



Original Article (SPINE)

Management and Outcome of Ozone Therapy in the Lumbar Spine Disc Disease with and without Use of Corticosteroids

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ABSTRACT

Objectives: To determine the Consequences and out-turn of ozone with and without the use of peri-ganglionic infiltration of corticosteroids in lumbar spinal generative disc disease.

Material and Methods: Comparative study was conducted in the Neurosurgery Department Pakistan Institute Of Medical Sciences Islamabad from December 2014 to November 2020. We included 338 patients with herniated lumbar disc with backache and radiculopathy. Randomly categorized in groups A and B. Group A was given 4 to 6 ml of intradiscal ozone along with 40 to 80 mg of peri-ganglionic methylprednisolone while group B only received 4 – 6 ml of intra-discal ozone. The visual analog scale was used to assess the degree of pain and modified Macnab criteria were used to assess the post-procedural outcome, periodic follow was carried out up to 6 months after the procedure.

Results: 169 patients were enrolled in group A with 70 females and 90 males. Group B had a total of 169 patents with 89 females and 80 males. In group A, a single procedure was required in 89 patients, twice in 27, and thrice in 10 patients to completely obliterate pain. While in group B, 71 patients had the single procedure, twice in 92 and thrice in patients. Data were compared by the Chi-square test, which was further confirmed by a significant P-value of 0.061.

Conclusion: The combination of percutaneous ozone chemodiscolysis along with the preganglionic injection of steroids as compared to single ozone therapy is the most effective, rapid, and long-lasting method of relieving backache and radiculopathy associated with lumbar disc herniation.

Keywords: Ozone Chemodiscolysis. Preganglionic Steroid Injection. Disc Herniation, Minimally Invasive.

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INTRODUCTION

Acute or chronic low backache is the commonest condition that affects daily life chores and quality of performance.^{1,2} Disc herniation and degenerative spinal disease is the leading cause of low back, other factors lifestyle, obesity, increased workload, inflammatory, infectious, and neoplastic condition may also contribute equally.^{3,4}

Mechanical compression on the nerve root and dorsal root ganglion directly may produce local and radicular pain in involved segments of the spine and indirect pain may occur due to peri-neural vessel compression.⁵

Even in the absence of direct or indirect mechanical compression of nerve root or ganglion, still, pain is initiated by inflammation of epidural tissue or surrounding spinal nerve root and facet capsule mediated by inflammatory cascade.⁶

To overcome this inflammatory reaction variety of therapeutic modalities had been used starting from supporting measures that decreased mechanical friction to nonsteroidal anti-inflammatory drugs, which play a major role to eliminate the pain.⁷

Recently minimally invasive surgery is widely preferred by both neurosurgeons and neuro-radiologist, to save time, money, and tissue. Nowadays most patients more rely on the least invasive procedures like ozone therapy.⁸

Ozone chemonucleolysis due to its immune modulation anti-oxidative along with the strong inhibitory effect on inflammation causes disc dehydration and rapid relief of pain.⁹

The peri-ganglionic administration of long-acting steroids when given along with ozone will further enhance the effect of ozone therapy.¹⁰

In this comparative study, we divided the sample into equal numbers and group A was administrated lumbar Intra-discal ozone solution along with peri-ganglionic steroids while group B received only intra-discal ozone, effects and

outcome were monitored and compared in both groups.

MATERIAL AND METHODS

A comparative study was supervised in the neurosurgery department, Pakistan institute of medical and health sciences Islamabad from December 2014 to November 2020.

Inclusion Criteria

(a) Clinical Assessment

Patients aged 25 – 90 years, backache and radiculopathy, numbness, VAS (visual analog score) 5 and above, patient preference for a minimally invasive procedure, failure of pharmacological and physiotherapy for more than 4 months, and drug intolerance were included.

(b) Radiological Criteria

Lumbar intervertebral disc prolapses with a diffuse disc bulge, annulus tear, and radiological findings co-related with the clinical findings, were included.

Exclusion Criteria

(a) Clinical Criteria

Patients aged less than 25 years, with coagulation disorder, Active ischemic heart disease, uncontrolled diabetes Mellitus and Hypertension, acute traumatic lumbar disc herniation with major motor neuro-deficit, and cauda equine syndrome were excluded from the study.

