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Article

RESOLUTION OF A CASE OF C5-C6 CERVICAL DISC HERNIA WITH DEEP PARAVERTEBRAL CT-GUIDED INFILTRATION OF OXYGEN-OZONE. A FIVE-MONTH MRI CHECK

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ABSTRACT

The authors describe the case of a patient with C5-C6 cervical disc herniation completely resolved with infiltrative treatment with oxygen-ozone according to the "CT guided deep paravertebral technique", with MRI control at five months.

In this study, we found that oxygen-ozone therapy can be a possible first therapeutic approach for patients with C5-C6 cervical disc hernia, as it can act both symptoms, neck, pain and branchialgia.

KEYWORDS: *oxygen, ozone, cervical disc herniation, cervicalgia*

INTRODUCTION

Oxygen-ozone therapy for herniated discs was introduced in 1985 (1-4). Over the years, numerous series have been presented in the literature which reports positive results ranging from 75% to 90% (5-12).

Neck pain and cervicobrachialgia are highly disabling pathologies, more widespread in every social category and at an increasingly precocious age. They can arise acutely, for example, following strain, trauma, or unusual movements, or slowly, often with progressive worsening (13-17). Moreover, they can have numerous etiologies related to vertebral pathology: disc diseases, facet joint diseases, spondylolysis or lyses, spinal canal stenosis, root cysts, meningiomas, and primary or metastatic tumor pathology. A precise diagnosis made after a careful, objective examination and supported by suitable instrumental examinations is therefore essential. In particular, in addition to the standard radiograms of the

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spine, Computerized Axial Tomography (CT) and/or Nuclear Magnetic Resonance (MR) are indispensable for a correct diagnosis (1-20).

A case of C5-C6 cervical disc herniation completely resolved after treatment with oxygen-ozone performed with CT-guided deep paravertebral technique is reported. In addition, the MRI control examination supported clinical data carried out five months after treatment.

Clinical Case

IM 53-year-old male came to our clinic referring to left cervicobrachialgic symptoms with loss of strength in the upper limb and tingling paresthesias in the left C6 distribution area; clinically, a deficit in the left C6 distribution territory was detected. The patient came to our attention in July 2016, bringing an MRI performed in April 2016, in which a large left paramedian C5-C6 hernia was visible.

The neurosurgeon assessed the severity of the subjective symptoms and, viewed the MRI, advised the patient to undergo surgery promptly. The patient, however, refused the proposed intervention and contacted us in order to get different therapeutic options. He freely opted to attempt oxygen-ozone therapy (by previously signing the informed consent). Therefore, intraforaminal CT treatment with oxygen-ozone was carried out using a 22 G needle, infiltrating at a concentration of 25 mg/ml by administering 3 cc of the gaseous mixture (Fig. 1, Fig. 2A-B-C-D).

After the session, the patient was clinically re-evaluated and reported a clear improvement in pain symptoms with a net increase in strength. Clinical control ten days after, allowed appreciating a complete resolution of the pain and paresthetic symptoms. The patient did not take pain-relieving and anti-inflammatory drugs.

In September 2016, a control MRI was performed (Figure 3 A-B-C-D), which shows the complete disappearance of the C5-C6 disc herniation. Clinically, the patient did not complain of any disturbance.

The patient, for diagnostic purposes, underwent an MRI of the cervical spine at the Clinical Institute City of Brescia with Siemens Magnetom AERA 1.5 T system in April 2016; the study was performed using standard sequences followed by Fat / Sat sequences without contrast administration (Table I).

The infiltrative treatment was performed using Hitachi model Supria 16/32 Computed Tomography (CT) equipment.

The patient underwent CT-guided targeted injection of an oxygen-ozone gas mixture using the deep paravertebral infiltration technique. For the production of the oxygen-ozone mixture, a "Maxi Ozon Active generator device Medica SRL, Bologna, Italy" was used, equipped with a digital photometer for the regulation of ozone concentrations, with check valves for the collection of the gaseous mixture in absolute sterility.

