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REVIEW ARTICLE

Management Strategies in Chronic Lumbar Facet Joint Syndrome - A Review of Literature

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Introduction

Acute low back pain is a common cause of pain in majority of adult population. Most experience an acute episode at some stage. It is causes disability in both young and middle-aged individuals and prevalent in 4-33% of the population. Facet joint pain contributes to a significant proportion of this prevalence. Here in this review, we present, the background, current treatment and evidence on the management of facet joint arthritis.

Background

Low back pain is a major source of disability and absence from work incurring higher costs to the healthcare system. Of the population with acute low back pain, approximately 2% to 34% will eventually experience chronic low back pain [1]. Facet joint interventions are the second most common procedure performed at the pain management centers in the US from 1998 to 2003. Lumbar facet joint pain contributes to 15-40% of the chronic back pain [2]. Facet syndrome, or zygapophyseal joint pain, is a degenerative disease that affects the joint capsule and presents itself with axial lumbar pain. In advanced stages, it may cause nerve entrapment with radiating pain to the gluteal area and posterior area of the thigh above the knee, which worsens with extension. They resolve with no specific treatment. Initial therapy for facetogenic pain is usually non-specific with analgesic drugs, anti-inflammatory drugs, physical support, and blocks.

Acute low back pain is pain lasting for < 3 months whereas chronic low back pain is defined as pain that persists for ≥ 3 months. These acute episodes develop into chronic low back pain (persists more than 3 months) in 8-12% of patients [3]. 85% are non-specific low back pain not attributable to a specific pathology (fracture, infection, osteoporosis, tumour) [4].

Goldthwait, in 1911, was the first to suggest that facet joint could be a source of low back pain. The potential of the zygapophyseal joint as a unique source of lumbar pain has been demonstrated in several histological studies [5]. But interestingly, it was not until 1933, the term “facet syndrome” was used by Ghormley to describe the condition.

Pathophysiology

This condition is associated with osteoarthritis with the pain originating from the synovium, cartilage and capsule of the facet joint [6]. Two medial branches of the primary dorsal rami (nerve of Luschka) of each spinal nerve innervate a facet joint [7]. The joints are covered by nociceptors with free and encapsulated nerve terminations that contain substance P [8]. It is this facet joint capsule degeneration that is described as “facet syndrome” or “zygapophysial joint pain”. Cadaveric studies show that facet arthrosis is present in 100% of the specimens older than 60 years [9]. Eubanks, et al. argue that 57% of patient above the age of 30 years have facet arthrosis [10].

Clinical Tests

There are different clinical tests for facet joint pain described in the literature but none of these can reliably distinguish it from other sources of pain. Imaging

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studies of the facet joint are of limited value with poor co-relation to facet joint symptoms. There is no gold standard for diagnosing facet joint pain. This cannot be diagnosed clinically or radiologically. There is little evidence for using diagnostic blocks. There is a lack of validity with false-positive test results and are unvalidated methods of diagnosing the source or sources of CLBP [11]. But these are still used today for in diagnosing facet joint pain and testing the validity of radiofrequency denervation procedures. Therefore, the diagnosis is established either by a facet joint block or a facet nerve block [12]. A positive test will indicate the joint injected is the source of pain; a negative test shows that the facet joint is not the cause [12]. There is no reference standard for local anaesthetic blocks. These are used to maximise true positive and minimise false positive responses. Concordant response is long-lasting relief following bupivacaine but short-lasting relief following lidocaine. Discordant response on the other hand is when pain relief following lidocaine is longer than following bupivacaine [13].

Relevance

Single blocks have a high false-positive rate [14] and double blocks have a sensitivity and specificity of 54% and 88% respectively with a high false negative and lower false positive rates [13]. Diagnostic nerve blocks are a valid, sensitive, and specific test for confirming facetogenic pain [15]. A placebo response rate of 38% (false positives) has been demonstrated for uncontrolled lumbar facet joint blocks, along with a low positive predictive value of 31% [16]. In placebo controlled, randomized studies, the results of intraarticular corticosteroid injections remains controversial. Both RF denervation and steroid injection are proven to be superior to placebo [17].