(b) Radiological Criteria

The inflammatory, infectious, and other benign as well as malignant lesions involving the lumbar spine with structural deformity of the lumbar spine and paravertebral muscles, and pregnancy were excluded.

Clinical Assessment and Data Collection Procedure

Patients with the clinical sign and symptoms of lumbar disc herniation with having co-relation of clinical findings with lumbar disc herniation on MRI were admitted.

Randomly divided into group A who were given intra-discal ozone along with peri-ganglionic methyl prednisolone and group B were given only intra-discal ozone.

Before proceeding with both procedures an individual assessment of pain threshold was done by VAS scoring and post-procedural assessed by Excellent, good, fair, and poor Mac nab criteria.

The outcome and prognosis of both Group A and B were compared and the results were documented.

In brief information about ozone procedure and steroid use, its effects and consequences were explained to close relatives, and written informed consent was taken. Ethical committee approval was taken and guardians were informed and consented in written and documented in proforma.

Data Analysis

SPSS (statistical package for social services), version 25 data analyzer was used to assess data. Both groups A and B were compared with respect to post-intervention of steroids and ozone only and their results were documented.

T-test was performed to ascertain the post-intervention overall clinical improvement and P-the value of less than 0.05 was considered significant.

Numerical Data

Numerical data for example age was assessed by Mean and standard deviations.

Categorical Data

Like gender, clinical assessment of pain and post-

intervention prognosis was entitled frequencies and percentages.

RESULTS

Demographic Assessments

Among 338 lumbar spinal disc disease, 169 patients were equally distributed in groups A and B with a random selection of age and gender and disc herniated disc location.

Group A had 70 females and 90 males while group B had 89 females and 80 males.

Radiological Assessment

All patients with herniated lumbar spinal disc who presented to us with lower backache and sciatica without neuro-deficit were assessed thoroughly and magnetic resonance imaging and Computed tomography scan (CT scan) of the lumbosacral spine were done in all patients.

Level of Lumbar Disc Herniation

Herniated lumbar disc in group A was at the level of L4-L5 in 74 patients and in group B it was in 84 patients detailed in Table 1.

General and Clinical Assessment

All patients with the lumbar herniated disc were vigilantly assessed and their clinical and radiological co-relation was mandated for the procedure. In the group, A Visual analog score (VAS) was done to check the pain severity experienced by each patient with labeled scoring.

In group A, pre-procedural grade VAS 9 – 10 (worst) was noticed in 6% of patients and VAS 10 (worst) was found in 7.1% of patients with a mean duration of the clinical course of 12 to 18 weeks, detailed in Table 2. All patients who met the sample criteria were admitted for daycare surgical procedures and prepared for both intra-discal ozone and peri-ganglionic methylprednisolone therapy.

Procedure

After written informed consent the procedure was conducted in the operating room in a prone position lower back of the patient was scrubbed with betadine solution (povidone-iodine, 10%) sterilized draping was done then transparent op-site dressing was applied to the concerned and limited area.

In both groups, A and B 2 ml of xylocaine with adrenaline were inserted into the subcutaneous tissue to reduce the intensity of local pain and bleeding.

Both groups received intra-discal ozone mixture solution of about 4-6ml, while group A in addition to ozone solution also received peri-ganglionic 40-80ml of methylprednisolone.

Ozone solution was produced automatically by ozone machine and under the guidance of fluoroscope first ozone solution of 3 – 5 ml was injected by Chiba needle of 24 gauge through posterior-lateral via superior articular space than under guidance projected into the core of disc into and around the nucleus purposes accuracy of direction was confirmed by lateral and anterior-posterior images on the image intensifier. It takes about 3 – 5 minutes to spread the solution into and around the prolapsed disc material. In addition to this group, A was followed by a peri-ganglionic injection of 1 – 2 ml of 40 – 80 mg methylprednisolone.

At the end of the procedure patient was kept in a prone position on the operating table for 10 minutes at least, then shifted to the recovery room and kept under close clinical observation for a maximum of 2 hours.