Fig. 1. *Positioning of the needle with a right lateral approach.*

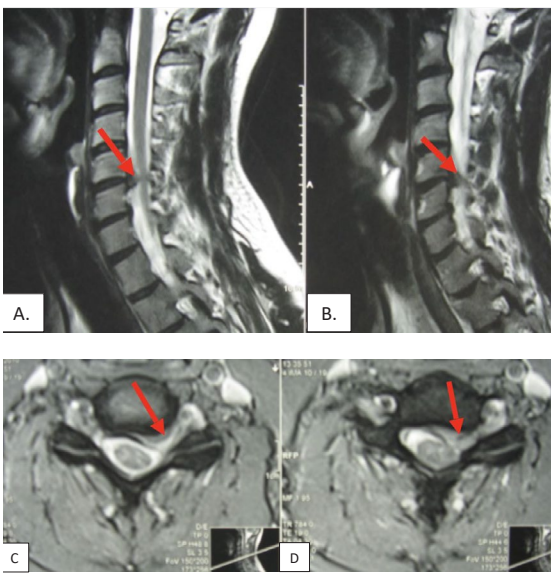

Fig. 2. ***A-B)*** *Sagittal MRI (14/04/2016): C5-C6 sub-ligamentous disc herniation (arrows), survey carried before treatment, on the date of the treatment.* ***C-D)*** *Axial MRI (14/04/2016): C5-C6 sub-ligamentous disc herniation (arrows), a survey carried out before treatment and on the date of the treatment.*

Infiltration technique

After receiving written informed consent from the patients, the injection level was established based on

neuroradiological findings and clinical symptoms. Preliminary CT scans confirmed the level with the patient in a prone position to determine the point of needle entry. The skin was disinfected using a polyvinylpyrrolidone iodine solution after local anesthetic with ethyl chloride spray. CT-guided puncture was then performed using needles with a caliber of 22 G. CT guidance also served to check the correct position of the needle.

An aseptic technique was used to fill a 10 ml polyethylene syringe with a gas mixture of oxygen-ozone 3 ml at a concentration of 25 µg/ml gas was injected using a microporous filter to minimize the risk of contamination.

The injection site was disinfected and local anaesthesia was applied using an ethyl chloride spray. Infiltrations were done by specialist neuroradiologist at the Neuroradiology Service of Istituto Clinico Città di Brescia. The puncture site was identified by CT scan and marked on the patient's skin. The distance from this point to the foramen was subsequently measured. A 22 G Terumo needle (a 9 cm needle) was positioned 2-3 mm from the foraminal region, close to the ganglion of the affected nerve root. A CT scan was then repeated to check correct needle placement.

Once the treatment was completed, the patient remained for about two hours. At the end of the observation period, the patient was asked to re-evaluate the painful and paresthetic symptoms. A similar clinical check was performed after a further 10 days.

The control MRI was performed at the same Clinical Institute of the City of Brescia that had performed the first investigation, using the same equipment and settings of the study.

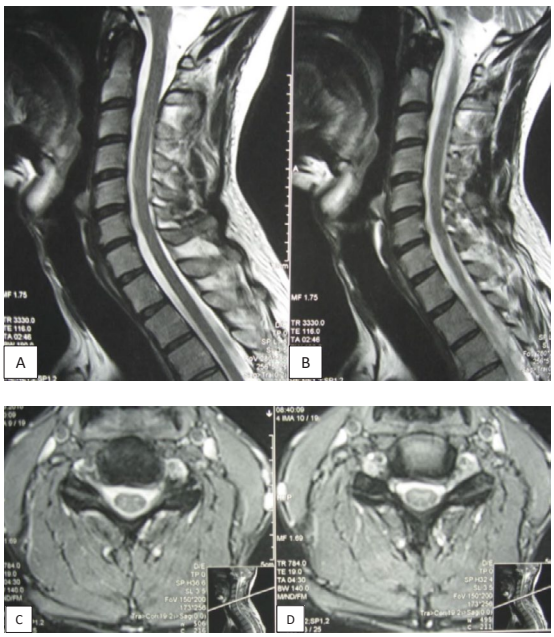

Fig. 3. ***A-B)*** *Sagittal MRI after ozone therapy (10/09/2016) - The MRI investigation documents the complete disappearance of the herniated disc.* ***C-D)*** *Axial MRI after treatment with oxygen-ozone therapy (10.09.2016) – Complete The disappearance of the hernia.*

DISCUSSION

The clinical case presented is of undoubted gravity from a clinical point of view, so that a surgical herniaectomy – although refused by the patient – was considered as the first therapeutic option.

By watching the imaging, it was initially doubtful that the success of the infiltrative treatment, and only the patient's insistence on attempting with oxygen-ozone led us to try. However, the clinical evolution was rapidly favorable, in complete disagreement with what we expected and with what was also suggested by the neurosurgeon colleague. The surgical option was therefore discarded.

After treatment, the patient expressed complete resolution of the painful symptoms. The clinical improvement was then confirmed by MRI scan, which showed complete disappearance of the treated disc herniation (five-month control).

