



## Current Trends of ESRD Patients with Ozonedialysis: Ozone “The Wonder Therapy” For Dialysis

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### ABSTRACT

Ozone therapy is known to be the current successful method of dialysis which is first taken up in Germany. Medical oxygen known to be an ataxic generator is used to generate medical ozone, ensuring the inert contact of all the materials related to ozone. Surprisingly this useful and effective therapy is not recognised in our country like India but is widely accepted and practised in the countries like South America, Europe, Russia, Thailand, Bulgaria, Indonesia, Cuba, etc.; since over 70 years it is used as a successful method of treating various illnesses; like used to halt the progression of diabetes, Kidney diseases, detoxification of the body, coronary artery disease, etc.; Ozone is prepared freshly “on-site” just before starting the session, as it should be administered immediately after its generation. They should be accurate, reliable and should project the ozone concentration (1-80 $\mu$ g/ml) as reproducible measurements by using a suitable device. Ozone Therapy has learnt to be an effective therapy for ESRD patients irrespective of the stages of disease dealt. The importance and the applications of Ozone therapy in the current medical field are discussed and emphasised in the present review. This review may help the researchers in planning further research to improvise the therapy or to sophisticate the method of implementation, and it also helps in delivering details of the therapy for better understanding of the medical practitioners.

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### INTRODUCTION

Ozone therapy is known to be the current successful method of dialysis which is first taken up in Germany and was the first country to manufacture this medical ozonation and used ozone-oxygen mixtures in various practices such as in geriatrics, stomatology and also in vascular surgery. Wherein, it was used in medical cosmetology by Italian ozone-therapists. It is learnt that west European countries and Switzerland has many specialised ozone therapeutic clinics and Cuba had established a known Ozone research centre. It observed that ozone therapy had delivered exciting and most promising

results in various countries like Mexico, Japan, Brazil and USA, ensuring efficient, good tolerance, an efficient and easy to use the method with zero or no side effects (Bonforte *et al.*, 2013). Meaning of ozone in Greek is emanating an odour and is a natural, unstable molecule. The pure ozone gas possesses a pale sky blue colour with a pungent smell. Ozone is three oxygen atoms containing molecule (O<sub>3</sub>) with a molecular weight of about 48.00.

The structure of ozone is cyclic, maintain a distance of 1.26 Å among the atoms, and in dynamic equilibrium, it exists in various mesomeric states. The solubility of ozone is ten folds more than oxygen which is about 49.0 and 4.89 respectively in 100ml of water at 0°C. This characteristic feature of ozone having greater solubility in the water when compared to oxygen facilitates immediate interaction of ozone with biomolecules of biological fluids or any other soluble compound. It is speculated that ozone or oxygen polymers may have a therapeutic role in healthcare and traces are generated in the form of oxygen polymers (O<sub>4</sub>) or ozone polymers (O<sub>6</sub> y O<sub>9</sub>) (Clavo *et al.*, 2005). Medical oxygen known to be an ataxic generator is used to generate medical ozone, ensuring the inert contact of all the materials related to ozone. They should be accurate, reliable and should project the ozone concentration (1-80 µg/ml) as reproducible measurements by using a suitable device. Medical ozone is a mixture of ozone in oxygen, with an approximate range between 0.5 to 5 % of ozone concentration. Total ozone dose is equal to the product of gas volume (ml) and ozone concentration (µg/ml). According to the European Union, the ozone generators are treated as sanitary products possessing II-b qualification, and it should be registered with a known entity under a notified manufacturer (Neimark *et al.*, 2014). Compared to oxygen, ozone is more powerful oxidant; practically, it can oxidise various non-organic and organic compounds. Ozone related to bio-organic compounds is learnt to be selective in its reaction with double bond containing compounds like proteins, peptides, amino acids, and nucleic acids and also primary the unsaturated fatty acids, they make up the basis of cell membranes by a lipid bilayer and blood plasma consisting of lipoprotein complexes. Ozone is dominant in its reactions with unsaturated fatty acids in the biological media, and it is involved in the formation of many products, including ozonides. These ozonides are the compounds consisting of many numbers of oxygen atoms in a single molecule (Peretyagin *et al.*, 2008).

