

REVIEW ARTICLE

Ultrasound vs Fluoroscopy in Pain Intervention

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ABSTRACT

Fluoroscopy-guided intervention is the gold standard for chronic pain management. Most of the pain physicians are very comfortable with fluoroscopy-guided procedures. Ultrasonography (USG) is slowly emerging with satisfactory results in the field of chronic pain management. Both have its advantages and disadvantages. Most of the articles are in favor of fluoroscopy for spine procedures, whereas USG is unique in regional nerve block procedures. More studies are required to prove the superiority of one technique over the other.

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ULTRASOUND VS FLUOROSCOPY IN NEURAXIAL BLOCK

There is an established role of fluoroscopy in neuraxial block. Hazra et al¹ in their study showed that fluoroscopy helped visualization of needle tip at S3 (Fig. 1). This is important for drug distribution at the desired level. Fluoroscopy also provided epidurogram showing filling defect (Fig. 2) helping further management for adhesiolysis. With ultrasonography (USG)-guided caudal epidural block (Fig. 3), these observations were not available as the needle tip is obscured by acoustic shadow.¹ Moreover, USG may give a false-positive result.² Drawback of fluoroscopy is radiation hazard, which might cause cell mutation and cell death. Drawbacks of USG include its dependence on skilled operator and difficulty in imaging structures behind bone and air. Prenatal sex determination is also a real social problem in India and Prenatal Diagnostic Techniques Act is imposed on its use.²

Regarding transforaminal epidural block (Fig. 4), USG guidance is not highly recommended injections due to