Table I. *MRI Scan Protocol.*

T2 SAG	(Thickness 3 mm, Gap 20%, TR 3500, TE 100, Fov 300 mm, Matrix 384 Pd HF)
T1 SAG	(Thickness 3 mm, Gap 20%, TR 550, TE 9.7, Fov 300 mm, Matrix 384 Pd HF)
T2 AX	(Thickness 3 mm, Gap 10%, TR 4280, TE 100, Fov 220 mm, Matrix 384 Pd AP)
T2 SAG pair	(Thickness 3 mm, Gap 20%, TR 3900, TE 100, Fov 300 mm, Matrix 384 Pd HF)
T1 COR	(Thickness 3 mm, Gap 15%, TR 420, TE 9.1, Fov 300 mm, Matrix 384 Pd RL)
T1 FS SAG	(Thickness 3 mm, Gap 20%, TR 2500, TE 39, Fov 300 mm, Matrix 384 Pd HF, Fat/Sat)
T1 FS AX	(Thickness 3 mm, Gap 20%, TR 3500, TE 39, Fov 220 mm, Matrix 384 Pd AP, Fat/Sat)

The excellent therapeutic result is therefore attributable to the mechanisms of action of the oxygen-ozone mixture at the site of the disease.

The pharmacological action of ozone therapy is carried out, in fact, in a multifactorial way: decontracting (action with better oxygenation of the muscles), eutrophic (with stimulation of tissue reparative processes), antiphlogistic (resolution of inflammation with reduction of prostaglandin synthesis), analgesic (diffusion of a gaseous mixture of oxygen-ozone through the anatomical structures responsible for pain), neoangiogenetics (increased oxygenation with improved transport and release of oxygen at the tissue level), "chemical acupuncture" reflexotherapy effect (capable of interrupting the chain of chronic pain through antalgic mechanisms of the antinociceptive and neuropathic type, activating blood circulation, immunomodulating, adaptation to oxidative stress).

In the herniated disc, oxidation is the mechanism by which ozone destroys the connective "cells" that contain water in the pulpy nucleus. The water is thus released, and the hernia is reduced. Thanks to the oxygen-ozone anti-inflammatory and dehydrating action, the hernia's size is thus reduced.

CONCLUSION

In recent years several studies have demonstrated the utility of oxygen-ozone therapy in the treatment of herniated discs (1-20).

Oxygen-ozone can be curative thanks to several factors linked to its mechanisms and administration techniques: improvement of local circulation (with effect in eutrophication in the proximity of the compressed nerve root and muscle spasm); normalization of the level of cytokines and prostaglandin (with anti-inflammatory and pain reliever); increase in the production of superoxide dismutase (with minimization of oxidizing reagents); proximity to the herniated material (which causes accelerated dehydration or destruction of a non-vascularized tissue that justify the good end-result).

The rapid resolution of pain with no complications and the safety due to the control of infiltration by TC, allow to propose oxygen-ozone therapy technique as a viable alternative to surgical treatment of disc herniation and therefore a method of choice between conservative therapies.

Oxygen-ozone therapy can be considered as a possible first line approach to these patients since it can act both on the symptom "neck pain and brachialgia" and on the cause of "herniated disc", (i.e. inflammation).

Conflict of interest

The authors declare that they have no conflict of interest.

REFERENCES

1. Leonardi M, Simonetti L, Barbara C. Effetti dell'ozono sul nucleo polposo: Reperti anatomo-patologici su un caso operato. *Rivista di Neuroradiologia*. 2001;14(1_suppl):57-59. doi:10.1177/19714009010140s113
2. Andreula CF, Simonetti L, De Santis F, Agati R, Ricci R, Leonardi M. Minimally invasive oxygen-ozone therapy for lumbar disk herniation. *AJNR American journal of neuroradiology*. 2003;24(5):996-1000. https://pubmed.ncbi.nlm.nih.gov/12748111/
3. Muto M, Andreula C, Leonardi M. Treatment of herniated lumbar disc by intradiscal and intraforaminal oxygen-ozone (O2-O3) injection. *Journal of Neuroradiology*. 2004;31(3):183-189. doi:10.1016/s0150-9861(04)96989-1
4. Leonardi M. Oxygen-ozone chemonucleolysis for herniated disc with sciatica. A comparison of treatments in patients with sub-acute and chronic symptoms. *Rivista Italiana di Ossigeno-Ozonoterapia*. 2006;(5):33-36.
5. Dall'Olio M, Princiotta C, Cirillo L, et al. Oxygen-Ozone Therapy for Herniated Lumbar Disc in Patients with Subacute Partial Motor Weakness Due to Nerve Root Compression. *Interventional Neuroradiology*. 2014;20(5):547-554. doi:10.15274/inr-2014-10078
6. Iliakis E. Ozone treatment in low back pain. *Orthopaedics*. 1995;19:29-33.
7. Oder B, Loewe M, Reisegger M, Lang W, Ilias W, Thurnher SA. CT-guided ozone/steroid therapy for the treatment of degenerative spinal disease--effect of age, gender, disc pathology and multi-segmental changes. *Neuroradiology*. 2008;50(9):777-785. doi:10.1007/s00234-008-0398-2
8. Splendiani A, Perri M, Conchiglia A, et al. MR Assessment of Lumbar Disk Herniation Treated with Oxygen-Ozone Diskolysis:

