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Regional blocks in post cardiac surgeries and their role in Enhanced Recovery Program

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Abstract: As our population ages and faces more health issues, there are more and more cardiothoracic surgeries being done. Anesthesiologists are increasingly involved in care before, during, and after surgery (perioperative care). This means it's important to choose anesthesia that manages pain well, both during the operation and as the patient recovers. In heart surgery, if pain isn't well-controlled, it can lead to long-term pain problems and increased sensitivity to opioid medications. In recent years, surgery aims for shorter stays and quicker removal of breathing tubes. This has led doctors to avoid strong pain medication during surgery. To manage pain without heavy drugs, some doctors are using fascial plane nerve blocks. These blocks are safe and avoid blood pressure changes that can happen with other pain control methods. Since pain is a big issue after heart surgery, new anesthesia techniques have opened the door for better pain management strategies. Recent cardiac surgery has seen a rise in regional anesthesia techniques. This is done to cut down on opioid use during surgery and to help patients recover faster afterwards. This study looks at the most common regional techniques used today in cardiac surgery. These include blocks for the chest wall (like PECS I and II, SAP, ESB, and PVB), blocks for the sternum (like TTMPB and PSINB), and blocks that involve the nerves along the spine (like TEA and high spinal anesthesia).

Keywords: *Regional blocks, post cardiac surgeries, Enhanced Recovery Program*

Introduction

Cardiovascular disease is the principal cause of mortality worldwide, causing roughly a third of all deaths [1]. As the United States population ages, there will likely be more heart and chest surgeries [2]. Studies have shown that if pain after surgery like chest wall splitting (sternotomy) and chest cavity incision (thoracotomy) is not well managed, it can lead to chronic pain in 20-50% of patients [3-5]. In the 1990s, doctors commonly used high doses of long-lasting opioid anesthesia to control pain after heart surgery. This helped keep patients' blood pressure stable (hemodynamic stability) but also led to them needing breathing machines (mechanical ventilation) for longer, extending their stay in intensive care (ICU) [6]. Today, while opioids are still the main pain medication after heart surgery, practices have shifted. There's a stronger focus on getting patients off breathing machines sooner (extubation), shorter hospital stays, and quicker discharges. The rise of social and political movements against opioid misuse has further fueled the use of multimodal pain management in heart and chest surgery. This approach often combines regional anesthesia guided by ultrasound with faster recovery

programs (ERAS). As a result, it's becoming increasingly common for patients to breathe on their own immediately after surgery, eliminating the need for a breathing tube in the operating room [7].

Neuraxial anesthesia, while an option for cardiac surgery, is debated due to potential complications like blood pressure swings and bleeding around the spinal cord. Interestingly, research suggests using total spinal anesthesia with general anesthesia (GA) for cardiac surgery might be safe, with no reported cases of spinal bleeding [8]. This is promising because chest wall blocks, like pectoralis, serratus anterior, erector spinae, and paravertebral blocks, avoid these blood pressure changes altogether and are gaining favor for this reason.

A major drawback of chest wall blocks is that they don't numb the inner chest area (internal mammary region), which can leave lingering pain. To address this, doctors developed sternal blocks like parasternal intercostal nerve blocks (PSINB) and thoracic transversus muscle plane block (TTMPB). These newer blocks effectively target the nerves supplying the front of the chest wall (T2-T7), providing more complete pain relief. [9]

PECS I and II blocks

Introduced in the early 2010s, pectoralis I (PECS I) and pectoralis II (PECS II) nerve blocks became a tool in breast surgery to manage pain in the upper front and side of the chest wall [10, 11]. Kumar et al. [12] investigated if a nerve block after surgery (PECS block) could improve recovery in patients undergoing heart bypass or valve replacement surgery (coronary artery bypass grafting (CABG) or valve surgeries). They studied 40 patients, splitting them into two groups: one receiving the nerve block and a control group. All patients had their chests opened through the breastbone (midline sternotomy). The study found significant benefits for patients who received the nerve block. They were able to breathe on their own (be extubated) much sooner than those in the control group. Additionally, they reported lower pain scores at various times after coming off the ventilator (extubation), both at rest and when coughing. Finally, the nerve block group achieved better lung function as measured by peak inspiratory flow rates.

