

Rib Fractures



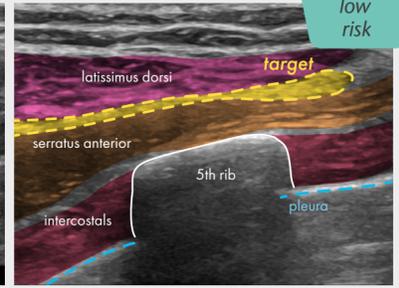
Serratus plane
rib fractures, chest drains

Identify: Starting with the probe in a transverse plane in the midaxillary line, scan posteriorly until the latissimus dorsi muscle appears. There is usually an artery in the serratus anterior plane (a branch of the thoracodorsal artery).

Target: The aim is to inject in the fascial plane between latissimus dorsi and serratus anterior.

Tips: This approach is also very suitable for insertion of a nerve catheter. This block relies on adequate volume for spread eg 30ml of local anaesthetic.

Avoid: Vascular puncture, intravascular injection, pneumothorax.



low risk

Proximal Lower Limb



Fascia iliaca
fractured neck of femur, femoral shaft

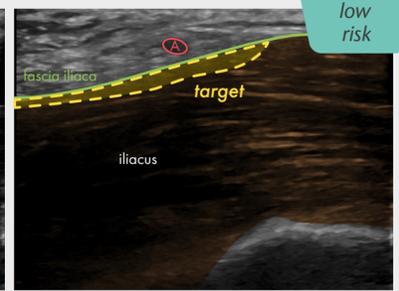
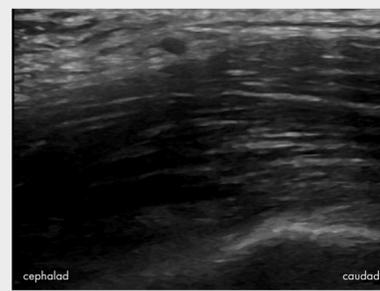
Identify: Start with the probe in a sagittal plane just medial to the anterior superior iliac spine and slide medially; note the deep circumflex iliac artery (a branch of external iliac) which lies superficial to the fascia 1-2cm above the inguinal ligament and is a useful landmark.

Target: Use an in-plane approach from the caudal end of the probe. The target is to deposit local anaesthetic on the belly of the iliacus muscle, beneath the fascia proximal to the inguinal ligament. Observe the spread of local anaesthetic proximally above the muscle and beneath the fascia

(and clearly beneath the circumflex artery).

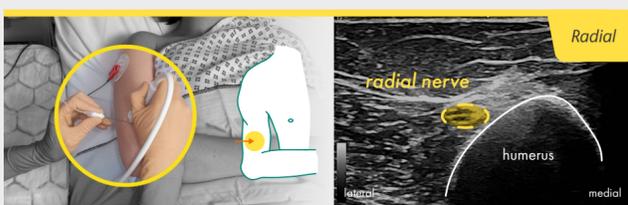
Tips: Lateral tilt of the probe may improve the view and an assistant may be required to retract the abdomen in an obese patient. This suprainguinal parasagittal view demonstrates the muscle & fascia passing deep into the pelvis - gravity aids the spread of LA towards the lumbar plexus (this approach is also suitable to catheter placement).

Avoid: Injection distal to the inguinal ligament.

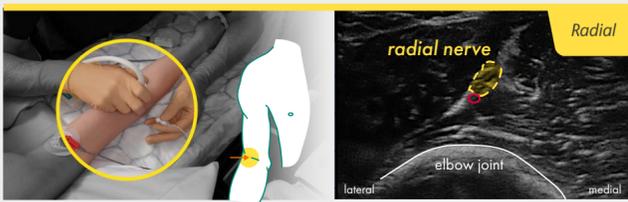


low risk

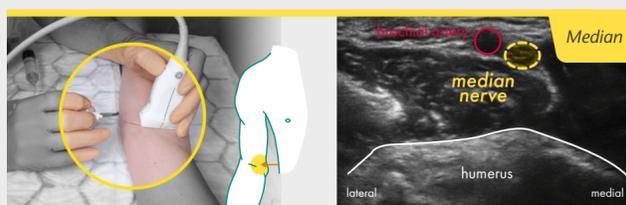
Peripheral Upper Limb



Proximal: Flex the elbow, place the probe over the lower 1/3 of the humerus in an axial plane, look for the rounded appearance of the nerve looping around the distal humerus.



