Interscalene Block

The brachial plexus shares a close physical relationship with several structures that serve as important landmarks for performance of an interscalene block. In its course between the anterior and middle scalene muscles, the plexus is superior and posterior to the second and third parts of the subclavian artery. The dome of the pleura lies anteromedial to the inferior trunk.

INDICATIONS

- Shoulder, upper arm, elbow surgery
- Unsuitable for most forearm and hand surgeries because inferior trunk anesthesia can be incomplete in up to 50% of blocks
- Continuous techniques also provide excellent analgesia and may improve rehabilitation and functional recovery after major shoulder surgery

CONTRAINDICATIONS

- **ABSOLUTE**
  - Patient refusal
  - Inability of patient to cooperate and remain still during procedure
- **RELATIVE**
  - Coagulopathy
  - Infection at site of insertion

ANATOMY

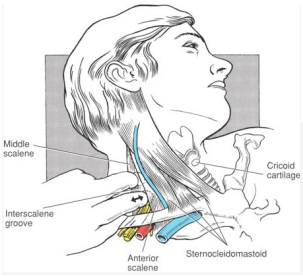
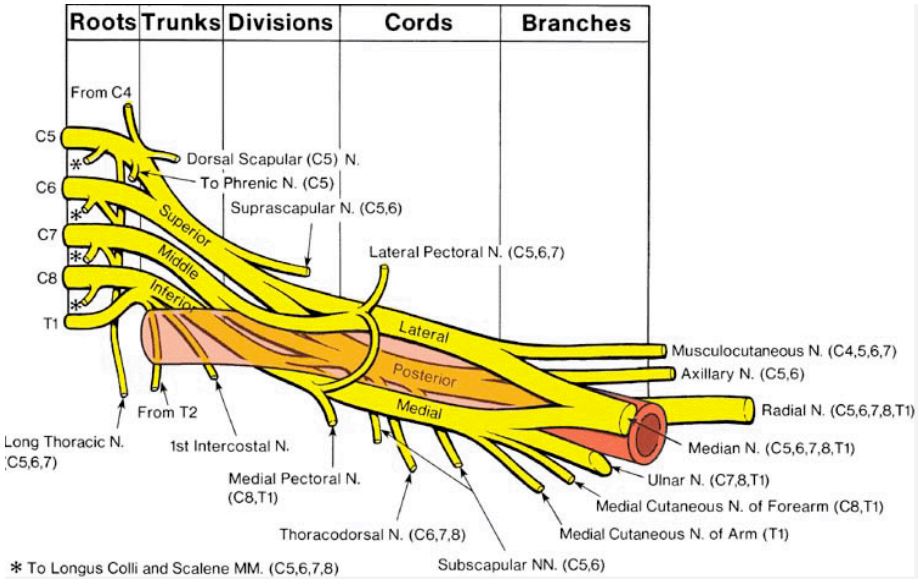


Figure 13-11. Identifying the interscalene groove is essential for any interscalene technique. The anesthesiologist's fingers are placed into the groove between the anterior and middle scalene muscles. If the groove is difficult to palpate, have the patient lift his head from the bed. Place the fingers on the contracted sternocleidomastoid muscle. As the neck is relaxed, sweep the fingers slowly and laterally, off the sternocleidomastoid and into the interscalene groove.

Brachial Plexus Anatomy:



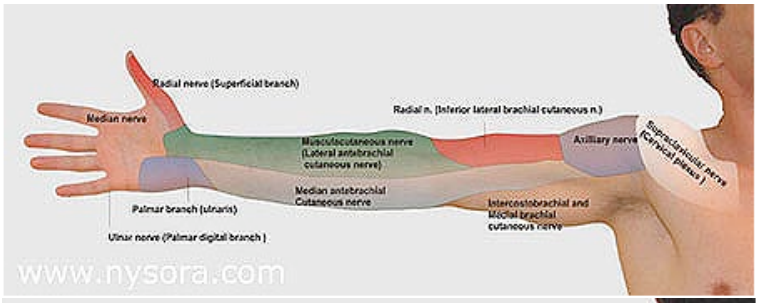
LANDMARKS

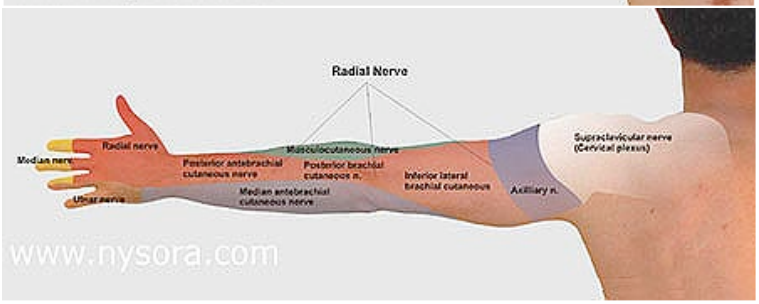
- Clavicular head of the sternocleidomastoid muscle (posterior border)
- Clavicle
- External jugular vein

