40 Quadratus Lumborum Blocks

BLOCK AT A GLANCE

Comprises a group of interfascial plane injections of local anesthetic at different locations around the quadratus lumborum muscle.

- **Indications:** Analgesia for the anterolateral abdominal wall and parietal peritoneum
- **Goal:** Local anesthetic spread either lateral (QL1), posterior (QL2), or anterior (QL3) to the quadratus lumborum muscle to block the anterior rami of spinal nerves T10-L1 (and, eventually, the paravertebral sympathetic chain)
- **Local anesthetic volume:** 15 to 30 mL

General Considerations

The ultrasound-guided quadratus lumborum (QL) block was developed from the transversus abdominis plane (TAP) block to achieve a more consistent and extended block of the anterior rami of spinal nerves supplying the abdominal wall. The various QL block techniques (i.e., QL1, QL2, QL3) aim to improve the analgesia after surgeries involving the abdominal wall. Several technique variations have been devised to enhance the spread of local anesthetic (LA) to reach the thoracic paravertebral space, and eventually the sympathetic chain. Other variations aim to extend the block to the lumbar plexus and provide analgesia to the lower extremity. New modifications continue to be implemented: the transverse oblique paramedian (TOP) and the supra-iliac anterior QL3, for instance, are thought to result in a more cranial and caudal spread of the LA, respectively. However, the available evidence so far is insufficient to draw conclusions.

Mechanisms of action of QL block variants are mainly related to the anatomical injection site but inconsistent. As an example, the spread of the LA with an anterior QL block (QL3) may reach the paravertebral space, lumbar nerve roots, and sympathetic chain, and result in weakness of the lower extremities, as has been reported. For safety and efficacy of QL blocks, adequate ultrasound (US) images are crucial, yet often challenging to obtain. Without adequate images, the QL blocks are associated with variable success rates and risks of iatrogenic injury to the kidney, liver, and/or spleen.

Limitations

Similar to many interfascial plane blocks, the duration, extent, and quality of the analgesia between the different QL blocks vary. The block characteristics depend on the injection site, anatomical characteristics of the fascial planes, the volume of the LA injected, and whether the injectate reaches the intended target nerves.

Anatomy

The QL muscle originates from the posterior part of the iliac crest and the iliolumbar ligament and inserts on the 12th rib and the transverse processes of vertebrae L1-L4. The QL muscle is located between the psoas muscle (anterior) and the erector spinae muscles (posterior). Both the QL and psoas muscles pass posterior to the medial and lateral arcuate ligaments of the diaphragm to insert in the transverse processes (Figure 40-1). To understand the potential mechanisms of action of the QL block, it is essential to understand the anatomy of the fasciae that surround the muscles at this level.

The ***thoracolumbar fascia (TLF)*** is a complex arrangement of multilayered fascial planes and aponeurotic sheaths that form the retinaculum around the paraspinal muscles of the lower back and sacral region. Anatomical variations of TLF are common, but it is usually described as a fascial structure consisting of anterior, middle, and posterior layers. The posterior TLF layer surrounds the erector spinae muscles, the middle layer separates the QL from the erector

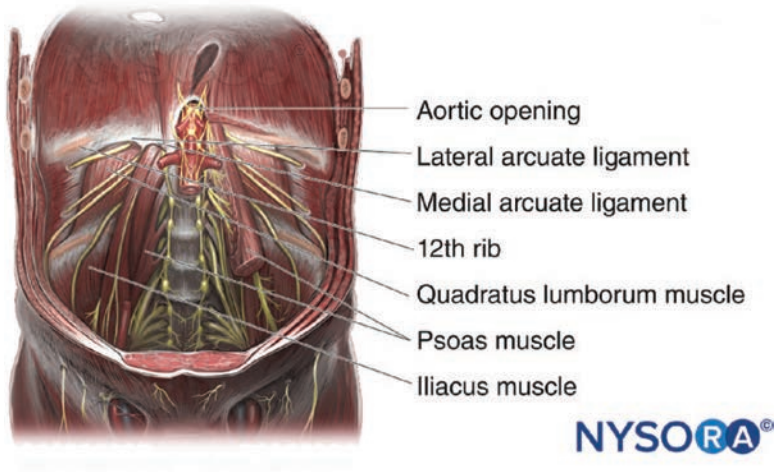


FIGURE 40-1. Anatomy of the quadratus lumborum.

spinae muscles, and the anterior layer covers the anterior aspect of the QL muscle (Figure 40-2). Cranially, these fascia layers follow the QL and psoas muscles through the arcuate ligaments and the aortic hiatus of the diaphragm, and continue with the endothoracic fascia, providing a potential pathway for the spread of injectate toward the thoracic paravertebral space.

