EDITORIAL

Truncal Nerve Block for Acute Perioperative Pain Management for Abdominal and Thoracic Procedures: A Review of Literature and Techniques

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Management of acute perioperative pain for abdominal and chest wall procedures has widely changed over the years. Neuraxial analgesia along with possible opioid administration were once the standard of care for postoperative pain control. Those methods however were accompanied by complications and increased costs due to the invasive nature of epidural/intrathecal methods and increased abuse potential with opiate administration.[1] Alternative techniques such as truncal nerve blocks have changed the management of perioperative pain for intrabdominal and intrathoracic procedures. These blocks utilize ultrasound guided regional anesthesia to provide safe and effective pain control with surgery. Truncal nerve blocks are now one of the key components of multimodal pain management.[2]

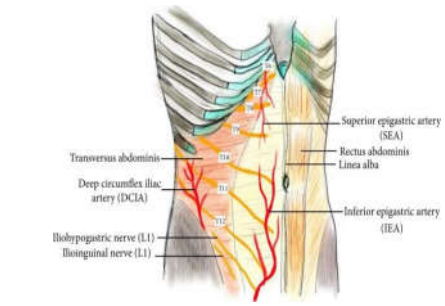
This review aims to explore the different forms of truncal nerve blocks and their impact on approaching perioperative pain management. The review will go in depth on the transversus abdominis block (TAP block), the rectus sheath block, the quadratus lumborum block, the erector spinae block, the serratus anterior block, and the pectoralis block (PEC 1/PEC 2 Block).

Transversus Abdominis Plane Block (TAP)

The TAP block aims to provide analgesia to the anterolateral abdominal wall. This technique was first introduced as landmark-guided technique in 2001 but has now become more reliable with ultrasound guided regional anesthesia (UGRA). This block requires anesthetic to be introduced in the fascial plane between the transversus abdominis muscle and the internal oblique muscle. The local anesthetic will block the anterior and lateral cutaneous branches of thoracolumbar nerves T6-L1. TAP blocks have been shown to provide analgesia for various surgeries such as hysterectomy, cholecystectomy, hernia repairs and even cesarean section3.

TAP blocks can be done via a lateral, a subcostal, a posterior or an oblique subcostal approach among others.[3] Analgesia provided by TAP blocks can therefore vary in duration and effectiveness based on which approach is applied. Additionally, TAP blocks can be combined, called dual TAP block, if infraumbilical and supraumbilical analgesia is required. Although TAP blocks can be short in duration, they can be prolonged if combined with a continuous TAP block. [3,4]

Systematic reviews have shown that TAP blocks are as safe and effective as other standard analgesic techniques such as wound infiltration and epidural analgesia. TAP block also significantly reduced the amount of narcotic consumption and delayed the need for opioids in the post-operative period. Subjective outcomes such as pain control and patient satisfaction were improved by TAP blocks.[5]



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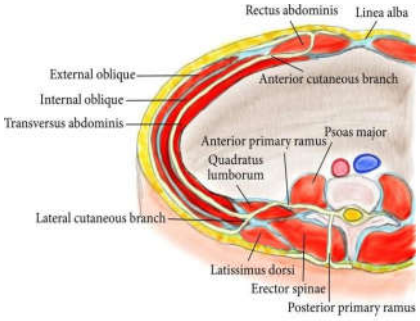

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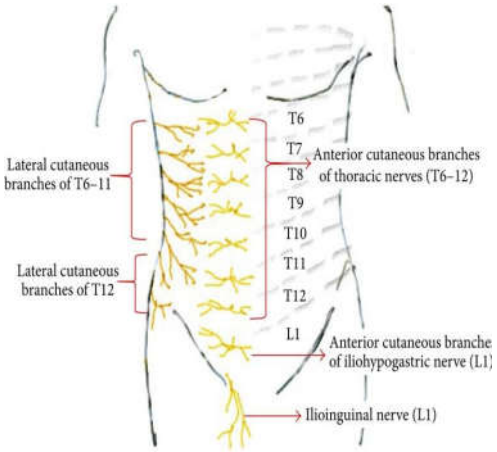

