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PRACTITIONERS' SECTION

Lumbar Facet Joint Interventions

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ABSTRACT

Facet joints or zygapophyseal joints are paired synovial joints in the vertebrae that are commonly affected by degenerative changes that cause pain and disability. It is one of the most prevalent causes of low back pain and is more commonly seen in older population. Facet joint interventions may involve an intra-articular joint injection and medial branch block. Both of them are relatively simple and straightforward procedures best performed under fluoroscopy for guidance to properly target and place the needle.

Keywords: Facet joint, Intra-articular injection, Medial branch, Radiofrequency ablation.

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INTRODUCTION

The facet joints are a pair of joints in the posterior aspect of the spine. Although these joints are most commonly called the facet joints, they are more properly termed the zygapophyseal joints (abbreviated as Z-joints), a term derived from the Greek roots zygos, meaning yoke or bridge, and physis, meaning outgrowth. Facet arthropathy is the second most common cause of low back pain after disk pathology. It is mainly caused as a result of age-related degeneration of paired synovial zygapophyseal joints in vertebrae. The cartilage inside the facet joint can break down and become inflamed, triggering pain signals in nearby nerve endings. Evaluation includes medical history and clinical examination. Pain is most commonly generated on extension and ipsilateral rotation of spine. Computed tomography/magnetic resonance imaging can be done to rule out other causes of back pain. The poor correlation between history and physical examination findings and zygapophyseal pain has led to widespread acceptance of the use of diagnostic blocks to confirm the facet joint as a primary pain generator. Diagnostic test of choice for facet arthropathy is a diagnostic block using a local anesthetic. The rationale for these blocks is that the anesthetic blockade of a painful joint will abolish pain arising from that joint for the duration of the anesthetic effect, while anesthetic blockade of a nonpainful joint will not alter the pain report. Medial branch blocks and intra-articular injections are widely touted to be equally effective diagnostic tools. Fluoroscopic guidance and contrast enhancement enable precise delivery of drug to target structures.

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ANATOMY

Facet or joints provide support, stability, and mobility to spine. Made of inferior articular process of upper vertebra and superior articular process of lower vertebra, these small synovial joints have a maximum volume of 1 to 2 mL.[1] Stacked vertically, they create a hinge-like link between the vertebrae and are important for sideways rotation of lumbar spine. Since it is a weight-bearing joint, it is subjected to large pressures, and thus, is prone to undergo age-related deterioration. It is lined with a cartilage that allows the joint to move freely without any friction. Facet joints are also surrounded by lubricating joint capsules that contain synovial fluid, connective tissue, and nerve endings for pain transmission. The facet joints are situated between the pedicle and lamina of the same vertebra. On the ventral aspect, the capsule is deficient and the joint is in contact with the ligamentum flavum.[2] These joints act as articular pillars that provide structural stability to the vertebral column as a whole. Held in place by posterior longitudinal ligament, these joints allow the spine to bend, twist, and extend in different directions. They restrict excessive hyperflexion and hyperextension of spine.

The facet joints are richly innervated by the nerve fibers from the medial branch of the dorsal ramus of spinal nerves L1 to L5. Each facet has a dual nerve supply from the dorsal ramus at the same level as well as from the level above. Each spinal nerve root innervates two facets; it supplies the facet joint at the level it exits, as well as the subsequent lower facet.[3] Therefore, L4 and L5 facet joint is supplied by L3 and L4 medial branches located respectively, at L4 and L5 transverse processes (Table 1). Medial branch also innervates the multifidus, interspinales, and intertransversarii mediales muscles,

the interspinous ligament, and, possibly, the ligamentum flavum.[4] Histological studies have shown that capsules of the facet joints are richly innervated with free nerve endings. This means that they are endowed with the appropriate sensory apparatus to transmit proprioceptive and nociceptive information.[5] Each nerve emerges from its intervertebral foramen and enters the posterior compartment of the back by coursing around the neck of the superior articular process. Hugging the neck of the superior articular process, the medial branch passes caudally and slightly dorsally to enter the multifidus muscle. Intermediate and lateral branches arise from the dorsal ramus at the same point as the medial branch. Finally, the medial branch crosses the vertebral lamina where it divides into multiple branches that supply the multifidus muscle, the interspinous muscle and ligament, and two facet joints.