Both groups A and B were assessed for pain immediately after procedures. In the recovery

room, pain assessment was done and preoperative VAS was compared with post-procedural VAS.

In group A 77% of patients got immediate pain relief from VAS-8 to VAS 1 while in group B

Table 1: Level of prolapsed lumbar disc.

Group – A (Intra-Discal Ozone Plus Steroids)		Group –B (Intra-Discal Ozone Only)	
Level	Percentages	Level	Percentages
L4-L5	46.1%	L4-L5	50%
L5-S1	35.5%	L5-S1	41.4%
L3-L4	18.3%	L3-L4	9%

Table 2: Pre-operative visual analog score (VAS).

Group – A (Intradiscal Ozone Plus Steroids)		Group – B (Intra-Discal Ozone Only)	
VAS Score	Percentages	VAS Score	Percentages
VAS-9-10 (worst pain)	6%	VAS-10 (worst pain)	7.1%
VAS-8-9 (severe pain)	47.3%	VAS-9 (severe pain)	47.3%
VAS-8 (mod-severe)	41.4%	VAS-8 (moderate pain)	40.2%
VAS-7 (moderate pain)	5.3%	VAS-7-8 (mild – moderate pain)	13%
p- value	0.717 (Insignificant result)		

Table 3: Macnab criteria for post-procedural outcome in Group – A and Group – B

Excellent		Good		Fair		Poor	
A	B	A	B	A	B	A	B
53.2%	38.4%	41.4%	18%	5.3%	39.0%	0%	5%
p-value	0.023 (significant result)						

Table 4: Frequency of procedures required in **Group – A** (Intra-discal Ozone Plus Steroids) and **Group – B** (Ozone only).

	Single		Twice		Thrice	
	A	B	A	B	A	B
	53.2%	41.4%	29%	23%	13%	34%
p-value	0.061 (insignificant result)					

56% of patients got some relief of pain from VAS 8 to VAS 3 which proved highly significant p-value of 0.01

Follow-up, Outcome, and Performance

Noticeable resolution of pain occurred after the second week of therapy in group B from VAS- 8 to VAS -0 in 2 4% of the patient as compared to group A in which 15% of patients got pain relief from VAS -8 to VAS -0. with a p-value of 0.05.

Also, the majority of patients 20% in Group B got improved from VAS -9 to VAS-1 after 8 weeks as compared to group A in which 8.2% of patients had pain resolution from VAS-10to VAS-1, with a p-value of 0.8.

Further, pain and numbness assessments were carried out up to six months of therapy in both groups who received ozone plus steroids (A) and ozone alone(B), and their overall performance was assessed by utilizing Mac-nabs for Excellent, Good, Fair, and poor depend on the degree of every-day performance and difference was proved by the p-value of 0.023 (Table-3).

Frequency of Ozone and Steroid Therapy Procedures

About 53.2% of patients in group A got improved with a single shot of ozone plus steroid therapy as compared to group B in which 41.4% had overall improvement with a single shot of ozone therapy alone and that difference was proved by applying a p-value of 0.061. Detailed in Table 4. Patients who failed to upgrade with 1st procedure had booked for a second and, then third trials of therapy in both groups A and B.

Group A patients have maximum improvement of symptoms within 2 weeks of therapy in contrast to group B patients who got better within 4-8 weeks of therapy (Table 5).

In our study, we noticed a remarkable improvement in patients who were given intra-discal ozone plus peri-ganglionic steroids (group A) as compared to intra-discal ozone therapy alone (Group B). Which was further approved by a p-value of 0.71.

Table 5: Pre and post-procedure outcomes in **Group – A**, and **Group – B** at variable time intervals according to VAS scoring.

Immediate		After 2 Weeks				After 6 Months					
Group – A		Group – B		Group – A		Group – B		Group – A		Group – B	
VAS	%	VAS	%	VAS	%	VAS	%	VAS	%	VAS	%
8 to1	77%	8 to3	52.6%	8to 0	15%	8to 1	58%	10 to1	8.2%	9 to 1	20.1%
p- value < 0.01 (Significant result)				p -value<0.05 (Significant result)				p- value 0.805 (Insignificant result)			

DISCUSSION

A variety of, biological and pharmacological agents have been used for intra-discal, Peri-ganglionic, and peri-foraminal injections to treat low backache and sciatica¹¹.

