Check for updates

CASE REPORT

Case report: Intradiscal oxygen ozone therapy in uncontained lumbar disc herniation [version 1; peer review: 1 approved, 1 approved with reservations]

Arockia Doss

Nedlands Ultrasound & Perth Spine Care, Suite 3, 55 Hampden Road, Nedlands, Australia

V1 First published: 30 Aug 2012, 1:13
<https://doi.org/10.12688/f1000research.1-13.v1>
Latest published: 30 Aug 2012, 1:13
<https://doi.org/10.12688/f1000research.1-13.v1>

Abstract

Percutaneous intradiscal oxygen ozone (O2O3) for contained lumbar disc herniation (LDH) is used as a minimally invasive alternative to surgery. This article reports excellent benefit in two patients with uncontained LDH following treatment with minimally invasive percutaneous intradiscal injection of O2O3. There is an urgent need for more research and awareness into this less expensive non-surgical out-patient treatment.

Open Peer Review

Approval Status ? ✓

	1	2
version 1 30 Aug 2012	? view	✓ view
1. Nikolai Bogduk , The University of Newcastle, Callaghan, Australia		
2. Wally Kos , Dalcross Hospital, Sydney, Australia		

Any reports and responses or comments on the article can be found at the end of the article.

Corresponding author: Arockia Doss (rocki@btinternet.com)

Competing interests: I Dr Doss have no competing interests in this paper to any agency or third party. I have not received any financial or non financial incentives in relation to this article.

Grant information: The author(s) declared that no grants were involved in supporting this work.

Copyright: © 2012 Doss A. This is an open access article distributed under the terms of the [Creative Commons Attribution License](#), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited. Data associated with the article are available under the terms of the [Creative Commons Zero "No rights reserved" data waiver](#) (CC0 1.0 Public domain dedication).

How to cite this article: Doss A. **Case report: Intradiscal oxygen ozone therapy in uncontained lumbar disc herniation [version 1; peer review: 1 approved, 1 approved with reservations]** F1000Research 2012, 1:13 <https://doi.org/10.12688/f1000research.1-13.v1>

First published: 30 Aug 2012, 1:13 <https://doi.org/10.12688/f1000research.1-13.v1>

Editorial note:

Please note that the refereeing status of this article was changed from "indexed" to "[v1; ref status: approved 1, approved with reservations 1]".

When this article was first published, *F1000Research* was still in its beta phase; during this period articles that received any two of "Approved" or "Approved with Reservations" statuses from the reviewers were labelled as "indexed". When the journal was formally launched in January 2013, the requirements for indexing were tightened, and only articles that are given either two "Approved" or one "Approved" plus two "Approved with Reservations" statuses by the reviewers are labelled "indexed". The new criteria for "indexing" can still be met in the future if a new revised version receives the necessary approval status from the reviewers.

Introduction

Symptomatic lumbar disc herniation (LDH) is common with a life-time incidence of 2% with most occurring at the L4/5 level in the 30 to 50 age group. LDH affects mobility, function, quality of life and costs highly to society^{1,2}. Treatment options include simple analgesics, physical therapy and corticosteroid injections, as well as percutaneous and conventional discectomy. Long term outcomes, complications and occasionally suboptimal results of open disc surgery have lead to the development of percutaneous techniques³. Percutaneous minimally invasive treatments for LDH aim for chemical, mechanical or thermal methods to decompress the disc. These are based on a study by Hijika *et al.* (1975) that stated that, 'reduction of intradiscal pressure reduced irritation of the nerve root and the pain receptors in the annulus and peridiscal area'³⁻⁸.

Percutaneous techniques are typically reserved for contained small to medium sized LDH. This report describes the use of minimally invasive percutaneous intradiscal oxygen ozone (O2O3) gas in two patients with severe low back pain and sciatica due to compressive uncontained LDH.

