Regional anesthesia for minimally invasive cardiac surgery: Pleural, paravertebral, epidural and parasternal blocks.

Minimally invasive cardiac surgery gained popularity in the 1990s with MIDCAB and valve procedures being performed through small thoracotomy incisions with peripheral cannulation for cardiopulmonary bypass (CPB). The practice continues to evolve. During the last decade we have seen the advent of robotic-assisted cardiac surgery including mitral valve surgery and internal mammary artery harvest for CABG. Patients undergoing minimally invasive procedures have smaller incisions, less surgical trauma, and in theory, less pain. These patients are often ideal candidates for early extubation and accelerated recovery following surgery, however achieving these goals requires a collaborative effort from the cardiac anesthesia and surgery teams, ICU staff and postoperative nurses. The anesthetic provided should be tailored to facilitate rapid recovery, and may include regional anesthetic techniques to help provide analgesia with less systemic opioids.

Thoracic epidural anesthesia (TEA) is commonly employed to supplement postoperative analgesia for numerous surgical procedures. While improvements in outcome remain debated, the benefits of TEA in both non-cardiac and cardiac surgery are well described. Specifically in patients undergoing CABG, benefits include improved analgesia and pulmonary function, earlier extubation and reduced arrhythmias. [1] Because of concern of possible neuraxial hematoma following epidural placement prior to systemic heparinization for CPB, we have not seen widespread use of TEA for patients undergoing cardiac surgery.

Thoracic paravertebral blockade (PVB) provides unilateral analgesia by blockade of spinal nerve roots at one or more vertebral levels and can be performed as single injections or a continuous infusion through a catheter. Use of thoracic PVB has been described for breast, thoracic and cardiac surgical procedures. In patients undergoing thoracotomy, analgesia from PVB and TEA are comparable. [2] The thoracic paravertebral space lies just anterior to the transverse processes, lateral to the vertebral bodies and neural foramen, and posterior to the
parietal pleura. Being removed from the central neuraxial column, the risk of neuraxial hematoma is felt to be reduced, however there is an increased risk of pleural puncture and pneumothorax. The thoracic paravertebral space is continuous with the epidural space, and may result in spread of local anesthetic or catheter migration into the epidural space resulting in bilateral neural blockade. PVB is commonly performed with ultrasound guidance.

Intercostal nerve block is commonly employed following rib fractures and less-invasive thoracic surgical procedures where TEA is not used. Once spinal nerves leave the paravertebral space they traverse along the underside of the ribs as intercostal nerves. The intercostal nerves are easily accessed percutaneously or through the surgical field and local anesthetic can be injected at multiple levels if desired. Due to the proximity of the intercostal blood vessels, local anesthetic absorption limits the duration of the block, requiring repeat injections or continuous infusion for effective analgesia. Blockade of the upper anterior intercostal nerves, or parasternal block, is an effective way to provide temporary analgesia for patients following median sternotomy.

Intrapleural anesthesia (IPA) is achieved by catheter insertion between the parietal and visceral pleura. This can be done percutaneously, or under direct vision through the surgical field. It is felt that infusion of local anesthetics can provide postoperative analgesia by diffusion through the pleura into the intercostal muscles. Similar to TEA and thoracic PVB, a sympathetic blockade can result as well. Two issues limit widespread application of IPA in patients undergoing surgery involving the thorax: 1. It is felt that IPA is better suited for subcostal pain relief, and is often inadequate for thoracic surgical procedures, and 2. IPA requires larger doses of local anesthetics and may increase the risk for local anesthetic toxicity.

There are several options for regional analgesia supplementation for patients undergoing minimally invasive cardiac surgery. These blocks will be discussed in further detail during the talk. Also some of the highlights from the literature comparing different block techniques will be presented. The talk will conclude with discussion of how regional anesthesia was incorporated into our minimally invasive cardiac surgery practice as part of our comprehensive anesthetic plan to facilitate extubation in the operating room and enhance rapid recovery postoperatively.

References
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