Minimally invasive Ozone therapy has been widely used especially in Europe and Asia since 1990 to treat the low back effectively as an alternative minimally invasive therapy.¹²⁻¹³

Glucocorticoids due to their powerful anti-inflammatory have been widely used for ages to treat low back, it has been effectively injected into sacroiliac joint, facet joint, nerve root block, epidural as well as intra-discal and peri-ganglionic sites.¹⁴⁻¹⁷

In our study we experienced more than 50% of patients in the group had excellent performance in group A, which was noticed immediately after the procedure and within 2

weeks of intradiscal-ozone plus peri-ganglionic methyl-prednisolone therapy, while in group B it was 38.4%, we noticed a greater reduction in VAS score in both groups A and B, ozone plus steroid group surprisingly had a greater effect within 2 weeks and that difference is quite evident with a p-value of 0.01, While in only zone group VAS gradually reduce after 2 weeks (the detail is given in Table 5).

In contradict to the study conducted by Kilic et al. in 2021, they noticed no significant difference between intradiscal steroid plus ozone and intradiscal only ozone both having a 50% reduction in VAS score.¹⁸

Andreula CF et al reported 53.3% to have Excellent performance while 25% have poor also transient numbness of the leg for 2 hours after procedure.¹⁹. While we reported that 0% of the patient had poor performance and no complication in the intradiscal ozone plus peri-ganglionic steroids group.

Most of the studies preferred non-particulate steroids like dexamethasone to avoid any inadvertent intravascular injection.²⁰ In our study, we carefully used peri-ganglionic particulate steroid-like methylprednisolone because of its relatively long-term effects through the translaminar approach and experienced 0% complication.

In our study, lumbar disc herniation was most commonly noticed in the L4-L5 disc space. Excellent postoperative performance was found in group A about 53.2% as compared to 34.4% in group B.

VAS was greatly reduced in group A within weeks of therapy in group A as compared to group B in which major improvement in VAS score was noticed after 2 weeks (Details are in Table 5). We also notice that group A had fewer chances about 13% of repeat procedure as compared to 34% in group B which is quite clearly proved by a P-value of 0.061.

LIMITATIONS

We had a limited number of patients and limited time of follow up up-to six months, procedures were performed by a single neurosurgeon. Intradiscal and periganglionic space was used. Control was randomly selected irrespective of age, gender, and prolapsed intervertebral disc.

RECOMMENDATIONS

A multidisciplinary approach should be conducted in collaboration with neuro-radiologist and neurological surgeons who have sound and safe knowledge and skills and their mutual collaboration may enhance the quality of life and efficacy of the procedure. Further advanced research should conduct on stem cell application in intervertebral disc space in human beings keeping the safety and efficacy of the procedure at first hand. Other anti-inflammatory agents like, cytokine antagonists, and hydrogel-based biomaterials can be tried at a large scale whether used alone or in combination with intra-discal ozone or steroids.

CONCLUSIONS

The pairing of anti-oxidative percutaneous ozone chemonucleolysis along with the peri-ganglionic application of anti-inflammatory steroid has proved the most effective, rapid, and long-lasting effect that can dramatically improve the overall performance and quality of life and also reduce the VAS pain score less than half in patient's herniated lumbar disc with sciatica as compared to single ozone therapy.

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Additional Information:

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Human Subject: Consent was obtained by all patients/participants in this study.

Conflict of Interest:

In compliance with the ICMJE uniform disclosures form, all authors declare the following:

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AUTHORS CONTRIBUTIONS

Ser. #	Authors Full Name	Intellectual Contribution to Paper in Term of:
1.	Syed Aamir Shah	Study design and methodology.
2.	Fahmida Arab Mallah	Paper writing, referencing, data calculations.
3.	Imran Mirbahar	Analysis of data and interpretation of results.
4.	Muzammil Dilbar	Data collection and calculations.
5.	Ubaidullah khan	Literature review and manuscript writing.
6.	Dr. Muhammad Anees	Analysis of data and quality insurer.