The ***lateral raphe*** is a dense connective tissue layer formed where the aponeurosis of the transversus abdominis and internal oblique muscles join the fused posterior and middle TLF at the lateral border of the erector spinae muscles. The **lumbar interfascial triangle (LIFT)** is a fat-filled space along the lateral border of the erector spinae muscles from the 12th rib to the iliac crest.

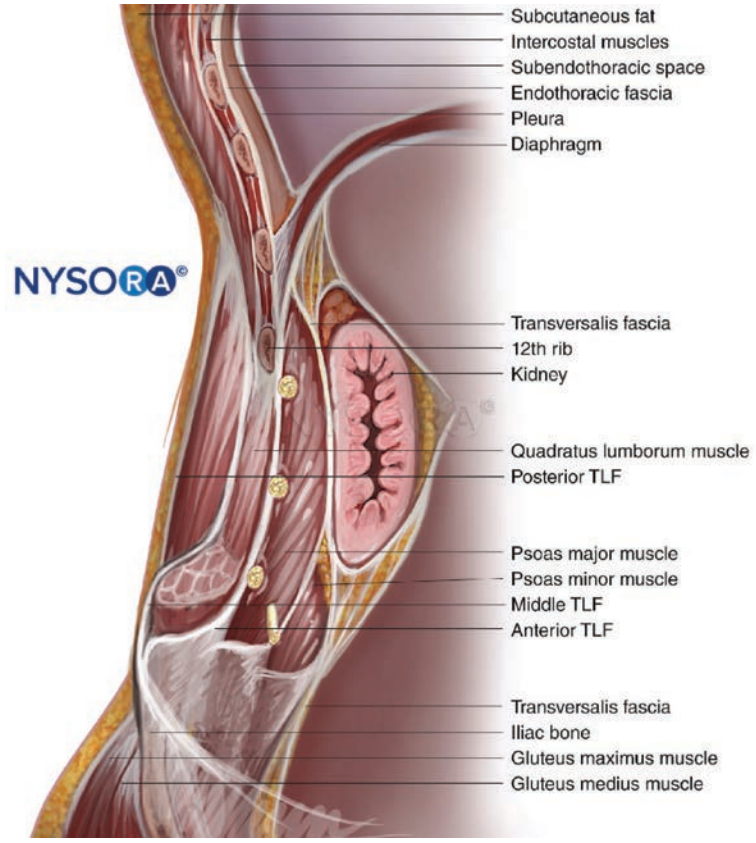


FIGURE 40-2. Anatomy of the fasciae surrounding the quadratus lumborum muscle showing the thoracolumbar fascia (TLF) and its posterior, middle, and anterior layers.

The ***transversalis fascia (TF)*** is the innermost layer of the parietal fascia of the abdomen. It is part of the endo-abdominal fascia investing the abdominal cavity and covering the deep surface of the transversus abdominis, QL, and psoas major muscles. It communicates with the endothoracic fascia posterior to the diaphragm with a possibility of LA spread into the thoracic paravertebral space, and it extends caudally as well, communicating with the fascia iliaca over the psoas major and iliacus muscle, resulting in a potential spread of LA to the branches of the lumbar plexus.

Cross-Sectional Anatomy and Ultrasound View

A cross-section at the level of the L3 vertebra shows a transverse view of the paraspinal muscles and surrounding fascial planes, along with the anterior branches of the spinal nerves (Figure 40-3). The subcostal (T12), iliohypogastric, and ilioinguinal (L1) nerves travel between the psoas major muscle and the QL muscle to enter the transversus abdominus plane. The lumbar plexus elements can be seen between the intervertebral foramen and the psoas muscle compartment.

With the transducer placed over the flank of the patient, and oriented medially, the transverse process of the L4 vertebra appears as a hyperechoic structure with an acoustic shadow behind. The psoas major, QL, and erector spinae muscles appear as hypoechoic structures, surrounded by hyperechoic fasciae, located anterior, superficial, and posterior to the transverse process respectively. This arrangement of the muscles produces a sonographic pattern often referred to as the "shamrock sign" (Figure 40-4). The tiny nerves cannot be seen.