The medial branch of the L5 dorsal ramus has a different course and distribution. From the L5/S1 intervertebral foramen, the medial branch of the L5 dorsal ramus runs along the groove formed by the junction of the ala and the root of the superior articular process of the sacrum before hooking medially around the base of the lumbosacral facet joint, the L5 dorsal ramus divides into medial and lateral branches, with the medial branch continuing medially, innervating the lumbosacral joint.

Table 1: Course and distribution of medial branches

Facet joint	*Target medial branches of posterior primary rami*
L1 / L2	T12, L1, L2
L2 / L3	L1, L2, L3
L3 / L4	L2, L3, L4
L4 / L5	L3, L4, L5
L5 / S1	L4, L5, S1

FACET JOINT INJECTION PROCEDURE

The patient is placed in the prone position on the fluoroscopy table. A towel roll or pillow can be placed under the abdomen to facilitate easier entry into the joint. Antiseptic dressing and draping is done. As with any lumbar intervention, a baseline anteroposterior (AP) fluoroscopic view of the lumbar spine is obtained and the fluoroscope is oriented. Level chosen to be blocked is identified under fluoroscopic view in the true AP projection. Once the level is identified, the fluoroscopy ray is rotated ipsilateral obliquely until a view of the "Scotty dog" is obtained. The "Scotty dog" is formed by the superior as well as the inferior pars of the same vertebra (Fig. 1). The "ear" of the dog is the superior articular process (pars) and the "front legs" of the dog