Case 1

A 46 year old, non-smoker, male plumber and gas fitter with body mass index (BMI) of 27.3, presented in January 2011 with discogenic type low back pain, left lower limb sciatica to the calf, lateral foot, toes and hyperalgesia to the sole of the foot, which were managed with manual therapy and oral analgesics. In June 2011 symptoms returned after he had been playing with his son and was admitted to the emergency department due to severe low back spasm. An MRI showed a large uncontained L4/5 disc herniation compressing the spinal canal and the left L5 root compatible with his symptoms (Figure 1a,b). He refused surgery and was referred for percutaneous intradiscal O2O3 treatment in June 2011 with an Oswestry Disability Index (ODI) of 24% suggesting mild to moderate disability. He had been on oral Tramadol 200mg BD and Naproxyn 500mg PRN. There was weakness to resisted left big toe dorsiflexion due to L5 nerve compression. Following written informed consent explaining the risks and outcomes, under CT guidance using a sterile technique, and local anaesthetic in a prone position, 20cc medical grade Oxygen Ozone (27µg/ml) was

injected into the nucleus pulposus of the disc through a 22g spinal needle (Figure 1c,d). The needle was withdrawn out of the disc and Celestone Chronodose (5.7mg) was injected into the anterior epidural space. Two months post intradiscal O2O3, ODI was 8% (77% reduction from pretreatment) and at seven months his pain had completely resolved. He returned to normal activities with cessation of all analgesics. Mild paraesthesia of the left L5 distribution persisted with resumption of usual work and activities at this time. MRI at seven months showed dramatic resolution of disc herniation and decompression of the spinal canal (Figure 1e,f).

Case 2

A 30 year old mother with BMI of 30.1, lifelong non smoker, suffered debilitating low back pain for about 8 years. Intermittent exacerbation of pins and needles and right lower limb sciatica were treated with spinal corticosteroids, nonsteroidal antiinflammatories and opiates. Acute episodes needed admission to emergency department. Prior to referral for consideration of percutaneous intradiscal O2O3 treatment as a last option, she had been reviewed by spinal surgery and chronic pain management. She was on Tramadol 200mg, Panadeine Forte, Lyrica and OxyNorm. At presentation for percutaneous treatment, ODI was 66% (moderately severe disability), there were normal reflexes and power of lower limbs, dysaesthesia to right lateral foot and right paravertebral spasm. MRI showed a 12mm LDH with an extrusion compressing the right L5 root and L4/5 disc degeneration (see Figure 2). Following written informed consent explaining the risks and outcomes, under CT guidance, in a prone position using local anaesthetic and sterile technique, 10cc O2O3 (27µg/ml) gas was injected into the nucleus pulposus of the L4/5 disc through a 22G spinal needle. The needle was withdrawn and O2O3, followed by Triamcinolone (40mg), was injected around the right L5 nerve. At 4 weeks follow up there was dramatic improvement with no low back or radicular pain. At nine months telephone interview ODI was 4% (improved by 93% from pretreatment ODI), with complete cessation of all medications and the occasional niggling pain.

Discussion

Minimally invasive percutaneous intradiscal injection of O2O3 has been widely used in Europe for LDH since 1996⁹. It is proposed that O2O3 acts by 'mummifying' the disc reducing disc volume with an effect of a discectomy. The chemical properties of oxygen ozone, by way of reaction of the hydroxyl radical with carbohydrates and amino acids leading to the breakdown of nucleus pulposus with rapid disappearance of herniated disc material³, may explain this phenomenon of 'chemical discectomy'. The MRI in Figure 1 shows reduction in disc height and marked resolution of the herniated disc material after O2O3 treatment. This supports the phenomenon of ozone induced chemical discectomy. O2O3 also down-regulates nerves and has an anti-inflammatory effect¹⁰.

In a randomized controlled trial, Gallucci *et al.* showed that intraforaminal and intradiscal injections of a steroid, anaesthetic and Oxygen Ozone are more effective at six months than injections of only a steroid and anaesthetic at the same sites¹¹. Leonardi *et al.* showed in 600 patients with LDH and sciatica treated with intradiscal oxygen

Figure 1. Case 1, **1a**: Pretreatment sagittal T2 weighted MRI shows large left paracentral uncontained disc herniation at L4/5 compared with normal disc margin at the levels above and below, **1b**: Pretreatment axial T2 weighted MRI with arrow pointing to posterior displacement and compression of thecal sac due to the disc herniation, **1c&d**: CT guided intradiscal O2O3 injection in another patient illustrates needle placement in the nucleus pulposus of disc and distribution of O2O3 in the disc, epidural and paraspinal spaces, **1e&f**: follow up MRI seven months after intradiscal O2O3 injection shows complete resolution of disc herniation, note the reduction in disc height and hydration in **1e** compared to **1a** and restoration of normal thecal sac margin highlighted by the arrow in **1f** in comparison to **1b**.