Patient diagnosed as having facet joint pain are considered for medial branch blocks as it innervates the joint. Bogduk, et al., Dreyfuss, et al. and Sowa, et al. suggest that both intra-articular (IA) and medial branch blocks (MBBs) provide comparable diagnostic and therapeutic value. But these are base on 2 small studies [18]. Medial branch blocks have a higher success rate than peri-capsular injections at 3 months in a follow up study. Cohen, et al. in an indirect comparison of RCTs found that Medial branch block was a better prognostic tool than intra-articular injections [19].

Technical Challenge

It is very technically challenging to target the medial branch of the dorsal ramus. After successful RF denervation, pain usually recurs after 1-3 years implying possible nerve regeneration [2]. A diagnostic block with local anesthetic infiltration is necessary to identify the facet joint [20]. The precise location of the nerve should be mapped [21]. If satisfactory results are not obtained, the first surgical alternative must be the medial branch denervation with thermocoagulation [17].

Radiofrequency Denervation

Shealy, in 1975 described the technique for radiofrequency localisation and coagulation of nerves innervating the facet joints [22] with modifications of his technique with variable results. Radiofrequency denervation is commonly used in pain clinics for treatment of chronic low back pain. There is evidence of long-term pain relief usually up to one year with radiofrequency treatment [23]. But the failure rates are between 30-50% [3]. These failure rates include mis-diagnosis and poor patent selection. Lakemeier, et al. in a randomised controlled double-blind trial showed that there were no significant differences between steroid injections and facet joint radiofrequency denervation [24]. Radiofrequency denervation (“rhizotomy”) is used for chronic facet joint pain that has been refractory to other conservative treatments. It can offer more sustained relief, but the evidence supporting both of these uses is conflicting [7].

Two systematic review and meta-analyses concluded that facet joint radiofrequency denervation might be more effective for pain control than corticosteroid injections [25]. One of the non-validated outcome study included in the analysis had skewed the results in favour of radiofrequency denervation [26]. Recent systematic review showed moderate evidence that RF denervation of the intervertebral facet joints is more effective for CLBP than placebo [17]. Leggett, et al. showed that in their systematic review of 11 RCTs, five of the six studied and both the RCTs they reviewed, showed statistically significant pain reductions with radiofrequency ablations in the short term (1-2 years) [27].

Procedure

The radiofrequency generator produces an alternating current (frequency, 250 to 500 kHz) through an electrode. This is then passed through an insulated needle. At the tip of the needle, this electric field produces thermal energy by molecular ionic movement and friction (Kline 1996). This heat creates a small lesion within a nerve that prevents conduction of nociceptive impulses [28].

Numerous randomized controlled trials (RCTs) and observational studies have been completed assessing the ability of RFA to treat low back pain. The Cochrane database systematic review included 23 RCTs. It suggests that there is moderate evidence that facet joint RF denervation has a greater effect on pain compared with placebo over the short term, Low-quality evidence that shows it is more effective than placebo for function over the short and long term. Very low to Low quality evidence that RF denervation is effective for pain than steroid injections over the short, intermediate and long term [25]. 5 studies not fulfill the main outcome measure and only pain was used as an outcome measure. One study in the database, looked at treatment related

costs [29]. In six studies, the blinding code was broken in cases of treatment failure, and an escape treatment was offered. No adverse effects were reported in 10 studies.

Lee, et al. looked at 7 trials involving 454 patients who had undergone radiofrequency denervation (231 patients) and control treatments such as sham or epidural block procedures (223 patients). The radiofrequency group exhibited significantly greater improvements in back pain score when compared with the control group for 1-year follow-up compared to SHAM procedures [30]. A 3-year study showed that RF coagulation to the facet joint capsule rather than the dorsal medial branch showed significant improvement [31]. A small retrospective observational study with a short term follow up reported no correlation between medial branch block and pain relief after radiofrequency ablation [32]. Previous response to treatments and psychopathology problems also affects outcomes.

