

Transversalis Fascia Plane block, a novel ultrasound guided abdominal wall nerve block.

Introduction

The lateral cutaneous branches (LCB) of the thoraco-abdominal nerves (T6 to L1) arise proximal to the angle of the rib, run a short distance with the main nerve and emerge through the overlying muscles in the mid axillary line (1). They pass superficially to supply the skin of the lateral thorax, abdomen and upper thigh to the greater trochanter of the femur. It is rare however to produce block of the LCB when performing ultrasound guided posterior transversus abdominis plane (TAP) block as previously described (2). The LCB of nerves T6 to T10 leave the main nerves before they enter the abdominal wall. T11 lateral branch leaves the main nerve near the end of the 12th rib and may be accessible local anesthetic from the TAP. The sub-costal nerve (T12) and ilio-hypogastric nerves normally give off their LCB before entering the TAP and these pass through the TAP in a more posterior position than the local anesthetic of an ultrasound guided posterior TAP block.

Local anaesthetic injected into the layer between the transversus abdominis muscle aponeurosis and its deep investing transversalis fascia will spread proximally over the inner surface of the quadratus lumborum muscle and block the proximal portions of the T12 and L1 nerves. This will produce block of both the anterior and lateral branches of these nerves. This block called the Transversalis Fascia Block (TFP) targets these nerves anatomically between the lumbar plexus block and the TAP block. The block can be performed with the patient supine.

Technique

Using an in-plane technique the needle passes from anterior with the patient supine. A linear or curvilinear ultrasound probe is orientated transversely over the lateral abdomen between the iliac crest and costal margin. The external oblique, internal oblique and transversus abdominis muscles are imaged as well as the more posterior transversus aponeurosis.

The reflection of peritoneum curving deep to transversus abdominis is identified and the overlying peri-nephric fat. This is generally more prominent nearer the iliac crest. On the right the liver may be imaged deep to peritoneum. The quadratus lumborum muscle is also identified medial and posterior to the aponeurosis of transversus abdominis. It may be confused with the partly overlying erector spinae muscle which is more superficial and often more prominent on ultrasound.

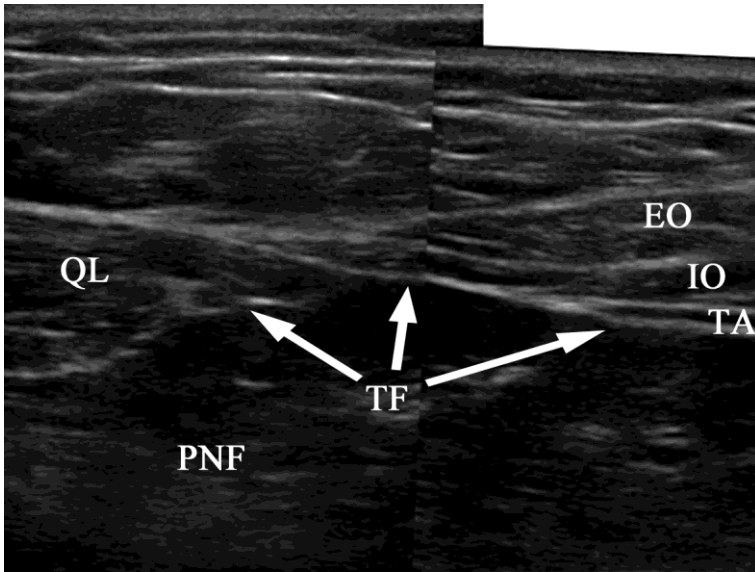


Fig 1 Composite sonogram of the lateral abdominal wall showing transversus abdominis muscle (TA), internal oblique muscle (IO), transversalis fascia (TF), peri-nephric fat (PNF), and quadratus lumborum muscle (QL)

The block area should be sufficiently posterior that peri-nephric fat rather than peritoneum underlies the transversalis fascia to minimise the risk of peritoneal penetration. After imaging the target area the needle insertion point is selected to bring the 100 to 150 mm needle to the target in plane and relatively perpendicular to the ultrasound to enhance needle visibility. The probe is slid anteriorly to image the needle throughout its course in the abdominal wall. The end point is easier to determine if the needle is passed through the posterior “tail” of the transversus muscle as the transversus aponeurosis is thinner and less well defined as a separate layer.