In another study by Yalamuri et al. [13], a PECS block was successfully used to improve pain management after mitral valve repair surgery (right anterior thoracotomy approach). This nerve block provided significant chest wall pain relief using a specific medication (0.2% ropivacaine with epinephrine) and dosage (30 ml).

A study by Marcoe et al. [14] investigated the use of two specific nerve blocks (PECS 1 block and subcostal TAP block) for pain management after surgery. They compared these techniques to standard pain management without nerve blocks in 112 patients. The groups with nerve blocks used significantly less opioid medication during surgery (over 50% reduction) and overall (almost 50% reduction) compared to the control group. However, the study didn't find a significant difference in pain medication use or hospital stay length after surgery between the groups.

Studies suggest PECS blocks are a safe option for cardiac surgery due to the area's minimal risk of encountering major nerves and blood vessels [15]. Additionally, ultrasound guidance makes it a technique that can be learned quickly. Existing research shows promising benefits, including allowing patients to breathe on their own sooner (extubation) and reducing the need for opioid painkillers during surgery [12, 14]. Both these factors contribute to a better patient experience.

For cardiac patients, good pain control is essential for proper breathing and maintaining metabolic activity. Fortunately, PECS blocks can be performed with the patient lying flat (supine), making them convenient to administer without disrupting the operating room flow. Furthermore, these blocks have potential as a pain relief option after surgery (postoperative analgesia), possibly even as a way to manage unexpected pain (rescue block). It's important to note that the studies reviewed were limited by the small number of patients involved.

Serratus anterior plane block

The Serratus anterior plane (SAP) block, introduced in 2013 [16], numbs the side chest wall by targeting intercostal nerves from T3 to T9. It's similar to the PECS II block but with a lower and more sideways injection for broader pain relief. However, it doesn't affect the middle chest area [16]. Research suggests higher volumes (over 40 ml) might be needed to reach a wider area, including T1 to T8 [17].

Although the SAP block is well-established for thoracotomies, research hasn't explored its use in sternotomy. Interestingly, some studies have shown its effectiveness in procedures involving implanting cardiac devices. De Waroux et al. [18] reported that a single-shot SAP block enables anesthesiologists to avoid GA and perioperative opioid use for cardiac defibrillator implantation. Droghetti et al. [19] replicated the same result in their study, except for one patient who required conversion to GA due to anxiety. Magoon et al. [20] randomized 100 adults undergoing cardiac surgery via thoracotomy approach to SAP, PECS II, or intercostal nerve block groups. While all groups reported similar pain levels shortly after surgery, patients who received the spinal anesthetic or the shoulder blade nerve block had significantly lower pain scores later on ($p < 0.05$). Additionally, patients in the intercostal nerve block group required significantly more fentanyl, compared to the other two groups ($p < 0.001$). This suggests that spinal anesthesia and the shoulder blade nerve block may be more effective for controlling pain after heart surgery through a chest incision.

While SAP block carries potential risks like infection, pneumothorax, and nerve toxicity, it's considered very safe for heart and chest surgeries. This is because ultrasound guidance makes these complications extremely rare. Similar to the PECS block, SAP is typically done with the patient lying on supine position, avoiding any need to move them later. Additionally, it can be performed after general anesthesia is administered, reducing patient discomfort and anxiety. Another benefit is that SAP block has minimal risk of injuring the pleura or spinal cord compared to the paravertebral block.

Unlike techniques like high spinal or thoracic epidurals that have hemodynamic effects, SAP offers the potential benefit of minimal to no such impact because it doesn't block the sympathetic nervous system. However, this lack of sympathetic blockade may also mean weaker analgesia and difficulty predicting how far the local anesthetic will spread in different patients. Since SAP is a relatively new approach for cardiac surgery, more research is necessary to confirm its effectiveness and compare it to existing options.

