Ultrasound vs Fluoroscopy in Interventional Pain & Musculoskeletal Medicine

Scott Naftulin, DO, FAOCPMR, DABPMR
Northeastern Rehabilitation Associates, PC
Spine, Sports & Pain Medicine
Clinical Professor, Philadelphia College of Osteopathic Medicine
Clinical Professor, DeSales University
Master Instructor, Spine Intervention Society

Objectives

Upon completion of this presentation, the attendee will:

- Understand the advantages of ultrasound in the performance of interventional pain procedures
- Understand the limitations of ultrasound in performing image-guided procedures
- Understand the benefits of fluoroscopy in performing spine interventions
Image Guidance

Visualizes needle or other surgical instrument in real-time when performing medical procedures such as spinal injections

Alternative to anatomic landmark placement of needle/instrument

Image Guidance

Improved procedure efficacy = better outcomes

Lowers potential risks and complications

More cost-effective
Image Guidance

CT / MRI  
Ultrasound (sonography)  
Fluoroscopy

CT / MRI

Limited availability
Unable to visualize intravascular injection
High startup cost

Will not be further addressed Today.
**Ultrasound**

Recent rapid growth in use due to Technological advances

- Leading to better visualization/higher resolution
- Compact size
- Lower equipment costs and therefore better availability

**Fluoroscopy**

- Uses ionizing radiation (i.e. x-rays)
- Allows for image guidance during procedures involving the entire neuraxis (spine)
- Standard-of-care in interventional pain medicine
Ultrasound

Does NOT use radiation therefore safer especially in pediatric/pregnant population

Portability allows point-of-care diagnostics (i.e. sidelines, workplace)

Alternative to fluoroscopy WITH LIMITATIONS

Ultrasound

Limitations due to patient body habitus

In larger or obese patients, visualization of target tissues insufficient especially in lumbar spine or hip

Limited evidence-basis to present

Fluoroscopy-guided procedures have been scientifically validated
Ultrasound

Limitations based upon anatomic target

May not label vertebral levels accurately especially below C6 level and in more degenerative spines

Cannot see “through” bone or air

Not demonstrated to be useful in thoracic spine

Mis-labeling of target levels >>> can lead to false-positive / negatives

Poor accuracy in lumbar spine – where most spine problems occur

Steep learning curve (i.e. Many hours to effectively master)

Most experienced interventional pain physicians are skilled in fluoroscopy
Ultrasound

- Images soft-tissues including cartilage, ligaments, and muscles/tendons
- Allows direct visualization of nerves and blood vessels
- Cannot reliably rule out intravascular injection

Fluoroscopy

- Images bone
- Indirectly demonstrates location of soft tissues around the bone
- Requires injection of contrast to visualize blood vessels and expected flow of injectate (medication)
- Does NOT directly visualize nerves or blood vessels that should be avoided during interventions
Fluoroscopy - Contrast

- Fluoroscopy used to safely place needle/instrument
- Contrast injection using live fluoroscopy required to insure extravascular injection
- Contrast pattern demonstrates placement of injectate (medication) thereby confirming only the intended target tissues are injected
- Potential allergic or adverse reactions to contrast
- Potential renal injury from contrast especially in patients with diabetes mellitus or preexisting renal disease

Specific procedures
3rd Occipital Nerve (TON) Blocks

Nerve to the C2-3 facet (zygapophysial) joint

This joint is the most common cause of cervi-cogenic headaches

Commonly involved in motor vehicle accidents

82% success rate with ultrasound

Stellate Ganglion Blocks (SGB)

Used for numerous sympathetic-mediated pain conditions involving the head/neck or upper extremity

Examples include complex regional pain syndrome (CRPS, RSDS), cancer pain, orofacial pain, postherpetic neuralgia, etc.

Target is in the lower anterior neck (Chassaignac’s tubercle on transverse process C6)

Compared to landmark technique, more successful and less complications (hematoma, organ injury) with US-guidance

Sacroiliac Joint (SIJ) Injections

Ultrasound allows visualization of critical structures near the joint.

Limited accuracy of needle placement (missed 12.7% of time) into the joint (1)

Therefore, limited usefulness in diagnostic injections e.g. preoperative patient selection for SIJ fusions


Caudal Injections

Used to deliver local anesthetic and/or steroid to the lumbosacral epidural space.

Ultrasound allows 100% accuracy (1) of needle placement.

However, unable to accurately determine if intravascular or intrathecal before injecting due to acoustic bony shadowing. Thus, limited use by practitioners.

Cervical Transforaminal (C-TFESI) Injections

Method of delivering medication to the cervical spinal nerves or epidural space for diagnosis, treatment or presurgical planning

Ultrasound may be helpful in avoiding intravascular complications \(^{(2,3)}\)

Fluoroscopy with live contrast injection (+/- digital subtraction imaging) remains the modality of choice for these procedures


Other US-Guided Interventions

Peripheral joints - hip, knee, shoulder, etc.

In larger patients, fluoroscopy may be required especially for hip injections

Peripheral nerve blocks: carpal tunnel syndrome, meralgia paresthetica, postherniorraphy, etc.
Salient Points

All musculoskeletal interventions should be performed with image guidance to maximize patient safety and outcome.

Fluoroscopy with contrast injection remains the mainstay for spinal interventions.

Ultrasound remains significantly operator-dependent with a steep learning curve.

Salient Points

Ultrasound can be used when fluoroscopy is contraindicated (pregnancy).

Ultrasound (US) is equal or superior to fluoroscopy for certain procedures (e.g. stellate ganglion blocks, cervical medial branch blocks, peripheral joint/nerve injections, etc.).

US limitations include lack of intravascular visualization and difficulty in performing neur-axial techniques (spinal injections).
Thank you!

Visit us at:
www.nerehab.com
www.specialtyspinecare.com