General Medicine:Open access

Jadon, Gen Med (Los Angeles) 2016, 4:3
http://dx.doi.org/10.4172/2327-5146.1000252

Research Article Open access

Low Back Pain due to Lumbar Facet Joint Arthropathy and its Management

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Rec date: March 22, 2016; **Acc date:** June 13, 2016; **Pub date:** June 19, 2016

Abstract

Low back pain is a very common problem which brings a patient to orthopedic clinic or pain clinic. It is estimated that it affects about 60–80% of general population in the whole life and facet joints are responsible for back pain in 15%–45% of such cases. Multimodal approach including analgesics and back strengthening exercise are primary treatments. However, sustained relief can be achieved by radiofrequency ablation after proper diagnosis.

Keywords: Back pain; Facet joint arthropathy; Intra articular injection; Medial branch block; Radio frequency ablation

Introduction

The vertebral facet joints (zygapophyseal joints) are synovial joints with hyaline cartilage a synovial membrane, and a joint capsule [1]. Facet joints (zygapophyseal joints) are responsible for flexion, extension, and rotation movements of the spine. As any typical synovial joint, facet joints have two articular surfaces formed by inferior articular process (IAP) of the upper vertebra and the superior articular process (SAP) of the lower vertebra [2]. Facet joints are potential source of pain in low back pain (LBP) and its prevalence increases with age [3,4].

All the structures of facet joint and surrounding areas are richly supplied with nerves and they may become source of pain either due to physical injury or due to release of inflammatory mediators [5]. The common causes of facetogenic pain are swelling of synovial membrane due to inflammation, capsular stretch, entrapment of synovial membrane between the articular surface and impingement of nerves by osteophytes. Degenerative conditions and trauma are the most common conditions leading to pain from facet joints. Disk degeneration leads to abnormal weight transfer and motion in the spine and results in facet joint arthritis [6]. It has been reported that as many as 89% -95% individuals of 65 and older have varying degrees of Facet Joint Arthritis (FJAO) and the L4-5 and L5-S1 are the most commonly affected joints [1,3,4,6].

Facet as "Pain Generator"

Facet joints are an important contributor for back pain. Injection of hypertonic saline into the facet joints results in pain which corresponds to the tertiary of that particular facet joint and this pain is reproducible [7,8]. Maps of pain distribution after facet injections have been made by fixed pain patterns in volunteers and patients which help in diagnosis of affected facet joint causing pain. Each facet joint is innervated by nerve branches arising from posterior primary rami and known as medial branches. Two branches of medial nerve supplies one facet joint, one nerve arising from same level and one from a level above [9].

Pain Generators in Facet Joints

Facet joints have rich innervations with encapsulated, un-encapsulated, and free nerve endings. Joint capsule contains substance P and calcitonin gene-related peptide which are known pain mediators [10]. Nerve endings in facet capsules also contain Neuropeptide-Y which is responsible for sympathetically mediated neuropathic pain [11]. Presence of nerve fibers in other areas like subchondral bone and intra-articular inclusions indicate that these structures are also potential places for facet related pain other than the joint capsule [12,13]. Presence of Inflammatory mediators like prostaglandins, cytokines interleukin-6 and tumor necrosis factor-alpha (TNF-α) in the cartilage of facet joint and synovium of degenerative lumbar spine indicates, the nociceptive pain source [14,15].

Patho Mechanism of Facet Arthropathy

Trauma is a rare cause for facet joint related pain. Most of the time degenerative changes either secondary to disc generation [16] or repetitive strain injuries of facet joints are responsible for the facetal pain [17,18]. Repetitive strain on facet joints leads to inflammation of synovial membrane, fluid accumulation and distention which results in pain from stretching the joint capsule [19]. Symptoms of sciatica may be present when the foramen is already narrowed by joint hypertrophy and/or osteophytes and inflammatory distension of synovial membrane compress the exiting nerve root in the neural foramen or spinal canal [20,21].

Numerous other causes like rheumatoid arthritis, ankylosing spondylitis and capsular tears, have also been described as causes of facet joint pain [2]. Occasionally asymmetrical facet joints (facet joint tropism) may be responsible for back pain as it may result intervertebral disc degeneration and herniation [22,23].