Erector spinae plane block

Studies have shown that the erector spinae plane (ESP) block is a valuable tool for surgeries in the chest and abdomen, especially those involving the median sternotomy. Compared to other fascial plane blocks, ESP block offers an advantage. Cadaver studies using MRI suggest that ESP block can reach the supplying the T2 to T6 nerves, making it beneficial for median sternotomy. This technique has even earned its name "paravertebral by proxy" due to its effectiveness.

In Krishna et al. [26] study, 106 patients undergoing elective cardiac surgery and requiring cardiopulmonary bypass (CPB) were randomized into ESP or acetaminophen and tramadol groups. The ESP group had a significantly lower pain score ($p = 0.0001$) and patients experienced a significantly higher duration of analgesia ($p = 0.0001$). Although there are no official guidelines yet, experts recommend this nerve block to be performed close to the surface and be easily compressed if bleeding occurs [27].

Nagaraja et al. [28] randomized 50 patients undergoing cardiac surgery into bilateral continuous ESP and thoracic epidural groups. The study compared two pain management techniques done a day before cardiac surgery. While both groups had similar times on ventilator support, breathing exercises, and ICU stays, the pain scores were slightly lower in one group. However, even the "higher" pain scores were still relatively low (average below 4 on a 10-point scale). Since most cardiac surgery patients are on blood thinners, a technique that avoids the spine (ESP block) is preferable. This study suggests that ESP could be a strong alternative to the thoracic epidural.

While all nerve blocks carry some theoretical risks like infection, hematoma, and local anesthetic toxicity, ESP blocks haven't shown any complications in reported cases. Even for patients with anticoagulated, neurological deficits with ESP blocks is very low compared to other options like paraxial blocks. Plus, the chance of complications like epidural abscess or Horner syndrome is practically zero with ESP blocks, especially compared to spinal or epidural. This is because ESP blocks are much easier and safer to perform, especially with ultrasound guidance. The needle is highly unlikely to puncture the pleural space because it targets transverse process. On top of the safety profile, Krishna et al. [26] showed that the ESP block led to faster recovery for patients. They were taken off ventilator support earlier, began eating a regular diet sooner, and

left the intensive care unit quicker. This suggests that the pain relief from ESP block not only improved pain scores but also accelerated recovery after surgery. However, while these results are encouraging, ESP block is a new technique, and more research is needed to confirm its long-term effectiveness in cardiac surgery.

Paravertebral block

Paravertebral block (PVB) is a chest wall pain relief technique traditionally done by feeling specific anatomical landmarks. Similar to other regional anesthesia methods, ultrasound guidance is becoming more common as technology access improves. The effectiveness of this block depends on where the numbing medicine is injected. However, instead of a single large dose, a method using several smaller injections at different levels is preferred [28]. Clinical data appear to be favorable towards PVB. Sun et al. [29] investigated 60 patients undergoing off-pump CABG (OPCABG) compared to those with PVB combined with GA and those with GA alone. They reported that pain scores, morphine-equivalent consumption, and time to extubation were lower, and ICU stay was shorter in the block + GA group. El Shora et al. [30], 145 patients with cardiac surgeries via median sternotomy were randomly assigned to into bilateral PVB + GA vs. thoracic epidural + GA. While pain levels were similar, those receiving PVB spent less time in intensive care (ICU) and experienced fewer complications like trouble urinating and vomiting. These findings support a larger analysis by Scarfe et al. [31] which reviewed 23 studies involving over 1,100 patients. Their analysis also suggests PVB is linked to less nausea, vomiting, and difficulty urinating compared to epidural analgesia

Studies show PVB offers significant advantages over thoracic epidurals for cardiac surgery patients. These benefits include better blood pressure control, less nausea and vomiting, and less difficulty urinating, all while providing effective pain relief [28]. However, the potential for complications like pleural puncture and pneumothorax are major concerns for anesthesiologists, often leading us to avoid using PVB.