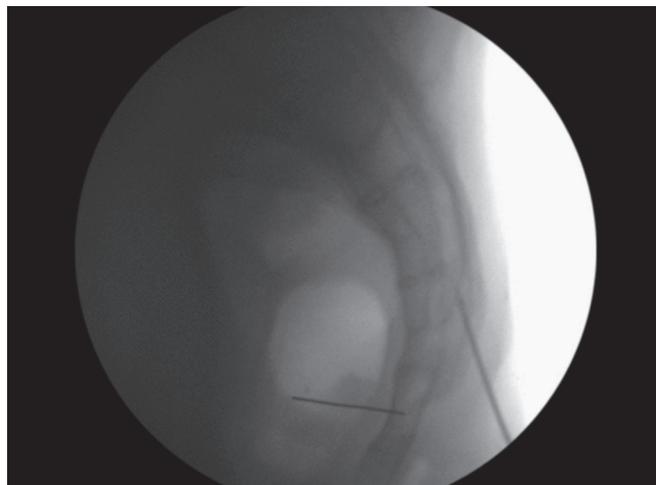


Fig. 1: Needle tip at S3

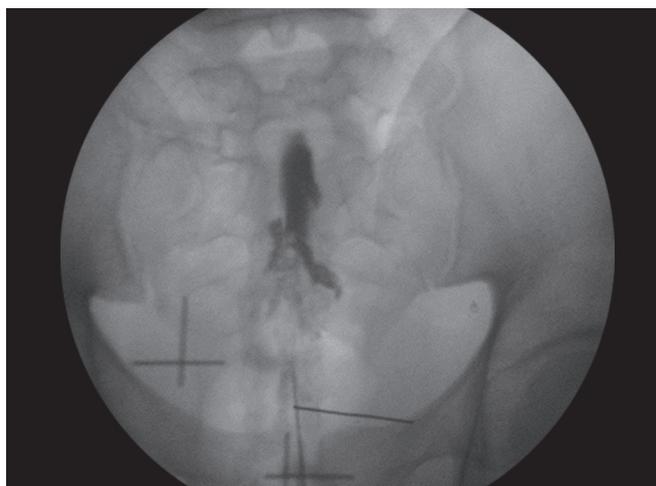


Fig. 2: Epidurogram showing filling defect

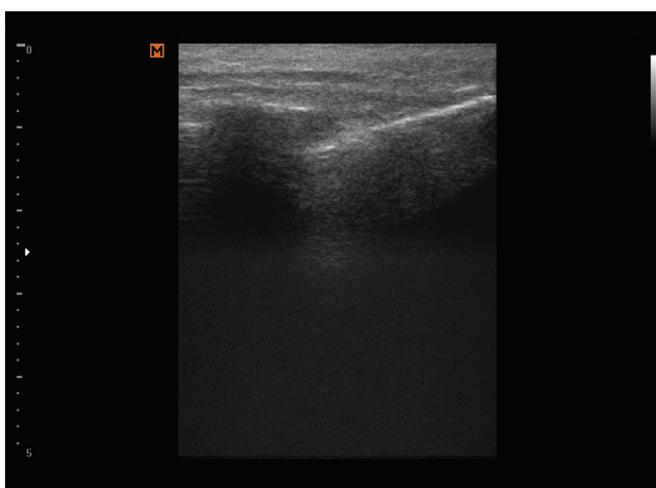


Fig. 3: The USG-guided caudal epidural block

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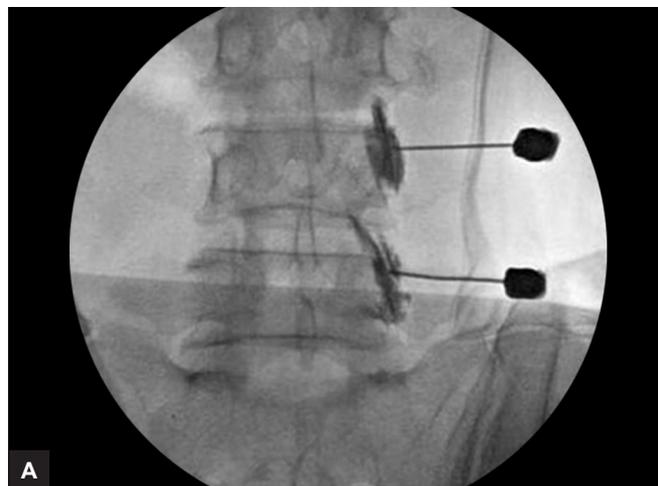
Fig. 4: Fluoroscopy-guided transforaminal epidural block (the dye spread)

the inability to visualize vasculature within the spinal canal during an injection or assess the depth of the needle once advanced past the bone. The USG in interlaminar or transforaminal epidural injection provides no assurance that the injectate has not been placed intravascularly or that a dural puncture has not occurred.^{3,4} Fluoroscopy delivers the drug very close to the site of discoradicular conflict, the drug is visualized spreading from lateral to medial, if needle placement looks satisfactory; but, if the contrast is only flowing laterally outside the foramen, it may not be beneficial as the drug is not reaching the site of inflammation. Needle placement can be rectified to get better drug placement.^{3,4}

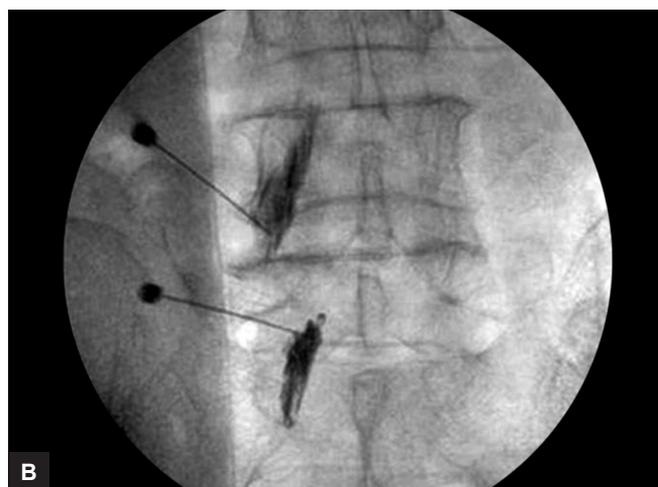
Due to the limited resolution at deep levels and the presence of bony artifacts that limit visualization, USG was considered not as useful in neuraxial (epidural or intrathecal) blocks.⁵ Recently, several groups have demonstrated high success rate using real-time USG guidance.^{6,7}