DISTRIBUTION OF ANESTHESIA

- The interscalene approach to brachial plexus blockade results in consistent anesthesia of the shoulder, upper arm, and elbow, but is often insufficient for the hand
- It frequently spares the lowest branches of the plexus, the C8 and T1 fibers, which innervate the caudad (ulnar) border of the forearm
- Because the interscalene block is placed relatively high along the nerve roots, cephalad spread of local anesthetic usually involves the non-brachial plexus supraclavicular nerve, thereby ensuring anesthesia of the shoulder cape
- Separate blockade of the suprascapular nerve is unnecessary when an interscalene block is used for anterior, open shoulder surgery, but may be a valuable adjunct for surgery that involves the posterior shoulder joint, such as total shoulder arthroplasty or shoulder arthroscopy
- The interscalene approach occasionally fails to anesthetize the anterior axilla for anterior arthroscopic port placement, which then requires supplementation of the intercostobrachial nerve

The labeled areas without colour are not anesthetized consistently with the interscalene brachial plexus block:





EQUIPMENT

- Sterile towels and 4"x4" gauze packs
- 20-mL syringes with local anesthetic
- Sterile gloves, marking pen, and surface electrode
- One 1½" 25-gauge needle for skin infiltration
- A 3-5 cm long, short bevel, insulated stimulating needle
- Peripheral nerve stimulator
- Local anesthetic for skin/subcutaneous infiltration
- Catheter if continuous technique
- 35-40 mL of local anesthetic solution for nerve block injection

NERVE STIMULATION:

- Twitch of the pectoralis, deltoid, triceps, biceps muscle or any twitch of the hand or forearm at 0.2-0.4 mA current
- Twitch of any of those muscles all result in the same success rate

TECHNIQUE

Procedure Using Nerve Stimulation Technique

1. Landmarks: Using the maneuvers described, the interscalene groove is palpated by rolling the fingers posteriorly off the lateral border of the sternocleidomastoid muscle; mark the groove as high as possible. After the patient relaxes, the prominent transverse process of C6 can often be felt directly in the groove and should be marked.
2. Needling: A skin wheal is raised in the interscalene groove at the level of the cricoid. A 22-gauge, 2.5-cm (or less) insulated needle is introduced through the wheal. The needle is directed medially, caudally, and slightly posteriorly in the direction of the C6 transverse process. The caudad tilt of the needle is important to avoid either entering the neural foramen or injection into the dural nerve root sheath, and thus high-spinal anesthesia or spinal cord injury. Avoiding medial placement, by using a mostly caudad and posterior direction, may reduce the risks even more. The superficial structures of the plexus have been shown to be located at an average, shallow depth of 5.5 mm.
3. Nerve localization: Applying an initial current of 0.8 mA is sufficient for stimulation of the plexus (usually at a depth of 1 to 3 cm), and the current is reduced to aim for a threshold current of 0.4 mA before injection after obtaining an appropriate motor response. Diaphragmatic or trapezius twitches should be avoided, as they are associated with cervical plexus stimulation; a diaphragmatic response indicates that the phrenic nerve is being stimulated and that the needle is too anterior.
4. Injection: After careful aspiration, 25 to 30 mL of local anesthetic is injected in small increments to detect intraneural or intravascular placement of the needle. Pain on injection may indicate intraneural injection and should prompt immediate cessation of injection and repositioning of the needle.

Troubleshooting:

Response Obtained	Interpretation	Problem	Action
Local twitch of the neck muscles	Direct stimulation of the anterior scalene or sternocleoidomastoid muscles	Needle pass is in the wrong plane; usually anterior and medial to the plexus	Withdraw the needle to the skin level and reinsert 15° posteriorly
Needle contacts bone at 1-2 cm depth; no twitches are seen	The needle is stopped by the transverse process	The needle is inserted too posteriorly; the needle is contacting the anterior tubercles of the transverse process	Withdraw the needle to the skin level and reinsert 15° anteriorly
Twitches of the diaphragm	This is the result of stimulation of the phrenic nerve	The needle is inserted too anteriorly	Withdraw the needle and reinsert 15° posteriorly
Arterial blood noticed in the tubing	Puncture of the carotid artery (most common)	The needle insertion and angulation is too anterior	Withdraw the needle and keep a steady pressure 2-3 minutes; reinsert 1-2 cm posteriorly
Pectoralis muscle twitch	Brachial plexus stimulation (C4-5)		Accept and inject local anesthetic
Twitch of the scapula	Twitch of the serratus anterior muscle; stimulation of the thoracodorsal nerve	Needle position is posterior/deep to the brachial plexus	Withdraw the needle to the skin level and reinsert the needle anteriorly
Trapezius muscle twitches	Accessory nerve stimulation	Needle posterior to the brachial plexus	Withdraw the needle and reinsert
Twitch of: pectoralis, deltoid, triceps, biceps, forearm, and hand muscles	Stimulation of the brachial plexus	None	Accept and inject local anesthetic