Transversus thoracic muscle plane block

New pain relief technique for chest wall surgery (discovered in 2015) involves injecting local anesthetic between specific muscles in the chest wall. This targets nerves in the area T2-T6. A study showed patients undergoing median sternotomy who received this block preoperative had less need for opioid pain medication after surgery, along with reduced pain and itching at 12 hours post-surgery, compared to those who received a placebo. In a study by Zhang et al. [34], researchers investigated the effects of a technique called TTPM on 100 children undergoing open-heart surgery. The children were randomly assigned to either receive TTPM (bilateral block) or no treatment. The group that did not receive TTPM needed significantly more fentanyl medication during and after surgery. Additionally, they took longer extubation time and spent more time in ICU and hospital overall.

Cardiac surgery is falling behind in adopting new pain management methods (ERAS and opioid-free anesthesia) compared to other areas of medicine. While traditional heavy reliance on narcotic painkillers leads to problems like delayed extubation, urinary retention, nausea, and pulmonary problems after surgery, there are reasons anesthesiologists hesitate to use safer techniques like thoracic epidural or even high spinal blocks. These blocks can cause profound hypotension and epidural hematoma. This is especially risky for patients with severe left main disease or triple vessel disease who rely on good blood pressure to keep coronary perfusion. Since these patients often need heparin infusion, some anesthesiologists might avoid neuraxial procedures altogether.

A study by Kumar et al. showed PECS blocks to be more effective for pain relief after median sternotomy compared to IV pain medication. However, these blocks don't directly numb the area of incision because they don't target the specific nerves supplying the skin. This raises questions about how PECS blocks actually achieve pain relief. While some case studies suggest combining PECS and SAP blocks for chest injuries, more research is needed to understand their exact mechanism. These blocks offer a safer alternative to epidurals, especially for patients on blood thinners. Both PECS and SAP blocks can be done with the patient lying on their back and even under general anesthesia if time allows. Additionally, they are very safe due to their superficial location and minimal risk of bleeding. An important drawback is that these blocks don't affect visceral pain. This can be confusing for both patients and surgeons who might think the block isn't working because they still feel some discomfort.

Both PVB and ESP injections can numb the area around a median sternotomy incision because they block the nerves supplying that region. Research shows they're effective for pain relief after this surgery. Anesthesia guidelines advise against deep nerve blocks when patients are on blood thinners, but ESP blocks might be an option since some experts consider them more superficial. There haven't been large studies comparing different fascial plane block techniques to see which is definitively better.

ENHANCED RECOVERY After Surgery (ERAS) is a global initiative developing programs to improve patient outcomes and streamline healthcare delivery. These programs combine best practices, standardized care, regular evaluations, and team feedback, keeping the patient at the center. Early results, particularly in cardiac surgery, have been promising [1-4]. However, some worry that established practices, often based on experience rather than strong evidence, might be replaced with unproven "enhanced recovery" methods in cardiac surgery [5]. A cautious approach is crucial when updating practices. The original ERAS protocol for colorectal surgery was built on gathering the best available evidence. Recognizing this need, the Society for Enhanced Recovery After Cardiac Surgery (ERAS Cardiac) recently published evidence-based guidelines for cardiac surgery based on a thorough review and expert consensus. These guidelines include 22 recommendations ranked by the strength of the evidence and the confidence in their effectiveness.

Target for perioperative pain management for cardiac surgery with median sternotomy as well as thoracotomy and intercostal approach: intercostal nerves

In cardiac surgery with a median sternotomy, doctors use peripheral nerve blocks to target the nerves that control feeling in the chest wall [34,35 ▪ ,36 ▪ ,37 ▪]. These intercostal nerves branch out from the spinal cord and run between muscles in the chest. By blocking these nerves with an anesthetic, surgeons can reduce pain after surgery. This approach can be done by injecting the anesthetic near the intercostal nerves at different locations along the chest wall.