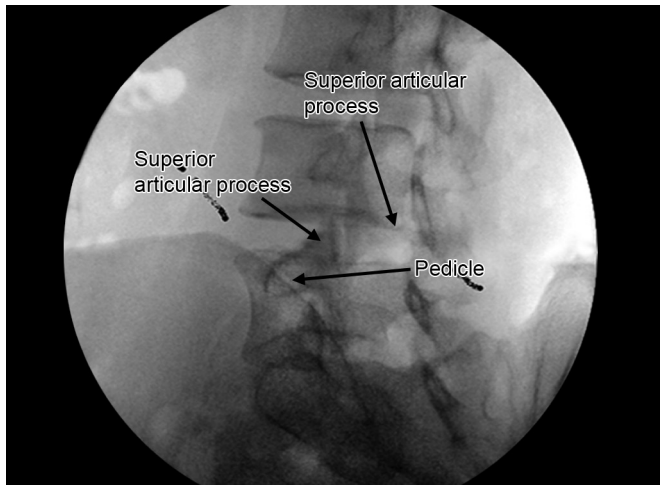


Fig. 1: Oblique fluoroscopy "Scotty dog" view

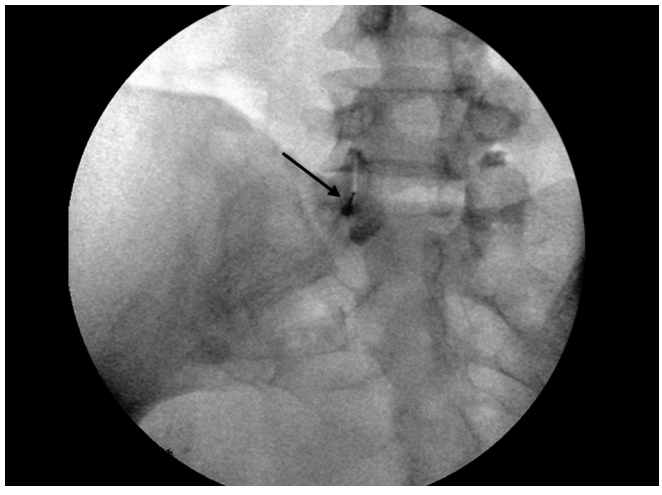


Fig. 2: Needle insertion

are formed by the inferior articular process (pars). The intervening line denotes the facet joint; it should be maximally opened up for joint access. Once this view has been obtained, the skin is anesthetized with LA, and the 22-gauge spinal needle is directed vertically toward the facet joint. Then, the same 6-cm long needle is steered into the joint line as shown in under fluoroscopy guide (Fig. 2). Care should be taken to pass the tip of the needle directly to the facet joint by observing its tip frequently with fluoroscopy. Sometimes, puncture of the joint capsule can be felt as a typical hard cheese feel. More often, however, the bone prevents further advance of the needle after entering the joint. About 0.2 to 0.3 mL of nonionic contrast medium is injected (Fig. 3). A typical joint shadow with upper and lower recess is seen, checked in lateral view (Fig. 4). Then 1 to 1.5 mL of drug is injected into each joint, and the needles are removed. Patient is enquired for disappearance of pain and the spine is extended rotated and laterally flexed to look for disappearance of pain.

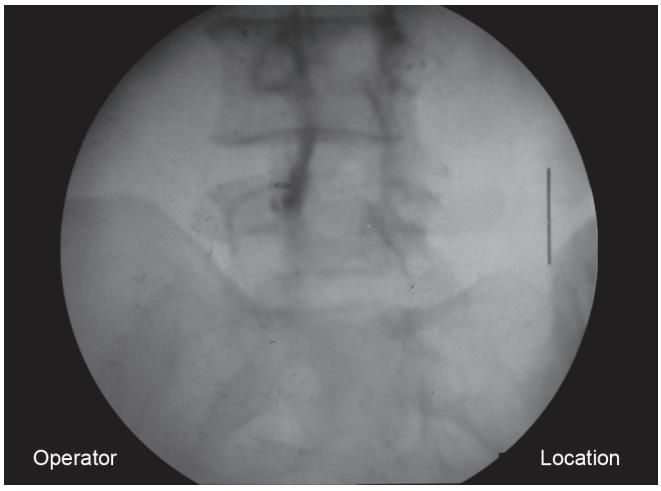


Fig. 3: Dye spread

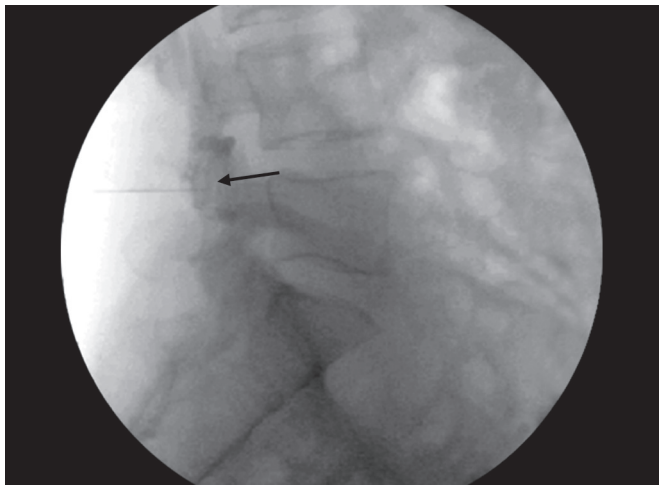


Fig. 4: Lateral view: Needle at the level of facet line posterior to the foraminal opening, below the level of intervertebral disk

MEDIAL BRANCH BLOCK

The lumbar medial branch blocks have essentially replaced, or should replace, intra-articular injections in the diagnosis of lumbar facet joint pain. Medial branch blocks are relatively easier to perform and safer. There is evidence for medial branch block therapy and radiofrequency neurotomy of lumbar medial branch blocks to be effective in managing chronic low back pain.[6,7] To block the sensory innervation to a lumbar facet joint, it is necessary to block the two medial branch nerves, which supply the joint. To block the L3/4 facet joint, block the L2 medial branch at the transverse process of L3 and the L3 medial branch at the transverse process of L4.