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Figure 1: Illustration of nerves and anatomy of anterolateral abdominal wall. (a) Nerves and vasculature in T6-L1. (b) Cross section of abdomen with anterior primary ramus of segmental nerve dividing into anterior and lateral cutaneous branches. (c) Nerve distribution of T6-L1. 3

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Rectus Sheath Block (RSB)

The rectus sheath block aims to provide analgesia in midline surgeries. The block involves injecting local anesthetic between the rectus abdominis muscle and posterior rectus sheath. This block targets the terminal anterior branches of the thoracic nerves T6-T12. However, due to anatomical variances in where T9-T12 nerves pass through the rectus muscle, the block can fail in providing analgesia.[2]

In a meta-analysis with eight randomized control trials, patients in the RSB groups did not show lower pain control and did not use less opioids compared to the control groups.1 Additionally, in a study that compared TAP block and RSB after cesarean sections, TAP block provided better pain control.6 RSB application is therefore limited to midline abdominal wall surgeries such as umbilical and moderate size ventral hernia.

Quadratus Lumborum Block (QL block)

Quadratus lumborum block (QL block) aims to provide analgesia to nerves surrounding QL muscles. The extent of the QL block varies according to site of injection, volume of injectate and type of QL block used. Cadaveric studies showed that QL block can cover from T7-L4 dermatome levels.7 QL muscle originates from the posteromedial side of the iliac crest and inserts at the 12th rib and the transverse processes of L1-L4 vertebrae. Since the QL muscle is in the posterior abdominal wall and close to retroperitoneal viscera, the QL block is in a deeper plane and therefore requires technical expertise.[7]

The block involves injecting local anesthetic in multiple points around the QL muscle, with different approaches such as the lateral QL block, the anterior QL block, and the posterior QL block. The spectrum of analgesia differs based on the type of QL block administered since each demonstrates a different mechanism of action. The spread of local anesthetic into the paravertebral space can reach sympathetic nerves which could explain visceral in addition to somatic pain coverage with QL blocks.[7]

Anterior QL block can be performed by injecting local anesthetic between the QL muscle and the psoas major muscle. This method would cover both the thoracic paravertebral space and lumbar nerve roots.[7] This method has shown to provide good analgesia in hysterectomies and cesarian section.

Lateral QL block is performed by injecting anesthetic at the lateral border of the QL muscle. This method reaches the transversus abdominis muscle and the subcutaneous tissue. This method has shown to decrease morphine requirements during cesarian section, and even outperformed a femoral nerve block during a hip hemiarthroplasty for femoral neck fracture.[7]

Posterior QL block requires injection of local anesthetic near the paravertebral space, between the QL muscle and erector spinae muscles. The posterior QL block is safer and more reliable than the other QL blocks because of the ability to use additional anatomical landmarks such as the psoas and L4 vertebrae.[2,7] Posterior QL block has been associated with reduced opioid use after cesarian section, decreased pain score after laparoscopic gynecological surgery, and reduced nausea and vomiting. [7,8,9]

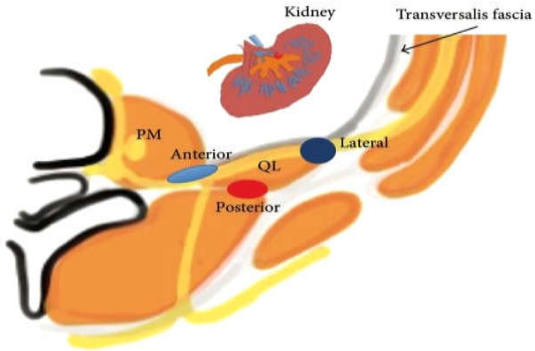

Figure 2: Illustration of cross section showing injection sites of local anesthetic for the anterior, posterior, and lateral injection sites for the quadratus lumborum (QL) block. The injection sites are depicted in reference to the QL muscle, the transversalis fascia (gray line) and the psoas major (PM).[9]

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Serratus Anterior Block

The serratus anterior block provides analgesia anterolateral chest wall by blocking the long thoracic, thoracodorsal, and third to sixth intercostal nerves. The block is done via ultrasound guided injection of local anesthetic at the level of 4-5th Ribs and at the mid axillary line beneath the serratus anterior muscle and above the rib. This block can be used for thoracic and breast analgesia such as for thoracotomy, rib fractures, and lateral wall chest surgeries.[10,11]