ozone at least 70% achieved excellent or good outcome. In addition, a combined intradiscal oxygen ozone and concomitant periganglionic cortisone and oxygen ozone injection achieved a cumulative effect that enhances overall outcome of treatment of pain caused by disc herniation with a satisfactory therapeutic outcome in 78% of patients at six months follow up in 300 patients¹⁰. Muto *et al.* showed that between 1996 and 2003 of 2200 patients with low back pain or sciatica due to LDH, CT guided intradiscal oxygen ozone injection achieved an 80% success in 1750 patients at 6 months follow up. Success rate dropped to 75% in 1400 patients followed up to 18 months. Reduction in size of herniated disc was seen in 63% of followed up patients. Failure was mostly due to calcific herniated disc, spinal canal stenosis, recurrent disc herniation and multilevel degenerative disease⁹. A meta-analysis of twelve studies showed that oxygen ozone treatment in herniated discs is an effective and

extremely safe procedure, with impressive improvement in pain and function in view of the broad inclusion criteria of patients ranging from 13 to 94 years with all types of disc herniations. It also showed that pain and function outcome scores were similar for LDH treated with surgical discectomy but the complication rate is much lower (<0.1%)¹². A randomized controlled trial is underway comparing microdiscectomy and percutaneous O2O3 intradiscal therapy¹³.

Lu *et al.* showed that percutaneous ozone injection is safe in large LDH in 58 patients with overall efficacy of 91.4% with excellent and good outcome in 63.8% and 27.6% respectively¹⁴. Wu *et al.* used a combination of O2O3 with collagenase injection and compared this with surgery for uncontained LDH and followed them up for 12 months. They showed non-statistically significant difference between the two groups at 3 and 12 months, though the surgical

Figure 2a&b. Case 2 pre treatment T2 weighted MRI shows uncontained compressive L5S1 disc herniation.

group had a statistically significant greater improvement in the first few weeks¹⁵.

The total health care cost for disorders of intervertebral discs and bones in the spinal column was estimated at US\$ 25.8 billion¹⁶. Cost per procedure of intradiscal O₂O₃ is free from recurring operative instrumental consumable cost. Oxygen Ozone is procured from inexpensive medical grade oxygen that is processed through an oxygen generator, obtained as a one off capital non-recurring expenditure. Percutaneous intradiscal treatment is an outpatient procedure that attracts far less expense compared to procedures that require hospitalization. There are other cost savings for the individual, community and health systems due to reduced recuperation time.

In summary, Oxygen ozone is a minimally invasive, effective, low risk treatment for refractory LDH with potential to reduce health care costs and there is an urgent need for more research and awareness into this non surgical outpatient treatment.

Consent

Consent was obtained from both patients to publish this anonymized case report.

Competing interests

I Dr Doss have no competing interests in this paper to any agency or third party. I have not received any financial or non financial incentives in relation to this article.

Grant information

The author(s) declared that no grants were involved in supporting this work.

Acknowledgements

I wish to thank the patients, their next of kin for consenting to undergo this procedure. I also thank Drs Chris Wallman, Richard Obadua and Norman Pinsky for referring these patients for this procedure.

References

1. Kelekis AD, Somon T, Yilmaz H, *et al.*: **Interventional spine procedures.** *Eur J Radiol.* 2005; **55**(3): 362–383.
[PubMed Abstract](#) | [Publisher Full Text](#)
2. Shah RV, Everett CE, McKenzie-Brown AM, *et al.*: **Discography as a diagnostic test for spinal pain: a systematic and narrative review.** *Pain Physician.* 2005; **8**(2): 187–209.
[PubMed Abstract](#)
3. Kelekis AD, Filippiadis DK, Martin JB, *et al.*: **Standards of practice: quality**

