

Ozone disc nucleolysis as an alternative to open disc surgery for slip disc

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Abstract

Back pain associated with herniated disks has become an important and increasing general health problem, both in Bangladesh and across the world. After all methods of conservative treatment have been exhausted, nucleolysis may be a minimally invasive alternative to surgery. In nucleolysis, chondrolytic substances, or other substances which reduce the pressure within the disk by other means, are injected into the nucleus pulposus under CT or C-arm guidance. Among various substances, which have been employed for nucleolysis, an ozone-oxygen mixture appears to be very promising. The water-binding capacity of ozone results in a reduction of pain. Moreover, it has an anti-inflammatory effects and results in an increase of perfusion to the affected area. Ozone is converted into pure oxygen in the body and has a low allergic potential. Recent minimally invasive therapeutic methods such as percutaneous nucleotomy or laser treatment have not been shown to result in superior results compared with ozone nucleolysis.

Key words: Ozone, disc prolapsed, pain management

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Introduction

Studies as early as 1934 drew attention to the role of herniated nucleus pulposus as an important cause of low back and leg pain.¹ Apart from conservative therapy, all other forms of treatment aim at decompressing the nerve roots, which are the cause of the patient's discomfort. These can be done by taking the disc out by surgery or by decompressing the foramen and disc by different interventions. The various treatment options have confused clinicians due to significant failure rate associated with different kinds of surgeries as well as with different interventions. Outcome studies of lumbar disc surgeries document a success rate between 49% to 95%.² Good to very good results are achieved in over 90 % in patients with simple, acute disc herniation, and in more complicated cases it is achieved 80 to 85 % of the time.

Traditional open back Surgery for slip disc

In traditional open back surgery, a five- to six-inches incision may be needed in order to see the

affected nerve root. In creating such a sizeable incision, a large area of muscle also has to be cut to make an opening of three to five centimeters, leading to risks of substantial blood loss.

Complications of back surgery also include the use of general anesthesia, which, depending on age and overall health, could be a significant risk factor. In addition to the invasiveness of the surgery, back surgery side effects that need to be considered are the length of the stay in the hospital, the painful weeks/months of recuperation time, the heavy use of pain medications afterwards, and the time you will have to spend away from work.

Another important complication after back surgery is the likelihood of scar tissue formation. In many cases, the amount of back surgery scar tissue formation leads to additional spine conditions, which could eventually lead the patient to need another surgical procedure. Unfortunately, there is 60% success rate of full recovery of symptoms with open back surgery. This poor success rate

appears to be due to complications from back surgery.

Scar tissue formation caused by back surgery can be extremely painful, limit mobility and flexibility, and greatly diminish quality of life. Extensive scar tissue build-up is typically associated with the long incisions and other tissue damage experienced during traditional open-back surgery. While scar tissue itself is typically not painful, excessive formation of scar tissue can trigger pain if it binds to or impinges on nerve roots.

Patients with failed back surgery often live in significant pain and disability. This is a loop in which patients are caught: good pain relief brings the illusion of improved physical ability. But for many patients with failed back surgery, after a brief honeymoon period, pain, spasm, and weakness reappear at a low activity level. Although the nerve roots were not damaged directly by the failed back surgeries, the nerves are now encased in a web of scar tissue, which causes pain and spasm every time there are movements of the spine and legs.

Reasons for failure of surgery

Causes of failed back surgery for herniated nucleus pulposus includes: Dural fibrosis, arachnoidal adhesions, muscle & fascial fibrosis, mechanical instability resulting from the partial removal of bony and ligamentous structures required for surgical exposure and decompression leading to facet & sacro-iliac joint dysfunctions, radiculopathy and recurrent disc herniation.

