Ultrasound-Guided Spinal Procedures for Pain

A Review

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KEYWORDS

• Epidural • Facet • Interventional spine • Interventional pain • Pain management • Sonography • Spine injections • Ultrasonography

KEY POINTS

- Ultrasound (US) has become a more common imaging modality for spinal interventions.
- US has some advantages and disadvantages compared with fluoroscopy and other imaging modalities.
- Most typical spinal pain procedures described under fluoroscopy have also been described with US guidance.
- Although there are multiple studies demonstrating the accuracy of US-guided spine procedures using cadaveric dissections as well as comparing their accuracy to procedures with CT or fluoroscopic guidance, there are no large studies comparing the safety or efficacy of US-guided spinal interventions to CT or fluoroscopic guidance.
- Some spinal interventions where the spinal vascular supply may be at risk may still benefit from fluoroscopic or CT-confirmed contrast-controlled verification.

INTRODUCTION

The aging population presents musculoskeletal clinicians with an increasing incidence of degenerative changes of the spine and associated pain. Although interventional spine procedures have been in use for decades, common imaging modalities have relied on ionizing radiation for guidance. US has more recently become used to image axial structures and guide procedures in this region.

Like other imaging modalities, US has certain advantages and disadvantages. US imaging is ideal for visualizing soft tissues, bony surfaces, and needle manipulation

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in real time. Significant nerves and blood vessels can readily be visualized by a well-trained sonographer. Unfortunately, the deeper the tissue, the more challenging sonographic visualization becomes. In addition, bone completely obstructs US visualization of deeper structures in the path of sound waves. As such, clinicians should consider US one of several options for image guidance for spine procedures.

ULTRASOUND-GUIDED CERVICAL SPINE PROCEDURES

Anatomy

The cervical spine is composed of 7 vertebral levels with the atlanto-occipital (C0-C1) and atlantoaxial (C1-C2) having unique anatomic features. This article's focus is on the middle and lower cervical joints. Potential pain generators at each level include the vertebral body, facets, nerve roots, and disks. Under US guidance, the cervical facets and medial branches are relatively accessible in most patients.[1] At the C2-C3 level, the facet may refer pain to the third occipital nerve (TON), which may also be blocked.[2]

Indications

The cervical facets can be prominent pain generators in patients with both occipital and posterior neck pain. This pain can be related to osteoarthritic and whiplash injuries.[3] Facetogenic pain may be present despite normal CT, bone scan, or MRI findings. In whiplash-induced neck pain, medial branch blocks of the cervical facets are often needed to confirm the correct pain generator. Common interventions for facetogenic pain in the cervical spine include facet injections, medial branch blocks, and radiofrequency ablation of the medial branches.[4]

Technique

Ultrasound-guided technique for identification of the correct cervical level for cervical facet injections

The patient is placed in the lateral decubitus position with the side of interest facing upward. Typically, a high-frequency (>10 MHz) linear-array transducer is used in the axial plane to scan the lateral neck starting caudally (**Fig. 1**). The posterior tubercle of the segmental foramen can be well visualized. The C7 foramen can be localized because there is no prominent anterior tubercle (**Fig. 2**). The other cervical foramina have prominent anterior tubercles. At the C6 foramen, the C5-C6 facet is visualized. The needle then is advanced in-plane using an anterior-to-posterior approach. A posterior approach using a low-frequency (<10 MHz) curvilinear-array transducer in the prone position has also been described.[5]

Ultrasound-guided technique for cervical medial branch blocks and third occipital nerve blocks

For a TON block, the patient is placed in the lateral decubitus position and the transducer is placed in the coronal plane with the cephalic end of the transducer on the mastoid process. Next the transducer is moved 5 mm to 8 mm posteriorly until the articular pillar of C2 is well visualized (**Fig. 3**). The transducer is then translated caudally until the C2-C3 articulation along with the TON is visualized (**Fig. 4**).[2] To visualize the more caudal medial branches, the transducer can be translated caudally while maintaining a coronal view. The hyperechoic peaks with a cleft are articular processes and joints, whereas the hyperechoic valleys are where the medial branches lie. In an out-of-plane approach, a short 25-gauge needle can be advanced from anterior to posterior, targeting the deepest point in the near-contiguous hyperechoic bony