Understanding the anatomy of the anterior body trunk to perform peripheral nerve blocks in cardiac surgery

The intercostal muscle layers are located between the ribs. They are consisted of three layers: the external, internal, and innermost intercostal muscles [12 ▪]. But identification of each layer on ultrasound images is difficult. The intercostal nerves, arteries, and veins are located on the lower rib margin between the internal and innermost intercostal muscles. The transverse thoracic muscle is a very thin muscle that lies below the innermost intercostal muscle [34,36 ▪ ,38]; it may not be clearly identified on ultrasound images. Therefore, a high echoic "white line" below the intercostal muscle layer can be used as a guide, and the transverse thoracic muscle lies below this white line [37 ▪]. During mechanical ventilation, the movement of the pleura or the beating of a visible heart within the pericardium will appear as a hyperechoic layer on an ultrasound image. The pectoralis major muscle lies over the ribs.

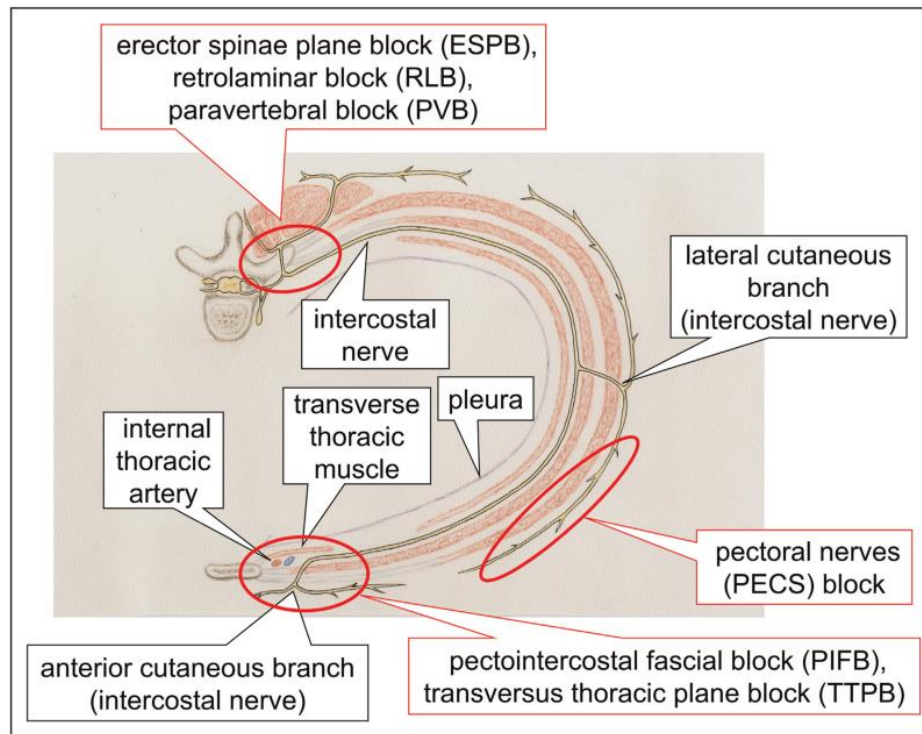


FIGURE 1: Schema of access points to the different injection points for intercostal nerve blocks for perioperative pain management for cardiac surgery. Peripheral nerve block for cardiac surgery with median sternotomy as well as intercostal approach is based on blocking the intercostal nerve at any approachable site.

Peripheral nerve block from the anterior approach for cardiac surgery with median sternotomy: parasternal intercostal nerve block

The anterior branches of the Th2–Th6 internal nerves are linked to pain related to median sternotomy. Blocking of these nerves close to the sternum is effective for pain management [12^{*}]. Additionally, parasternal intercostal nerve block (PSB) revealed significant efficacy for postoperative analgesia, requiring fewer opioids in the first 24 h postoperatively and no or less rescue dose of additional analgesics [39^{*},40^{*}], and showed lower postoperative pain scores in both pediatric patients [41^{*}] and adults [39^{*}] as well. Additionally, the alveolar–arterial oxygen gradient and pH values were better in the PSB group than in the placebo group [40^{*}]. However, studies reported no differences in the mechanical ventilation duration [39^{*},40^{*}]. Another study compared preoperative and postoperative ultrasound-guided PSB. They found that doing the PSB before surgery lowered the amount of opioids needed during the operation and helped maintain stable blood pressure. However, it didn't seem to affect the total amount of opioids needed overall or pain levels in the immediate hours after surgery [42^{*}].