The Role of DWI and Related ADC versus Intervertebral Disk Volumetric Analysis for Detecting Treatment Response. *The Neuroradiology Journal*. 2013;26(3):347-356. doi:10.1177/197140091302600316

9. 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):907-913. doi:10.1148/radiol.2423051934
10. Iliakis E, Valadakis V, Vynios DH, Tsiganos CP, Agapitos E. Rationalization of the Activity of Medical Ozone on Intervertebral Disc A Histological and Biochemical Study. *Rivista di Neuroradiologia*. 2001;14(1_suppl):23-30. doi:10.1177/19714009010140s105
11. Bonetti M, Cotticelli B, Raimondi G, Valdenassi L, Richelmi P, Bertè E. Ossigeno-ozono terapia vs infiltrazioni epidurali cortisoniche. *Rivista di Neuroradiologia*. 2000;13(2):203-206. doi:10.1177/197140090001300207
12. Bonetti M, Zambello A, Leonardi M, Princiotta C. Herniated disks unchanged over time: Size reduced after oxygen–ozone therapy. *Interventional Neuroradiology*. 2016;22(4):466-472. doi:10.1177/1591019916637356
13. Leonardi M, Simonetti L, Raffi L, Cenni P, Barbara C. Mini-Invasive Treatment of Herniated Disc by Oxygen-Ozone Injection. *Interventional Neuroradiology*. 2003;9(2_suppl):75-75. doi:10.1177/15910199030090s211
14. Perri M, Grattacaso G, Di Tunno V, et al. MRI DWI/ADC signal predicts shrinkage of lumbar disc herniation after O_2–O_3 discolysis. *The Neuroradiology Journal*. 2015;28(2):198-204. doi:10.1177/1971400915576658
15. Zhang Y, Ma Y, Jiang J, Ding T, Wang J. Treatment of the lumbar disc herniation with intradiscal and intraforaminal injection of oxygen-ozone. *Journal of Back and Musculoskeletal Rehabilitation*. 2013;26(3):317-322. doi:10.3233/bmr-130386
16. Lehnert T, Naguib NNN, Wutzler S, et al. Analysis of Disk Volume before and after CT-guided Intradiscal and Periganglionic Ozone–Oxygen Injection for the Treatment of Lumbar Disk Herniation. *Journal of Vascular and Interventional Radiology*. 2012;23(11):1430-1436. doi:10.1016/j.jvir.2012.07.029
17. Magalhaes FNDO, Dotta L, Sasse A, Teixera MJ, Fonoff ET. Ozone therapy as a treatment for low back pain secondary to herniated disc: a systematic review and meta-analysis of randomized controlled trials. *Pain Physician*. 2012;15(2):E115-129. https://pubmed.ncbi.nlm.nih.gov/22430658/
18. Rahimi-Movaghar V, Eslami V. The major efficient mechanisms of ozone therapy are obtained in intradiscal procedures. *Pain Physician*. 2012;15(6):E1007-1008. https://pubmed.ncbi.nlm.nih.gov/23159972/
19. Steppan J, Meaders T, Muto M, Murphy KJ. A meta-analysis of the effectiveness and safety of ozone treatments for herniated lumbar discs. *Journal of vascular and interventional radiology: JVIR*. 2010;21(4):534-548. doi:10.1016/j.jvir.2009.12.393
20. Xu L, Li Z-L, He X-F, et al. Evaluation of the Clinical Curative Effect of an O_2-O_3 mixture to Treat Lumbar Disc Herniation with Different Treatment Sessions. *Interventional Neuroradiology*. 2009;15(2):159-163. doi:10.1177/159101990901500204