INTRADISCAL OZONE TREATMENT OF NON-CONTAINED DISC HERNIATIONS: 18 MONTHS FOLLOW-UP

SUMMARY

Study Design. In the past 10 years, intradiscal ozone treatment has proved to be an effective modality in treating patients affected by degenerative disc disease (DDD). Few Authors published that ozone is highly effective in various states of degeneration of the intervertebral disc.

Objective. The intent of the Author was to observe clinical and morphological results of the intradiscal ozone treatment in patients affected by non-contained disc herniations on a 18 months clinical follow-up.

Methods. 104 patients were included in the study on the base of precise inclusion and exclusion criteria. The patients were followed on 18 months period by Visual Analogic Scale (VAS), Japanese Orthopedic Association Scale (JOA) and Overall Patient Rating Scale (OPRS). Disc herniation monitoring was evaluated after 5 months with an adequate MRI or CT scanning.

Results. There was a 3.77 points of gain on the VAS scale and a 54.7% of improvement on the JOA scale. The mean benefit of 71.55% and a median of 80% was found on the OPRS. On 5 months follow-up 22% of patients had an immovitated herniation volume, 41% had a reduction in the volume while 37% had a complete disappearance of disc herniation.

Conclusions. The intradiscal ozone treatment demonstrated to be an effective modality of treating patients that have overpassed conservative measures and have not yet fulfilled the indications for surgical treatment.

SOMMARIO

Negli ultimi 10 anni la discosclisi con ozono ha dimostrato di essere un metodo efficace nel trattamento di problemi degenerativi del disco intervertebrale. Numerosi Autori hanno messo in evidenza effetti positivi nelle più svariate patologie discali. L’obiettivo dell’Autore era la valutazione clinica e morfologica della discosclisi con ozono nei pazienti affetti da ernie discali non contenute sulla base di un follow-up di 18 mesi.

104 pazienti sono stati inclusi nello studio sulla base di specifici criteri di inclusione ed esclusione. I pazienti sono stati seguiti clinicamente mediante le scale di valutazione per il dolore e funzionalità: Visual Analogic Scale (VAS), Japanese Orthopedic Association Scale (JOA) e la Overall Patient Rating Scale (OPRS). Dopo 5 mesi è stata eseguita la valutazione morfologica del volume erniario con le immagini RMN o TC. I risultati indicano che la discosclisi con ozono è efficacemente una valida alternativa nei pazienti che hanno oltrepassato la possibilità di trattamento conservativo ma non hanno ancora raggiunto le indicazioni all’intervento chirurgico.

INTRODUCTION

Lumbar disc herniation is a pathologic condition most commonly responsible for lumboradicular pain, and the condition for which lumbar surgery is carried out most frequently. It is well known that the majority of patients suffering lumboradicular symptoms from a disc herniation will get better spontaneously and that the herniation will, eventually, disappear in a few months without any treatment. For more than 50 years, standard and, afterwards, microdiscectomy have been used to manage lumbar disc herniation.

In a number of reports on the long-term outcome of lumbar discectomy for lumbar disc herniation, the success rates were fairly consistent (between 76% and 93%), although evaluation methods varied, and approximately 10% of the patients underwent revisions. The latest study on this problem reported an average recovery rate exceeding 70%, with the rate of recurrence of 12.5%, results comparable with the respective rates in other studies. Yorimitsu et al., found residual LBP in 74.6% of patients in their group of whom 12.7% had severe symptoms (JOA score,1 point). Moreover, in a substantial proportion of patients with gradually increasing symptoms after primary successful surgical treatment, many authors seem to agree that peridural scar formation with tension on neural tissue plays an important role. Patients with extensive peridural scars are 3.2 times more likely to experience recurrent radicular pain than those with less extensive peridural scarring.

For 50 years too, surgeons have been searching for a method which will allow to reduce or eliminate the herniated disc material without the need for performing an open surgery. So, a number of mini-invasive percutaneous techniques were developed. The common principle of these techniques was that of acting directly on the disc content without accessing the spinal channel. Two main types of percutaneous treatments were conceived: a mechanical removal (endoscopic discectomy, automated discectomy, laser discectomy) and a chemical disruption of the nucleus pulposus (chymopapain, collagen, hydrocortisone, aproin).

The 1999 Cochrane study group found the following for different surgical treatment modalities in lumbar disc herniation:

1. There is strong evidence (Strength A) that chemonucleolysis with chymopapain produces better clinical outcomes than placebo.
2. There is considerable evidence (Strength A) of the clinical effectiveness of discectomy for carefully selected patients with sciatica caused by lumbar disc prolapse. Discectomy provides faster relief from the acute attack (Strength A), although any positive or negative effects on the lifetime natural history of disc problems are unclear (Strength C).
3. There is moderate evidence (Strength B) that clinical outcomes of microdiscectomy are comparable with those of standard discectomy.
4. There is moderate evidence (Strength B) that automated percutaneous discectomy produces poorer clinical results than standard discectomy or chemonucleolysis.
5. There is no acceptable evidence (Strength D) of laser discectomy.