### Medical Ozone Therapy

Surprisingly this useful and effective therapy is

not recognised in our country like India but is widely accepted and practised in the countries like South America, Europe, Russia, Thailand, Bulgaria, Indonesia, Cuba, etc.; since over 70 years it is used as a successful method of treating various illnesses; like used to halt the progression of diabetes, Kidney diseases, detoxification of the body, coronary artery disease, etc.; Ozone is prepared freshly "on-site" just before starting the session, as it should be administered immediately after its generation. Medical ozone therapy has many benefits in treating various conditions and illnesses like it detoxifies, rejuvenates, improves the quality of life, contributes for better health status, it decreases pain, stimulates white blood cell production, tumour necrosis factor production (TNF), interleukin-2 (IL-2) secretion, contributes for the significant increase of the levels of interferon, antineoplastic, at low concentration it also kills various types of bacteria, fight against viruses, most effective against fungi, increase the red blood cell elasticity and flexibility, oxidises arterial plaque, improves the antioxidant activity, involved in the degradation of petrochemicals and also accelerate citric acid cycle (Zaky *et al.*, 2011; Bonetti *et al.*, 2005; Bocci and Paulesu, 1990).

### Applications of Ozone Therapy

It is leant that few diseases share similar pathological disease progression wherein, one organ damage or disease may trigger other disease or affect other organs. For an instant, diabetes is known to be the common cause of kidney damage which may affect heart if not treated properly. In such situations, ozone therapy had proven to be effective and can be used at any instance irrespective of the disease stage/ phase. It can be used as adjunctive therapy along with the current treatment regime. Its useful in treating the kidney disease is herewith mentioned in controlling hypertension, decreases the fluid retention, decreases the protein excretion in urine, controls anaemia thereby, reduces the erythropoietin injections (if the patients are on administration) and prevents or delays the kidney damage. This would further delay the need for long term dialysis procedure. This therapy can be offered for the patients on hemodialysis or peritoneal. This therapy, when given to diabetic patients, it was observed that the patient achieved stable HbA1c and controlled glucose levels. As a result, the usage of oral medication or insulin dose was decreased further this would prevent or prolong the effect of diabetes in effecting Kidney/retina/nerve (Al-Jaziri and Mahmoodi, 2008; Magalhaes *et al.*, 2012).

Ozone therapy is also proven to be effective to coronary artery disease patients too. It was observed

that this therapy helps in opening of the coronary arteries thus reduces or removes the vessel blocks, facilitating improved blood supply to the heart muscle with flexible blood cells and smooth blood flow. This may ultimately prevent heart attacks. Ozone therapy has also been known to be effective in treating atherosclerosis, peripheral artery disease, immune-deficiency related diseases, viral infections such as HIV, Hepatitis B and C and certain bacterial infections, etc.; (Al-Jaziri and Mahmoodi, 2008; Magalhaes *et al.*, 2012). For about 90% patients with Cervical/ Lumbar spine disc prolapse, Ozone Nucleo-lysis is proven to be an effective procedure wherein 80% of the patients respond to 5ml of Medical ozone or oxygen gas in the disc and with one injection about 3ml in the facet joint. There would be a need for the second injection in about 10% after three months. This is an outpatient procedure performed in operation theatre with the help of 'CT-arm control' to monitor the precision of the injection given. This should be carefully practised only by the trained Neurosurgeon or Orthopaedic, or Anaesthetist and symptoms persist if any due to remaining disc prolapse, then surgery is recommended (Clavo *et al.*, 2004).

### Types of ozone therapy

#### Ozone dialysis (eboo) therapy

Ozone dialysis is known so far known to be the most efficient oxidative therapy is a whole-body-blood oxygenation therapy, wherein the procedure facilitates the passage of the whole body blood volume through a dialysis cartridge in an hour (similar to dialysis for End-Stage Renal Failure procedure). In this procedure, venous blood that appears dark in colour is drawn from one arm and is reinfused by oxygenated bright red coloured blood through the other arm (Lintas *et al.*, 2013) thereby ensuring removal of toxins, fat deposits, kills the pathogens of various sources like yeast, fungi and also helps in killing cancer cells. Ozone therapy is learnt to be the most potent detoxifying therapy. Ozonides are the products formed by the conjugation of phospholipids act as catalysts and helps in systemic healing of damaged muscle tissues or organs (Paolo *et al.*, 2005).

#### Ozone bagging

Before the implementation of ozone bagging procedure, one should ensure that the wound is cleaned, removal of slough and then debridement is done. Debridement facilitates easy and better absorption of oxygen gas/ ozone by the wounded area.

