

anaesthetic coverage afforded by this block with a paucity of motor effects makes it an attractive alternative to the 'traditional' combination of a cervical plexus and interscalene brachial plexus block.⁹

Surgical site infiltration Surgical fixation under local infiltration analgesia alone has been reported in a few studies which typically use high volume local anaesthetic in combination with a vasoconstrictor.^{4 18} Subcutaneous infiltration produces local nociceptive blockade, and deeper subperiosteal infiltration is postulated to facilitate endosteal local anaesthetic spread via nutrient vessels from the periosteum; thus blocking sensory fibers in the periosteum and within bone. On a similar note, the successful use of ultrasound-guided haematoma block for pain relief in the emergency department has been reported⁷; in this approach the fracture haematoma serves as a medium for local anaesthetic spread into the surrounding structures and periosteum. Even if expertise for regional block performance is unavailable, local anaesthetic infiltration should at least be considered in fixation surgeries performed under general anaesthesia alone.^{4 6}

Other regional techniques Some small studies or reports have utilised other regional blocks, such as a supraclavicular brachial plexus or pectoralis (PECS) I or II blocks as part of the regional anaesthetic regimen with varying degrees of success.⁴ The former likely targets the trunks or divisions distal to the origin of the subclavian and lateral pectoral nerves, while the latter mainly provides block of the medial and lateral pectoral nerves, although it can be argued that spread to muscles adjacent to the clavicle (such as the pectoral muscles) might play a role in nociceptive inhibition. These will not be elaborated upon given the paucity of evidence, somewhat limited mechanistic plausibility, as well as availability of other techniques which can provide better coverage.

Conclusion Several regional anaesthetic approaches have been described in the literature, and the feasibility of awake surgical fixation has been well reported. The regional anaesthetic of choice depends largely on whether surgical anaesthesia is required or if analgesia provision without anaesthesia is sufficient for the clinical context. If analgesia desired as part of a general anaesthetic, a superficial/intermediate cervical plexus block or supraclavicular nerve block may suffice. Although a superficial/intermediate cervical plexus block has previously been the technique of choice for surgical anaesthesia provision, it has a propensity for undesirable motor effects such as hemidiaphragmatic paresis; which can be mitigated by the use of a clavipectoral fascial plane block with or without a cervical plexus block.¹¹ Clavipectoral fascial plane block may be a promising new tool in the anaesthesiologist's armamentarium for anaesthesia and analgesia provision in clavicle fractures and fixation surgery.

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#36929 THORACIC EPIDURALS FOR ERAS IN THORACIC AND ABDOMINAL SURGERY- STILL RELEVANT?

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Introduction In recent decades the high thoracic epidural analgesia (HTEA) has been increasingly replaced as the gold standard in minimal invasive surgical procedures. We strongly believe however it still is a viable (and maybe even essential) technique in major open surgery.¹ Adequate placement of a HTEA is difficult art to master.² Although published failure rates average from moderate to high, the lack of standardized definition of failure hampers a clear view on the problem.³ Due to reduced caseloads since the (r)evolution of minimal invasive surgical techniques training and competence proficiency have also diminished seriously.⁴ Fascial plane blocks (FPB), although extremely popular due to the advancement of ultrasound guided block techniques and the laparoscopic/

thoroscopic/robotic approaches have failed to be a valid alternative for major surgery. The lack of visceral pain coverage, limited duration of analgesia and dermatome coverage are the main drawbacks of almost all FPB's. Examining the relevance and correct implementation of HTEA, while debunking some myths and exploring the possible solutions for the lack of training is the primary objective of this article.⁵

Discussion Although major open surgical techniques like abdominal, thoracic and vascular surgery have steadily decreased over the years they will remain an important part of care in more specialized healthcare institutes. Major surgery has a significant morbidity and mortality and should therefore be thoroughly managed. Despite controversy about the influence of the HTEA on morbidity and inflammation there is still more than enough evidence of its potential beneficial effect.⁶

Surgical safety has increased dramatically over the years so impact of a single intervention like HTEA analgesia on morbidity is naturally much more difficult to prove. The impact on pulmonary function, cardiovascular system and inflammation although proven, have diminished with enhanced recovery programs and multimodal approaches. The analgesic effect, complication rate and educational training problems are somewhat easier topics to dive into.