When compared to no block, the serratus anterior block decreased post-operative opioid consumption, increased time to first analgesia request, and decreased nausea and vomiting. However, there was so significant difference in those parameters when comparing the serratus anterior block to the paravertebral block. It is worth noting that the serratus anterior block is easier to easier to perform than the paravertebral block.[11]

Erector Spinae Plane Block (ESP block)

The erector spinae plane block is performed by ultrasound guided injection of large volume of local anesthetic (0.3-0.5 ml/kg) into the plane between the transverse process of the relevant vertebra and the erector spinae muscle. Local anesthetic will spread from three to six vertebral spaces in the cranio-caudal direction. The effect of this block is presumed to be through diffusion of local anesthetic into planes deeper to erector spinae muscle and into dorsal and ventral rami of corresponding spinal segment.[8,13]

ESP block has been used for thoracic, breast, and some abdominal procedures. While the mechanism of action is not fully understood, ESP block has shown to provide good pain control and decrease opioid use following abdominal surger.[8,12]

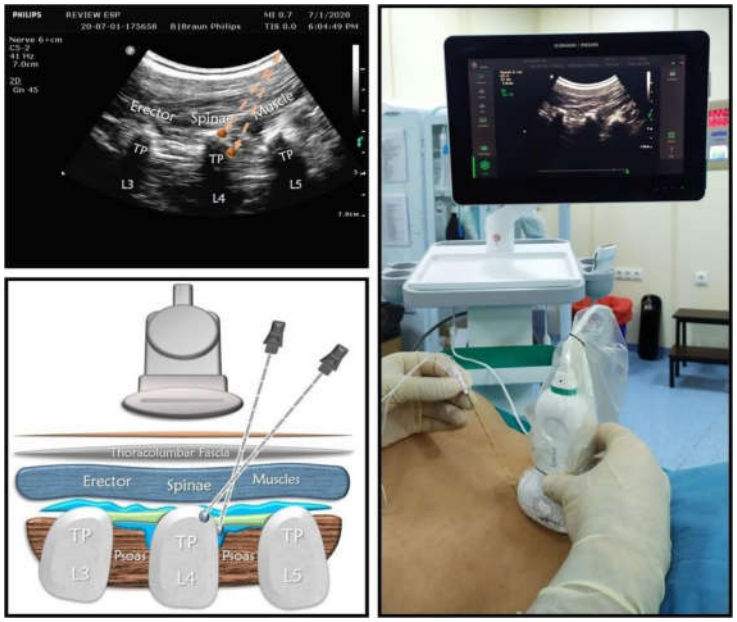

Figure 3 :Ultrasound, illustration, positioning of ultrasound probe and needle for the erector spinae plane block in the prone position. Illustration depicts L3-L5 transverse process(TP) in reference to the psoas, erector spinae muscles and thoracolumbar fascia. [12] Adapted from Tulgar et al.,2020. Licensed under CC BY 4.0 DEED

Pectoralis Block (PEC I and PEC II blocks)

PEC I block involves injecting local anesthetic at the midclavicular line 1-2 cm beneath the clavicle between the pectoralis major and the pectoralis minor muscle. The PEC I block target the medial and lateral pectoral nerves.[11]

The PEC II block requires the needle to be advanced deeper to inject local anesthetic between pectoralis minor and the serratus anterior muscle. The PEC II block covers the axillary region by targeting the intercostal and long thoracic nerves.[11]

PEC I and PEC II blocks are mainly used for breast surgeries and lateral chest wall. They have also been used for pacemaker placement.2 When studies compare PEC I/PEC II blocks with paravertebral blocks, PEC block patient had a lower opioid use and lower pain levels in the first twelve hours following surgery.[2]

CONCLUSION:

Advancements in ultrasound-guided regional anesthesia have made truncal nerve blocks offer a great addition to acute perioperative pain management for abdominal and thoracic procedures. While neuraxial analgesia and opioid administration are considered standard of care, truncal blocks offer efficient and localized analgesia.