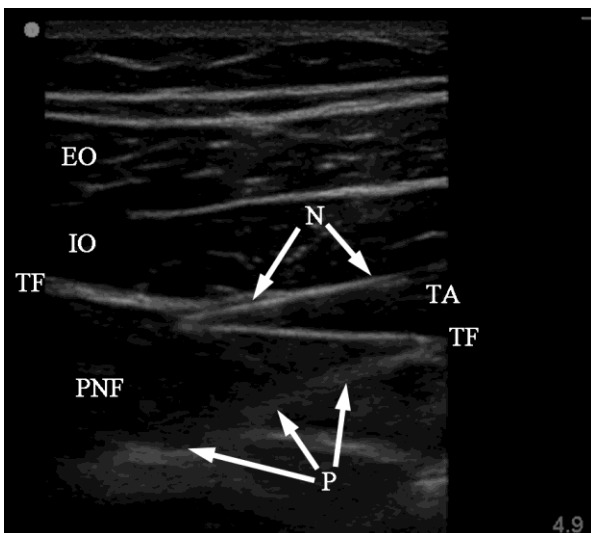


Fig 2. Sonogram at commencement of the TFP injection, showing needle (N), transversus abdominis muscle (TA), transversalis fascia (TF), peri-nephric fat (PNF), peritoneal reflection (P), internal oblique muscle (IO) and external oblique muscle (EO). The needle is positioned through the “tail” of the transversus abdominis muscle

After passing out the deep surface of transversus abdominis muscle, local anesthetic is injected which pushes the transversalis fascia from the transversus muscle. The local anesthetic is seen to run both anteriorly and posteriorly. The needle can be passed more posteriorly into this hydro-dissected area to improve spread over the anterior surface of the quadratus lumborum muscle. Although the needle has only passed a few millimetres beyond the TAP the pattern of spread is quite different, passing postero-medially over the inner surface of quadratus lumborum. Local anaesthetic may also be placed into the TAP on withdrawal of the needle to achieve more extensive block of anterior branches of nerves above T12.

Discussion

The sub-costal nerve (T12) proximally passes deep over the anterior surface of the quadratus lumborum muscle, which extends from the 12th rib to the iliac crest. It then continues a short distance deep to the aponeurotic posterior extension of the transversus abdominis muscle before passing through the aponeurosis into the TAP (3). The ilio-hypogastric nerve also passes deep to quadratus lumborum proximally and continues deep to the transversus muscle aponeurosis and then belly to penetrate to the TAP in a more anterior and highly variable position (4).

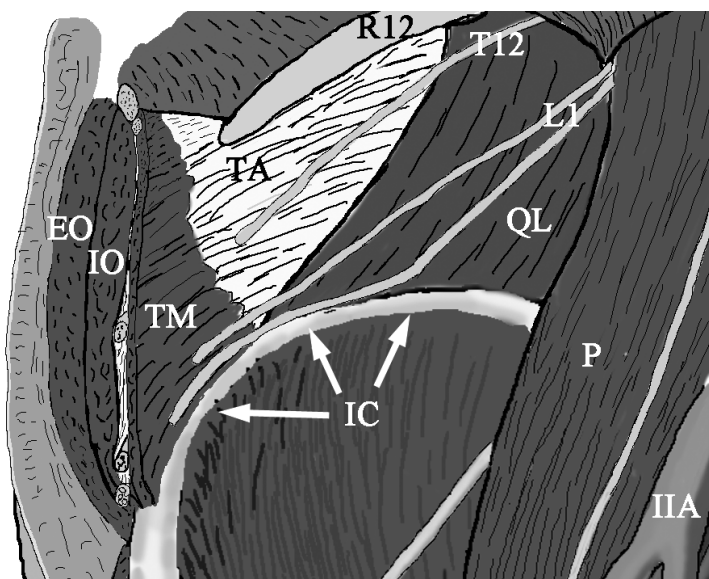


Fig 3. Diagram of the posterior abdominal wall from in front showing 12th rib (R12), T12 and L1 nerves, iliac crest (IC), transversus aponeurosis (TA), transversus muscle (TM), quadratus lumborum muscle (QL), internal oblique muscle (IO), external oblique muscle (EO), internal iliac artery (IIA) and psoas muscle (P).

Lining this neural plane on the inner surface of quadratus lumborum and transversus abdominis is the transversalis fascia. This fascia in turn overlies the peri-nephric fat which forms a crescent around the lateral abdominal wall deep to transversalis fascia and separating it from peritoneum.

