

Abdominal Wall Blocks

Christian Egeler, MD (Wuerzburg) FRCA
ABMU HB Swansea/Wales
Christian.egeler@wales.nhs.uk

Abdominal wall blocks have undergone a resurgence of interest in recent years. Many different approaches and techniques have been described:

- Blind double pop technique by Rafi through the angle of petit,
- US techniques, which can be classified as posterior, anterior and subcostal
- Rectus sheath
- Quadratus Lumborum Muscle Compartment
- Classical 'ilioinguinal' / hernia block

Initial studies on the blind technique showed significant and prolonged analgesia, however those have not been reproduced with US techniques which poses questions as to where exactly the injection point is with the blind technique. Major research gaps remain to clarify the most effective endpoint of injection depending on the surgical procedure. LA spread to the paravertebral space as proposed with the blind technique remains to be proven to be relevant in clinical practice.

1. Anatomy

The abdominal wall receives 2 anatomically separate nerve supplies:

- a. The majority of the abdominal wall is innervated via the **intercostal nerves T6 – T11**. They split into lateral and anterior cutaneous branches. The latter follow the intercostal spaces and enter the abdominal wall between Internal Oblique (IO) and Transversus Abdominis (TA) muscles. They then continue through the linea semilunaris into the rectus sheath, supplying the External Oblique and Rectus Abdominis muscle and midline skin. The lateral cutaneous branches become superficial and divide into anterior and posterior branches to innervate the abdominal wall lateral to the rectus sheath.
- b. **Subcostal, Iliohypogastric (IH) and Ilioinguinal (II) nerves** traverse on the anterior surface of the Quadratus Lumborum muscle and enter the anterior abdominal wall through the Thoracolumbar fascia and aponeurosis origin of TA and then continue – like intercostal nerves – between IO and TA muscle. IH (usually larger) and II are very closely associated with the iliac crest and inguinal ligament. Subcostal and IH nerves give off lateral branches, which supply anterior and lateral gluteal skin down to the greater trochanter and sometimes beyond. The anterior branches of these 3 nerves continue between IO and TA muscles which they supply. Cutaneous innervations are skin over the suprapubic area (IH), under inguinal ligament (IH, II) and scrotum/labium area (II).

Whilst anatomical descriptions show an idealised dermatomal supply, there is extensive communications and overlap between peripheral branches.

- c. **Abdominal wall muscles** are External Oblique (EO), Internal Oblique (IO) and Transversus Abdominis (TA) muscles. It is worth noting that at the upper third of the rectus sheath TA reaches under the rectus muscle but retreats lateral lower down. EO, IO and TA muscle fascias encase the rectus muscle superficially (EO, IO) and deep (IO, TA) above the arcuate line whilst below the line all three muscle fascias reach over the rectus sheath, only the transversalis fascia (which is separate to the TA fascia) continues deep to the sheath.

Quadratus Lumborum Muscle stretches from iliac crest to 12th rib with medial attachments to lumbar transverse processes. It can be visualised on US from posterior giving a recently called 'shamrock' appearance with Psoas and Ileocostal muscles or from posterolateral which allows an overview of the lateral part of IO and TA, the TA aponeurosis inserting into the thoracolumbar fascia and a triangular retroperitoneal space containing lower pole of kidney.

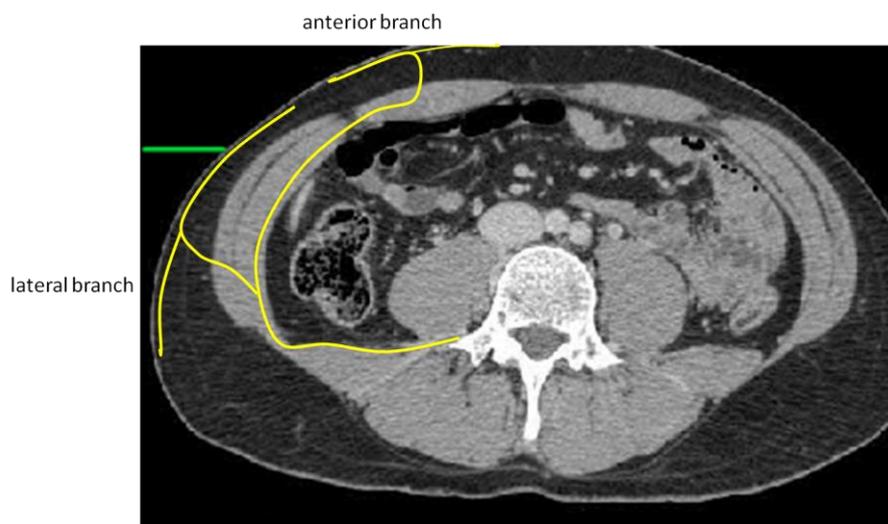
- d. **Thoracolumbar fascia (TLF)**, which covers the back muscles, inserts inferiorly at the iliac crest and connects laterally with the Transversus Abdominis Muscle. It has a strong superficial and middle layer surrounding the erector spinae and ileocostal muscles. The middle and thin deep layer of the TLF surrounds the quadratus lumborum muscle.