Truncal nerve blocks facilitated by ultrasound guidance, offer precise and targeted analgesia, often minimizing opioid consumption. While some blocks, such as the RSB offer similar pain management to paravertebral blocks, others like the TAP block and QL block have shown increased efficacy in many procedures. Overall, truncal nerve blocks will play a role in multimodal analgesia and are tools that can enhance patient care and improve surgical outcomes.

REFERENCES:

1. Abdildin Y, Tapinova K, Salamat A, Shaimakhanov R, Aitbayev A, Viderman D. Rectus Sheath Block in Abdominal Surgery: A Systematic Review with Meta-Analysis. Rom J Anaesth Intensive Care. 2023;30:43-50. Published 2023 Apr 20. doi:10.2478/rjaic-2023-0006.

2. Go R, Huang YY, Weyker PD, Webb CA. Truncal blocks for perioperative pain management: a review of the literature and evolving techniques. Pain Manag. 2016;6:455-68. doi:10.2217/pmt-2015-0012.

3. Tsai, H.-C., Yoshida, T., Chuang, T.-Y., Yang, S.-F., Chang, C.-C., Yao, H.-Y., Tai, Y.-T., Lin, J.-A., C Chen, K.-Y. (2017). Transversus Abdominis Plane Block: An Updated Review of Anatomy and Techniques. BioMed Research International, 2017, 8284363. doi:10.1155/2017/8284363.

4. Petersen, P. L., Hilsted, K. L., Dahl, J. B., C Mathiesen, O. (2013). Bilateral transversus abdominis plane (TAP) block with 24 hours ropivacaine infusion via TAP catheters: A randomized trial in healthy volunteers. BMC Anesthesiology, 13(30).

5. Ma N, Duncan JK, Scarfe AJ, Schuhmann S, Cameron AL. Clinical safety and effectiveness of transversus abdominis plane (TAP) block in post-operative analgesia: a systematic review and meta-analysis. J Anesth. 2017;31:432-52. doi:10.1007/s00540-017-2323-5.

6. Yörükoğlu HU, Şahin T, Öge Kula A. Transversus Abdominis Plane Block Versus Rectus Sheath Block for Postoperative Pain After Caesarean Delivery: A Randomised Controlled Trial. Turk J Anaesthesiol Reanim. 2023;51:43-48. doi:10.5152/TJAR.2023.22724

7. Elsharkawy H, El-Boghdadly K, Barrington M. Quadratus Lumborum Block: Anatomical Concepts, Mechanisms, and Techniques. Anesthesiology. 2019;130:322-35. doi:10.1097/ALN.0000000000002524

8. Pirie K, Traer E, Finniss D, Myles PS, Riedel B. Current approaches to acute postoperative pain management after major abdominal surgery: a narrative review and future directions. Br J Anaesth. 2022;129:378-93. doi:10.1016/j.bja.2022.05.029.

9. Ueshima H, Otake H, Lin JA. Ultrasound-Guided Quadratus Lumborum Block: An Updated Review of Anatomy and Techniques. Pain Research and Management. 2017;2017:2752876. doi:10.1155/2017/2752876.

10. Xie C, Ran G, Chen D, Lu Y. A narrative review of ultrasound-guided serratus anterior plane block. Ann Palliat Med. 2021;10:700-6. doi:10.21037/apm-20-1542

11. Ní Eochagáin A, Carolan S, Buggy DJ. Regional anaesthesia truncal blocks for acute postoperative pain and recovery: a narrative review. Br J Anaesth. Published online January 18, 2024. doi:10.1016/j.bja.2023.12.020

12. Tulgar S, Aydin ME, Ahiskalioglu A, De Cassai A, Gurkan Y. Anesthetic Techniques: Focus on Lumbar Erector Spinae Plane Block. Local Reg Anesth. 2020;13:121-33. Published 2020 Sep25. doi:10.2147/LRA.S233274

13. Chin KJ, El-Boghdadly K. Mechanisms of action of the erector spinae plane (ESP) block: a narrative review. Mécanismes d'action du bloc du plan des muscles érecteurs du rachis (erector spinae, ESP) : un compte rendu narratif. Can J Anaesth. 2021;68:387-408. doi:10.1007/s12630-020-01875-2.