Clinical Presentation

Facet arthropathy in lumbar area causes low back pain with radiation to the buttock and posterior-lateral thigh (rarely below knee) on the affected side [24-27]. The pain is exacerbated by extension and side bending (twisting) on affected side and decreases on flexion. Very frequently, pain is referred to the groin, buttocks and hip. Groin pain is most common with involvement of facet joints in the lower levels.

However, all lumbar levels are capable of producing groin pain. Pain from the upper lumbar facets tends to extend into the flank, hip, and upper lateral thigh, whereas pain from the lower lumbar levels is likely to penetrate deeper into the thigh, usually in the lateral and posterior aspects. Infrequently, the facet joints of L4-5 and L5-S1 can cause pain in the lateral calf, and rarely into the foot. Radicular symptoms are not commonly seen with facet arthropathy. However, osteophytes, synovial cysts and occasionally facet hypertrophy may manifest as radicular pain. Pain due to facet involvement is often described as a "deep, dull ache" and maybe either unilateral or bilateral. On physical examination, tenderness may be noticed over the affected joint and extension of back causes increase in pain. This simple clinical examination can also be helpful for isolating symptomatic levels. Neurological examination is always negative. Pain due to facet joints is maximum during initial movement after rest (difficulty in getting up in morning due to stiffness) and improves with movement. With progressive degeneration, many joints are involved either on the same side or bilaterally. Studies have shown that 70% of cases have bilateral involvement and involvement of more than 3 regional joints in many patients.

Diagnosis

It is mostly clinical [26,28] as anatomical changes due to degeneration seen on x-rays, CT or MRI do not correlate well with symptoms [26,29]. Various study even have failed to correlate the clinical features of facet arthropathy with diagnostic or therapeutic injections [29,30]. Fractures or dislocation of facets joints due to injury and other symptomatic conditions like cysts pressing over nerves can be diagnosed by imaging techniques (Table 1).

Grades of Degeneration	Radiological findings
0	Normal zygapophysial joints/ joint space 2-4 mm
1	Narrowing of Joint space with formation of mild osteophyte with or without hypertrophy of the articular process
2	Sclerosis and narrowing of joint space, moderate osteophyte formation or moderate hypertrophy of the articular process or mild subarticular bone erosions
3	Severe narrowing of the joint space with excessive osteophyte formation or severe hypertrophy of the articular process or formation of subchondral cysts or presence of severe subarticular bone erosions

Table 1: Levels of degeneration of facet joints based on magnetic resonance imaging.

Electrical stimulation of the medial branch may also assist in identifying referral pain patterns. Facet joint as a source of pain can be confirmed by injection of local anaesthetic either into facet joint (intra articular injection) or by medial branch blocks. However, there is a high incidence of false positive (20-50%) and false negative (11%) results [31,32]. Use of sequential blocks by using short acting local anaesthetic like lidocaine followed by longer acting drugs like bupivacaine results in better diagnosis and can predict successful treatment [33,34]. The reasons for false positive results are placebo-response, myofascial pain and epidural spread. To get a precise block (high specificity) at a particular medial branch in lumbar area, the amount of local anaesthetic should be kept as low as 0.5 ml and target point of injection is kept at place between the upper border of the transverse process and the mamilloaccessory ligament. There are also other Interventions that may reduce the incidence of false-positive lumbar facet blocks. These interventions are [26,31,33,35]:

- Placebo-controlled blocks, or sequential local anesthetic blocks with two different local anaesthetic of variable duration of action.

- Lower target point on the transverse process.

- Reduced injectate volume to 0.5 ml.

- Less amount of local anesthetic for skin infiltration.

- Use of single-needle approach (single entry point for two or more medial branch blocks).

- Computed tomography guidance (for intra-articular injections) in patients with severe spondylosis.

- Avoided use of sedation or intravenous opioids.

- False-negative blocks also may be a result of a multiple factors, although the predominant mechanism(s) remains unclear. Venous uptake of LA (8-33% of lumbar facet blocks) and aberrant innervations of facet from nerves other than branches of the dorsal rami are important causes for false negative responses.

- Although, debate exists regarding the need for serial block (synonyms: dual blocks, sequential block) or placebo-controlled blocks before proceeding to interventional therapy like radiofrequency ablation, diagnostic image-guided medial branch nerve blocks have level I evidence for identification of painful facet joint.