ULTRASOUND VS FLUOROSCOPY IN SPINE PROCEDURES

Both fluoroscopy (Figs 5A and B) and USG (Fig. 6) in lumbarfacet joint injections have high success rates. Yoon et al³ conducted a randomized control trial, comparing USG and fluoroscopy in the lumbar facet joint injections. Both groups that received fluoroscopic and USG-guided injections showed significant improvement in pain control and return to activities with no significant residual pain. Greher et al⁸ demonstrated that direct visualization of the facet nerve at a 5 cm depth using USG guidance was unable to be performed, but using their method based on a sonographic cross-axis and long-axis view, the authors were able to set the needle target point for a lumbar medial branch nerve block. They also proved that an injection of 1 mL solution resulted in a remarkable spread



A



B

Fig. 5: Fluoroscopy-guided lumbar facet joint injection

around the needle tip as confirmed on fluoroscopy. Jung et al⁹ stated 91.6% success rate with fluoroscopy-guided lumbar medial branch block. For cervical facet, USG may be a better option.¹⁰

The USG-guided injection of the sacroiliac (SI) joints has been demonstrated to have a high success rate of up to 90%.¹¹ After the sacral cornu is identified,

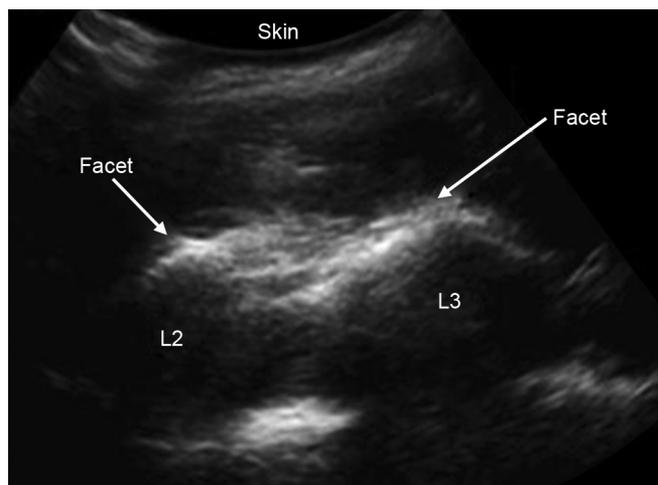


Fig. 6: The USG-guided lumbar facet joint block

the transducer is moved in a lateral direction until the lateral edge of the sacrum is observed. The transducer is then moved in a cephalad direction until the SI joint is identified.

Fluoroscopy and computed tomography-guided techniques have advantages related to more precise localization of the joint during these procedures.¹² The diagnostic application of USG in the SI joint may be limited because of the significantly lower accuracy rate (87.3%) *vs* fluoroscopy (98.2%) in a study done by Jee et al.¹² The needle missed to enter the joint in 12.7% of the patients in the USG group.¹²

ULTRASOUND VS FLUOROSCOPY IN PERIPHERAL NERVE INTERVENTION

Fluoroscopy is effective for visualization of bony structures, but not soft tissues. It thus has limitations when performing peripheral procedures. The USG has numerous advantages¹³:

- More affordable and portable avoiding any radiation exposure
- Provides direct visualization of muscles, tendons, ligaments, nerves, vessels, and bone
- Allows visualization of small peripheral nerves and their associated branches
- Real-time USG guidance of needle placement and medication administration provides an advantage in ensuring accuracy
- The USG-guided supraclavicular brachial plexus block in regional anesthesia is very popular. There are more than 1000 publications supporting this
- The USG-guided occipital nerve block, supra scapular nerve block for frozen shoulder, and lateral cutaneous nerve block for meralgia paresthetica have met with high success rate

- The USG identifies musculoskeletal structures, nerves, and vessels accurately and, therefore, compared with fluoroscopy, for peripheral structures, USG is better.

