CHAPTER 9: TRANSVERSUS ABDOMINIS PLANE (TAP) BLOCK

TRANSVERSUS ABDOMINIS PLANE (TAP) BLOCK

The innervation of the antero lateral 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 antero lateral part of the abdomen and the suprapubic area. The first lum bar nerve originates th e iliohypogastric and il ioinguinal nerves, which run in proximity to the antero superior 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 descri bed in 2001 by Dr Rafi, who at the tim e 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 Fr ench surgeon and anatom ist in his "Traite des maladies chirurgicales et des operations qui leur conviennent", published posthum ously in 1774. The triangle is form ed anteriorly by the fr ee 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 occupi ed by the internal oblique superficially and th e transversus abdominis underneath. The triangle can have d ifferent dimensions, although according to one study involving 80 cadavers it is us ually 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" techni que performed through the triangle of Petit, which was identified by palpation. The technique re lies on the operator's ab ility 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. Th e 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 cr ossing through the fascia lining the superficial aspect of the internal oblique muscle, and the second pop is th e result of the n eedle crossing the combined internal oblique deep f ascia and the fascia covering the supe rficial aspect of the transversus abdominis muscle, under which the desired neurovascular plane is found. It is important to notice that a need le inserted though th e triangle of Petit doe s not traverse the external oblique since this muscle does not insert on the thoracolumbar fascia and instead it has a free border that becom es the anteri or boundary of the triangle. No part of the external oblique extends into the area of the tr iangle. The internal oblique and transversus abdominis muscles on the other hand do continue m edially 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 enti re abdominal wall (T7-T10), but this is

neither backed by the clinical ev idence nor by the anatomy. It is m ore likely that a TAP block performed either using landm arks or ultrasound can provide analgesia and/or anesthesia from about T10 level (um bilical region) to L1 (sup rapubic region). If a h igher spread is desired a subcostal injection into the transversus abdominis plane is needed.

It is im portant to keep in m ind that becau se 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 analg esia of th e abdominal wall, below the um bilicus. 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 trav el between the transversus abdominis (deep) and the internal obli que (superficial) m uscles 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 b e blocked elevated and turned to the opposite side.

Type of needle

A 5 or 10cm, 21G, insulated needle can be use d. Using an 18-G epidural needle provides a better visualization of this larger needle an d its curved rounded tip c ould 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 latera l abdominal wall at the level of the m id axillary line.

Needle insertion

The needle can be inserted in plane or out of plane. W e prefer to insert the needle in plane from anterior to posterior, as shown in figure 9-1.

Fig 9-1. Needle insertion, in plane. The needle is in serted in plane, from anterior to posterior. (On a model with permission).

The characteristic ultrasound im age obtained at around the m idaxillary line level is shown in figure 9-2.

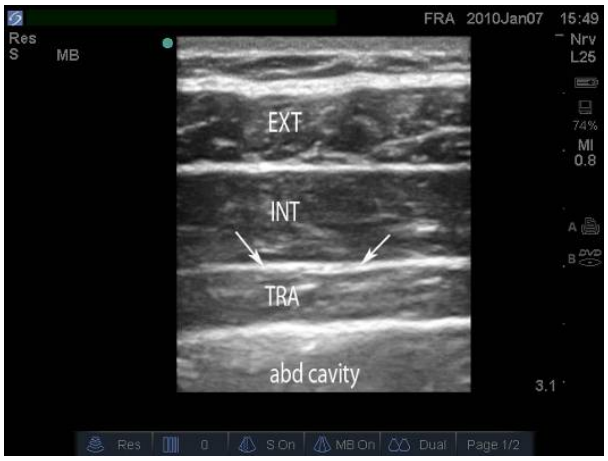

Fig 9-2. TAP block. With the probe placed diagonally over t he lateral abdominal wall, th e external oblique (EXT), internal oblique INT) and transversus abdominis (TRA) are easily distinguished. The arrows sh ow the fascial plane between the in ternal oblique and trans versus muscles where the injection is p erformed. Author's collection.

In bigger patients a reasonable good image can be obtained by applying pressure to the transducer in order to com press the subcutaneous layer and adi pose tissue. Figures 9-3, and 9-4 show the needle advancing toward the TAP in an obese patient.

Fig 9-3. Needle insertion. Compared to figure 9-2 a thick layer o f adipose tissue (significantly compressed by probe pressure) can be observed under the skin. The needle (white arrow) is seen traversing the external oblique (ext). Also shown are i nternal oblique (int) and transversus (tra). Author's collection.

