

Mini Review

Non-operative management of Discogenic Back Pain by Intradiscal Interventions: an evidence based review

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Abstract: Intervertebral disc is an important pain generator and contributes about 26%-42% in etiology of chronic back pain. The common causes are either annular tears or prolapsed nucleus pulposus. Non-surgical treatment is aimed at either repair of annulus or removal of part of nucleus to reduce the pressure on the nerves. New evidence are going to support the favourable outcome and safety of such interventions. This brief review has highlighted the various treatment modelities and evidences to support their use.

1.Introduction

Intervertebral disc is an important pain generator and contributes about 26%-42% in etiology of chronic back pain. Degenerative changes in the disc are supposed to be a basic pathology responsible for discogenic pain. In normal disc the nucleus pulposus (NP) which is gelatinous in consistency is well preserved by a thick fibrous structure, annulus fibrosus (AF). However, degenerative changes results in weakness of annulus and nucleus material may leak through these weak areas. This protruding nucleus causes pain either by physical pressure and adhesions over the nerves or due to release of pain mediators due to reaction with local tissues. Surgery is often done to remove the protruding disc and releasing the pressure over nerves. Surgery seems a definitive answer to this problem however, 20-30% patients continue to suffer back pain after successful surgery which is often more severe and difficult to treat. Interventional procedure to address the disc related pain are minimally invasive procedures which provides effective pain relief with minimal procedure related morbidity. Contrary to surgery where the second surgery is more difficult and often result in poor results these procedures can be repeated if relief is inadequate. Moreover, these interventions do not affect the future choice of treatment if patient opt for surgery later on. The intradiscal interventions are done with the objectives: to remove the

protruding NP, to reduce the volume of NP by removal a part of it to decrease pressure by protruding NP, to reorganize the NP by chemical nucleolysis (Ozone), physical (coblation), or electrical (radiofrequency) energy and to destruct the granulation tissue and enhance the repair process in the annulus and disc. The repair of disc and destruction of granulation also decreases the expression of cytokines and pro-inflammatory mediators.

Classification and indication of intradiscal procedures:

Since the first injection of Chymopapain in 1963 many percutaneous intradiscal therapies have been used to treat discogenic back and leg pain. A classification of such percutaneous procedures is given below.

1. Annuloplasty
 - 1.1. Intradiscal electro-thermal therapy (IDET)
 - 1.2. Radiofrequency posterior annuloplasty (RFA)
 - 1.3. Biacuplasty
2. Percutaneous disc decompression
 - 2.1. Laser discectomy
 - 2.2. Radiofrequency coblation (plasma discectomy)
 - 2.3. Mechanical disc decompression (Dekompressor)
 - 2.4. Manual percutaneous lumbar discectomy (PLD)

2.5. The SpineJet® Percutaneous Hydrodiscectomy System

3. Endoscopic percutaneous discectomy

Annuloplasty:

These techniques are used when pain arise from annular tears with internal disc derangement (IDD). Annuloplasty techniques like IntraDiscal Electrothermal Therapy (IDET), discTRODE and Biaculoplasty thermally treat the lesions of IDD. Although the therapeutic mechanisms of thermal annuloplasty is not fully understood however research studies demonstrate that the procedure can be effective in selected patients with degenerative disc disease characterized by discographically proven painful annular fissures.

Percutaneous disc decompression (discectomy):

This is an established technique and is being used for 40 years to manage the prolapsed disc. Discectomy treat contained disc through central decompression of the disc. A small volume of tissue from the disc nucleus is removed which results in large reduction in overall disc with consequent relief of neural compression. Previously DISC Nucleoplasty and Dekompressor were the two leading percutaneous discectomy technologies. However, Laser discectomy, Radiofrequency coblation (plasma discectomy), Percutaneous Hydrodiscectomy and Endoscopic percutaneous discectomy currently being used.

Chemical Nucleolysis is currently being done with Ozone. A mixture of Oxygen and Ozone (70:30) is injected in the disc. Ozone reacts with proteoglycans present in the disc and causes loss of water by decreasing water binding capabilities of proteoglycan molecules thus reducing pressure within the disc.