Distribution of Analgesia

The distribution patterns of somatic analgesia with QL blocks depend on the site of injection among other factors. The extent of sensory blocks in Figure 40-5 are only orientative.

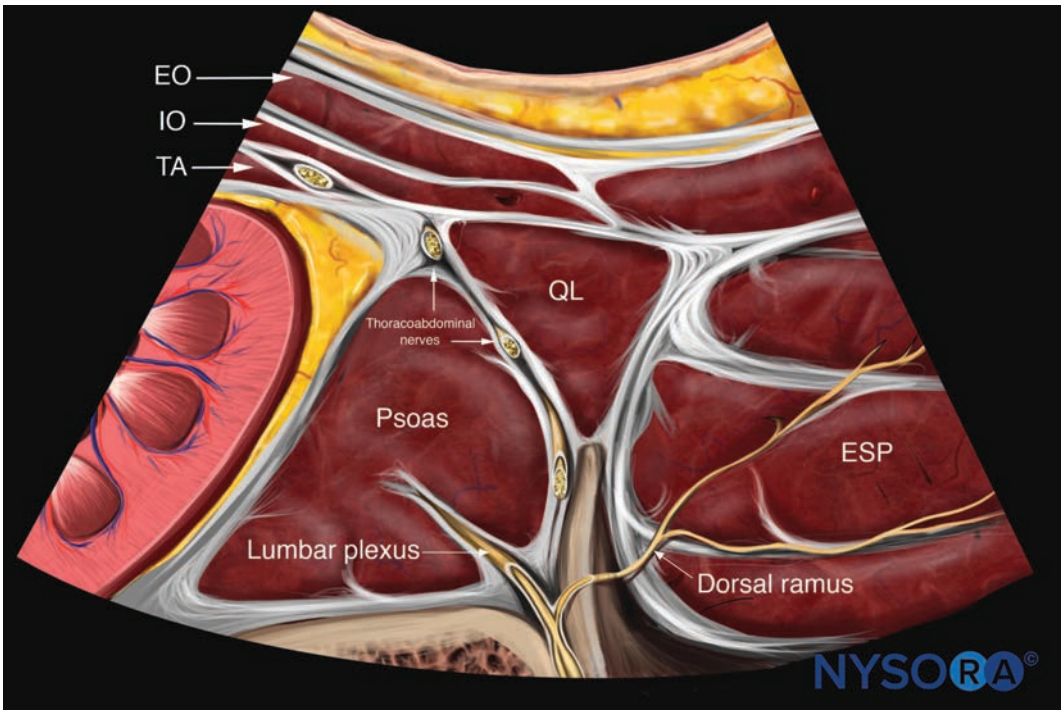


FIGURE 40-3. Cross-section anatomy of the quadratus lumborum (QL) muscle at the level of the L3 vertebra. EO, external oblique muscle; IO, internal oblique muscle; TA, transversus abdominis muscle; ESP, erector spinae muscles.