To perform the medial branch block, the patient is positioned in the prone position with a pillow under the abdomen. Fluoroscopic imaging is obtained. The C-arm must be adjusted to an oblique position. To maximally visualize the landmarks of the "scotty dog" configuration, the overlying skin is marked, prepared, and draped in the usual sterile fashion. A 2% lidocaine is used to anesthetize the skin and subcutaneous tissues. A 22 G spinal needle is then inserted percutaneous and advanced under fluoroscopic guidance. Utilizing an oblique view with the "scotty dog" identified, the needle is advanced "down the beam" toward the target using a slightly superior starting position to the final target. The needle will be directed anterior, medial, and caudal to reach the target location. Prior to injection, however, final needle tip position should be confirmed using both AP and lateral imaging to ensure that the needle tip is neither too deep nor too medial. On AP imaging, the tip of the needle should be at least in line with the lateral margin of the silhouette of the superior articular process and, if possible, medial to this margin. On lateral imaging, the needle tip should be within the confines of the shadow of the dorsal elements and not protruding into the foramen (Figs 5 to 7). After negative aspiration, 0.2 to 0.5 mL 2% lidocaine is injected. For L5 dorsal ramus block, the junction between

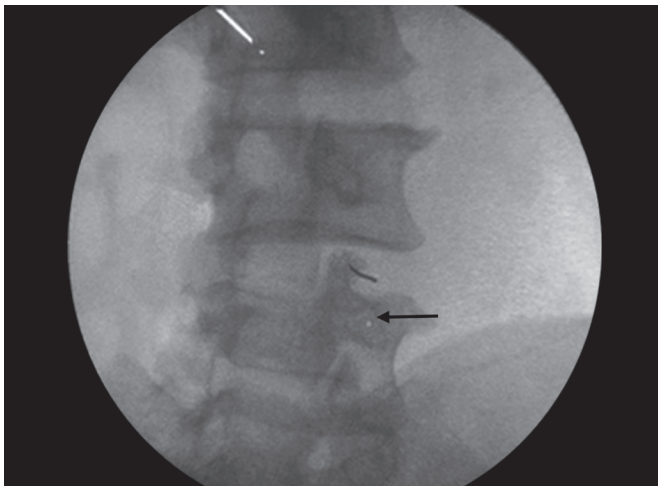


Fig. 5: High on the eye of "Scotty dog"

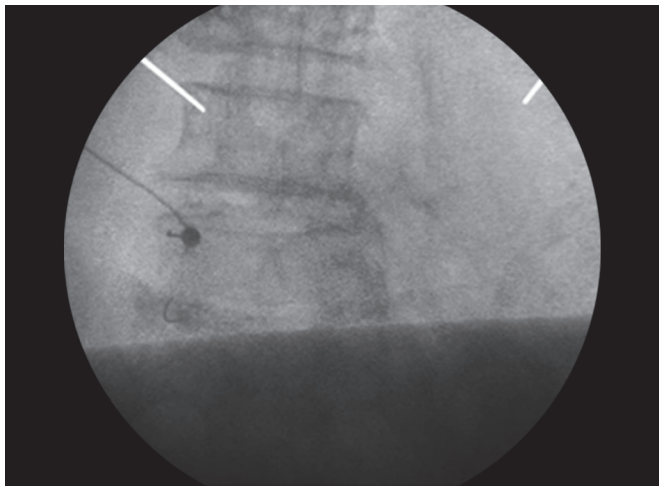
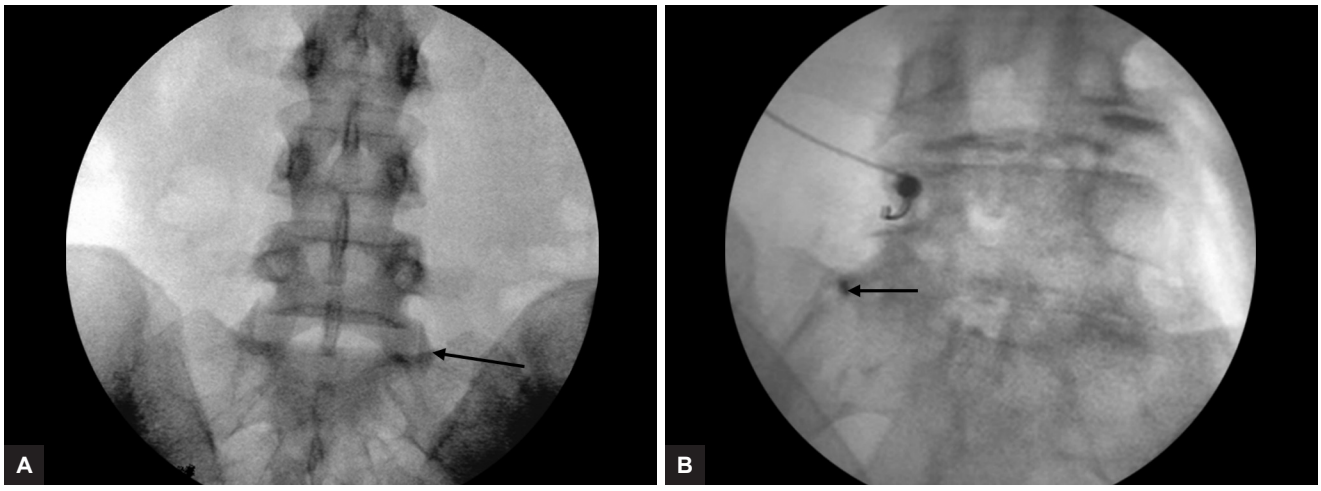