A RCT study evaluated whether radiofrequency denervation in addition to a standardized exercise program is more effective than the standardized exercise program alone for patients with chronic mechanical low back pain. They did not recommend radiofrequency denervation to treat low back pain but only in a research setting. However, this study was not blinded and this overestimates the outcomes. The findings do not support the use of radiofrequency denervation to treat chronic low back pain from these sources [33]. RF denervation showed statistically significant improvement in outcome measures and can be used in carefully selected patients with chronic back pain [17]. But other studies have shown short-term relief at 4 weeks with not benefit at 3 months [34]. The combined outcome measure and VAS showed no difference between RF and sham groups at 3 months [35].

The National Institute for Health and Care Excellence (NICE) guideline (NG59) for the assessment and management of low back pain and sciatica in over 16 s recommend referral for assessment for RF denervation based on 3 criteria:

1. When non-surgical treatment has failed and
2. The source of pain is thought to arise from structures supplied by the medial branch nerve and
3. They have moderate or severe levels of localised back pain (rated as 5 or more on a visual analogue scale, or equivalent at the time of referral. They also recommend that RF denervation should only be performed after a positive diagnostic block.

Radiofrequency denervation has shown to improve function, pain and analgesic use for 6-12 months [36]. Other studies have documented follow up of up to 3 years [37]. One study found that 56% patients had pain relief at 33 months [38]. This study demonstrated minimal degradation of pain relief. More than half of the patients reported greater than 50% reduction in pain at 3 years. It is also likely that re-innervation of the facet joint from neural re-growth occurs after radiofrequency ablation proportional to the size of the initial thermal lesion [39]. One study showed that dual as compared to single diagnostic medial branch blocks affords better outcomes with radiofrequency ablation in the longer term. However, these differences were not statistically significant and the study was not powered for this sub-analysis [40]. Those patients who had benefitted from radiofrequency ablation showed a 10-16 month longer improvement in their symptoms.

There is a concurrent improvement in function with pain reduction (MSQ III score) [40] with variations in analgesic usage with radiofrequency ablation [35]. Some studies had a shorter duration of follow up [36]. Cohen, et al. in a case-control study showed that medial branch blocks had better outcomes with radiofrequency ablation compared with IA blocks when used as a test before denervation [19]. In support of this view, most studies have used medial branch blocks to select patients for radiofrequency denervation. These blocks give better outcomes than intra-articular injections [41]. Some patients may have aberrant nonmedial branch innervation to their facet joints, which was shown to occur in 11% of people [12].

Ackerman, et al. in a randomized study showed that a significant proportion of those who had local injections and steroids had sustained relief at 12 weeks in comparison to medial branch blocks. These patients had a positive lumbar facet joint SPECT imaging [42]. However, there is only fair-to-moderate evidence for intraarticular steroid injections [16]. Facet joint injection with Methylprednisolone did not show any benefit and not significantly different from saline injection.

Patients with positive single photon emission CT scans showed significant benefit from Intra-articular facet joint injections [43]. False negative diagnostic injections will result in denying treatment whereas; false positive injections will decrease the success rate of radiofrequency denervation. Technical failure rate is higher with professionals who did not perform these procedures as a routine leading to lack of infiltration inaccuracy. CT guidance and contrast agents improve effectiveness of lumbar facet joint injections [44]. It is a technical challenge to target a small nerve as it courses through a bony canal. To efficiently block a single facet joint, the medial branch both at the same level and the level above need to be targeted due to its dual innervation. Several studies have reported regeneration of the lesioned nerve [45].

One Block Vs. Two Blocks before Denervation

Two medial branch blocks in excess of 75-80% benefit has been reported [39]. On the other hand there are studies that suggest that a single set of medial branch

block is sufficient evidence to proceed to radiofrequency ablation [46]. There is an economic argument for single intervention medial branch blocks in terms of its cost-effectiveness and complication rates [47].

Alternate Techniques

An 8-year retrospective review suggested variation of the lumbar medial branch neurotomy technique, called 360-degree facet rhizotomy with radiofrequency. It had only one year of follow up data. They reported satisfactory results in a high percentage of patients. This 360' technique involves placing the probe on the dorsal and lateral end of the superior articular process of the facet joint and with a circular movement apply heat upon a wider zone.