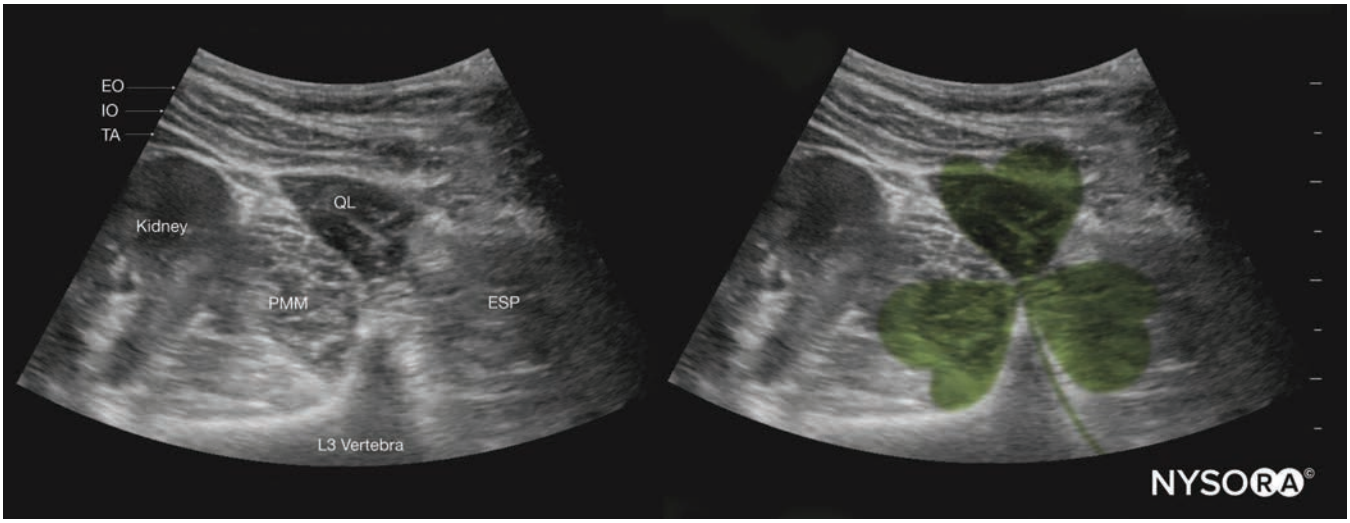


FIGURE 40-4. Sonoanatomy of the shamrock sign: psoas major (PMM) located anteriorly, quadratus lumborum (QL) located superficial, and erector spinae muscles (ESP) located posterior to the transverse process. EO, external oblique muscle; IO, internal oblique muscle; TA, transversus abdominis muscle.

Block Preparation

Equipment

- Transducer: High-frequency linear transducer for QL1, and low-frequency curved transducer for QL2 and QL3
- Needle: 80- to 100-mm, 22- to 25-gauge needle

Local Anesthetic

QL blocks typically require 15 to 30 mL of LA (0.2-0.4 mL/kg). Low concentrations (i.e., 0.125-0.375%) of long-acting LAs such as bupivacaine, levobupivacaine, or ropivacaine should be used.

Patient Positioning

For QL blocks the lateral decubitus or sitting positions may be used. The lateral decubitus position may allow for better ergonomics and imaging of the relevant US structures and neuraxis (Figure 40-6). The supine position is suitable only for lateral QL blocks (QL1 and QL2), although visualization of the neuraxial and paravertebral structures will be impaired. For the TOP QL3, the patient should be in a lateral or sitting position.

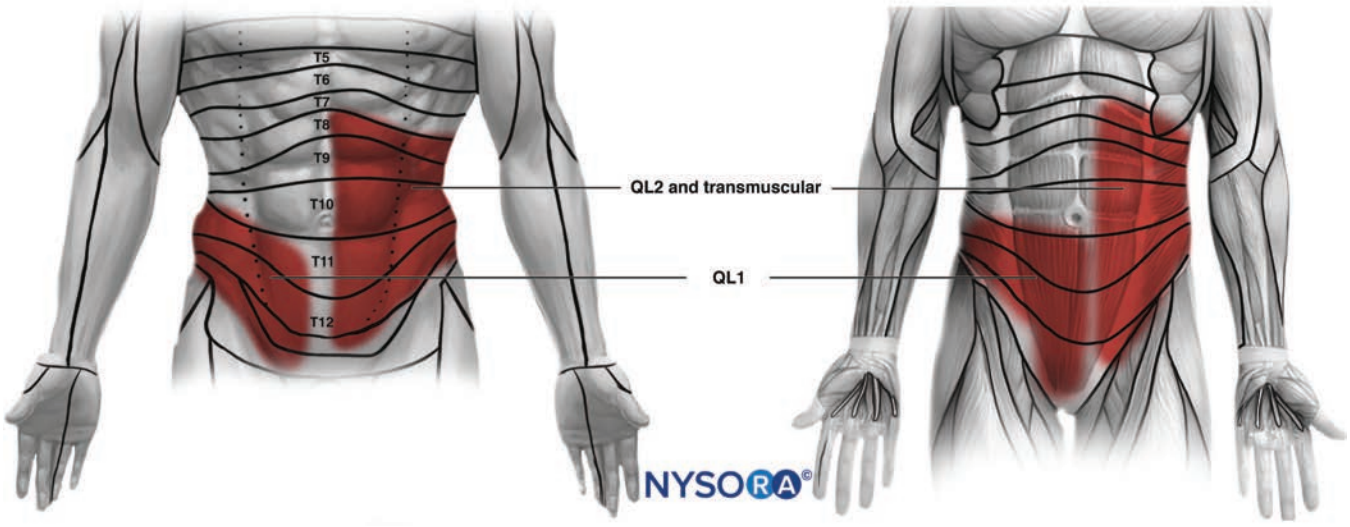


FIGURE 40-5. Sensory distribution after the performance of different QL blocks.