ULTRASOUND VS FLUOROSCOPY IN VISCERAL GANGLION BLOCK (STELLATE GANGLION BLOCK)

The USG allows visualization of all important structures in the neck. The C6 transverse process is identified by its prominent anterior tubercle. Fluoroscopy increases the accuracy of identifying Chassaignac's tubercle; however, identifying the tissue plane between the longus colli muscle and the prevertebral fascia is not accomplished. Use of fluoroscopy is an improvement, but the critical structures, such as the thyroid gland and the carotid artery might be injured. Vascular structure is not identified by fluoroscopy. Continuous fluoroscopy can detect intravascular injection. The carotid artery must be retracted laterally, and the vertebral artery lies in close proximity; thus, intravascular injection is a real big concern. The USG with Doppler imaging technique is unique in identifying vascular structures.³ With the use of USG, the great vessels of the neck and the thyroid gland can be directly visualized, and a needle trajectory that avoids these structures can be selected from the start. Any practitioner who has made the transition from blind or fluoroscopically guided stellate ganglion block (Fig. 7) to USG guidance (Fig. 8) will attest that the technique has been tremendously simplified and the safety of the technique made more certain.¹³⁻¹⁶

The USG and fluoroscopy both have their merits and demerits:

- For spine procedures, fluoroscopy is always a better option, whereas USG is a better option for peripheral nerve block and visceral ganglion block.

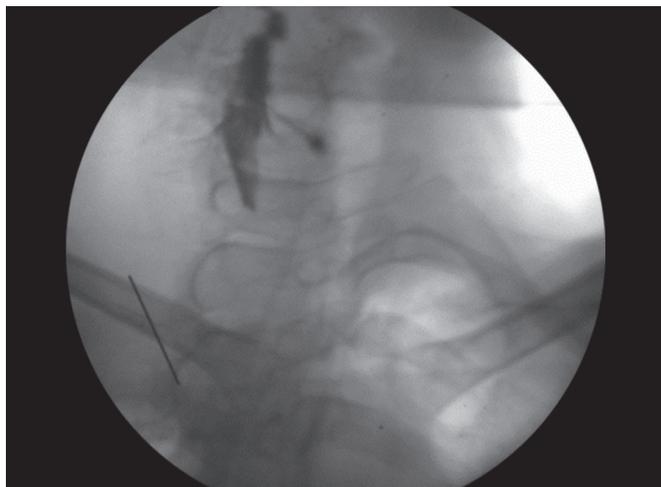


Fig. 7: Fluoroscopy-guided stellate ganglion block

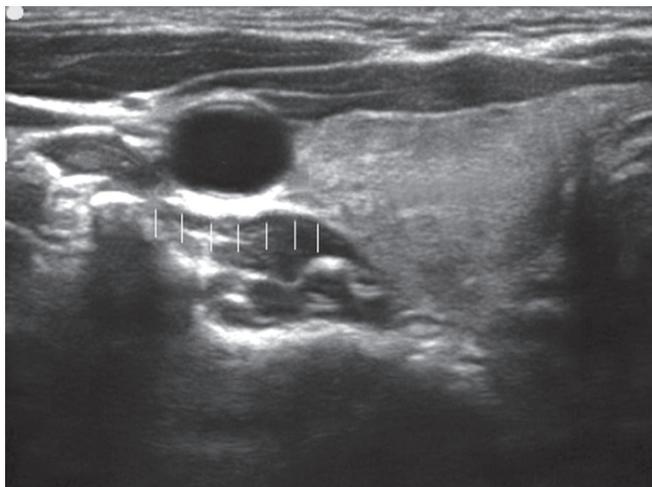


Fig. 8: The USG-guided stellate ganglion block. Dotted lines indicate site of injection

- The USG needs expertise, whereas fluoroscope can be learnt by a beginner as it includes only a short learning curve.
- The USG works better to identify neurovascular bundle, whereas the fluoroscope identifies bone only.
- The USG avoids radiation hazards and is applicable to pregnant patient, children, and the young.