Fig. 6: Anteroposterior view



Figs 7A and B: L5 medial branch block

the sacral articular process and upper sacral border where L5 dorsal ramus runs, there is no pedicle to serve as a radiological landmark (Figs 7A and B). The response to medial branch blocks has been reported to correlate with treatment outcome; however, to avoid false-positive response dual block (lidocaine and then bupivacaine) or placebo controls have been advocated before progressing to radiofrequency ablation (RFA).

RADIOFREQUENCY ABLATION OF MEDIAL BRANCH NERVE

The RFA of the medial branch nerve may be considered to obtain prolonged pain relief when diagnostic medial branch block gives 50 to 80% pain relief in patients without previous back surgery, whereas 35 to 50% pain relief in patients with failed back surgery syndrome.

Procedure

For RFA procedure, the patient is placed prone and appropriate levels are identified under fluoroscope. The overlying skin is marked and the area is cleaned and draped in sterile fashion. Lidocaine is used for local anesthesia of the skin and soft tissues. Light sedation is optional. At each level, using AP, lateral, insert a 22-gauze 10- to 15-cm insulated 5- to 10-mm active-tip radiofrequency cannula percutaneous, and advanced under fluoroscopic guidance, and oblique projections as described above. Aspiration is performed to exclude blood or cerebrospinal fluid. Needle placement is also confirmed with sensory stimulation at 50 Hz at 5 V and motor at 2 Hz at 1 V. Once needle position is confirmed, mixture of preservative-free 2% lidocaine, 5 mL, is injected at each level to provide local analgesia during the heating process. The radiofrequency probes are then inserted through the needles and lesioning done at (80°C for 1 minute); after the heating cycle has finished, the steroid is given, the needles are removed, and sterile bandages are applied. Postprocedural examination and postsedation monitoring are performed and documented. Numbness or dysesthesias have been reported after radiofrequency denervation, but tend to be transient and self-limiting.

COMPLICATIONS AND SIDE EFFECTS

Complications from facet joint nerve blocks or intra-articular injections in the lumbar spine are exceedingly rare. The most common complications are:

- Complications related to the placement of the needle
- Complications related to the administration of various drugs.

Most problems, such as local swelling, pain at the site of the needle insertion, and pain in the low back are short-lived and self-limited.

More serious complications may include dural puncture, spinal cord trauma, subdural injection, neural trauma, injection into the intervertebral foramen, and hematoma formation; infectious complications including epidural abscess and bacterial meningitis; and side effects related to the administration of steroids, local anesthetics, and other drugs.

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