2. Block approaches

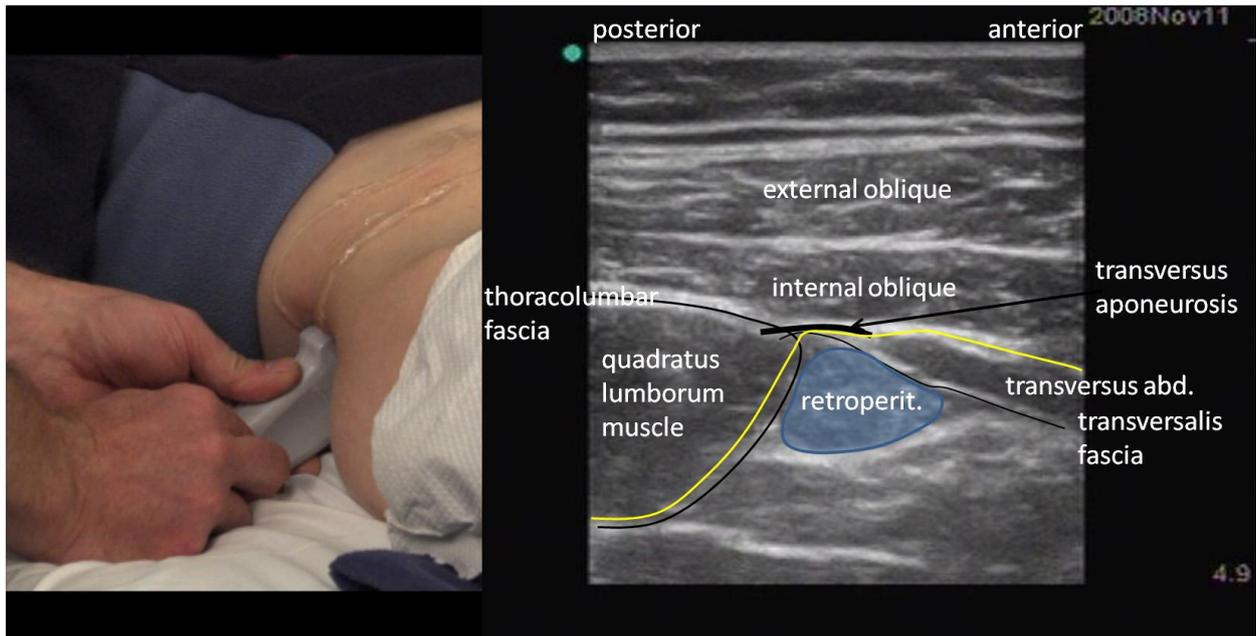
- a. **Rectus sheath:** a bilateral injection placed laterally to lift the rectus abdominis muscle off the deep muscle fascia and sheath (visible as a double line on US). Depending on spread this may have to be done above and below the umbilicus. This will block the anterior branches only. Catheters can be placed for postoperative infusions/ boluses and tend to be very effective for abdominal midline incisions. They can be placed pre-incision under US, by the surgeon upon closure or – more difficult due to oedema and air introduced during surgery – postoperatively.
- b. **Anterior TAP** block: LA injection between internal oblique and transverses abdominis muscles on the anterior abdominal wall will again mainly affect the anterior cutaneous nerves.
- c. **Posterior TAP:** Following TA laterally, it can be seen forming the TA aponeurosis linking with the anterior layer of TLF. Just before that point both lateral and anterior nerve branches can be blocked when LA is placed between the 2 muscle layers. This approach – volume dependent - will mostly block intercostals T10 /T11, and subcostal, IH and II.
An injection aimed superficial or posterior to the TA aponeurosis may only affect the lateral cutaneous branches.
- d. **Subcostal TAP:** This will primarily block intercostals nerves (anterior branches) as they enter the abdominal wall and are amenable for catheter placement to cover midline incisions. During preop placement our approach will be from lateral to medial, for postop placement access is easier from anterior aiming obliquely lateral.

- e. **Quadratus Lumborum Compartment** block: Placing LA at the anterior aspect of the QLM will block subcostal, IH and II, but not any intercostals nerves. A study in our institution showed no spread to the paravertebral space (unpublished). However this block appears to be very effective for iliac crest bone graft, pelvic surgery, and covers the top end of a lateral incision for hip surgery.
- f. **Blind TAP at Angle of Petit:** This blind approach aims to identify the gap between external oblique and latissimus dorsi muscles and iliac crest. The initial studies suggested that this approach deposits LA between IO and TA muscles, though other studies have found that the endpoint can be in a number of different spaces including liver, kidney/paranephric space and bowel. Whilst this approach has been published to be very effective, the endpoint remains unclear.
- g. **Classical hernia block:** The endpoint again being between IO and TA muscle, this approach is slightly above the level of the ASIS. Under US a neurovascular bundle can often be identified – however this may in fact represent the subcostal or T11 intercostal nerve, not the IH or II, since those 2 are very close to the iliac crest and ASIS and may themselves not be easily identifiable (hence the second part of the injection aimed towards and under the ASIS)
- h. **Genitofemoral block:** Not strictly an abdominal wall block, but effective for testicular surgery. It can be found by tracing the inferior epigastric artery deep to the rectus sheath to its origin from the external iliac artery. The genital branch follows testicular vessels on the surface of psoas muscle, crosses the external iliac and inferior epigastric artery entering the spermatic cord. The femoral branch continues on the iliopectineal arch/fascia iliaca lateral to the external iliac artery into the femoral triangle under fascia lata. Ilioinguinal nerve terminal fibres follow the spermatic cord superficially.

cutaneous nerve anatomy (simplified)



Pic 1: The course of Subcostal, IH and II Nerve via the QLC into the TA Plane



Pic 2: View of the posterior TAP plane and Quadratus Lumborum Compartment

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