Procedure Using Ultrasound Guidance

1. Scanning: Two scanning techniques are recommended for viewing the brachial plexus at the interscalene level: (1) beginning anteriorly at the cricoid cartilage level (C6) with movement from anterior and medial to posterior and lateral towards the interscalene groove, and (2) scanning proximally from the supraclavicular fossa to the interscalene location.
2. Appearance: At the supraclavicular fossa, the brachial plexus (trunks/divisions) can be seen in short axis as a tightly enclosed cluster (i.e., a honeycomb) superior and lateral to the subclavian artery. After tracing the nerves in a proximal fashion toward the interscalene groove, the nerve structures (roots/trunks) in a sagittal oblique section are visualized as three (usually) or up to five round or oval-shaped hypoechoic structures, sometimes with few internal punctate echoes, lying between the scalenus anterior and medius muscles. C8 and T1 roots may be difficult to identify because of their depth.
3. Needling: A skin wheal is raised in the groove at the level of the cricoid cartilage. A 22-gauge, 5-cm (or less) needle (insulated is recommended) is introduced either out of plane (OOP) or in plane (IP) to the probe and advanced to a maximum of 3 cm for most patients. For OOP needle insertion technique, the clinician stands beside or cephalad to the probe and places the initial needle puncture site cranial to the probe. The needle is typically angled somewhat caudally toward the US beam plane. For IP needle insertion technique, the needle is moved from lateral to medial (still slightly caudad) and will first penetrate the scalenus medius muscle before entering the interscalene groove. It is recommended to use NS to provide further nerve localization.
4. Local anesthetic spread: A test injection of D5W is recommended and will help confirm nerve localization and estimate the pattern of local anesthetic spread. Local anesthetic should be deposited in the midst of the neural structures so that it spreads to surround the nerves circumferentially. Local anesthetic distention in this compartment can be seen by US as a hypoechoic (fluid) expansion.

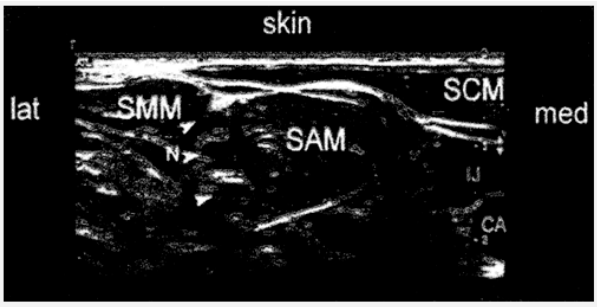


Figure 13-15. Transverse ultrasound image of the interscalene region. Arrows delineate the hypoechoic brachial plexus as it resides between the anterior (*SAM*) and middle (*SMM*) scalene muscles. SCM, sternocleidomastoid muscle; IJ, internal jugular vein; CA, carotid artery. From Perlas A, Chan VWS, Simons M. Brachial plexus examination and localization using ultrasound and electrical stimulation. *Anesthesiology* 2003;99:429–435, with permission.

COMPLICATIONS

- Vascular puncture: Not common
  - Intraarterial injection of the vertebral and carotid arteries with immediate seizure
  - Intravenous injection and systemic local andesthetic toxicity
- Neuraxial injection: High spinal or epidural anesthesia
- Anesthesia of the cervicothoracic sympathetic chain and/or the recurrent laryngeal nerve is relatively common
- Ipsilateral phrenic nerve block resulting in diaphragmatic paresis occurs in 100% of patients undergoing interscalene blockade, even with dilute solutions of local anesthetics, and is associated with a 25% reduction in pulmonary function
  - This effect probably results from anterior spread of solution over the anterior scalene muscle and may cause subjective symptoms of dyspnea
  - Although rare, respiratory compromise can occur in patients with severe respiratory disease
- The incidence of pneumothorax is low when the needle is correctly placed at the C5 or C6 level because of the distance from the dome of the pleura.
- Severe hypotension and bradycardia (i.e., the Bezold-Jarisch reflex) have been reported in awake, sitting patients undergoing shoulder surgery under an interscalene block. The cause is presumed to be stimulation of intracardiac mechanoreceptors by decreased venous return, which produces an abrupt withdrawal of sympathetic tone and enhanced parasympathetic output. This effect results in bradycardia, hypotension, and syncope. The frequency of this reflex is decreased when prophylactic β-blockers are administered.
- Nerve damage or neuritis can occur with any peripheral nerve block, but it is uncommon and is usually self-limited

REFERENCES

- Neural Blockade Cousins P. 326
- Barash P. 971-973
- Miller Anesthesia Chapter 52
- NYSORA website