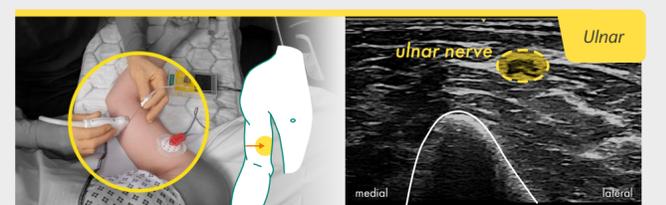
Distal: Extend the elbow, place the probe over the lateral half of the elbow crease. The radial nerve here has a characteristic spindle shape (2 components + artery).



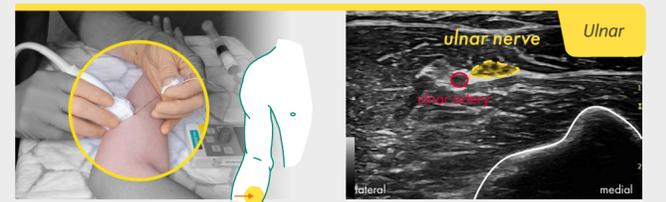
Proximal: Extend the elbow, the nerve lies medial to the brachial artery just above the elbow skin crease.



Distal: At the mid-forearm level the nerve is a hyperechoic, honeycombed structure at the centre of 3 fascial planes. There may be an accompanying artery which should be avoided.



Proximal: On the medial side of the distal humerus, above the medial epicondyle, locate the nerve before the nerve enters the cubital tunnel. Do not block the nerve in the tunnel itself.



Distal: Nerve lies on the medial side of the ulnar artery. Starting at the wrist, scan proximally until they separate.

medium risk

Shoulder



Interscalene
shoulder injuries

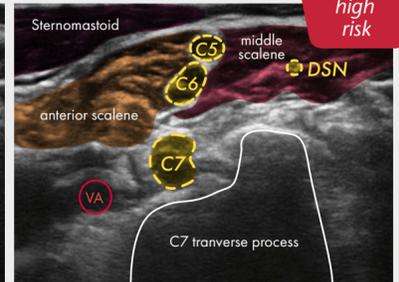
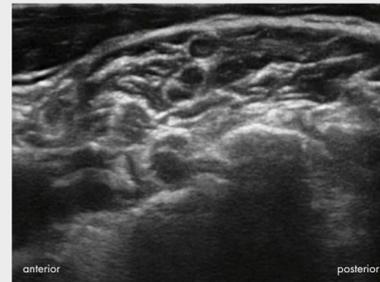
Identify: 2-3 roots in a vertical alignment between anterior and middle scalene muscles; identify C5 & C6 nerve roots; use doppler to check for vascular structures.

Target: Using an in-plane approach from the posterior end of the probe aim for the interscalene groove between the C5 and C6 roots.

Tips: An easy way to locate the interscalene site is to scan up from the supraclavicular region; the distinctive

morphology of the transverse processes helps to identify the correct level (symmetrical tubercles at C5, larger anterior tubercle at C6, no anterior tubercle at C7).

Avoid: The dorsal scapular nerve (DSN) lies in the middle scalene muscle-avoid direct needle trauma; the vertebral artery lies deeper but within needle range; large volume injections increase the risk of phrenic nerve, sympathetic blockade (Horner's syndrome) or epidural spread.



high risk

Distal Upper Limb



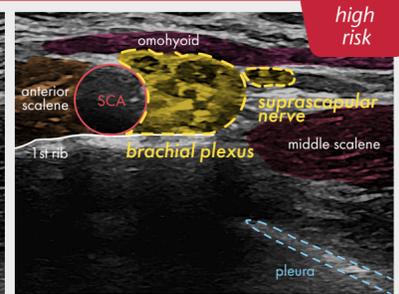
Supraclavicular
upper limb injuries below the shoulder

Identify: The subclavian artery lying on the first rib with underlying pleura. The brachial plexus appears as a honeycombed structure lateral and superficial to the artery.

