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Original Article

Lumbar facet joint injection in treating low back pain: Radiofrequency denervation versus SHAM procedure. Systematic review

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ABSTRACT

The lumbar facet joints have been implicated as one of the causes of low-back pain syndromes. About 15–40% of patients who presented with chronic low-back pain was attributed to lumbar facet joint pain. The purpose of this study was to analyse whether radiofrequency denervation is better than SHAM procedure in treating chronic low-back pain caused by lumbar zygapophysial joints pathology. From the four identified randomised control trials, there is conflicting evidence at an intermediate 3–6-month stage, however; one study demonstrates statistical significance of radiofrequency denervation at 3 months. Longer-term follow-up is needed to prove the efficacy of radiofrequency denervation technique.

1. Introduction

Acute low back pain is one of the most common causes of generalised pain [1] with majority of the adult population experiencing an acute episode at some stage of their lives.[2] A specific cause is only found in a few patients [3] and often, symptoms tend to resolve in the majority of patients without any specific treatment. However, in about 8–12% of patients, chronic low back pain develops and becomes a major source of disability.[2,4]

The lumbar facet joints have been implicated as one of the causes of low back pain syndromes.[5–7]About 15–40% of patients who presented with chronic low back pain were attributed to lumbar facet joint pain.[8,9]The source of innervation of the lumbar facet joints is by the medial branches of the dorsal ramus and has been described briefly by Bogduk and Long.[10–12] In 1975, Shealy published his first paper describing a technique for radiofrequency localization and coagulation of articular nerves supplying spinal facets.[13] Since then, his technique has been modified and used with varying results of success.[14–17] The aim for neurotomy is based on the premise that cutting the nerve supply to a painful structure may relief pain and subsequently permits a return of function. There are two essential criteria that determine treatment success. Firstly, the structures responsible for the pain, at or near the articular facets joints must be identified by use of a diagnostic block.[18–23] Secondly, the precise location and section of the nerve supply to that joint must be identified [12, 24,25]

The aim of this study was to conduct a rigorous scientific evaluation of the available randomised controlled trials and provide evidence to compare the outcome of radiofrequency denervation compared to sham or placebo procedures for the treatment of chronic low back pain caused by lumber zygapophysial (facet) joint pathology.

2. Methods

2.1. Study design and objectives

This is a systematic review of randomised control trials comparing outcomes of radiofrequency denervation versus sham treatment of the lumbar facet joints as a treatment modality for chronic low back pain.

2.2. Search strategy for relevant studies

We sought randomised control trials that compared radiofrequency denervation to placebo treatment for low back pain. We performed an electronic search on the 10th August 2016 using the Ovid Medline, EMBASE and PubMed databases to identify relevant articles. The search criteria were restricted to “Randomized Controlled Trial”. For the Medical Subject Heading (MeSH) term “Low Back Pain” and “radiofrequency” were used, with “surgical” as the subheading. Articles were restricted to the English language and limited to the most recent articles published between January 2000 up to the current date.

2.3. Inclusion criteria

Two reviewers (M.A.; R.S.) independently selected the trials that were included in the review. The title, key words and abstracts were reviewed to determine if the study met the inclusion criteria. Papers

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were considered for review if they satisfied all the following inclusion criteria: They were original articles on the treatment of chronic low back pain caused by facet joint osteoarthritis. In adult patients above 17 years of age and including both genders. Continuous low back pain with or without radiating pain for more than 6 months with focal tenderness over the facet joints. The articles described treatment consisting exclusively of RCTs comparing radiofrequency neurotomy versus placebo/sham procedure as the primary study. Reported at least 1 of the following primary or secondary outcomes of interest: global perception of improvement; improvement of back and leg pain; range of motion of the lumbar spine; hip movement; quality of life variables or clinical signs and rates of complication. Articles published after January 2000 and limited to English language.

The report quality was assessed using a checklist for the consolidated standards of Reporting Trials (CONSORT).[26]

2.4. Exclusion criteria

The following articles were excluded: non-randomized controlled trials, any study performed before January 2000, articles not published in English language, studies carried out for patients which are confined to an age group which is below 17 years of age and pain duration for less than six months. Studies carried out that included patients with prior radiofrequency denervation treatments, coagulopathies, malignancy, infections, mental handicap, psychiatric disorders, motor deficits or any other indications for surgical treatment were excluded. All experimental studies and studies comparing radiofrequency neurotomy with other methods for treating facets joints osteoarthritis were also excluded.

