

THE ROLE OF ULTRASOUND ELASTOGRAPHY FOR PERIPHERAL BLOCKADES

Tea Gubeladze, MD

Regional Clinical Specialist, Mindray; President, Georgian Ultrasound Elastography Association, Tbilisi, Georgia

Present address: 11 Zakariadze St, Tbilisi 0177, Georgia | Tel: +995 599 23 23 11 | Email: geoelastography@gmail.com

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Background. Ultrasound guidance is essential in contemporary regional anaesthesia [1]. B-mode imaging depicts anatomy, needle position and local-anaesthetic spread, but provides limited information about tissue mechanics and injection-induced deformation. Strain elastography displays relative tissue deformation, whereas shear-wave elastography (SWE) estimates stiffness from shear-wave propagation. These techniques may therefore add mechanical contrast to conventional imaging.

Objective. To critically evaluate ultrasound elastography as an adjunct to peripheral nerve blockade, with particular emphasis on identifying altered mechanical properties associated with inflammatory oedema in the nerve and surrounding perineural tissues.

Evidence synthesis. In a translational study of 83 Thiel-cadaver blocks and two patient blocks, strain visibility during injection was rated better with sonoelastography than with B-mode imaging ($p=0.04$), and patient recordings showed a dose response between 1 and 5 mL of local anaesthetic [2]. In a subsequent Thiel-cadaver study, 20 trainee anaesthetists assessed 40 median-nerve injections. Fused B-mode/elastography improved recognition of intraneural injection compared with B-mode alone (diagnostic odds ratio 21.7 versus 7.4; $p<0.001$), as well as diagnostic confidence and interobserver reliability [3]. In a clinical feasibility study involving 11 patients and 110 paired images, nerve diameter measured on SWE and B-mode showed no systematic difference; inter-rater reliability for nerve area was high for both modalities. Importantly, the blocks themselves were guided using B-mode, while SWE remained investigational [4].

Perineural inflammatory oedema. This is a relevant pre-block target because oedema and inflammation can blur tissue planes and alter compliance. Elastography can map stiffness and heterogeneity across the nerve–perineural interface, highlighting a mechanically abnormal region when morphologic change is subtle. In a clinical study of ulnar neuropathy at the cubital tunnel, the affected nerve was significantly stiffer on SWE than nerves in symptomatic control groups (66.8 kPa versus 21.2 and 33.9 kPa); the disease process may include ischaemia, inflammation, oedema and fibrosis [5]. This supports elastography as a complementary marker of an abnormal nerve–perineural complex, but not as a specific test for oedema alone.

Clinical implications. Before blockade, combined B-mode and elastography may help identify inflammatory or oedematous change and define a safer tissue plane. During injection, elastography may improve visualisation of early tissue deformation and small-volume injectate spread and support recognition of a suspected intraneural injection. Interpretation is vulnerable to probe pressure, motion, anisotropy, depth, region-of-interest placement and platform-specific colour scales. Because increased or decreased stiffness is not disease-specific, the elastogram must be correlated with B-mode morphology, Doppler findings and the clinical context.

Conclusion. The principal added value of ultrasound elastography may be the detection of abnormal mechanical patterns caused by inflammatory oedema in and around a peripheral nerve, followed by better-

informed planning of the block. It remains an adjunct rather than a stand-alone diagnostic, guidance or safety modality and must not replace B-mode anatomy, continuous needle-tip visualisation, assessment of injectate spread or established monitoring. Standardised protocols and prospective outcome studies are required before routine adoption.

Conflict of interest. The author is employed by Mindray.

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