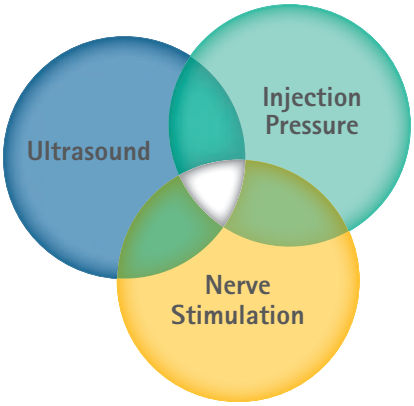
Triple Monitoring

Enhancing Safety in Peripheral Nerve Blocks

Regional Anesthesia



B BRAUN
SHARING EXPERTISE

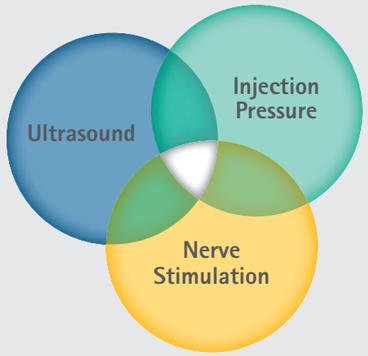
Triple Monitoring

A Multimodal Approach for Peripheral Nerve Blocks

Ultrasound
Monitors needle advancement and spread of local anesthetic in real time.[12,13]

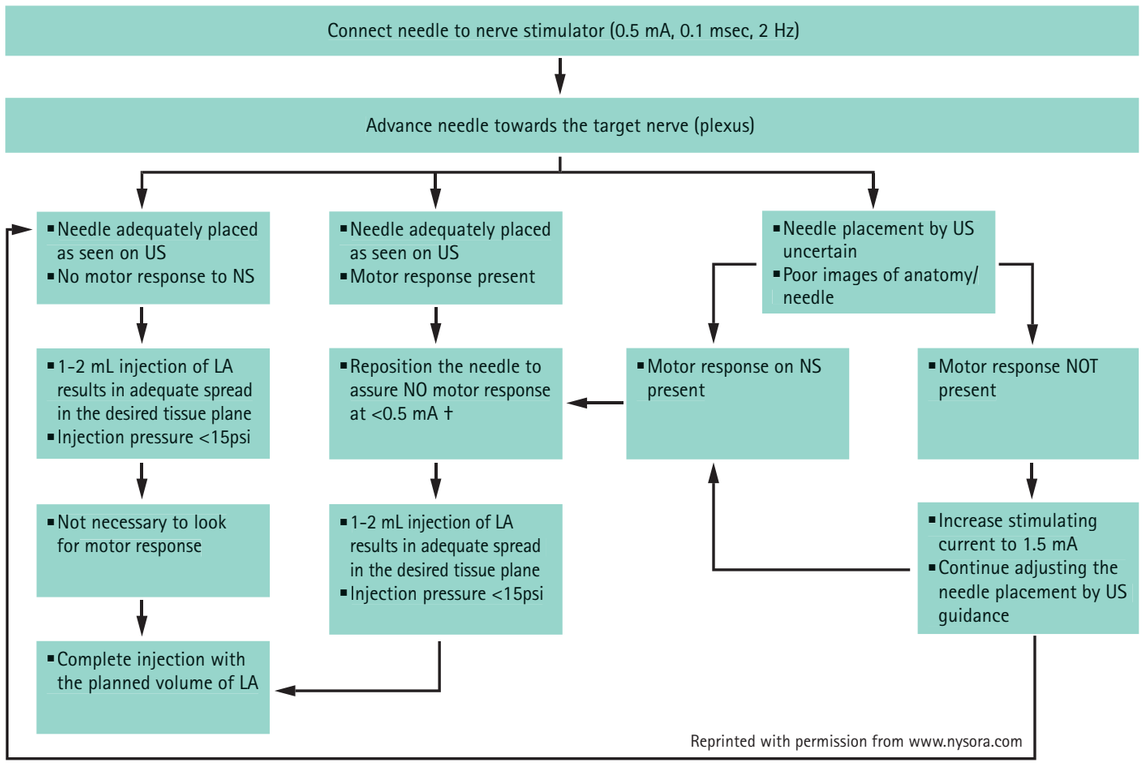
Nerve Stimulation
Identifies nerves by eliciting specific distal motor response; response at < 0.5 mA may indicate needle-nerve-contact or intraneural placement of the needle.[1,5,7]