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concentrations (20-30 mg/ml) it seems to affect the regulation of the immune system and at low concentrations (< 20 mg/ml) it improves the microcirculation.

Referring to the histological work of Illiakis et al, the intradiscal application of ozone-oxygen mixture at high concentrations initially gives rise to formation of an interstitial oedema together with eosinophilic degeneration of cytosol and nucleus pulposus cell shrinkage. On the first day the alterations are mild and became more pronounced at the end of the first week with cellular degeneration. In the second week the oedema decreases and there is disc volume decrease due to cellular degeneration. At the end of the fifth week there is a complete degeneration of the nucleus with loss of cells and replacement of the matrix by fibrous connective tissue. Similar results were reported also by Jucopilla et al in their experimental work on pigs.

The primary effects of ozone inside the intervertebral disc are supposed to be the next: reduction of the inflammation due to oxygenation of the algogenic processes; direct interaction of the oxygen-ozone mixture with the mucopolisaharids of the nucleus pulposus with consequent reduction in water content and disc volume; improvement of the local microcirculation with reduction of the venous stasis and better arterial blood supply with consequent diminutive of the ischemic changes at the nerve root level.

Ozone, both in vitro and in vivo, if applied in adequate concentrations, has no toxic effects. The primary condition is the dose range as the ozone quantity must not exceed the enzymatic antioxidant (superoxide dismutase and catalase and glutaldehyde) capacity of the organism. These enzymes impede the association of superoxide anion and hydrogen peroxide (HO2). There is not to be afraid of free radical formation as these form at a pH of 8 while at a pH 7.5 the predominant mechanism is the ozonolysis that principaly determines the production of peroxides and not of free radicals. Also, experimental tests in animals and humans did show essentially lack of negative effects. Experimental studies too, indicates that the ozone application to the human body, if in adequate doses and concentrations, have no mutagenic properties.

MATERIAL & METHODS

PATIENT POPULATION

Patient population included 104 patients of both sex's treated for disc herniation between July 2000 and January 2002. Age ranged between 20 and 80 years. Each patient had gone through clinical investigation done by the treating surgeon and by a physiotherapist. All of the patients had performed a neuroradiological investigation by MRI and/or CT scanning. All of the patients had failed to respond to conservative measures of pharmacological and/or physiotherapeutic treatment instituted for at least 1 month. All of the patients treated were detailed explain in what the treatment consisted, on the possibilities of success as well as on risk factors and all of the patients accepted the treatment by signing the informed consent.

Elements for inclusion in the study:

- acute pain symptomatology lasting for at least 1 month not responsive on conservative treatment modalities
- non-contained disc herniation at one or more levels situated between L2 and S1
- level of disc herniation corresponding to the level of symptoms
- confirmation of pathology by MRI/CT scanning

Elements of exclusion from the study:

- severe motor palsy (Fisher < 4)
- other spinal problems (tumors, lysis, fracture, deformity, stenosis, ecc)
- previous spinal surgery
- history of spinal trauma
- history of mental disease
- use of narcotics or therapy for mental illness
- emotional traumas in the last 36 months

PERCUTANEOUS TECHNIQUE

The intradiscal application of ozone-oxygen mixture was performed in operating theatre under deep sedation. The patient was prepared by the anesthesiologist with pharmacological sedation (Atropin, Diazepam, Midazolam) half an hour before the procedure and then brought to the operating room and positioned in lateral decubitus lying the affected side upwards with the legs folded. The operating table was folded as to assume an upwards conveys shape. This allowed the surgeon to have an easier access to the lower discale space even in the patients with a high iliac crest or important space between the transverse processes. The injection needle for ozone-oxygen delivery was a 22 G Chiba type售拍o-Diksins (27 cm) needle that was introduced by standard postero-lateral, extra-articular percutaneous approach. All the procedure was done under continuous fluoroscopic control. Ones in place, the position was confirmed by latero-lateral and antero-posterior imaging but without contrast medium as to avoid any interference of ozone introduced by standard postero-lateral, extra-articular percutaneous approach. The injection needle was introduced to the disc space at an approximate velocity of 10 ml/min. The gas mixture inside the disc space appeared on the fluoroscopic screen as a positive contrastography. Some of the gas mixture escaped from the disc space and run into the epidual space both in cranial as well as in caudal direction. During the gas infiltration the patient was deeply sedated by Propolol. The patient was dismissed the next morning. For the first two days we recomend not to assume the sitting position but walking was encourged.