Before the session's commencement, the affected limb should be wiped using saline; this will make

the affected area wet. The ozone-resistant-plastic bag is fed with 100 ml normal saline through the elastic strap at the top. Enclose the limb in the bag after wetting it and suck the air from the bag using a suction device. Then ozone gas with a concentration of 65mcgm/ml should be freshly prepared using ozone generator and fed immediately into the bag to inflate the bag to the possible extent with the help of a strap at the top, holding ozone gas. It should be continuously pumped for about half an hour to 1 hour. Avoid over-inflation and if indicated, let out the excess ozone gas through small silicone tube outlet at the inside of the top of the bag. Silicone made tube is used for Ozone delivery since it is ozone resistant. The tube and the bag are to be removed after completion of the session. A later wound is bandaged by the application of Ozone oil and by a non-adherent sterile dressing. The session should be carried out on a daily bases for 4-6 weeks in a well-ventilated room. The concentration of ozone is reduced to about 40mcgm/ml as per evident healing, and further, the treatment should be continued until complete healing is achieved. The studies demonstrate that amputation could be avoided by practising ozone bagging therapy (Moore *et al.*, 2000; Martínez-Sánchez *et al.*, 2005; Hernández *et al.*, 1995).

#### Direct intravenous ozone gas 2.5% / medical oxygen 97.5% injection ('div') using a digital pump to deliver with safety and accuracy. (no nitrogen in the gas mixture)

Patients suffering from Nonspecific Chronic Ill-Health Syndromes, whose tooth is filled by mercury amalgam will experience a toxic effect which can be treated using only ozone therapy. As it is an effective detoxifier, Medical ozone chelates mercury from nervous tissue and brain. It is also studied that Medical ozone therapy acts as an effective anti-ageing agent, energiser, anti-fungal, anti-viral, anti-bacterial, anti-parasitic, a combatant of oxidative stress, immune-modulator, possess systemic therapeutic and local analgesic effect and also proven to be modern therapy for any Ischemic states (Ajamieh *et al.*, 2004; Fernández *et al.*, 2008).

#### Intra-articular ozone injection/ prolozone therapy

Certain studies demonstrated that freshly prepared ozone gas is injected known to be an intra-articular injection, after the administration of lidocaine in the diseases like Osteoarthritis, rheumatoid Arthritis, 'Meniscus Tear' etc.; results in good healing status without any surgical procedures and without using steroids (Brigelius-Flohé and Flohé, 2011; Chang *et al.*, 2005). The response may vary from patient to

patient, but there are enough chances wherein surgical intervention may not be required.

### Mechanism of action

Uric acid, ascorbic acid, glycoproteins and sulfhydryl group of proteins including albumin are good oxidising agents. Hence they consume little ozone during their oxidation, resulting in the formation of 'reactive oxygen species (ROS), this further may trigger various biochemical pathways. The sound antioxidant system can neutralise ROS in a minute. ROSs: acts on Erythrocytes and facilitates improved oxygen delivery, for immune-activation it acts on Leucocytes and Platelets for releasing autacoids and specific growth factors. One of the critical ROS is Hydrogen Peroxide (H<sub>2</sub>O<sub>2</sub>). Ozone quickly gets dissolved in plasma, further reacts with Poly-unsaturated fatty acids (PUFAs) diffuses immediately into leukocytes, erythrocytes and platelets triggering various biochemical pathways. It gets converted into water in plasma and also into intra-cellular water by certain powerful antioxidant enzymes like glutathione peroxidase (GSH-Px), catalyses, and free reduced glutathione. Hydrogen peroxide acts as one of the ozone messengers in its therapeutic range.

LOPs (Lipid Oxidation Products) involve in delivering a message to specific cell receptors to elucidate a minimal and calculated oxidative stress, and this is an adaptive response. Continuous interaction among the biochemical reactant and bio-catalysts like metabolic system, antioxidants and enzymes causes rapid production and maintenance of normal antioxidant status.

LOPs also known to act on Endothelium and facilitate the increased release of Nitric oxide (NO), on Bone Marrow which in turn generates super-gifted erythrocytes and also causes the release of stem cells, further stimulate other organs for up-regulation of the Oxidative Stress Proteins and antioxidant Enzymes (Ozone tolerance) (Bocci and Valacchi, 2015; Dattilo et al., 2015).

### CONCLUSIONS

The present review emphasises the importance of Ozone therapy, and elaborately explains its applications in the current medical field. It also opens an area of research for the researchers to further plan the studies for the betterment of the therapy and also helps the medical practitioners to understand the details and effectiveness of therapy.

### Conflict of Interest

The authors declare that they have no conflict of interest for this study.

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