Newer ozone disc nucleolysis

Without the necessity of a surgical procedure, disc herniations can be treated with a minimally-invasive procedure using ozone. Muto suggested intradiscal injection of ozone for disc hernia in 1998 under CT guidance, and Leonardi popularized fluoroscopy guided ozone injection into the intervertebral disc¹³. Ozone modifies the core of the intervertebral disc in such a way that the disc herniation resolves. The treatment is carried out under local anaesthesia, and ozone is introduced through a fine needle into the intervertebral disc without the need to open the spinal canal. The micro-therapy is carried out under the precise guidance afforded by computed tomography or C arm. Under a skilled practitioner's hand, scar

formation is minimal or non-existent. The procedure takes between 20 and 30 minutes. A hospital stay and postoperative physiotherapy are not necessary.

How does ozone nucleolysis work?

The effects of ozone therapy are due to the action of active, free radical oxygen atoms being liberated during the breakdown of ozone molecules, a process which occurs within the nucleus pulposus. In the disc, this oxygen free radical (also called the singlet oxygen) attaches to the proteoglycan bridges in the jelly-like material of the nucleus pulposus¹³. This results in the destruction of these proteoglycan bridges. Water is released from the breakdown of this matrix, which causes the disc to solidify and shrink back into the annulus fibrosis¹³. The result is the decompression of nerve roots, and the elimination of radicular pain.

Other positive effects have been attributed to ozone nucleolysis. It has been suggested to have an anti-inflammatory action due to inhibitions on the formation of inflammation-producing substances¹⁵. In addition, as the anatomy of the disc changes, tissue oxygenation may increase¹⁵. All these effects would have a positive impact on the extent of nucleus pulposus damage, as well as the amount of pain experienced by the patient.

Indications of ozone nucleolysis

Ozone nucleolysis may be done in most disc-related pain. The following are possible situations in which this therapy may be efficacious. It can be done in degenerated disc without any prolapse or nerve root irritation. This category is called discogenic back pain, or back pain due to internal disc disruption. Axial dull ache in the low back which increases with the flexion of the spine is the main clinical feature. Leg pain is not a feature, and there should not be any dermatomal pattern of radiation. Provocative discogram should be performed for diagnosis. Positive discogram (provocation of similar pain more than 7/10 at a pressure below 15 psi) proves the presence of sensitized nociceptors and suggests that ozone therapy may be efficacious. It can be done in contained disc prolapse or disc bulge with root irritation. It may be done in non-contained disc (extruded or sequestered disc).

Contraindications of ozone nucleolysis

There are few conditions when ozone therapy should not be performed. These are active bleeding from any site, pregnancy, G6PD deficiency, active hyperthyroidism, loss of control of urination & defecation, and progressive sensory & motor loss

Complications

Complications of ozone therapy are very rare. They include post-procedural muscle spasm, burning pain (which is transient), and discitis (very rare due to the bactericidal effect of ozone). Other complications are similar to a discographic procedure. On the other hand, surgical discectomy has much higher side effects compared to remarkably few side effects of ozone discectomy. Ozone therapy is usually a day procedure and general anesthesia is not usually required. Ozone therapy is gaining popularity in different countries, including India, due to low cost, shorter hospital stays, less post-procedural discomfort, and good side effect profile.

Comparative studies

There has been surge of interest in search of safer alternative methods of decompressing the nerve roots while maintaining the structural stability. Epidural steroid injection, transforaminal epidural procedures has a high success rate (up to 84%) but chances of recurrences are also high.⁵⁻⁷ Chemonucleolysis using chymopapain has moderate success rate (approximately 66% at one year).^{8,9} It has also the chances of anaphylaxis following intradiscal chymopapain injection.

Injection of ozone for discogenic radiculopathy (low back pain with radiation to legs) has developed as an alternative to chemonucleolysis and disc surgery. Bonetti et al. also reported excellent results in 74.4% patients after six months.¹⁰ Andruela et. Al. had similar results (70.3% at 6 months). Lu et al. showed "excellent" or "good" results of over 90%. However, ozone disc nucleolysis is a fairly new technology, and there are few (if any) randomized, controlled trials concerning this procedure. Further clinical research will be required to elucidate its efficacy. On an anecdotal level, however, ozone disc nucleolysis (performed by the first author on this article) has lead to significantly improved pain and function in a number of patients in Bangladesh,

and improved results have been tracked over many months. In addition, the relatively low cost of the technology means that it can be purchased and used in areas of poor financial resources, such as hospitals in the developing world.

