CHAPTER 9: TRANSVERSUS ABDOMINIS PLANE (TAP) BLOCK

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The innervation of the anterolateral abdominal wall is provided by the lower six thoracic (intercostal) nerves and the first lumbar nerve. The 7th intercostal nerve swings up and terminates around the xiphoid of the sternum at the highest point in the abdominal wall. The 10th intercostal runs from under the costal margin diagonally down and medially toward the umbilicus, while the 12th intercostal (subcostal) nerve innervates the lower anterolateral part of the abdomen and the suprapubic area. The first lumbar nerve originates the iliohypogastric and ilioinguinal nerves, which run in proximity to the anterolateral iliac spine before providing some innervation to the suprapubic area (iliohypogastric) and some of the inguinal and genital areas (ilioinguinal).

Main characteristics

This block was first described in 2001 by Dr Rafi, who at the time was working in Ireland. His technique involved the identification of the triangle of Petit, an anatomical formation first described by Jean Louis Petit (1674-1750), a French surgeon and anatomist in his “Traite des maladies chirurgicales et des operations qui leur conviennent”, published posthumously in 1774. The triangle is formed anteriorly by the free posterior border of the external oblique muscle, posteriorly by the anterior border of latissimus dorsi and inferiorly by the iliac crest. The area of the triangle is occupied by the internal oblique superficially and the transversus abdominis underneath. The triangle can have different dimensions, although according to one study involving 80 cadavers it is usually small and it could be absent in up to 17.5% of the cases (Loukas et al 2007). Its absence is due to a latissimus dorsi overlapping the external oblique.

The original technique was a “blind” technique performed through the triangle of Petit, which was identified by palpation. The technique relies on the operator’s ability to feel a “pop” or loss of resistance as the needle is driven into the correct fascial plane. Controversy exists as to how many “pops” are supposed to be felt. The most accepted version involves two pops, but even among the people that accept this version there is no agreement as to the reason for them. In my opinion the first pop is due to the needle crossing through the fascia lining the superficial aspect of the internal oblique muscle, and the second pop is the result of the needle crossing the combined internal oblique deep fascia and the fascia covering the superficial aspect of the transversus abdominis muscle, under which the desired neurovascular plane is found. It is important to notice that a needle inserted through the triangle of Petit does not traverse the external oblique since this muscle does not insert on the thoracolumbar fascia and instead it has a free border that becomes the anterior boundary of the triangle. No part of the external oblique extends into the area of the triangle. The internal oblique and transversus abdominis muscles on the other hand do continue medially to insert on the thoracolumbar fascia and fill the area of the triangle. The use of ultrasound greatly facilitates the performance of this block and eliminates the need to feel subjective “pops”.

Another point of controversy is the extent of analgesia. Some authors believe that analgesia after a TAP block can extend through the entire abdominal wall (T7-T10), but this is
neither backed by the clinical evidence nor by the anatomy. It is more likely that a TAP block performed either using landmarks or ultrasound can provide analgesia and/or anesthesia from about T10 level (umbilical region) to L1 (suprapubic region). If a higher spread is desired a subcostal injection into the transversus abdominis plane is needed.

It is important to keep in mind that because the thoraco lumbar nerves originate their important lateral perforating branch between the anterior and midaxillary lines the block needs to be performed not anterior (proximal) than the midaxillary line.

TAP Block Technique

Indications
To produce anesthesia or analgesia of the abdominal wall, below the umbilicus. For analgesia of the upper abdomen a subcostal injection is needed.

Point of contact with the nerves
The needle approaches the thoraco abdom inal nerves as they travel between the transversus abdominis (deep) and the internal oblique (superficial) muscles at the level of the mid axillary line.

Patient position
The patient can be supine or in lateral position with the arm on the side to be blocked elevated and turned to the opposite side.

Type of needle
A 5 or 10cm, 21G, insulated needle can be used. Using an 18-G epidural needle provides a better visualization of this larger needle and its curved rounded tip could lower the risk of accidental penetration of the peritoneum and abdominal cavity.

Type of transducer
A linear high frequency (8-15 MHz) probe is usually sufficient. In larger patients a curved, low frequency (3-7 MHz) probe may be necessary.

Scanning
The probe is placed diagonally over the lateral abdominal wall at the level of the mid axillary line.

Needle insertion
The needle can be inserted in plane or out of plane. We prefer to insert the needle in plane from anterior to posterior, as shown in figure 9-1.
The characteristic ultrasound image obtained at around the midaxillary line level is shown in figure 9-2.

In bigger patients a reasonable good image can be obtained by applying pressure to the transducer in order to compress the subcutaneous layer and adipose tissue. Figures 9-3, and 9-4 show the needle advancing toward the TAP in an obese patient.
To produce a block above the umbilicus it is necessary to make a subcostal injection, as shown by Hebbard et al (Anesth Analg, 2008). At this location the injection is made in the plane between rectus abdominis and transversus muscle, shown in figure 9-5.

**Local anesthetic and volume**

Usually we inject 15-20 mL of local anesthetic solution for unilateral blocks or 30-40 mL total for bilateral blocks. 1% mepivacaine can be used but preferably either ropivacaine 0.5% or 0.375 bupivacaine is used to obtain a longer effect. We always add epinephrine as an intravascular indicator.
References

2. Rafi A. Abdominal field block: A new approach via the lumbar triangle. Anaesthesia 2001; 56: 1024-1026