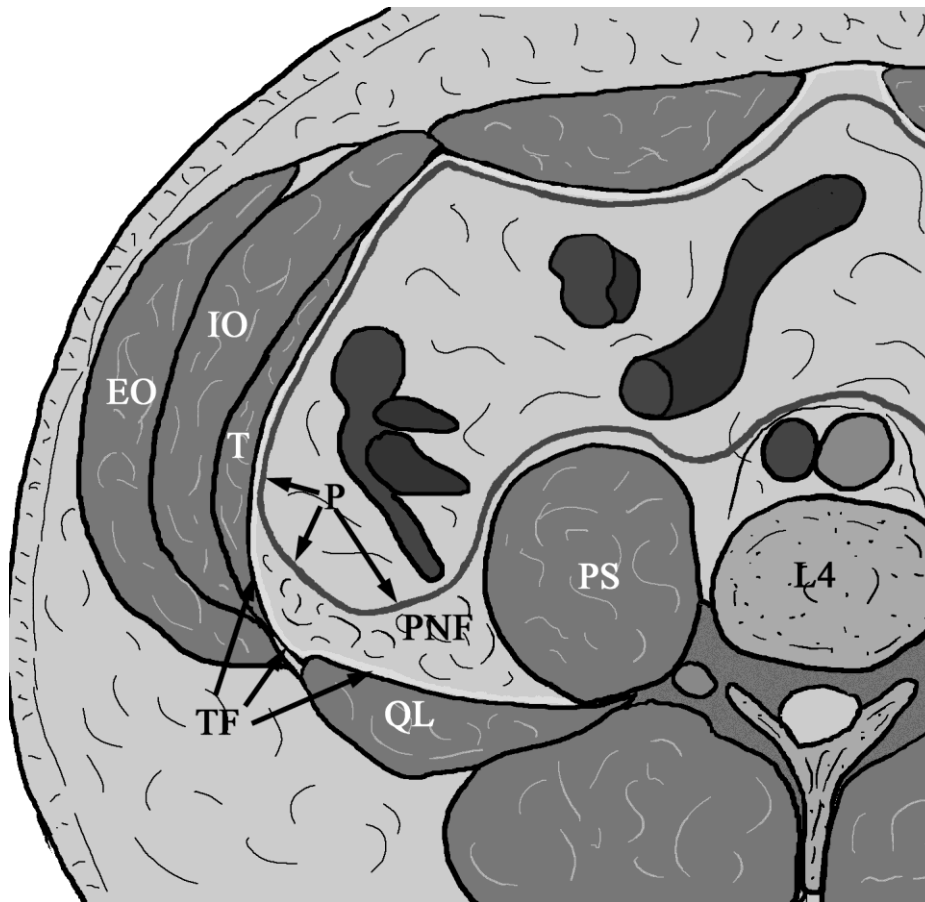


Fig 4. Diagram of transverse section through the abdominal wall immediately above the iliac crest showing the transversus abdominis muscle (T), quadratus lumborum muscle (QL), transversalis fascia (TF), internal oblique muscle (IO), external oblique muscle (EO), psoas muscle (PS), peritoneum (P), peri-nephric fat (PNF) and L4 vertebral body.

The LCB of the sub-costal nerve, which may be given off before the nerve penetrates the transversus aponeurosis, emerges through the lumbar fascia in a posterior position close to the border of latissimus dorsi muscle (5). The ilio-hypogastric nerve gives off the LCB deep to transversus abdominis muscle, which then passes through the TAP in a posterior position. Local anesthetic placed under ultrasound guidance near the posterior margin of transversus in the TAP appears restricted from spreading posterior to the muscle belly on imaging. This probably explains the lack of block over the iliac crest from ultrasound guided TAP block. In addition the main L1 nerves are normally deep to transversus muscle postero-laterally and unlikely to be blocked by local anaesthetic in the posterior part of the TAP. This was demonstrated in a series of cadaveric ultrasound guided TAP injections (6) where the L1 nerves remained deep to the posterior TAP block in one dissection. Ultrasound guided TAP blocks of the anterior abdominal wall aiming to include L1 should therefore be placed near the junction of the anterior and middle thirds of the iliac crest, by which point the L1 nerves are usually in the TAP (4).

This novel TFP block has been used clinically in cases of iliac crest bone harvest and operations where the lower lateral abdominal wall has been incised such as appendicectomy

and caecostomy, often in combination with TAP block on needle withdrawal. Compared to the more anteriorly placed ultrasound guided posterior TAP injection the block is limited in the anterior abdomen as only L1, T12 and possibly T11 will be blocked. T12 and L1 however supply laterally over the iliac crest as far as the greater trochanter enabling a simple and effective analgesic block over the iliac crest and upper lateral thigh as well as the lower abdomen. Clinical experience with this approach is limited at present and the subject of further investigation. The TFP is also continuous medially with the plane of the lumbar plexus and opening the plane with fluid may provide an alternative lateral approach to lumbar plexus block under ultrasound guidance.

References

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