Studies have shown that a procedure called preoperative paravertebral block (PSB) can be helpful in reducing inflammation during coronary artery bypass surgery [43]. This technique also appears to lower the amount of remifentanyl and propofol needed during surgery. However, a major drawback of PSB is the need for multiple injections, as the targeted nerves are located deep within the chest wall. To address this issue, researchers have identified two alternative injection sites that use fascial planes to spread the medication more broadly and potentially target multiple nerves with a single injection [44]. These techniques are called pectointercostal fascial block (PIFB) and transversus thoracic plane block (TTPB) [36^{*},37^{*}].

Pectointercostal fascial block and transversus thoracic plane block: aiming to enforce parasternal intercostal nerve block for multiple segments at once

Both ultrasound-guided PIFB and TTPB can be done in the supine position, similar to a PSB. To achieve pain relief for multiple chest wall segments at once, the local anesthetic is injected in different layers: For PIFB, the

injection targets the space between the pectoralis major muscle and the intercostal muscles [35 ▪]. For TTPB, the injection goes between the intercostal muscles and the transversus thoracis muscle [36 ▪, 37 ▪]. The PIFB is a simpler alternative to the TTPB for pain management after heart surgery. Unlike TTPB, PIFB involves injecting the numbing medication into a shallower tissue layer, away from important blood vessels and the lung lining. Studies have shown PIFB to be safe and effective in adults, reducing opioid use, pain after surgery, and the time needed on a ventilator after surgery. It may also shorten hospital stays.

PIFB is the 'superficial version of the TTPB' and a simpler block than the TTPB because injection of the local anesthetic is done into the more superficial fascial layer and away from the internal thoracic artery (ITA) and pleura [34,38,45]. Numerous clinical validations of the reproducibility and safety of PIFB have been reported in adult patients [34,38,45,46▪,47–49]. PIFB has been reported to reduce opioid consumption and postoperative pain both at rest and during cough in the first 24h after cardiac surgery [48]. In addition, PIFB reduces the time to extubation and also shorten hospital stays [49].

Studies are showing promise for using TTPB to manage pain in patients undergoing heart surgery with a median sternotomy. For example, a study on children found TTPB reduced their need for fentanyl medication during surgery and for the first 24 hours afterwards. It also helped lower their pain scores and get them off the ventilator faster [50 ▪]. Importantly, the study found the procedure to be safe with no complications related to the block itself. Additionally, research suggests the risk of complications from TTPB is similar to another pain management technique called PIFB [51 ▪].

ITAs are reported to be located just lateral to the sternum. They can be identified using ultrasound as anechoic linear structures or by color Doppler mode in combination [38]. The best way to find them is to position the ultrasound device sideways across the chest, but even then, they might not always be visible. One prospective, randomized, double-blind pilot study compared the efficacy and safety of TTPB and PIFB showed similar effectiveness for postoperative morphine consumption, pain scores at rest and during coughing, and requirements for rescue analgesia in the first postoperative 24h [52]. However, it PIFB requires multiple punctures on each side to cover the entire length of the sternum because the injected local anesthetic does not spread as widely as TTPB [35 ▪].

Combination with rectus sheath block: considering upper abdominal pain due to thoracic drain

After heart surgery, patients may experience pain not just in the chest where the incision was made (median sternotomy) but also in the upper belly area where a drainage tube was inserted [37 ▪]. There's also a separate study describing the use of both PIFB and RSB for pain relief during a defibrillator implantation under the skin [53]. While a combination of PIFB and RSB lowered the amount of methadone used during surgery, along with pain scores and opioid use in the first 12 hours after heart surgery involving a median sternotomy, these benefits seemed temporary. Pain and opioid use eventually became similar between groups with and without PIFB-RSB. However, the PIFB-RSB group did show a decrease in their overall daily opioid use. In addition to the shorter length of hospital stay without prolonging the time under general anesthesia in the PIFB-RSB group. Moreover, no complications associated with the block and safety have been reported [54].