PATIENT EVALUATION METHOLOGY

The patient's pain, function and disability were evaluated by the Visual Analogic Scale (VAS), Japanese Orthopedic Association questionary (JOA) and Overall Patient Satisfaction Scale (OPRS).

The evaluation was done before the procedure and on 2, 6, 12 and 18 months after the procedure. Approximately 5 months after the procedure, 89 patients performed MRI/CT control scanning. The tendency was to perform the same kind of imaging as preope ratively. The evaluation showed that 37% of patients had a complete reduction of their symptoms on a 18 months follow-up was 54.7%. There were no patients with sphincteric dysfunction before as well as after the procedure. The motor dysfunction improved earlier than the sensitive probably because the sensory disturbance arise before the motor one and is longer-lasting.

The Overall Patient Rating Scale evaluated the patient satisfaction with the treatment on a scale from 0 to 10, zero being the worse. The evaluation showed that 72% of patients had a complete reduciton of their herniation (superior to 80% of the preoperative volume). In 41% of patients the volume reduction was between 40 and 80% while in 22% of the selected patients there was no visible modificaton of disc herniation volume. A correlation between the clinically improved patients and disc volume reduction group of patients was not found.

Five patients had to be operated upon by microdiscectomy for a non-positive result with discosclerosis. The time mean passed between the discosclerosis and the surgery was 6 weeks as to evaluate if there was any kind of late improvement. Waiting more than this was not suitable as the patients could have
get better even spontaneously.
Four patients were submitted to a repeated intradiscal procedural with ozone 3 months after the first procedure. All of these patients were of age undre 30 and had a partial improvement (not greater than 50%) after the first procedure.

There were no complications observed although there are theoretical possibilities for complications. Eventual risks and complications may be divided in two groups: one related to the procedure (nerve root damage, infection and epidural or paravertebral hemorrhage) and one related to the ozone (systemic hypotension, bradycardy, vagal shock, meningeal irritation).

Special attention should be payed on patients referring hypertheridism, arterial hypertension, kahectic patients, patients that referrate states of general hypersensitivity as well as patients affected by phavysm.

DISCUSSION
It seems quite reasonable to suppose that clinical signs and symptoms of disc herniation are not caused primarily by the mechanical compression but that the biochemical factors play an important role in inflammatory sensitisation and immun response in the peridural environment of the nerve root. For these reasons it is to presume that a mechanical removal of the herniated tissue by open or percutaneous surgical procedures may not be needed and that the biochemical treatment could be sufficient to treat these patients. It has not to be forgotten that a disc herniation is neither a tumor nor a vascular lesion that, if not removed or occluded, may endanger the life of the patient. Studies have shown that there are no great differences, on a long-term follow-up (>5 years), between the patients treated surgically and those that had a conservative or no treatment.

The confirmation that the disc volume is not the most important but just one of the factors that influence the removal of symptoms comes from our observation of the results seen on control CT/MRI scans. Although only 37% of patients had a herniation volume reduction superior to 80% and 22% had their disc herniation immodified, the pain, motor and sensitive disturbances have improved in all of these patients in order of at least 60%.

The author is convinced that the disc herniation pathology has to be treated just in those patients that present with clinical signs and symptoms of the disease and that the treatment has to be proportionate to the severity of clinical signs and symptoms. In the patients in whom a disc herniation is found accidentally and there are no signs or symptoms of nerve root damage, the treatment has to be that of a "wait and treat when and if the symptoms should auras". It means that the disc disease is not a real pathological condition but primarily a degenerative and aging condition in which the absence of symptoms implicates a no-treatment attitude.

In this context, the intradiscal application of ozone-oxygen mixture has an important impact on the treatment of disc disease as it treats both the symptoms as well as the cause. It is a very simple and low-cost method both in terms of procedure costs as well as in terms of returning to working activities (5-7 days of home stay). It demonstrated to have a high improvement rate on clinical symptoms and an elevated impact on the cause of the problem. All of these in an almost total absence of risks and complications both on short and long-term follow-up.

The intradiscal ozone treatment for disc herniation is not ment as a method that intends to eliminate any of to-date gold-standard treatments (pharmacological, physiatric and surgical treatments). As for the chemonucleolysis with chymopapain, evidence supports ozone methods as a possible, less invasive option to be planned as an intermediate stage of treatment situated in between conservative management on one side and the open surgical intervention on the other. That means it is applicable to the patients that have overpassed the conservative treatment modalities but have not yet indications for surgical treatment. This particularly as it has been shown that if the clinical indications are uncertain, postponing surgery for further assessment of clinical progress may delay recovery but will not produce long-term harm.

It is the author's opinion that the intradiscal application of ozone should be included into the treatment modalities for disc herniation as an intermediate modality before passing to open surgery.

REFERENCES


