

Transversus Abdominis Plane (TAP) Block: Review Article

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ABSTRACT

Background: The transversus abdominis plane (TAP) block is a localized analgesic method for the abdomen wall on the anterolateral side. Ultrasound (US) guided TAP blocks are currently regarded as the gold standard. It is simple to obtain US images; it could be utilized in several surgical procedures including the abdominal wall on the anterolateral side. Though, US-guided TAP blocks' effectiveness varies, that may be owing to the variety of techniques used. The approach chosen has an effect on the area included and the duration of the block. To examine the true analgesic consequences of TAP blocks, we standardized the nomenclature system and defined all methods. While a single-shot TAP block has a restricted period, it remains an applicant for the analgesia threshold for abdominal wall operation due to the possibility of overcoming this restriction using the catheter method and liposomal bupivacaine. TAP blocks could be used more effectively to attain improvement of pain control with an integrated nomenclature and the advance of catheter method and/or local liposomal analgesics.

Objective: This review discusses the nomenclature system and current improvements in TAP block approaches.

Methods: The databases were searched for articles published in English in 4 data bases [PubMed – Google scholar-Egyptian bank of knowledge -Science direct] and Boolean operators (and, or, not) had been used such as [Transversus abdominis plane block AND Internal Oblique Muscle OR Ultrasound guided] and in peer-reviewed articles between January 2000 and August 2021.

Conclusion: With the improvement in US method, the successful rate and protection of TAP blocks have clearly enhanced.

Keywords: Internal Oblique Muscle, Transversus abdominis plane block, Ultrasound guided.

INTRODUCTION

The abdominal wall is made up of three muscles' layers: external oblique, internal oblique, and transversus abdominis, as well as their fascial sheaths. Nerve afferents passing by the transversus abdominis neuro-fascial plane innervate this muscle wall ⁽¹⁾.

The current method to providing analgesia after operation following incision of abdominal for inhibition the sensory innervation to the anterior wall of abdomen; despite, the clinical value of present techniques for blocking these nerve supplies is restricted, and the grade of block attained is unexpected. A significant cause of these blocks' qualified ineffectiveness is a deficiency of well-defined anatomic landmarks, which creates uncertainty about the precise needle placement and a deficiency of an obvious indicator that the local anesthesia isn't being put the accurate anatomical plane ⁽²⁾. A more dependable method of blocking neuronal afferents to the front wall of abdomen is based on anatomical research. The neural afferents pass within the neuro fascial plane. The lumbar triangle of Petit's is suggested as a possible entry site to this neuro fascial plane. The latissimus dorsi muscle encompasses the triangle posteriorly, while the external oblique muscle encompasses it anteriorly, with the iliac crest creating the triangle's base. The triangle is a stable and perceptible landmark ⁽³⁾.

Through the injecting local anaesthesia (LA) into TAP via the triangle of Petit, nerves of sensation of the

anterior abdominal wall are blocked prior to piercing the muscles and innervating the abdomen ⁽⁴⁾.

Anatomy:

The external oblique, the internal oblique, the transversalis muscles, and the rectus abdominis muscle comprise the muscles of abdominal wall (**Figure 1**) ⁽⁵⁾.

- **The External Oblique Muscle**

It is the biggest and most superficial muscle of the three muscles. It extends inferiorly from the lower 8 ribs' exterior and inferior sides. The fibers that originate in the lower ribs travel inferiorly and fuse with the iliac crest. The fibers run infero-anteriorly from the mid and highest ribs and terminate in a thick aponeurosis. The aponeurosis of the transversus abdominis and external oblique muscles links anteriorly to the aponeurosis of the transversus abdominis and external oblique muscles, forming the linea alba. The aponeurosis is responsible for forming the inferior inguinal ligament ⁽⁶⁾.

- **The Internal Oblique Muscle**

This muscle is a minor, more delicate than external oblique muscle. The iliac crest, and the inguinal ligament combine to form it. Its fibers wrap around the anterolateral abdomen, penetrating linea alba just over the transversus abdominis muscle anteriorly and lower six rib cartilages superiorly ⁽⁷⁾.



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- **The Transversus Abdominis Muscle**

Transversus abdominis is more interior of the three muscular layers, located just under internal oblique. Its fibers initiate in the iliac crest, inguinal ligament, the inner surfaces of the lower six rib cartilages, and lumbodorsal fascia. Its fibers cross the abdomen transversely, terminating in a wide aponeurosis. This aponeurosis develops laterally in comparison to the internal and aponeuroses of external oblique muscles, which persists medially and merges with the linea alba ⁽⁶⁾.

- 1 Branch of the anterior cutaneous n.
- 2 Rectus abdominis m.
- 3 External oblique m.
- 4 Internal oblique m.
- 5 Branch of the lateral cutaneous n.
- 6 Transversus abdominis m.