Current evidence regarding efficacy and safety:

Annuloplasty:

Biaculoplasty is a new annuloplasty technique works on the principle of bipolar radiofrequency. Karaman H¹, et al investigated the efficacy and safety of 'Trans Discal Biacuplasty' in a prospective observational study in 15 patients. During observation for six months they reported 10-point improvement in their Oswestry Disability scores compared to the initial values in 78.6% of patients. No complications were observed in any of the patients. There are other observation studies to support good outcome of this technique.^{2,3}

I-DET (Intradiscal electrothermal therapy) has been used more intensively in clinical practice. Smith and Nephew (Endoscopy division, Andover, MA, USA) have estimated that 60,000 Intra-Discal Electrothermal Therapy (IDET) procedures

have been performed worldwide up to June 2005 and its use continued afterwards also. A Systematic literature review from January 1995 to December 2005 concluded that IDET procedure appears to offer sufficiently similar symptom amelioration to spinal fusion without the attendant complications.³ Tsou HK et al⁴ reported persistent relief in 73.9% patients at the end of 3 years. Although published studies provided compelling evidence of the relative efficacy and safety of the IDET procedure⁵ a critical appraisal of the evidence of efficacy of IDET has not appeared in the literature.

Discectomy:

Automated percutaneous mechanical lumbar discectomy (APLD) was a commonly used technique few years back and many observational studies suggested good outcome in comparison to conservative technique and even with surgery. In a meta analysis of available literature from 1966 to September 2012, 80% patients showed positive results lasting one year or longer. This study concluded that automated percutaneous mechanical lumbar discectomy may provide appropriate relief in properly selected patients with contained lumbar disc herniation.⁶ However, another systematic review by same authors found limited evidence for PDD with Dekompressor.⁷

Percutaneous laser disc decompression (PLDD) is another safe and effective outpatient procedure for the treatment of herniated disc disease. A large clinical study which included 2400 patients have shown 89% of overall success rate according to the MacNab criteria with low complication rate.⁸ However, a meta analysis of reviewed literature from 1966 to September 2012 based on USPSTF criteria, indicated level of evidence for percutaneous lumbar laser disc decompression is limited for short- and long-term relief.⁹

Disc decompression or nucleoplasty using coblation technology has been investigated and found to be effective and safe technique to manage discogenic pain or radicular pain due to disc in lumbar as well as cervical region.^{10, 11} This technique is a promising tool in well selected cases of contained herniated disc or focal protrusion and provide persistent pain relief in the follow-up time up to 2 years after the percutaneous decompression of the disc.¹² A meta analysis of reviewed literature have also shown a fair evidence for nucleoplasty in managing radicular pain due to contained disc herniation.¹³

Endoscopic percutaneous discectomy is very effective technique to manage discogenic pain particularly disc prolapse. However, this technique requires more intensive training and know-how before it can be used safely and successfully. Current evidence support its efficacy in lumbar disc prolapse with or without foraminal stenosis.¹⁴

Ozone Nucleolysis is being used for many years and have been found an economical and safe technique to manage discogenic pain. Previously many studies have shown its efficacy however, lack of randomized trials the evidence were not acceptable worldwide. Recently randomized trials have proved it safe and effective to manage discogenic pain.

Other techniques: Recently many new techniques have been introduced to address annular, discal and endplate related issues. These technique included injection of methylene blue, ¹⁵biological agents like PRP (platelet rich plasma)¹⁶ or mesenchymal stem cells (MSCs)¹⁷ to repair and possibly regenerate the damaged tissues. Studies have shown promising results with these agents. However, at present paucity of enough literature is a limitation to give any opinion or recommendation for the use of these techniques.

Conclusion

Intradiscal Interventions provide safe and economical alternatives to surgical approach in chronic backache particularly in contained disc situations. However, in requested and migrated disc with severe compressive symptoms or signs of bowel and bladder involvement surgery is preferred choice.

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