ABSTRACT

Musculoskeletal low back pain is a common problem. Pain physicians commonly perform lumbar facet nerve blocks to diagnose facet joint related pain. Traditionally these procedures are carried out under fluoroscopy guidance. Recent advances in ultrasound technology and better understanding of the sonoanatomy of spine has led to the evolution of ultrasound-guided lumbar facet nerve block. This article describes the nerve supply of the lumbar facet joints and the technique of blocking these nerves under ultrasound guidance.

Keywords: Ultrasound, Low-back pain, Facet joint, Medial-branch block.

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INTRODUCTION

Application of ultrasound is a rapidly growing technology in the field of interventional pain management. Lumbar facet nerve blocks are used to diagnose pain originating from the facet joints. Studies have shown that ultrasound can be used for lumbar facet medial branches/dorsal rami blocks. The technique has the advantage of avoiding the risks of radiation and visualising real time navigation of the needle. Other benefits include portability and cost-factor.

ANATOMY

Lumbar facet (zygapophyseal) joints are made up of the inferior articular process of the vertebra above and the superior articular process of the vertebra below. Each of these joints is innervated by two nerves – medial branches (of the dorsal rami) from the same level and from the level above. For example, L4-L5 facet joint is innervated by the medial branches of L3 and L4. L3 medial branch runs in the junction between the superior articular facet and transverse process of L4. L4 medial branch runs in the junction between the superior articular facet and transverse process of L5. Lumbar facet joint pain may be diagnosed by selective blockade of these nerves. The course of L5 medial branch is variable. Hence, for L5-S1 facet joint related pain, the medial branch of L4 and ‘dorsal ramus’ of L5 are blocked. Dorsal ramus of L5 runs in the junction between the superior articular facet of S1 and the sacral ala.

EQUIPMENT AND RESOURCES

Low frequency curvilinear probe (2-5 MHz which has greater penetration but lesser resolution) is used at the lumbar level. The same level of aseptic precautions for fluoroscopy guided blocks should be taken for ultrasound guided blocks. The probe should have a sterile cover and sterile gel should be used. Whilst normal hypodermic needles can successfully be used for the diagnostic injections, newer echogenic needles may improve visibility. Although intravenous access is not routinely used, the procedure should ideally be performed in an area with access to resuscitation facilities.

SONOANATOMY OF LUMBOSACRAL AREA

In the lumbosacral area, a pre-procedural scan can be done by placing the probe on the subject either in the horizontal (transverse) orientation or vertical (longitudinal) orientation with respect to the spinal column. In general, bone does not permit passage of the ultrasound beams and produces an ‘acoustic shadow’. Between the bones, the soft tissues allow ultrasound beam to pass through to produce ‘acoustic window’. Understanding the sonograph images opens up the opportunity to apply it in different spinal interventions.

Sacrum is an appropriate area to begin the scanning. When the probe is placed in transverse orientation, the sacrum produces a horizontal hyperechoic (whitish) reflection (Figs 1 and 2). As the probe is gently moved cephalad towards the lumbar spine, the first acoustic window to
appear in the screen is the L5-S1 interspinous space. At this level, the shadows of L5-S1 interspinous ligament, superior articular facet of S1 and the ala of sacrum can be visualised. With appropriate positioning (eliminating the lumbar lordosis) the space can be opened to see the two horizontal hyperechoic reflections in the middle – ligamentum flavum (LF) (with the dorsal dura) and the posterior longitudinal ligament (PLL) (with the ventral dura). As the probe is gently moved cephalad, the bony L5 spinous process and the laminae produce an acoustic shadow. When moved further up, the L4-L5 interspinous space appears. At this level, the shadows of L4-L5 inter-spinous ligament in the midline, superior articular facet of L5 and transverse process (TP) of L5 can be made out. Gradual cephalad movement of the probe alternatively will show acoustic windows and acoustic shadows when the probe is on inter-spinous space (Figs 3 and 4) and over the spinous process respectively (Figs 5 and 6).

With the longitudinal orientation of the probe, again it is prudent to start scanning from the sacrum which produces a vertical hyperechoic reflection. As the probe is moved cephalad, depending on whether the probe is in the midline over the spine, paramedian over the lamina, articular facets or the transverse process, different sonographic patterns appear. When the probe is over the spine, as the lumbar spine is arranged like the tiles in a roof, no satisfactory acoustic window is visualised. However, when the probe is gently moved to either side to the paramedian area and positioned over the lamina, between the acoustic shadows produced by the bony lamina, the hyperechoic reflections of ligamentum flavum (LF) and posterior longitudinal ligaments (PLL) are visualised in the acoustic window (Figs 7 and 8). When the probe is over the articular facets—a continuous ‘saw-tooth’ hyperechoic bony reflection pattern can be recognised (Figs 9 and 10). If the probe is moved further away, laterally, it lies over the transverse processes of the lumbar vertebrae. This produces ‘fence’ like appearance with dark acoustic shadows (transverse processes) interrupted by the acoustic windows (psoas muscle) (Figs 11 and 12).

**LUMBAR FACET L1-4 MEDIAL BRANCH/L5 DORSAL RAMUS BLOCK-TECHNIQUE**

For the lumbar medial branch, the target point is the groove at the junction between the base of the superior articular process and the superior border of the transverse process. L5 dorsal ramus block under ultrasound is usually more difficult due to the anatomy; the nerve target point is the groove at the junction between the base of the superior articular process of S1 and the ala of sacrum. With the patient in the prone position and lumbar lordosis eliminated (with a pillow under the abdomen), the sacrum and correct lumbar level are identified with the lon-
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Fig. 5: Transverse—over the spine

Fig. 6: Transverse—over the spine (lumbar transverse view—spinous process)

Fig. 7: Longitudinal—over the lamina

Fig. 8: Longitudinal—over the lamina (lumbar longitudinal scan—lamina)

Fig. 9: Longitudinal—over the facets

gitudinal probe orientation—as described above. Then the probe is rotated to the transverse orientation, placed over the sacrum and gradually moved cephalad to the level interested until the interspinous ligament, the articular process, and the transverse process are identified. The needle is introduced and advanced inplane, lateral to medial, targeting the angle formed by the superior articular process and the transverse until bony contact is made (Fig. 13). For precision diagnostic block, the tip of the needle must be seen at the upper part of the transverse process. This can be confirmed by longitudinal scanning of the transverse processes.

The same principles are followed for L5 dorsal ramus block and the needle is advanced to make a bony contact between the superior articular process of S1 and the sacral ala. However, the ileal crest may obscure the view/obstruct the needle trajectory-requiring an out-of-plane approach.

LIMITATIONS

There are some limitations. Medial branch blocks in obese patients have higher failure rate and is not recommended...
to be performed by ultrasound guidance exclusively. The major shortcomings of ultrasound guided facet injections are the limited resolution at deep levels and bony artefacts that affect image quality. Intravascular spread is difficult to interpret. Modern machines are getting better with resolution and clarity. There is limited evidence for ultrasound guided radiofrequency denervation of the facet joints. To be completely independent from fluoroscopy controls, ultrasound guided procedures requires training and experience.

REFERENCES


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