REFERENCES

1. Hazra AK, Bhattacharya D, Mukherjee S, Ghosh S, Mitra M, Mandal M. Ultrasound versus fluoroscopy-guided caudal epidural steroid injection for the treatment of chronic low back pain with radiculopathy: a randomised, controlled clinical trial. *Indian J Anaesth* 2016 Jun;60(6):388-393.
2. Kothari K, Sahu DK. Ultrasonography versus fluoroscopy in modern pain management. *Indian J Pain* 2016 Jul;30(2):71-76.
3. Yoon SH, O'Brien SL, Tran M. Ultrasound guided spine injections: advancement over fluoroscopic guidance? *Curr Phys Med Rehabil Rep* 2013 Jun;1(2):104-113.
4. Couri B, Hurley D, Kasi R. Spinal injections for the diagnosis and treatment of spinal pain. *Oper Tech Sports Med* 2012 Jun;20(2):154-171.
5. Narouze SN. Ultrasound-guided interventional procedures in pain management: evidence-based medicine. *Reg Anesth Pain Med* 2010 Mar-Apr;35(Suppl 2):S55-S58.
6. Karmakar MK, Li X, Ho AM, Kwok WH, Chui PT. Real-time ultrasound-guided paramedian epidural access: evaluation of a novel in-plane technique. *Br J Anaesth* 2009 Jun;102(6):845-854.
7. Grau T, Leipold RW, Fatehi S, Martin E, Motsch J. Real-time ultrasonic observation of combined spinal-epidural anaesthesia. *Eur J Anaesthesiol* 2004 Jan;21(1):25-31.
8. Greher M, Scharbert G, Kamolz LP, Beck H, Gustorff B, Kirchmair L, Kapral S. Ultrasound-guided lumbar facet nerve block: a sonoanatomic study of a new methodologic approach. *Anesthesiology* 2004 May;100(5):1242-1248.
9. Jung H, Jeon S, Ahn S, Kim M, Choi Y. The validation of ultrasound-guided lumbar facet nerve blocks as confirmed by fluoroscopy. *Asian Spine J* 2012 Sep;6(3):163-167.
10. Siegenthaler A, Mlekusch S, Trelle S, Schliessbach J, Curatolo M, Eichenberger U. Accuracy of ultrasound-guided nerve blocks of the cervical zygapophysial joints. *Anesthesiology* 2012 Aug;117(2):347-352.
11. Narouze S, Peng PW. Ultrasound-guided interventional procedures in pain medicine: a review of anatomy, sonoanatomy, and procedures. Part II: axial structures. *Reg Anesth Pain Med* 2010 Jul-Aug;35(4):386-396.
12. Jee H, Lee JH, Park KD, Ahn J, Park Y. Ultrasound-guided versus fluoroscopy-guided sacroiliac joint intra-articular injections in the non inflammatory sacroiliac joint dysfunction: a prospective, randomized, single blinded study. *Arch Phys Med Rehabil* 2014 Feb;95(2):330-337.
13. Soneji N, Wenn Hsin Peng P. Ultrasound-guided pain interventions – a review of techniques for peripheral nerves. *Korean J Pain* 2013 Apr;26(2):111-124.
14. Siegenthaler A, Mlekusch S, Schliessbach J, Curatolo M, Eichenberger U. Ultrasound imaging to estimate risk of esophageal and vascular puncture after conventional stellate ganglion block. *Reg Anesth Pain Med* 2012 Mar-Apr;37(2):224-227.
15. Janik JE, Hoeft MA, Ajar AH, Alsofrom GF, Borrello MT, Rathmell JP. Variable osteology of the sixth cervical vertebra in relation to stellate ganglion block. *Reg Anesth Pain Med* 2008 Mar-Apr;33(2):102-108.
16. Elias M. Cervical sympathetic and stellate ganglion blocks. *Pain Physician* 2000 Jul;3(3):294-304.