- assurance guidelines for percutaneous treatments of intervertebral discs. *Cardiovasc Intervent Radiol*. 2010; **33**(5): 909–913.
[PubMed Abstract](#) | [Publisher Full Text](#)
4. Singh V, Derby R: **Percutaneous lumbar disc decompression**. *Pain Physician*. 2006; **9**(2): 139–146.
[PubMed Abstract](#)
 5. Choy DS, Ascher PW, Saddekni S, *et al.*: **Percutaneous laser disc decompressions. A new therapeutic modality**. *Spine (Phila Pa 1976)*. 1992; **17**(8): 949–956.
[PubMed Abstract](#) | [Publisher Full Text](#)
 6. Shields CB: **In defence of chemonucleolysis**. *Clin Neurosurg*. 1986; **33**: 397–405.
[PubMed Abstract](#)
 7. Eckel TS: **Intradiscal electrothermal therapy**. In: Handbook of diagnostic and therapeutic spine procedures. A.L. Williams and F.R. Murtagh, Editors. Louis St: CV Mosby, 2002; 229–244.
 8. Gangi A, Dietemann JL, Ide C, *et al.*: **Percutaneous laser disk decompression under CT and fluoroscopic guidance: indications, technique, and clinical experience**. *Radiographics*. 1996; **16**(1): 89–96.
[PubMed Abstract](#) | [Publisher Full Text](#)
 9. Muto M, Andreula C, Leonardi M, *et al.*: **Treatment of herniated lumbar disc by intradiscal and intraforaminal oxygen-ozone (O2-O3) injection**. *J Neuroradiol*. 2004; **31**(3): 183–9.
[PubMed Abstract](#) | [Publisher Full Text](#)
 10. Andreula CF, Simonetti L, de Santis F, *et al.*: **Minimally invasive oxygen-ozone therapy for lumbar disk herniation**. *AJNR Am J Neuroradiol*. 2003; **24**(5): 996–1000.
[PubMed Abstract](#)
 11. Gallucci M, Limbucci N, Zugaro L, *et al.*: **Sciatica: treatment with intradiscal and intraforaminal injections of steroid and oxygen-ozone versus steroid only**. *Radiology*. 2007; **242**(3): 907–13.
[PubMed Abstract](#) | [Publisher Full Text](#)
 12. Steppan J, Meaders T, Muto M, *et al.*: **A meta analysis of the effectiveness and safety of ozone treatments for herniated lumbar discs**. *J Vasc Interv Radiol*. 2010; **21**(4): 534–548.
[PubMed Abstract](#) | [Publisher Full Text](#)
 13. Kovacs Foundation: **The Effect of ozone therapy for Lumbar Herniated Disc**. In: ClinicalTrials.gov [cited 2012 Aug 30].
[Reference Source](#)
 14. Lu W, Li YH, He XF, *et al.*: **Treatment of large lumbar disc herniation with percutaneous ozone injection via the posterior-lateral route and inner margin of the facet joint**. *World J Radiol*. 2010; **2**(3): 109–12.
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
 15. Wu Z, Wei LX, Li J, *et al.*: **Percutaneous treatment of non-contained lumbar disc herniation by injection of oxygen-ozone combined with collagenase**. *Eur J Radiol*. 2009; **72**(3): 499–504.
[PubMed Abstract](#) | [Publisher Full Text](#)
 16. **The Cost Burden of Disease US and Michigan**. Issue Brief January. 2010.
[Reference Source](#)

Open Peer Review

Current Peer Review Status:

Version 1

Reviewer Report 18 September 2012

<https://doi.org/10.5256/f1000research.115.r302>

© 2012 Bogduk N. This is an open access peer review report distributed under the terms of the [Creative Commons Attribution License](#), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Nikolai Bogduk

Faculty of Medicine and Health Sciences, The University of Newcastle, Callaghan, Australia

Case reports should be used to publicise unusual or rare events that for epidemiological reasons cannot be reported in better, more informative formats such as case series and controlled trials.

There is nothing new or unusual about ozone therapy for disc herniation. There is already an abundant literature, with many case series, that describes this intervention. A report of two cases does nothing to enhance this literature. The science of this intervention can be advanced only by a randomised controlled trial.

Competing Interests: No competing interests were disclosed.

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

Reviewer Report 18 September 2012

<https://doi.org/10.5256/f1000research.115.r303>

© 2012 Kos W. This is an open access peer review report distributed under the terms of the [Creative Commons Attribution License](#), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Wally Kos

Dalcross Hospital, Sydney, Australia

I think the case report(s) are fine, the treatment methods complying with standard practice &

reflecting sound & safe practice.

Whilst not a scientific paper, it brings attention to a therapy which is poorly understood in the major part of the English speaking world. It could open up personal inquiry to the many papers published out of Europe & India.

Competing Interests: No competing interests were disclosed.

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.

The benefits of publishing with F1000Research:

- Your article is published within days, with no editorial bias
- You can publish traditional articles, null/negative results, case reports, data notes and more
- The peer review process is transparent and collaborative
- Your article is indexed in PubMed after passing peer review
- Dedicated customer support at every stage

For pre-submission enquiries, contact research@f1000.com

F1000Research