Injection Pressure
High opening injection pressure (> 15psi) may indicate or detect needle-nerve contact, intrafascicular needle placement, injection into poorly compliant tissues (fasciae, tendons) or needle obstruction.[1,4]



Suggested Standard Monitoring for Nerve Blocks [9]

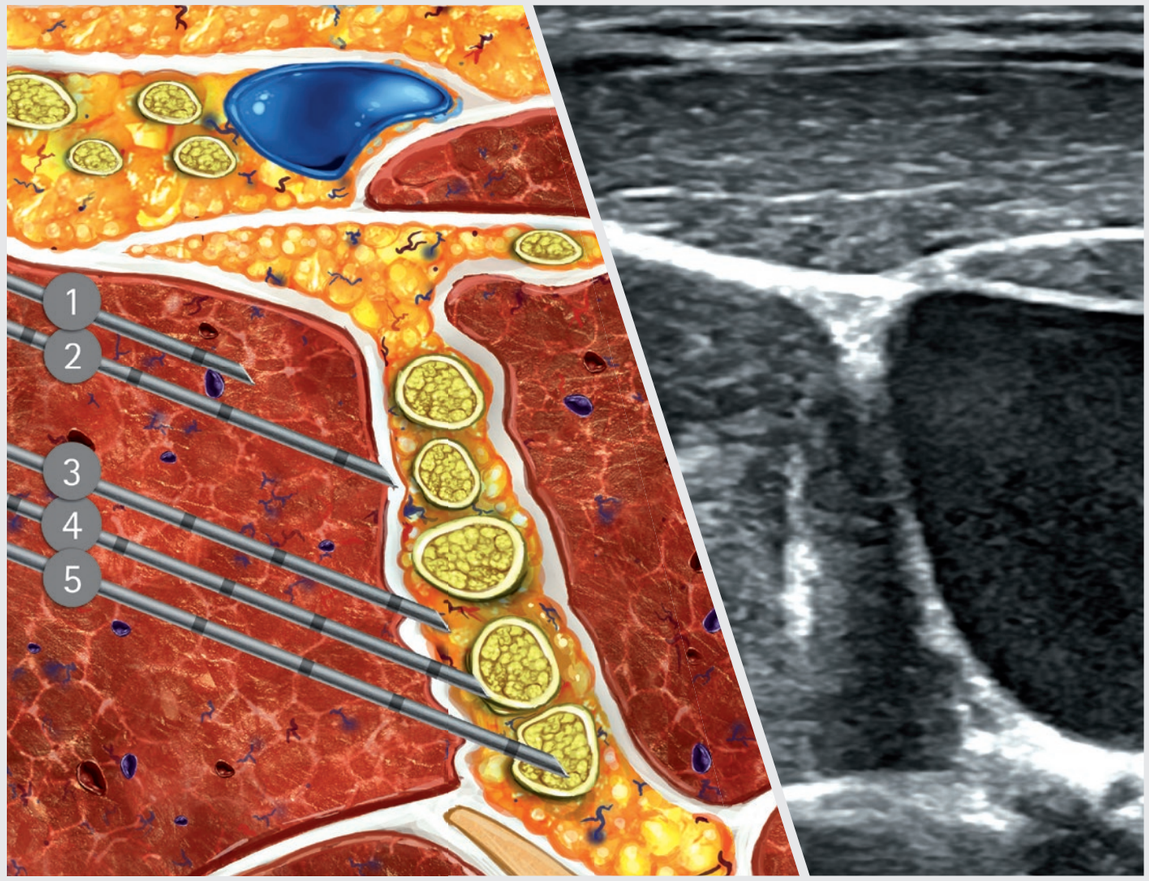
Combined Monitoring: Ultrasound + Nerve Stimulation + Opening Injection Pressure



Legend: US-Ultrasound, NS-Nerve Stimulation, LA- Local Anesthetic, Low Injection Pressure < 15psi *
* Experimental studies in large models/human cadavers suggest that opening pressure for intrafascicular injection requires > 15psi
† Experimental studies suggest that EMR at < 0.2 mA (0.1 ms) indicates intraneural needle placement; for additional safety margin, 0.5 mA is recommended in the guidelines by the collaborative group

