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New peripheral nerve blocks: are they worth the hype?

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The advent of portable ultrasound technology has revolutionised our ability to place peripheral nerve blocks within tissue planes. Ultrasound guidance has facilitated the introduction of new innovative approaches to deeper nerves not previously attempted using landmark-based techniques. The majority of these truncal blocks involve the branches of the spinal nerves.

A unique feature of truncal nerve blocks is that the nerve per se does not need to be visualised to achieve success. Local anaesthetic injected into the correct tissue plane will spread to reach the nerve. The path taken by the nerve and its branches together with the location of local anaesthetic placement determines the distribution of the block and possibly its duration.

Important considerations when performing these blocks include understanding the path of the nerve(s) and its anatomical relationships along that path as well as the extent of the sensory, motor, and autonomic distribution of the nerve. The thoracolumbar fascia plays an important role in defining the local anaesthetic spread. Spinal nerves, in general, divide into dorsal and ventral primary rami. The dorsal ramus passes through the erector spinae muscle and branches into medial and lateral posterior cutaneous branches. The ventral rami in the thorax pass deep to the intercostal muscles to branch into lateral and anterior cutaneous branches in the chest wall. In the abdominal wall they pass between the internal oblique and transversus abdominis muscles. The rami communicantes branch off the ventral rami anteriorly to join the sympathetic chain.

A variety of approaches have been described for the quadratus lumborum (QL) block, and the erector spinae (ESP) block. Both are essentially a more proximal approach to the spinal or intercostal nerve than the transversus abdominis plane (TAP) block. Irrespective of the volume used, spread of local anaesthetic is limited and unreliable after a conventional mid-axillary TAP block.

The ESP block is perhaps the most exciting of the tissue plane blocks described recently. The muscles of the back, i.e. the trapezius, rhomboids (above the level of T7), and the erector spinae form tissue planes that can be visualised with ultrasound and utilised for block placement. ESB is easy to perform and not very time-consuming. Local anaesthetic placed deep to the erector spinae muscle adjacent to the transverse processes of specific vertebra spreads cephalad over more dermatomes than a paravertebral block. Local anaesthetic also spreads medially into the paravertebral space where it blocks the sympathetic chain to provide visceral analgesia and laterally to block the intercostal nerves. Local anaesthetic placed between the transverse processes does not seem to affect the spread of local anaesthetic. Bilateral ESB behaves like an epidural, and, initial reports suggest that the duration of the ESB is longer than a paravertebral block. The duration of the block can be extended by catheter placement using either continuous infusions or intermittent bolus injections as needed.

The ideal dose for most of the fascial plane blocks in children has yet to be defined. Based on a series of unilateral ESP blocks in infants for gastrostomy placement at least 5 dermatomes were blocked using 0.5 ml/kg bupivacaine (i.e. 0.1 ml/kg/dermatome). In a neonatal cadaver study using 0.1 ml/kg dye spread over at least 3 spinal nerves (dermatomes) was noted.

The QL spread differs depending on the approach used. With the *lateral* approach, the local anaesthetic agent is placed lateral to the QL and posterior to the thoracolumbar fascia; while with the *anterior* approach the local anaesthetic is placed in the plane between the QL and psoas major muscle with spread into the paravertebral space; and the *posterior* approach places the local anaesthetic posterior to the QL and anterior to the latissimus dorsi. The *intramuscular* approach places the local anaesthetic within the QL muscle and blocks the nerve as it traverses the muscle. Each of these approaches have subtle differences in block distribution.

Are there advantages to the different approaches? Based on studies in adults, and limited series in children, it seems that the closer the local anaesthetic is placed to the origin of the nerve (i.e. in the paravertebral space) the spread is wider and covers more dermatomes. The duration also seems to be longer because the paravertebral space may act as a depot. A direct comparison between an ESP (at L1) and QL block (QL4-intramuscular approach) for lower abdominal surgery there was no difference in analgesia. This is not surprising since the same nerve is blocked albeit at different sites. Advantages over an epidural block include the ability to achieve unilateral blocks, to use when epidurals are contraindicated, reduces the potential

Table I: Characteristics of fascial plane blocks compared with neuraxial blocks

	ESP	Epidural	Serratus	QL	TAP
Spread	Extensive dermatome spread in muscle plane	Spread in fat filled space can be limited, unilateral, patchy	Less extensive spread	Posterior approach, fewer dermatome	More distal – fewer dermatomes covered
Neuraxial risk	Avoidance of neuraxial space	Neuraxial complications (bleeding, infection, nerve injury)	Avoids neuraxial complications	Avoids neuraxial space	Avoids neuraxial space
Pneumothorax (PNX) risk	PNX $n = 1$(adult)			Hematoma $n = 2$ (child)	Peritoneal injury
Absorption	Moderate systemic absorption (? epineph)	Less systemic absorption	Moderate systemic absorption (? epineph)	Moderate systemic absorption (? epineph)	Less systemic absorption (? epinephrine)
Coverage	Somatic and visceral	Somatic and visceral	Somatic	Somatic (? visceral)	Only somatic

for urinary retention and patients could be discharged earlier with continuous peripheral nerve catheters in situ.

Serratus anterior nerve block is another fascial block that is also gaining popularity in recent years. The serratus anterior muscle originates on the 1st to 8th ribs and inserts along the medial border of the scapula. At the level of the 5th rib the teres major, latissimus dorsi, and serratus muscles can be seen on ultrasound. This block induces analgesia in the anterolateral and posterior chest wall by targeting the lateral cutaneous nerves that lie in the interfascial plane between the serratus anterior and latissimus dorsi muscles. A block may also be successful when placed anterior to the serratus anterior muscle. The needle entry in the mid-axilla and the tissue plane can be easily identified using ultrasound guidance. Serratus anterior block has been used for thoracotomy, sternotomy and other chest wall procedures (e.g. breast surgery). A serratus anterior block is equally efficacious to an intercostal nerve block for post-thoracotomy pain, is longer lasting but does not cover visceral pain.

To make valid comparisons and to avoid confusion the nomenclature for the different approaches to a particular nerve block need to be standardised. Each block has value but the safety of each approach has yet to established. Block choice is determined by the surgical site but should also balance the risk and benefits associated with the block. To date the published numbers are small. One pneumothorax has been described in an adult, none in infants and children, after an ESP block. Two children with a coagulopathy have developed a hematoma after a QL block.

In conclusion, ultrasound-guided fascial plane blocks represent a rapidly expanding new era in regional anaesthesia. Individual nerves do not need to be identified. Instead, ultrasound is employed to identify a target muscular plane into which local anaesthetic is injected in such a way that the local anaesthetic spreads along the desired fascial plane to anaesthetise traversing nerves. Most are straightforward and easy to learn, and quick and easy to perform. Their introduction into clinical practice for both acute and chronic pain has come with a lot of hype as illustrated by the multitude of case reports or small case series that have been published over recent years. Further investigation is still needed in all age groups to establish the preferred approach for each block and to establish their role in clinical practice and multimodal analgesia.

Table II: Some indications for fascial plane blocks

Type of surgery	Thoracic
	Abdominal or hip
	Neck
Type of patient	Contraindication to epidural
	Spinal issues (hardware, abnormalities)
	Current or potential coagulopathy
	Failed epidural or paravertebral (PVB)
	Patient or parent fearful of epidural
	Rib fractures
	Unclear epidural vascular anatomy
Type of pain	Acute post-surgical pain or trauma
	Chronic pain

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