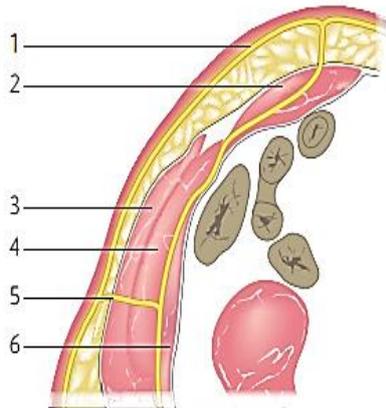


Figure (1): Muscles of anterolateral abdominal wall⁽⁸⁾.

Sensory supply of the abdominal wall:

The wall of abdomen is provided with sensation through the lower six thoracic nerves and the first lumbar nerve (**Figure 2**) ⁽⁵⁾.

- **Thoracic Nerves T6 – T11:**

The anterior fractions of T6–T11 supplies move along their respective intercostal spaces prior to crossing beneath the costal cartilages, entering the fascial plane between the internal oblique muscles and transversus abdominis. The nerves remain to penetrate the rectus abdominis muscle discontinuing providing feeling to the anterior abdomen skin. Around halfway through their innervation the thoracic nerves start giving lateral cutaneous divisions that move to posterior aspect, penetrating the external oblique muscle for providing feeling to the abdomen laterally and skin posteriorly ⁽⁹⁾.

- **Thoracic Nerve T12:**

The anterior branch of the nerve from T12 is extensive, extending anteriorly to the inferior border of the 12th rib and then under the arch lumbocostal, connecting the transversus abdominis and external oblique muscles with the other lower intercostal nerves. As part of the upper lumbar plexus, the T12 nerve provides a connecting division to the L1 nerve. T12's lateral cutaneous branch supplies skin to the upper gluteal area ⁽¹⁰⁾.

- **The Ilioinguinal and Iliohypogastric Nerves (T12 / L1):**

The iliohypogastric nerve is divided into two cutaneous divisions: an anterior division that provides skin above the hypogastrium and a lateral division that serves skin in the gluteal area. The ilioinguinal nerve runs through the inguinal canal and supplies feeling for the upper thigh skin, penis base, and scrotum ⁽¹¹⁾.

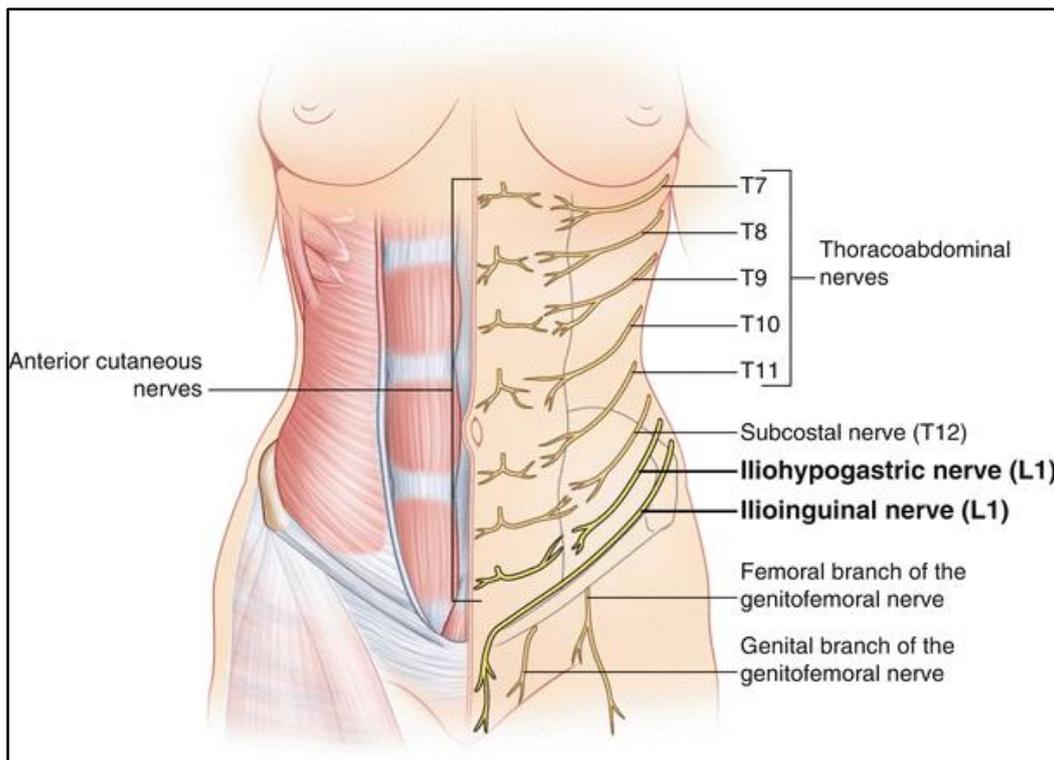


Figure (2): Nerve supply to the anterior abdominal wall ⁽¹²⁾.