Target: Using an in plane needle approach from the lateral end of the probe. You may need to make 2-3 injections in the brachial plexus sheath to ensure LA spread to all components including the "corner pocket" between the artery and rib.

Tips: Rotate the lateral end of the probe a little posteriorly to optimise the image; keep the 1st rib in view beyond the needle tip to protect against pneumothorax.

Avoid: Pneumothorax: avoid needle tip penetrating beyond the first rib - it is vital to keep the tip in view throughout.



high risk

Distal Lower Limb



Popliteal sciatic
injuries below the knee

Identify: At the level of the popliteal crease, identify the popliteal artery and vein. The larger tibial component lies just superficial to the vessels, the smaller common peroneal nerve will be lateral and more superficial. Scan up and down to find the point at which they join to form the sciatic nerve.

Target: Inject between the two components at the point where they separate or target the two nerves individually more distally.

Tips: Probe tilt is useful here to identify the nerves (anisotropy); ankle flexion & extension demonstrates the "see-saw" sign where the 2 components move around each other. Track the spread of local anaesthetic distally after injection to assess coverage of both nerves. The lateral decubitus position is shown here and is very stable but alternative positions are the prone or supine with leg elevation, depending on patient factors.

Avoid: Inadequate needle length, direct nerve trauma, intravascular injection.



high risk

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Level of Risk Associated

- Low Risk:** Fascial plane blocks - simple & effective (volume-dependent). Low risk
- Medium Risk:** Peripheral nerve blocks can be used singly or in combination. Nerve stimulator is useful to confirm target. The aim is circumferential spread of local anaesthetic around nerve. Risk = direct needle trauma
- Higher Risk:** Advanced blocks for experienced USGRA practitioners. Risks = multiple. Continuous needle control is essential selection should be given careful consideration.



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Serratus Anterior Plane (lateral rib fractures)

low risk



Preparation: Select appropriate needle / catheter and ensure full aseptic technique. Drapes and probe cover are not shown in images to allow for clearer interpretation of needle position.

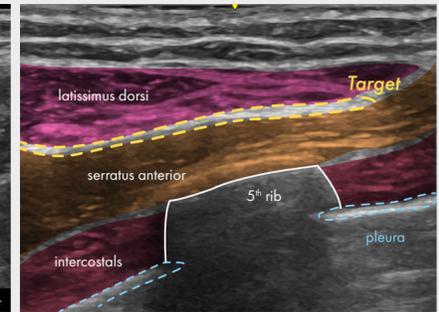
Identify: Starting with the probe in a transverse plane in the mid-axillary line, scan posteriorly until the latissimus dorsi muscle appears. There is usually an artery in the serratus anterior plane (a branch of the thoracodorsal artery).

Target: The aim is to inject in the fascial plane between latissimus dorsi and serratus anterior. "Deep" serratus anterior catheters

can also be inserted where local anaesthetic is deposited between the ribs / intercostal muscle and serratus anterior, this is a more advanced technique.

Tips: This block relies on adequate volume for spread eg 30ml of local anaesthetic. An intermittent bolus regime can be used post procedure. Continuous infusion regimes can also be used but boluses for breakthrough pain may be required.

Avoid: Vascular puncture, intravascular injection, pneumothorax.



Erector Spinae Plane (posterior rib fractures)

medium risk



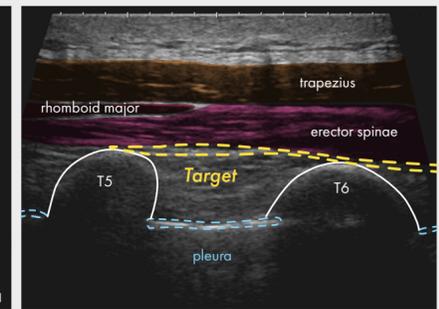
Preparation: Select appropriate needle / catheter and ensure full aseptic technique. Drapes and probe cover are not shown in images to allow for clearer interpretation of needle position.

Identify: Count the spinous processes to identify the correct spinal level. In the paramedian plane identify the corresponding transverse process, overlying muscle layers and underlying pleura.

Target: Using an in-plane approach from the cephalic end of the probe, the target is the fascial plane deep to the erector spinae muscle.