Other alternate techniques included Medial branch Kryorhizotomy [48]. A visualized endoscopic rhizhotomy to target the variable dorsal ramus anatomy can provide a more consistent and long lasting benefit than the "gold standard" traditional X-ray guided technique [49]. There is comparable efficiency of endoscopic facet debridement to radiofrequency ablation of the dorsal nerve [50]. Laser denervation of the dorsal capsule of the facet joint appears to be a more preferable target for facet joint denervation [51].

Yilmaz, et al. reported improvement - on a 100 scale - from 75.2 preoperative to 24.6, 12 months after the operation [52]. There were no significant differences noted between radiofrequency denervation and facet joint steroid injections in terms of lumbar facet joint related back pain and functional improvement [24]. Radiofrequency denervation has been reported to show moderated-to-fair [16] and fair-to-strong pain relief and function. Controlled studies show mixed results with no difference reported between steroid and placebo groups [53], but significant improvement in the steroid group, and comparable outcomes in steroid and hyaluronic acid group [54]. A systematic review of randomised controlled trials supports that radiofrequency denervation is an effective treatment for lumbar facet joint pain. Five of six RCTs found statistically significant reduction in pain and one found no evidence of significant benefit [27]. However, the longest follow-up time point within these studies was one year.

A meta-analysis of 7 RCTs involving 454 patients, radiofrequency denervation resulted in improvement in back pain than sham or epidural blocks at 1-year follow up [30]. They performed sensitivity analysis and found that upon exclusion of one study, the radiofrequency denervation resulted in significant reduction in back pain scores relative to the MCID (minimal clinically important difference) and control treatments.

Manchikanti, et al. showed that there is strong evidence for long-term pain relief from radiofrequency denervation [29]. Some technical failures may be due to the fact the electrodes are directed perpendicularly onto a nerve, and not involve the nerve. Similarly, co-intervention with analgesics and physiotherapy is a common compounding factor [24,31]. There is superior long-term therapeutic outcome from shifting the target of radiofrequency denervation to the facet joint capsule [31].

MBB before RFN

A retrospective review by Holz, et al. showed that radiofrequency denervation improved disability scores and decreased pain. There was no correlation between medial branch blocks and pain relief after RFN. There is no consensus on how many medial branch blocks are needed before proceeding to RFN. They conclude that MBB does not predict RFN outcomes and the current diagnostic criteria for selecting patients for RFN based on MBB responses are less than optimal [32]. There were no significant differences in RFN outcomes based on a pain relief cutoff over 50% after MBB. A 70% cut off value for MBB pain relief after 2 blocks had better correlation with favorable RFN outcomes as compared with single MBB protocol [46].

It is known that there are multiple pain generators in chronic spinal pain and facet joint is one among them. As with whiplash injuries, central sensitization occurs and further accentuates and complicates the overall presentation [55]. The area of a suggested "affected zone" shows a significant overlap thereby limiting the accuracy to identify the demarcated affected zone. There can be a hyperalgesic response to sensory stimulation due to central sensitization. This will alter the local anaesthetic effect. There is a variable onset and duration of pain relief after local anaesthetic injection with MBB. This mechanism is not well known [56].

Conclusion

To perform a randomized trial using standardized selection criteria with an optimistic 40% RF denervation rate would require well more than 1000 subjects. There is no conclusive evidence with regards to the number of diagnostic or prognostic blocks that are required prior to a RFN. Various authors have proposed different protocols based on their experience. These include a placebo control in addition 2 MBBs. No blocks from the utility and cost-effectiveness point of view [47]. An ideal cut-off value to designate a block to be positive is a controversial area. There are no reported differences in RF outcomes with cut-off values between 50% and 80% [46].

There is conflicting evidence for the role of radiofrequency denervation in facet joint pain certainly in the longer term. But in the short term, this appears to be a procedure worth considering in managing the short to medium term pain, disability and loss of function.

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