Analgesic effect and side-effects.

The HTEA not only covers somatic pain via blocking of the spinal nerves, but also has a profound effect on visceral pain. This visceral coverage leads in turn to a dampening of the inflammation cascade.⁷ Non inferiority analysis of other analgesic techniques has almost always failed except the paravertebral block (PVB).^{8,9} For unilateral procedures like thoracotomy this makes the PVB of course a very interesting alternative. It is less compelling when bilateral catheters, especially because they have a higher rate of displacement.¹⁰

Of course, this highly effective pain relief comes at a cost. A HTEA will always produce an effect on hemodynamics. Hypotension has been one of the major issues urging anesthetists to stop using HTEA as a gold standard.¹¹ However, in modern day anesthesia with goal-directed fluid therapy or more moderate fluid replacements the use of inotropes or vasopressors has become a routine part of any tailored anesthesia approach. Using low percentage local anesthetic concentrations for postoperative infusion will allow to reduce and stop any hemodynamic medication postoperatively. It is therefore imperative to use the lowest concentration of local anesthetics (LA) for infusion rate while ensuring adequate analgesia.¹²

There is no reason to use high concentrations, being 0,5% of any LA, because 0,2% provides equivalent analgesia with less hypotension.¹³ In certain HTEA high-volume centers (like the University Hospitals of Leuven) low concentrations of 0,125% levobupivacaine have been routinely used for infusions during at least 10 years with no effect on patient satisfaction or pain control, while minimizing systemic hemodynamic repercussions. In addition, HTEA has been proven to increase intestinal blood flow which has a potential for anastomotic blood flow increase and reduction of postoperative ileus. These two effects make a compelling case for enhancing the role of epidurals in major open surgery.

This low concentration of LA will also allow early mobilization and enhance recovery. Especially when the thoracic epidural is placed at the correct (high) level.¹⁴ It is a persistent and sad misconception that low to mid thoracic epidurals are easier to place (quite the contrary). The myth that HTEA impedes enhanced recovery and hinders walking has in turn

also hurt its implementation. In fact, very recent literature showed even better mobilization when HTEA was used compared to opioids alone.¹⁵

Safety Neurological complications of the epidural although rare (estimated between 1:1000 and 1:14000) can be extremely devastating in case of hematomas and permanent neurological injury.¹⁶ Abscesses, meningitis and more solitary segmental nerve injuries are also rare but almost equally damaging in their consequences. For use in major surgery when adequate risk assessment is in place and proper techniques are used, these risks can be kept at a minimum.

For scheduled major surgery anticoagulant therapy is interrupted, making most patients eligible for HTEA. Of course, precautions on resumption of antithrombotic medication are extremely important, as well as exact knowledge of drug doses time till restart and stopping. Recent literature details all the essentials and an online application, developed by the European Society of Regional anesthesia, can quickly guide you through the maze of options.¹⁷

Reliability Failure rates have been quoted as being moderate to high throughout literature. The definitions of failure have nonetheless never been validated.^{18,19} In contrast relatively good failure rate definitions for lumbar epidurals in obstetrics were established.^{20,21} Interestingly, if the exact same criteria were used for most of the fascial plane blocks, the success rate would be close to zero for most of these blocks. Mechanical failures like catheter leakage, unintended catheter loss or even stretching tearing should be kept to a minimum if correct bandages and regular follow-up is in place with an acute pain service. Technical failure should be addressed by adequate knowledge of spine anatomy and training and we will address them in the last part of this article. Miscellaneous problems like unilateral block, inadequate dermatome coverage or inappropriate level of block can be addressed in a tailored individual approaches, by withdrawing the catheter, topping up or even re-insertion if needed.

