial plane blocks, may allow further opioid sparing in cardiac surgery to further reduce the incidences of nausea and vomiting, a trend that was noted in the trial by Burtoft et al.[8,27] Novel antiemetic drugs also may enhance pharmacologic prophylaxis and rescue in this setting. The dopamine antagonist amisulpride recently has demonstrated significant perioperative efficacy as an antiemetic.[28] Neurokinin-1 receptor antagonists, such as aprepitant, also may have a role in this setting as part of a multimodal protocol.[29]

In conclusion, Burtoft et al. are to be congratulated for highlighting the ongoing high incidence of significant pain, as well as nausea and vomiting, after minimally invasive heart surgery. Further trials should explore the impact of perioperative protocols that include multimodal analgesia, opioid sparing, targeted antiemetics, and long-acting fascial plane blocks. The engagement of all stakeholders also likely will minimize significant variations in practice so that all patients receive maximal analgesic and antiemetic therapy in a protocolized fashion. The newer antiemetics, including the dopamine antagonists and neurokinin-1 receptor antagonists, require further evaluation to evaluate their additive effects in this setting as part of the quest for optimal quality of recovery after cardiac surgery.

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