Treatment

Successful management of facetogenic pain requires “multimodal approach” for the treatment. Conservative therapy should be tried first which includes medical management, acupuncture, acupressure, tailored exercise, yoga and psychotherapy [26]. Pharmacotherapy and non-interventional treatments all have been tried. However, evidence for their success in isolation is limited and inconclusive. The optimal management of facet joint pain should include both non-interventional and interventional treatment. Interventional management is considered in patients when axial non-radicular spine pain or persistent cervicogenic headache resulting in functional disability for more than 3 months’ duration and do not responds to conservative treatment or physiotherapy.

Interventional Management of Facet Pain

Interventional approach to manage facet joint pain has dual advantage as; it is a definitive diagnostic tool and also has therapeutic value. Interventional management of facet arthropathy is done through injection of local anaesthetic (with or without steroid) either within the joint (intra-articular injection) or on to the medial branches [26,31,35-40]. Once diagnosis is confirmed, radiofrequency ablation (RFA) of medial nerves is done for long term effect.

Medial Branch Block

Patient should first be examined and baseline pain level is established before performing any diagnostic medial branch block. Under fluoroscopy correct level of target facet joint is identified, skin entry point is marked and area of entry point including surrounding area is cleaned with antiseptic solution and draped in sterile manner. 1-2% Lidocaine is injected to anesthetize the skin and subcutaneous

tissues. A 22-23G spinal needle is then inserted through anaesthetized skin and slowly advanced using fluoroscopic guidance. With every movement of needle, position of needle is checked by using Anterior-posterior (AP), lateral, and oblique projections. In lumbar area the target is, junction of the superior articular process (SAP) and the transverse process (TP) also known as eye of "Scotty dog" (Figure 1). After negative aspiration 0.2-0.5 ml of 2% lidocaine is injected. Patient is re-examined to assess the pain level and response to the block after 20 minutes. More than 50% reduction in baseline pain is taken as positive response. 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.

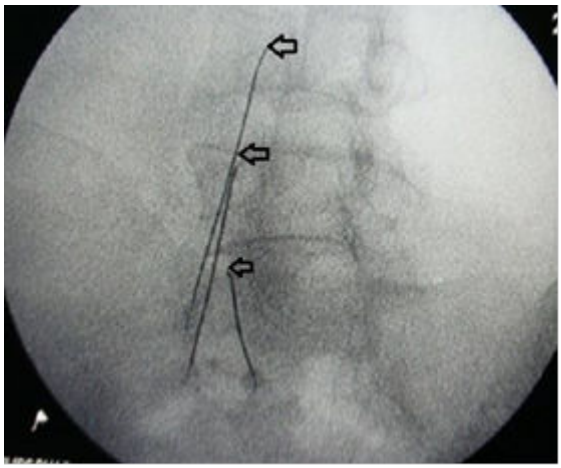

Figure 1: Medial branch block at L3, L4 and L5.

Intra-articular Steroid Injections

Intra-articular injection of a steroid and a local anesthetic in the facet joint is performed mainly for therapeutic purposes for relief of low back and neck pain. The procedure may also be used for diagnostic purposes to establish the cause of pain. The joint space can be entered directly or when direct access proves impossible or too difficult, an articular recess can be targeted. CT guidance may be required if joint is severely degenerated and osteophytes are present and there is inability to enter in to the joint during routine fluoroscopic guided procedure. Once intra-articular entry is confirmed (Figure 2) by contrast injection (0.2 ml), a mixture of local anesthetic and steroid is injected.

Commonly used steroids include depot-preparations of Methylprednisolone, triamcinalone, and betamethasone for lumbar area and clear steroid solution like dexamethasone in cervical or thoracic area. Intra-articular steroid injections are more effective if there is a clinical or radiological evidence of facet joint inflammation than if features of joint degeneration are present. While using repeated steroid injections, it is necessary to monitor total dose of steroid given during a 12-month period particularly in patients with insulin-dependent diabetes. Injection volume should also be limited to less than 2 ml because intra-articular injection may injure (rupture) joint capsule if large volume of drug is injected. Intra-articular injection is still being used although conclusions regarding effectiveness of intra-articular injections are inconsistent.