FIGURE 40-6. Patient position to perform QL block.

TECHNIQUES

For all QL block techniques, the external landmarks are the iliac crest, costal margin, and the posterior and midaxillary lines.

Lateral Quadratus Lumborum Block (QL1)

Initial Probe Position and Scanning Technique

With the linear transducer, the technique is similar to the posterior TAP block (see Chapter 38 for TAP blocks). The curvilinear transducer is placed in transverse orientation at the midaxillary line, between the iliac crest and the costal margin. The goal is to visualize the abdominal wall muscles (Figure 40-7).

The transducer is then slid posteriorly until the posterior aponeurosis of the transversus abdominus, internal oblique, and the QL muscles are identified. The target is just deep to the TAP aponeurosis but superficial to the TF at the lateral margin of the QL muscle. Applying some pressure and tilting the transducer may improve imaging of the fascial planes.

Needle Approach and Trajectory

The needle is inserted in-plane, from either the anterior or the posterior end of the transducer, until the tip pierces the posterior aponeurosis of the TA muscle, lateral to the QL muscle. The injection of 1 to 2 mL of LA should result in a visible spread along the lateral side of the QL muscle between the TA aponeurosis and the transversalis fascia (Figure 40-8).

Posterior Quadratus Lumborum Block (QL2)

Initial Probe Position and Scanning Technique

The transducer is placed in transverse orientation at the midaxillary line and slid posteriorly (similar to the QL1 block). The goal is to visualize the fascial plane between the posterior aspect of the QL muscle and the middle layer of the TLF (Figure 40-7).

Needle Approach and Trajectory

The needle is inserted in-plane, from either the anterior or posterior end of the transducer, toward the posterior aspect of the QL muscle and the middle layer of the TLF. The injection of 1 to 2 mL of LA should result in the pooling of LA along the posterior aspect of the QL muscle, posterior to the LIFT (Figure 40-8).

Anterior or Transmuscular Quadratus Lumborum Block (QL3)

Initial Probe Position and Scanning Technique

The transducer is placed in a transverse orientation over the patient's flank just cranial to the iliac crest and tilted caudally. The goal is to visualize the acoustic shadow of the L4 transverse process, the erector spinae muscles posteriorly, the QL muscle laterally, and psoas major muscle anteriorly (i.e., the shamrock sign) (Figure 40-7).

Needle Approach and Trajectory

The needle is inserted in-plane from the posterior side, and through the erector spinae and QL muscles until the tip reaches the plane between the QL and psoas muscle. The injection of 1 to 2 mL of LA should spread along this fascial plane (Figure 40-9).

Local Anesthetic Distribution

After confirmation of the correct needle tip position, the block is completed with the injection of 20 mL of LA while observing the spread along the corresponding fascial plane.

Variations of the Anterior QL3 Block

Several variations of the QL3 block have been described:

- The *transverse oblique paramedian (TOP QL)* is similar to QL3 but performed at the level of L2.
- The *supra-iliac anterior QL block technique* is performed at the level of the L5 transverse process.