Owing to its fairly high success rate, less invasiveness, and remarkably fewer side effects, ozone therapy for slip disc is becoming very popular in certain areas.¹¹⁻¹³ After that, successful outcomes of ozone therapy have been reported from various European centers. It is very important to note from those reports that complications of ozone therapy are remarkably rare.

Conclusion

Ozone nucleolysis is a new procedure which offers the promise of excellent pain relief and the avoidance of surgery in patients with prolapsed nucleus pulposus. In addition, it has the benefits of being a safe, cheap procedure which does not require highly expensive equipment. For these reasons, it appears to be an excellent option in the setting of Bangladesh, where the practice of pain management is still in its infancy.

References

1. Mixter WJ, Barr JS. Rupture of the intervertebral disc with involvement of the spinal canal. *N Eng J Med* 1934; 211:210-215
2. Vijay S. Kumar: Total clinical and radiological resolution of acute, massive lumbar disc prolapse by ozonucleolysis. *Rivista Italiana di Ossigeno-ozonoterapia* 2005; 4:104-106
3. Muto M, Andreula C, Leonardi M Treatment of herniated lumbar disc by intradiscal and intraforaminal oxygen-ozone (O₂-O₃) injection. *J Neuroradiol.* 2004; 31(3):183-9
4. Buric J, Molino Lova R. Ozone chemonucleolysis in non-contained lumbar disc herniations: a pilot study with 12 months follow-up. *Acta Neurochir Suppl.* 2005; 92:93-7
5. Vad VB, Bhat AL, Lutz GE, Cammisa F. Transforaminal epidural steroid injections in lumbosacral radiculopathy; A prospective randomized study. *Spine.* 2006; 22:220-224
6. Riew KD, Park JB, Cho YS, Gilula L, Patel A, Lenke LG, Bridwell KH. Nerve root blocks in

- the treatment of lumbar radicular pain. A minimum five-year followup. *J Bone Joint Surg Am* 2006; 88:1722-1725
7. Ng LC, Sell P. Outcomes of a prospective cohort study on peri-radicular infiltration for radicular pain in patients with lumbar disc herniation and spinal stenosis. *Eur Spine J* 2004; 13:325-329
 8. Krugluger J, Knahr K. Chemonucleolysis and automated percutaneous discectomy—a prospective randomized comparison. *Int Orthop* 2000; 24:167-169
 9. Revel M, Payan C, Vallee C, Laredo JD, Lassale B, Roux C, Carter H, Salomon C, Delmas E, Roucoules J. Automated percutaneous lumbar discectomy versus chemonucleolysis in the treatment of sciatica. A randomized multicenter trial. *Spine* 1993; 18:1-7
 10. Bonetti M, Fontana A, et al. Intraforaminal O2-O3 versus periradicular steroidal infiltrations in low back pain. Randomized controlled study. *Am J Neuroradiol.* 2003; 26: 996–100
 11. Lehnert T, Mundackatharappel S, Schwarz W, Bisdas S, Wetter A, Herzog C, Balzer JO, Mack MG, Vogl TJ. Nucleolysis in the herniated disk. *Radiologe.* 2006; 13:203-205
 12. Andreula CF, Simonetti L, De Santis Fet al: Minimally invasive oxygen ozone therapy for lumbar disc herniation. *American Journal of Neuroradiology* 2003; 24:996-1000
 13. Gautam Das, S. Ray, S. Iswarari, M. Roy, P. Ghosh; Ozone Nucleolysis for Management of Pain and Disability in Prolapsed Lumbar Intervertebral Disc: A Prospective Cohort Study; *Interventional Neuroradiology* 15: 2009: 330-334