Indication for transversus abdominis plane (TAP)

Block:

It could be utilized as portion of an analgesic procedure for operation of abdomen. Preliminary research can describe blocks spreading from T7-L1 utilizing bilateral doses. Following research have been incapable to give these results with the majority of research attaining topmost sensory levels around T9/10. It is reasonable to suggest that TAP block could only dependably be utilized for analgesia in operation, as caesarian section, radical prostatectomy, open appendectomy, total abdominal hysterectomy and hernia repair ⁽¹³⁾.

Complications:

TAP block is a reasonably secure method with a limited reported cases of substantial difficulties e.g., local anesthetic toxicity, bowel injury, intraperitoneal injection, hepatic and failure injury ⁽¹⁴⁾.

Techniques:

This block used to accumulate a huge amount of local anesthetic in both sides of TAP. The amount of dose utilized will be based on the determination of extreme dose of local anesthetic permitted. TAP block is accessible by landmark and US-guided methods ⁽¹⁵⁾.

I. Blind (Landmark) Technique:

The margins of Petit's triangle are composed of the iliac crest as the base, the external oblique muscle as the edge, and the latissimus dorsi as the posterior border. The triangle's bottom is constructed from fascial attachments of the internal and external oblique muscles. A regional anesthetic needle is introduced vertically into the skin in the Petit's triangle, just cephalad to the iliac crest and posterior to the mid-axillary line. The 1st 'pop' demonstrates that the external oblique muscle fascia has been penetrated, while the 2nd 'pop' shows that the internal oblique muscle fascia has been penetrated, thereby reaching the transversus abdominis fascial plane. A solution of local anesthetic could be inserted in neurovascular plane, thereby blocking sensory neurons prior to anastomosis of the anterior abdominal wall's different muscles ⁽⁴⁾.

Advantages of blind technique:

Benefit landmark method of TAP block above US guided are simple to achieve, economical, fewer time needed to prepare to inject TAP block, could be utilized at peripheral health center and emergency operation when ultrasound guidance (USG) is unavailable, could be injected by doctors without experience in US guided block ⁽⁴⁾.

Disadvantages of blind technique:

Disadvantages of blind method of TAP block are increased failure rate, inadvertent visceral perforation, pelvic hematoma and high risk of systemic toxicity from the local anesthetic owing to its injection into a highly vascular plan ⁽¹⁶⁾.

II. Ultrasound guided Technique:

TAP blocks could made by utilizing many methods as, the lateral, subcostal, and conventional posterior methods ⁽¹⁷⁾.

• Subcostal TAP Block:

The US probe is obliquely placed on the upper wall of abdomen along the margin of subcostal near the xiphisternum in the midline of the abdomen. The preferred site is in the fascial plane between the posterior rectus sheath and the transversus abdominis muscle. The needle is inserted and progressed from medial to lateral above the rectus abdominis, near to the midline. The injection is intended to spread the LA between the posterior rectus sheath and the anterior transversus abdominis muscle boundary. The probe is then laterally shifted till the aponeurosis of the external, internal oblique, and transversus abdominis muscles are recognized, and then further laterally until the transversus abdominis muscle is recognized. LA is then delivered into the fascial plane between the internal oblique and transversus abdominis muscles using the needle ⁽¹⁸⁾.

• Lateral TAP Block:

Supine positioning of the patient and placement of the US probe in the axial plane along the midaxillary line between the iliac crest and subcostal edge. On the belly wall, the external and internal oblique muscles, as well as the transversus abdominis muscles, are evident. The needle is inserted in the anterior axillary line and advanced to the fascial plane between the transversus abdominis and internal oblique muscles, roughly in the midaxillary line ⁽¹⁹⁾.

• Posterior TAP Block:

This method is like the lateral method, but the US transducer is shifted to observe the point where transversus abdominis terminates more posteriorly. Transversus abdominis terminates posteriorly and merges with the aponeurosis. Quadratus lumborum could be noticed posteromedial to the aponeurosis. Injection place is shallow to the aponeurosis close quadratus lumborum ⁽²⁰⁾.

Advantages of ultrasound guided technique:

US-guided methods have allowed reliable and safe block techniques reducing the prevalence of liver and other organ damages ⁽²¹⁾.

Disadvantages of ultrasound guided technique:

Due to TAP blocks using many LAs, there is a risk of LA toxicity. This issue has remained controversial because of several reports of people whose LA levels reached or above systemic toxic limits; therefore, careful attention could be given to the total doses of LA by determining the suitable levels within the maximum doses. Levobupivacaine and ropivacaine have a maximum dosage of 3 mg/kg ⁽²¹⁾.

CONCLUSION

With the improvement in US method, the successful rate and protection of TAP blocks have clearly enhanced. There are many various methods for US-guided TAP block, and the nuances of different method could impact the analgesic effects. It is necessary to categorize the “TAP block” group using a realistic nomenclature system before the comparison of analgesic impacts among various methods.

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