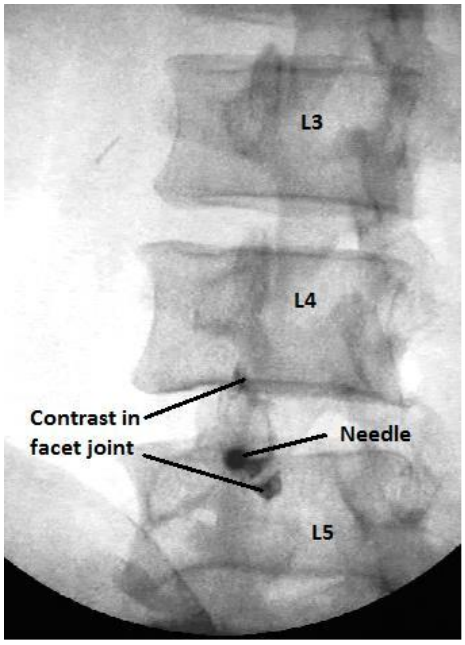

Figure 2: Intra-articular injection.

Recent literature reviews regarding their effectiveness have concluded that facet joint steroid injections have limited (level III) evidence of benefit it means either they are ineffective, or have no added benefit than other treatments. However, there is general agreement among pain physicians that intra-articular injection has a place in facet related pain and can be used if the patient has more than 50% sustained relief for more than 3 months and RFA is contraindicated or refused by the patient. Intra-articular facet steroid injections may also be considered if patient has posterior fusion and due to the presence of hardware or bone graft material access to medial branch is limited or risky.

Radiofrequency Ablation of Medial Branch Nerve

It is done to achieve prolonged and sustained pain relief when diagnostic medial branch block gives 50% to 80% pain relief in patients without previous back surgery and whereas 35% to 50% pain relief in patients with failed back surgery syndrome (FBSS). The success of medial branch RFA is variable and position of RF needle during nerve ablation is supposed to be a contributing factor. Therefore, it is recommended that the RFA needle should be positioned along the lateral neck of the superior articular process and not in the groove between superior articular and transverse processes.

RFA Procedure

RFA interventions in the neck can be done in supine, prone or lateral positions. For lumbar area, the patient is usually placed in prone position and appropriate levels are identified under fluoroscope. The procedure is similar to medial branch block except the contact of RFA needle to the target. In medial branch block the needle tip is targeted on-to-the, nerve. However, for lesioning by RFA, the needle shaft is placed parallel to the target nerve for effective lesion. Position of the RFA cannula (needle) is guided by using A-P, lateral, and oblique

projections of fluoroscope. Tip of needle should be directed to the base of the superior articular process because medial branch nerves lie between the intervertebral foramen and the mamillo-accessory ligament.

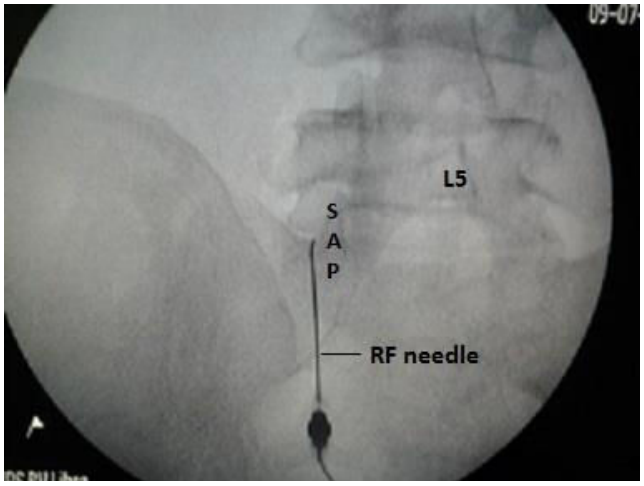

Figure 3A: Radiofrequency ablation at L5 (AP view).