How it works

For Interscalene Brachial Plexus Block



Reprinted with permission from www.nysora.com

	Needle tip position	Ultrasound	Nerve Stimulation	Opening Injection Pressure
1	Needle tip intramuscularly	Visual feedback, influenced by image-quality, patients sono-anatomy; highly user-dependent [6]	Local muscle twitch may be present, indicating intramuscular needle tip position	Non-specific; typically < 15psi
2	Needle tip placed against fascia (scalene sheath contact)		Local and/or distal motor response may be present	Typically high (> 15psi) as needle bevel is obstructed by the fascia
3	Needle placed in interscalene space		When present, distal motor response may occur at 0.5 mA, indicating proper needle placement	Low (< 15psi) as injection occurs into loose connective tissue perineurally [1]
4	Needle-nerve-contact (brachial plexus root)		Distal motor response may be present at ≤ 0.5 mA [1,8,10,11]	High (> 15psi) as the bevel of the needle is occluded by the connective tissue [1]
5	Needle tip placed in the root of the brachial plexus		Distal motor response commonly present at ≤ 0.5 mA [5]	High (> 15psi) as injection into fascicles requires higher opening pressure [1,4]

References

[1] Gadsden et al. Opening injection pressure consistently detects needle-nerve contact during ultrasound-guided interscalene brachial plexus block. Anesthesiology, 2014; 120:1246-53

[2] Kapur et al. Neurologic and histologic outcome after intraneural injections of lidocaine in canine sciatic nerves. Acta Anaesthesiol Scand, 2007; 51:101-7

[3] Lupu et al. Nerve expansion seen on ultrasound predicts histologic but not functional nerve injury after intraneural injection in pigs. Reg Anesth Pain Med, 2010; 35:132-9

[4] Orebaugh et al. Brachial plexus root injection in a human cadaver model: Injectate distribution and effects on the neuraxis. Reg Anesth Pain Med, 2012; 37(5):525-9

[5] Bigeleisen et al. Extraneural versus intraneural stimulation thresholds during ultrasound-guided supraclavicular block. Anesthesiology, 2009; 110(6):1235-43

[6] Sites et al. Characterizing novice behavior associated with learning ultrasound-guided peripheral regional anesthesia. Reg Anesth Pain Med, 2007; 32(2):107-15

[7] Chan et al. An ultrasonographic and histological study of intraneural injection and electrical stimulation in pigs. Anesth Anlag, 2007; 104(5):1281-4

[8] Voelckel et al. Signs of inflammation after sciatic nerve block in pigs. Anesth Analg, 2005; 101:1844-6

[9] Kwofie et al. Standard approaches for upper extremity nerve blocks with an emphasis on outpatient surgery. Curr Opin Anaesthesiol, 2013; 26(4):501-8

[10] Chan et al. An ultrasonographic and histological study of intraneural injection and electrical stimulation in pigs. Anesth Analg, 2007; 104(5):1281-4

[11] Tsai et al. Intensity of the stimulating current may not be a reliable indicator of intraneural needle placement. Reg Anesth Pain Med, 2008; 33(3):207-10

[12] Neal et al. The ASRA evidence-based medicine assessment of ultrasound-guided regional anesthesia and pain medicine: Executive summary. Reg Anesth Pain Med, 2010; 35:S1-9

[13] Sites et al. Incidence of local anesthetic systemic toxity and postoperative neurologic symptoms associated with 12,668 ultrasound-guided nerve blocks: an analysis from a prospective clinical registry. Reg Anesth Pain Med, 2012; 37(5):478-82

Additional relevant literature

- Claudio et al. Injection pressures by anesthesiologists during simulated peripheral nerve block. Reg Anesth Pain Med, 2004; 29(3):201-5
- Gadsden et al. Lumbar plexus block using high-pressure injection leads to contralateral and epidural spread. Anesthesiology, 2008; 109(4):683-8
- Hadzic et al. Combination of intraneural injection and high injection pressure leads to fascicular injury and neurologic deficits in dogs. Reg Anesth Pain Med, 2004; 29(5):417-23
- Theron et al. An animal model of 'syringe feel' during peripheral nerve block. Reg Anesth Pain Med, 2009; 34:330-2

For further information visit:
www.bsmart-bbraun.com

B. Braun Melsungen AG | 34209 Melsungen | Germany
Tel. +49 5661 71-0 | www.bbraun.com