Tips: Choose a site where the needle track would hit the transverse process if it was inserted too far - this acts as a safety net. Look for free spread of local anaesthetic in the fascial plane and use ultrasound to assess the segmental spread up and down the spine. An intermittent bolus regime can be used post procedure. Continuous infusion regimes can also be used but boluses for breakthrough pain may be required.

Avoid: Lateral injection - be sure to identify transverse processes not ribs.



Thoracic Paravertebral (unilateral rib fractures)

high risk



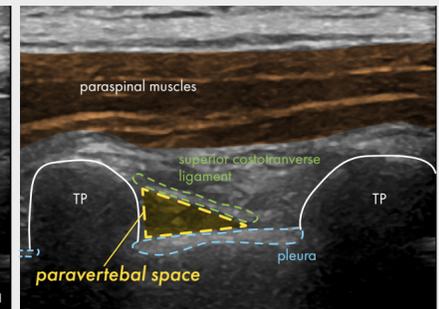
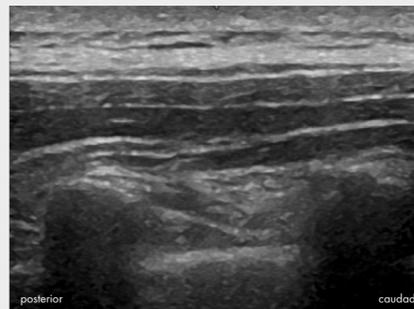
Preparation: Select appropriate needle / catheter and ensure full aseptic technique. Drapes and probe cover are not shown in images to allow for clearer interpretation of needle position.

Identify: In a parasagittal plane identify the ribs at the level you wish to block, then trace medially until the bony shadow changes to the more superficial and squarer outline of the transverse processes (described as tombstones). Tilt the probe laterally to demonstrate the pleura and superior costo-transverse ligament in the same image.

Target: The small triangular paravertebral space lies between the superior costo-transverse ligament and the pleura.

Tips: While maintaining the same probe orientation, angle the caudad end of the probe away from the midline to improve the needle access past the rib and transverse process below.

Avoid: Keep the needle tip in view at all times to avoid pneumothorax, never advance the needle if you cannot see the tip.



Thoracic Epidural (bilateral rib fractures)

high risk



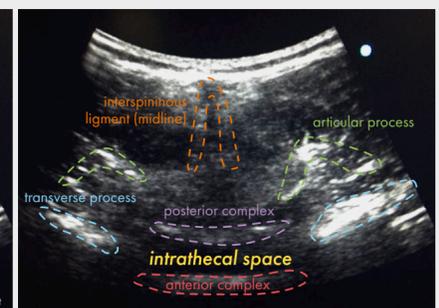
Preparation: Select appropriate needle / catheter and ensure full aseptic technique. Drapes and probe cover are not shown in images to allow for clearer interpretation of needle position.

Identify: The same scanning technique for the lumbar spine can be used. The transverse view shown can be used to identify midline and angle of needle insertion. A view of the anterior complex (anterior dura / posterior longitudinal ligament / posterior border of vertebral body) confirms correct probe position. The posterior complexes (ligamentum flavum / epidural space / posterior dura) will give an estimation of needle depth.

Target: This is an ultrasound assisted technique, epidural insertion will be by standard methods.

Tips: Paramedian views of the lamina with oblique angulation can also be used to identify the correct level and estimation of epidural space depth. Traditionally lumbar scanning is done with a curvilinear probe due to the increased depth of the lumbar spine, however a linear probe may be suitable for some patients.

Avoid: The steeper angle and longer length of the spinous processes in comparison to the lumbar region needs to be considered when scanning and orientating the probe.



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Continuous Nerve Block



Single Shot



Level of Risk Associated

- **Low Risk**
Fascial plane block. Simple and effective (volume dependent).
- **Medium Risk**
Fascial plane block. Closer proximity to neuraxial structures and pleura.
- **Higher Risk**
Advanced block for experienced practitioners. Risks are multiple. Patient's coagulation status and catheter selection should be given careful consideration.

Multi Modal Analgesia

Pain associated with thoracic trauma should be managed with a multimodal approach. Regional analgesia is one component along with simple analgesics, neuropathic agents and opioids.

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