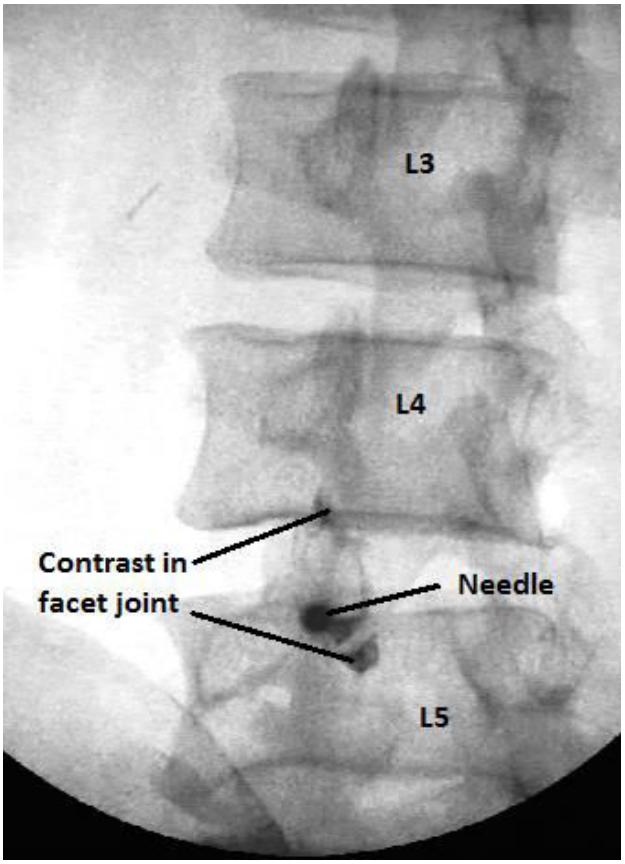

Figure 3B: Radiofrequency ablation at L5 (Lateral view).

Once satisfactory needle position is achieved, aspiration is performed to exclude blood or CSF and correct needle placement is confirmed with motor and/or sensory stimulation. After confirming needle position, a mixture of preservative-free 2% lidocaine and steroid is injected at each level to provide local analgesia during the heating process. The radio-frequency probes are then inserted through the needles and lesion is created at 80°C for 90 seconds (Figures 3A and 3B). Pulsed mode can also be used in similar manner at 42°C for 2-3 minutes. However, needle tip rather than shaft of needle is placed on-to the nerve for effective pulsed lesion or neuro-modulation.

After the heating cycle has finished, the needles are removed and sterile bandages are applied. After the procedure is over, patients are re-examined for effectiveness and any untoward effect. Post-sedation monitoring and documentation is done in recovery area till complete recovery. Documentation of pretreatment and post treatment pain perception, functional assessment, and analgesic/opiate requirements are must to monitor outcome. Complications like bleeding, infection, or incomplete pain relief may occur. Numbness or dysesthesia have been reported after RF denervation, but tend to be transient and self-limiting.

A Point to Ponder

Diagnostic medial branch block is necessary to establish the diagnosis of facet joint as pain generator in backache. It is advised that comparative block using short acting lidocaine followed by long acting local bupivacaine should be done as there is a high chance of false positive response. However, when determining the need for comparative LA blocks due to relative risk for a false-positive or false-negative diagnostic block, the complication rate of each diagnostic and RF procedure, the anticipated dropout rate, and cost effectiveness should be taken into account. Moreover, many patients respond with long duration of pain relief even to sham denervation, therefore it is still not accepted as standard of care.

Review of Efficacy

Uncontrolled trials have shown 18% to 63% success rate of intra-articular steroid injection Many prospective and observational studies also have supported the role of intra articular steroid particularly in patients who have inflamed facet joints [26,31,33]. Results of such studies have shown that Intra-articular steroid injections provide pain relief of intermediate duration in such patients. However, such results could not be substantiated on randomized controlled trials.

Opinion regarding therapeutic value of medial branch block with local anaesthetic with or without steroid is divided. However, few patients may have long relief after medial branch block with local anesthetic irrespective of steroid mixed or not. The results of medial branch RFA is more definitive and sustained. Although, variable success has been claimed by various authors the average relief is about 50% which last for 9 months to 1 year if conventional (thermal) RF is done and maximum up to 6 months if pulsed RF is done. However, correct needle placement on the target is must for good results.

Conclusion

Facet joints arthropathy is one of the leading causes of back pain. The radiological diagnosis does not correlate with clinical picture and is often misleading. Diagnostic blocks with local anaesthetic agents particularly by two separate agents at two different times (differential

block) are helpful to diagnose the site of pain. Radiofrequency ablation is evidence based treatment to provide sustained relief from pain of facet joint arthropathy.

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