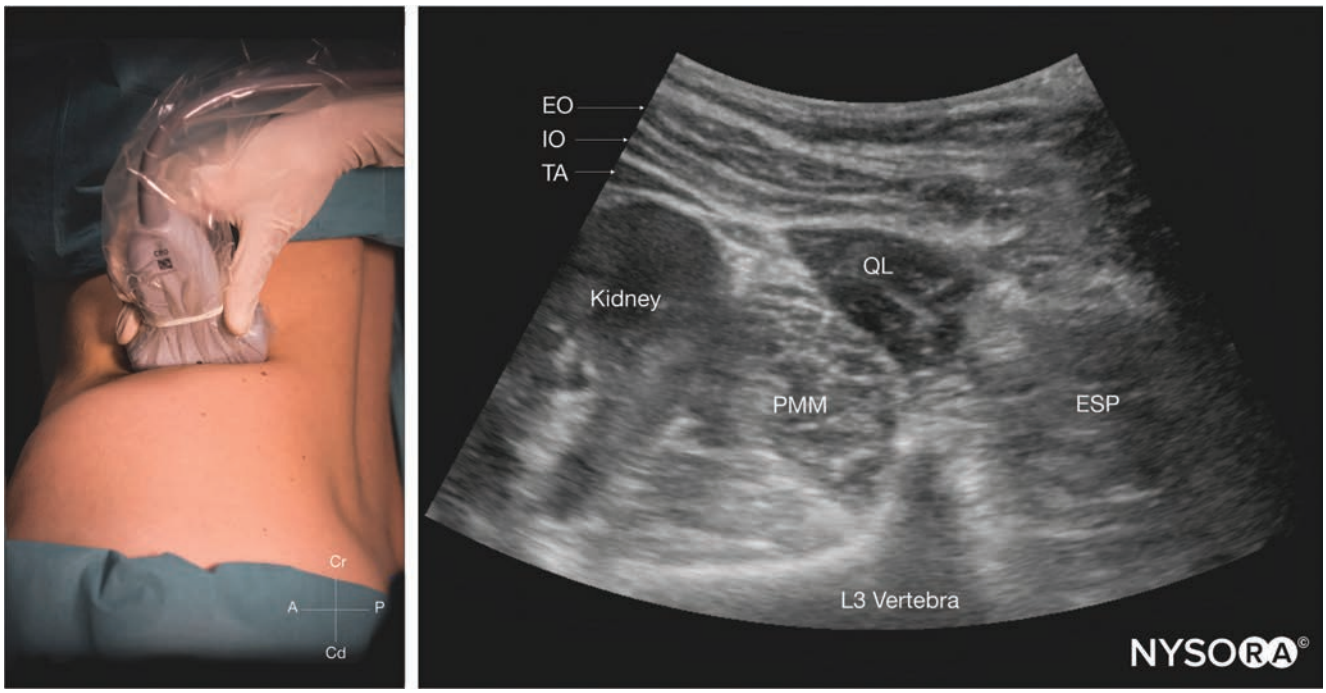


FIGURE 40-7. Transducer position and sonoanatomy to perform either a QL2 or a QL3 block. EO, external oblique muscle; IO, internal oblique muscle; TA, transversus abdominis muscle; QL, quadratus lumborum; PMM, psoas major muscle; ESP, erector spinae muscles.