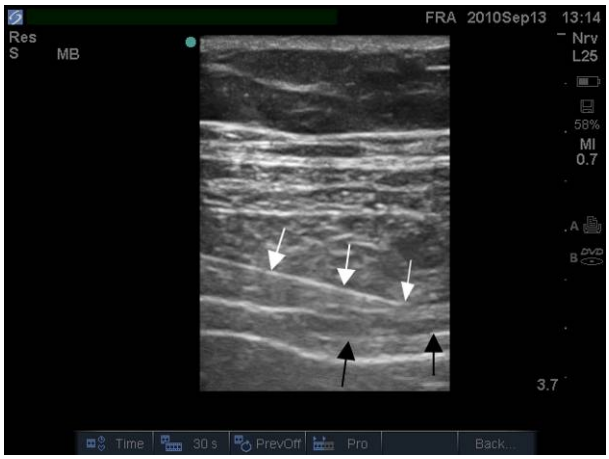

Fig 9-4. Needle reaching the subfascial TAP. The needle, shown with white arrows, has reached the TAP. The injected local anesthetic, shown with black arrows, is seen forming a small pool on top of the transversus abdominis muscle but under its superficial fascia (right TAP plane). Author's collection.

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.

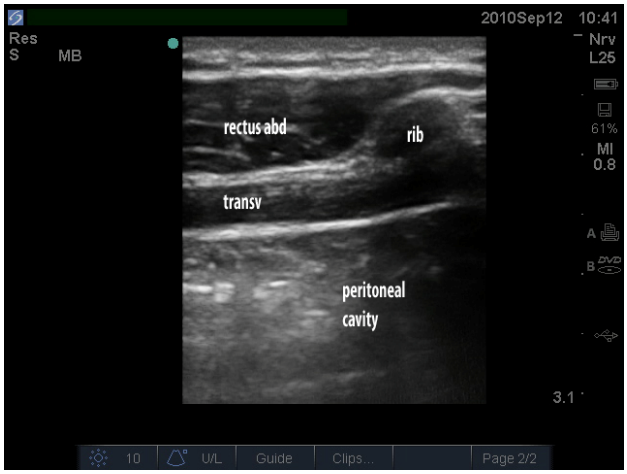

Fig 9-5. TAP subcostal. At the subcostal level the upper thoracoabdominal nerves (T7-T9) run in the plane between the rectus abdominis (rectus abd) anteriorly and transversus abdominis muscle (transv) posteriorly. Also shown is the costal margin (rib) and part of the peritoneal cavity. Author's collection.

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

1. Snell RS: Clinical anatomy for medical students, 5th edition. Boston, MA: Little, Brown and Company; 1986, pp 133-182
2. Rafi A. Abdominal field block: A new approach via the lumbar triangle. Anaesthesia 2001; 56: 1024-1026
3. Loukas M, Tubbs RS, El-Sedfi A, Jester A, Polepalli S, Kinsela C, Wu S. The clinical anatomy of the triangle of Petit. Hernia 2007; 11: 441-444
4. McDonnell J, O'Donnell B, Curley G, Heffernan A, Power C, Laffey J. The analgesic efficacy of transversus abdominis plane block after abdominal surgery: A prospective randomized controlled trial. Anesth Analg 2007; 104: 193-197
5. Hebbard P, Fujiwara Y, Shibata Y, Royse C. Ultrasound-guided transversus abdominis plane (TP) block. Anaesthesia and Int Care 2007; 35: 616-617
6. McDonnell J, Curley G, Carney J, Benton A, Costello J, Maharaj C, Laffey J. The analgesic efficacy of transversus abdominis plane block after cesarean delivery: A randomized controlled trial. Anesth Analg 2008; 106:186-191
7. Carney J, McDonnell J, Ochana A, Bhinder R, Laffey J. The transversus abdominis plane block provides effective postoperative analgesia in patients undergoing total abdominal hysterectomy. Anesth Analg 2008; 107: 2056-2060
8. Hebbard P. Subcostal transversus abdominis plane block under ultrasound guidance. Anesth Analg 2008; 106: 674-675
9. Griffiths J, Middle J, Barron F, Grant S, Popham P, Royse C. Transversus abdominis plane block does not provide additional benefit to multimodal analgesia in gynecological cancer surgery. Anesth Analg 2010; 111: 797-801