Training Diminishing caseloads have led to decreased training possibilities. However, epidural placement is considered a core competence as it is still the standard for anesthesia in caesarian sections and analgesia for child labor. Thoracic epidurals are not necessarily more difficult but require a more secure knowledge of spine anatomy. Next to teaching, anatomy simulators, online tools, webinars, video tutorials can aid in increasing competence and knowledge.

Although there is no thoracic epidural simulator (as far as we know) a few extremely well designed lumbar epidural fantoms are available for purchase and have good value for money.²² Video-based learning systems are also available and might yield some benefit when incorporated in training schedules.² Online tools like Virtual Spine: lumbar anatomy, 3D model, vertebra, spinal cord, dura, meninges, cauda equina, ultrasound (utoronto.ca) can further enhance knowledge and should be actively promoted.

In the modern era of ultrasound we should also not forget to use this valuable tool to at least identify the midline or identify the exact spinal level. Real-time ultrasound guidance is a possibility, although it is difficult, time and resource consuming.²³

Increasing and consolidating success.

Due to the controversy surrounding failure rates, ascertaining success is imperative. Fluoroscopy is an extremely valuable and powerful tool for lowering dislodgement of catheters while improving success rates, however, it is not practical to implement.

There is little evidence for waveform analysis in the form of an auditive sound adapter or by using a pressure transducer to evaluate pulsatility.²⁴ Probably the best way to assess correct catheter placement is the so-called 'Tsui test' or epidural electrical stimulation test.²⁵ Unfortunately it is not widely known or used.

Conclusion HTEA is the best and most complete regional analgesic technique at our disposal. It should be reserved for major surgery as it has drawbacks and side-effects. Nevertheless, it has a positive impact on pulmonary and functional recovery and reduces the need for opioids in a spectacular fashion. Unfortunately, it requires a lot of training to master and good follow-up with investment in an acute pain service team is essential. It should be actively promoted, trained and taught in secondary and tertiary centers with major open thoracoabdominal surgery.

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#36847 PIEB OR CONTINUOUS INFUSION FOR FASCIAL PLANE BLOCK CATHETERS

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Introduction Fascial plane blocks (FPBs) have gained significant popularity in regional anesthesia in an attempt to improve pain control and reduce opioid consumption while minimizing the risk of direct nerve damage or other neuraxial complications.¹ FPBs are performed by injecting local anesthetics (LA) into a plane between two specific fascial layers, a supposed connective tissue compartment separating different muscle groups or layers.² The LA is thought to diffuse within this plane to block multiple nerves traveling within or adjacent to this plane. Due to the increased distance between the place of injection and the nerves, these blocks are considered volume-dependent blocks. This contrasts the classical nerve or neuraxial blocks in which LA is injected in the vicinity of the targeted nerve(s). Nevertheless, the goal remains the same, i.e., causing a conduction block by administering LA, preventing the transmission of pain signals. Examples of FPBs include the transversus abdominis plane (TAP) block, the erector spinae plane block (ESPB), the rectus sheath block (RSB), and quadratus lumborum block (QLB), which are often used in abdominal, thoracic and breast surgeries.¹

In an attempt to prolong the analgesic duration of an FPB, a catheter can be left behind which allows additional administration of LA. Two common techniques used for administering LA through catheters rely on either a programmed intermittent bolus (PIB) or a continuous infusion (CI). Some advocate PIB over CI to increase the extent of FPBs,³ however, evidence is still limited. We will review the current literature on this topic and provide clinicians with tools to improve decision-making in prolonging the effects of FPB catheters.

Discussion

Programmed Intermittent Bolus

PIB is defined as the intermittent administration of a certain volume of LA at specific and programmed time intervals. This requires additional resources, including automated delivery system pumps. The PIB technique was primarily described in the field of labor analgesia in which programmed intermittent epidural bolus administration, compared to other