Pectoral nerves II block: aiming for analgesia in areas slightly displaced outward from the anterior thoracic midline.

There are cases of the atrioventricular block post congenital heart disease surgery, in which subcutaneous implantation of an implantable pacemaker in the anterior thoracic wall. These pacemakers or defibrillators require periodic battery changes, lead adjustments, or additions may be necessary if they are not sufficiently effective. These surgical fields are off the anterior thoracic midline and cannot be completely covered by the peripheral nerve block focused on the median sternotomy. In such cases, the pectoral nerves (PECS) block [55 ▪], especially the PECS II block, which block the lateral cutaneous branches of the intercostal nerve that provide the sensory supply to the lateral part of the chest wall [56 ▪]. During an ultrasound exam, a probe placed on the chest wall can show the third or fourth rib in cross-section. With this view, several muscles are layered on top of the rib: serratus anterior (deepest), pectoralis minor, and pectoralis major (most superficial). For a nerve block procedure, anesthetics are injected between these muscles. PECS I targets the area between

pectoralis major and minor, while PECS II injects between pectoralis minor and serratus anterior. PECS II is preferred due to its greater effectiveness [57].

PECS II is very simple to perform: the puncture needle is inserted in a long-axis approach toward the specific rib shown on the ultrasound, and once the puncture needle reaches the rib, a local anesthetic is injected after the aspiration test. Then, the local anesthetic is injected, and the ultrasound will show it spreading between the pectoralis minor and serratus anterior muscles. This PECS block can be applied as a single injection as well as a catheter-based infusion for surgeries with thoracotomy, such as minimally invasive cardiac surgery with an intercostal approach in adult patients [58,59].

Peripheral nerve block from the posterior approach for cardiac surgery: erector spinae plane block, retrolaminar block, and paravertebral block

To target the intercostal nerves branching from the spinal cord, several regional nerve block techniques are available: erector spinae plane block (ESPB), retrolaminar block (RLB), and paravertebral block (PVB). These blocks target the intercostal nerves close to the spine, both the anterior rami and lateral cutaneous rami. This makes them suitable for pain relief during heart surgeries involving median sternotomy and even procedures extending beyond the chest's center line. There are three main nerve block techniques used in pain management after heart surgery in children: ESPB, RLB, and PVB. ESPB and RLB target different bony structures in the back [60], while PVB targets the space beside the spine [61]. All three techniques use an anesthetic that spreads along the muscles of the back to provide pain relief [60]. Studies have shown that ESPB [62, 63] and PVB [61] can help reduce the amount of opioid painkillers children need after heart surgery. Studies have shown that ESPB and RLB are just as effective as other methods for pain relief after chest wall surgery [64]. Additionally, research suggests that using ESPB before heart surgery can help reduce certain markers of inflammation during surgery and recovery [65]. These techniques also seem to be safer and easier to perform compared to thoracic epidural catheter with a lower risk of incorrect placement and complications. The only downside is that unlike the previously mentioned blocks, ESPB and RLB require the patient to be on their side for injection. However, a benefit of ESPB and RLB is that they can be done in a blinded fashion, while the thoracic epidural catheter requires real-time ultrasound guidance for safe and accurate placement [61].

CONCLUSION:

While established regional anesthesia techniques are more common outside of heart surgery, studies show they could be highly beneficial for various cardiac procedures. Fast-track cardiac surgery aims to achieve both good pain relief and less reliance on opioids during surgery and recovery. This approach often involves protocols to get patients breathing on their own and moving around more quickly after surgery. Research suggests these "enhanced recovery" pathways can improve patient outcomes without compromising safety. They can lead to shorter stays in intensive care, less time on ventilators, and lower overall costs.

Regional anesthesia has been a key part of enhanced recovery for other surgeries by reducing the need for opioids. However, concerns about using certain regional techniques on patients taking blood anti-coagulant have limited its use in cardiac surgery. The recent development of the erector spinae plane block offers a new, potentially safer approach, opening the door for wider use of regional anesthesia in this setting

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