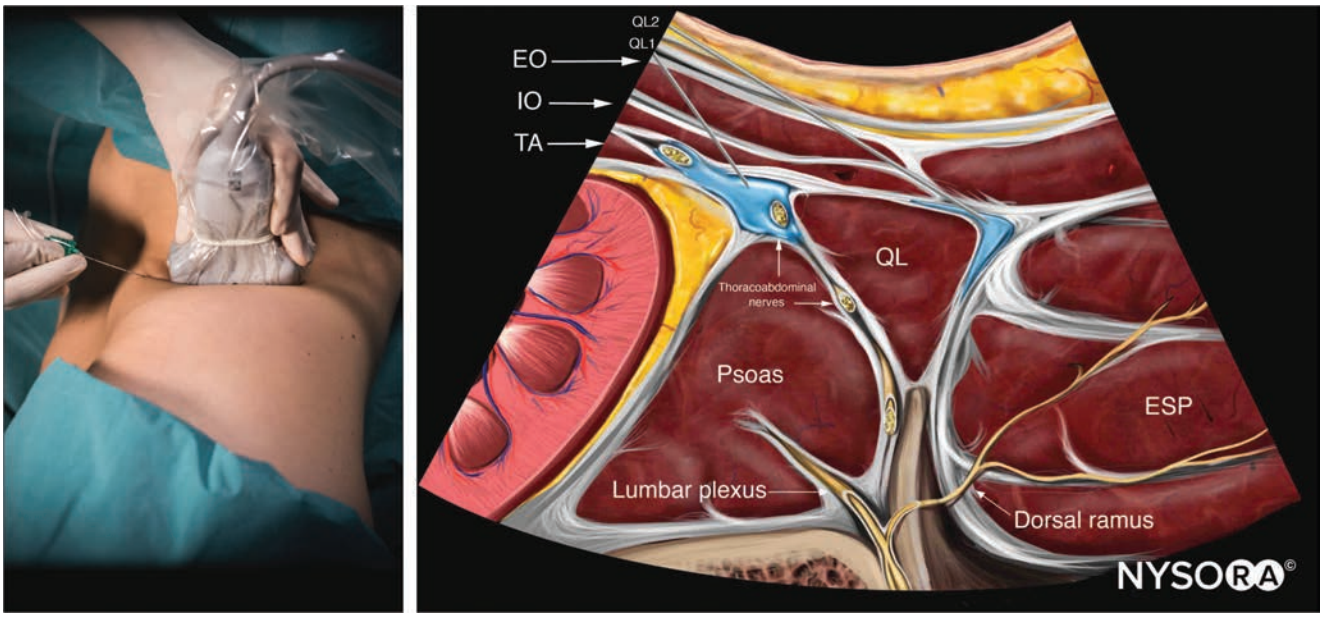


FIGURE 40-8. Reverse ultrasound anatomy of a QL1 or a QL2 block with needle insertion in-plane. EO, external oblique muscle; IO, internal oblique muscle; TA, transversus abdominis muscle; QL, quadratus lumborum; ESP, erector spinae muscles.

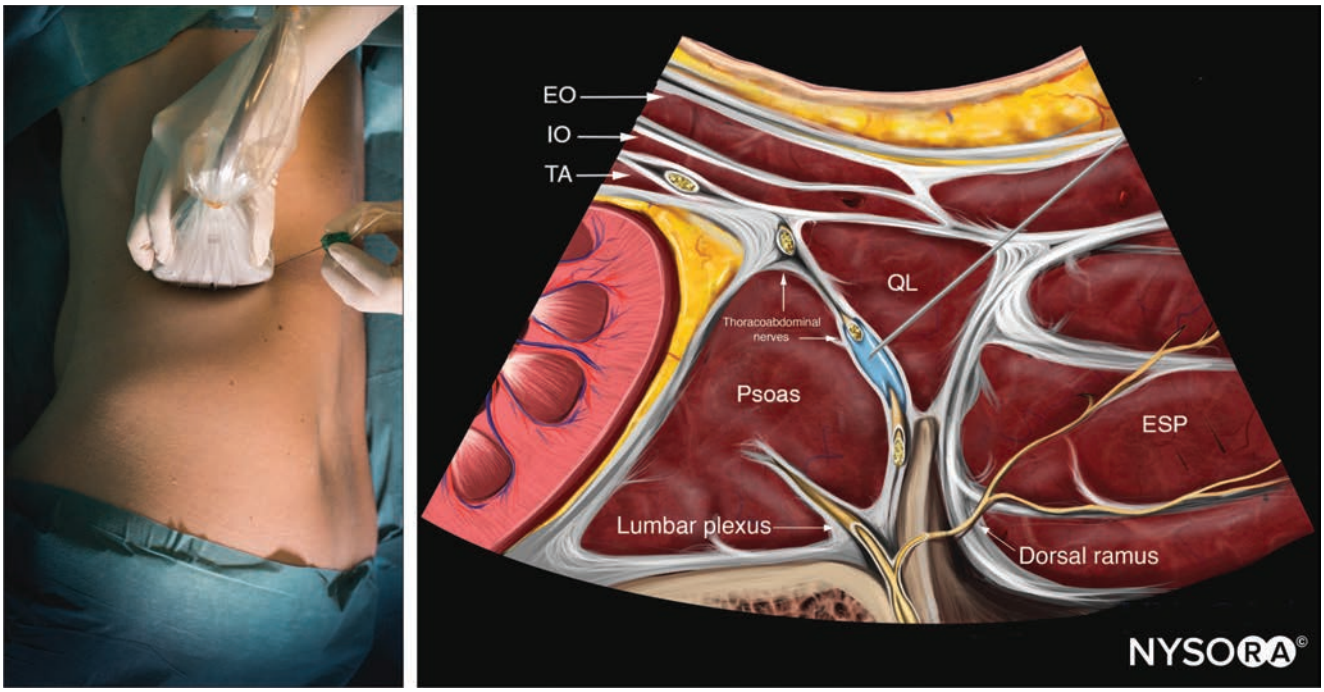
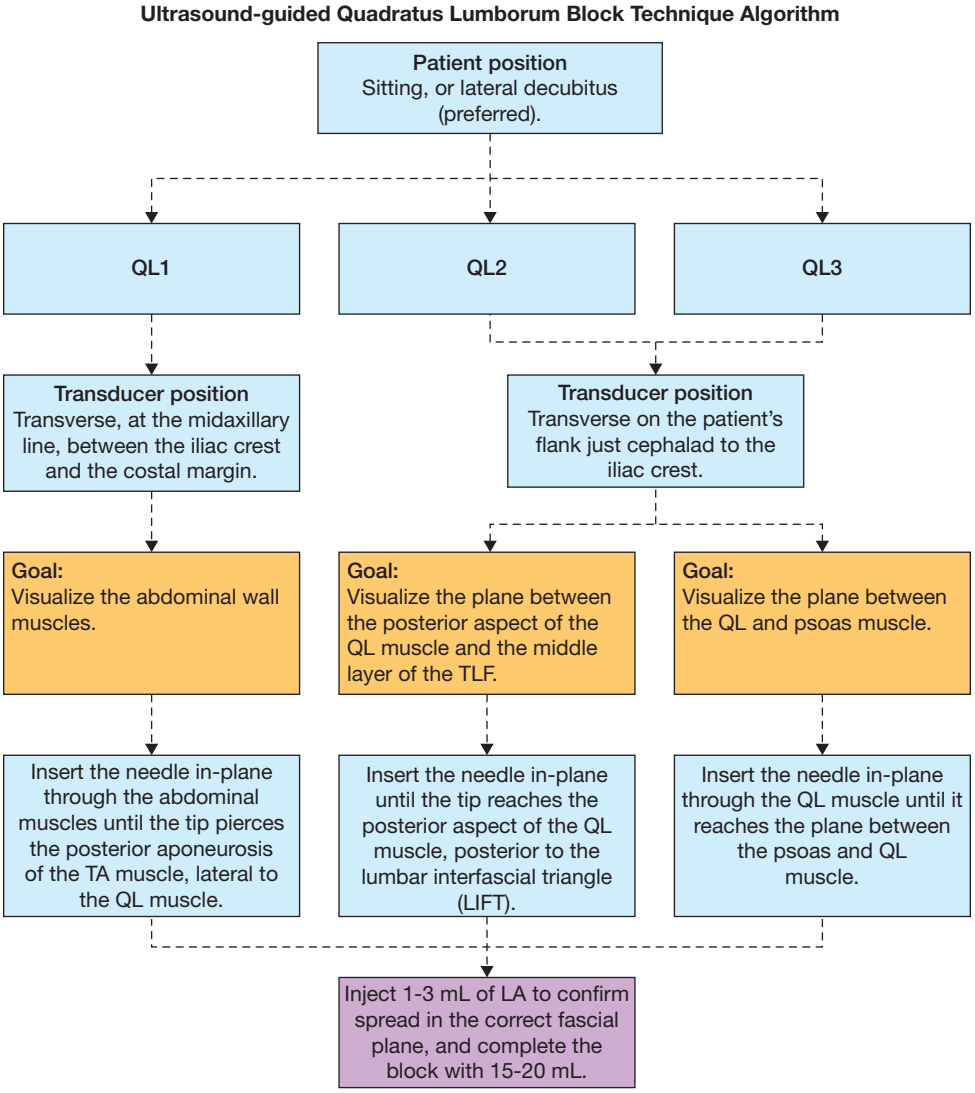


FIGURE 40-9. Reverse ultrasound anatomy of a QL3 block with needle insertion in-plane. EO, external oblique muscle; IO, internal oblique muscle; TA, transversus abdominis muscle; QL, quadratus lumborum; ESP, erector spinae muscles.

Problem-Solving Tips

- Close to the transverse process, the QL muscle is thin and best imaged from the anteroposterior aspect. When imaged from the flank, the muscle appears broader.
- Color Doppler imaging is recommended before insertion of the needle to rule out lumbar arteries on the posterior aspect of the QL muscle.
- The QL muscle is generally hypoechoic and posterior to the transversus abdominis muscle. The latissimus dorsi and erector spinae muscles are superficial and more hyperechoic.
- If you cannot identify the QL muscle easily, try to abduct and laterally flex the ipsilateral hip joint toward the same side of the block to contract the QL muscle.
- The kidneys, spleen, and liver are in the vicinity and exposed to iatrogenic injury, particularly when US imaging is suboptimal. Therefore, the use of QL blocks should entail risk/benefit assessment.

Flowchart



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