3. Results

3.1. Study identification and selection

Four papers were identified from using the above search criteria, proved to be eligible for the study and were concordant with our criteria [27–30]

1. Leclaire R, Fortin L, Lambert R, Bergeron YM, Rossignol M. Radiofrequency facet joint denervation in the treatment of low back pain: a placebo-controlled clinical trial to assess efficacy. Spine (Phila Pa 1976). 2001;26(13):1411-6; discussion 7.
2. Geurts JW, van Wijk RM, Wynne HJ, Hammink E, Buskens E, Lousberg R, et al. Radiofrequency lesioning of dorsal root ganglia for chronic lumbosacral radicular pain: a randomised, double-blind, controlled trial. Lancet. 2003;361(935)1:21-6.
3. van Wijk RM, Geurts JW, Wynne HJ, Hammink E, Buskens E, Lousberg R, et al. Radiofrequency denervation of lumbar facet joints in the treatment of chronic low back pain: a randomized, double-blind, sham lesion-controlled trial. Clin J Pain. 2005;21(4):335-44.
4. Nath S, Nath CA, Pettersson K. Percutaneous lumbar zygapophysial (Facet) joint neurotomy using radiofrequency current, in the management of chronic low back pain: a randomized double-blind trial. Spine (Phila Pa 1976). 2008;33(12):1291-7.

3.2. Description of included studies

The study characteristics have been described in the table below (Table 1). 3 of the identified studies were conducted in Europe, whilst one was conducted in Canada. All studies were double-blinded. Investigators included adult patients who presented with symptoms of lumbosacral back pain of varying duration. Leclaire et al.[27] included 70 patients with low back pain of a minimum of 3 months duration. Both Geurts et al. [28] and Van Wijk et al.[29] included 83 and 81 patients respectively with symptomatic low back pain for 6 months duration, whilst Nath et al.[30] included a smaller cohort of patients (40 patient) but longer duration of symptoms (2 years) (Table 2).

All patients included in the studies were deemed to have a positive response i.e. relief of low back pain after an intraarticular facet joint injection performed under fluoroscopic guidance. Both Geurts et al. and Nath et al. performed this diagnostic nerve block on 3 and 2 separate occasions respectively prior to patients being included in the trial. Leclaire et al. and Van Wijk et al. performed this diagnostic block on a single occasion. Methods for randomisation of patients into treatment of sham groups was deemed adequate in all studies with use of pre-assigned closed envelopes or a computer-generated randomization schedule. Apart from the study performed by Geurts et al., all other studies had an equal distribution of patient between the treatment and control groups.

3.3. Nature of radiofrequency technique

The surgical interventions have been well described in all four studies. Following appropriate identification of the medial branch of the distal portion of the spinal posterior rami using both stimulation at 5 Hz with a 0.5 msec pulse and regional anaesthesia, Leclaire et al. raised the temperature of the electrode tip to 80 °C for 90 s. A 22G electrode with a 5-mm exposed tip was utilised. Two neurotomies were performed (at the proximal and distal portions of the articular facet nerve) at a minimum of two levels (L4-L5 and L5-S1 unilaterally on the painful side or bilaterally). This was a pre-determined level based on the initial facet injection. The sham group underwent the same procedure, but the temperature of the tip was maintained at 37 °C.

Geurts et al. placed a 22G, 5 mm active-tip electrode in the dorsal-cranial quadrant of the intervertebral foramen and advanced the tip between a third and halfway into the pedicle column at a lumbar level. The technique had to be modified at sacral level, with use of a smaller 4 mm electrode tip. A sensory stimulation of 50 Hz and motor stimulation of 2 Hz was required to identify the root ganglion. The location of the dorsal root ganglion was confirmed by injecting iohexol and mepivacaine to produce dermatomal anaesthesia. The electrode was heated to a lesser temperature (67 °C), but an equivalent duration of 90 s. For the control group, no radiofrequency current was passed.

Van Wijk et al. performed a similar technique to Geurts et al. to identify the dorsal root ganglion using sensory and motor stimulation applied at 50 Hz and 2 Hz. A 22G electrode size was again utilised. 5 mL of 2% mepivacaine was subsequently injected through each electrode to obtain local anaesthesia. Electrodes were heated to 80 °C for 60 s in the treatment group but maintained in position without switching on the RF current in the control group.

Nath et al. confirmed the position of the tip of the electrode using four C-arm (tunnel, postero-lateral, cephalad and lateral) views. They injected 2mls of 5% bupivacaine to anaesthetise the target nerve and produce dermatomal anaesthesia. A 22G electrode size was utilised. A thermistor probe was inserted, and a 60 s lesion at 85 °C was performed. Another lesion was created 5 mm posterior to the initial lesion with a further 4 lesions medial and lateral to the initial two lesions to account for variations in location of the target nerve.

3.4. Analysis of primary and secondary outcome measures

All four studies used the visual analogue score (VAS) as one of their primary outcome criteria (POC). The VAS varied between measurements of generalised pain (VAS-GP), back pain (VAS-BP), leg pain (VAS-LP) or all the above.

Leclaire et al. utilised VAS-GP on a scale of 0–100. Baseline values on enrolment were similar at 51.9U for the treatment group and 51.5U for the placebo group. At 4 weeks for the treatment group, the VAS-GP improved by 3.6U, but at 3 months, pain was deemed worse by 0.5U. For the placebo group, pain was worse at 4 weeks with an increase of 0.6U, but at 3 months, pain had improved with a VAS-GP reduction by of 7.2U. Statistical analysis showed no significant difference between