

Therapeutic Utilization of Zinc Supplementation Concurrent with Ozone Therapy Ameliorates Diabetic Foot Ulcer and Attenuates Serum Level of C-reactive Protein- A Case Report Study

Reza Dadfar^{1,2}, Layasadat Khorsandi^{3,4}, Reza Goujani⁵, Seyyed Farid Mousavi⁶, Zahra Aslani⁷

¹Department of Anatomical Sciences, Faculty of Medicine, AJA University of Medical Sciences, Tehran, Iran, ²Department of Education and Research, Army Health Center of Excellence (NEZAJA), Tehran, Iran, ³Cellular and Molecular Research Center, Medical Basic Sciences Research Institute, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran, ⁴Department of Anatomical Sciences, Faculty of Medicine, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran, ⁵Social Determinants of Health Research Center, Yasuj University of Medical Sciences, Yasuj, Iran, ⁶Department of Surgery, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran, ⁷Infectious and Tropical Diseases Center, Health Research Institute, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran

Abstract

Non-healing diabetic foot ulcer (DFU) is one of the main complications in diabetic patients. This case reported a 65-year-old male with a neuropathic ulcer in the right foot came to Ahvaz Wound Clinic after the wound had not healed with routine treatments. In addition to the routine treatment program, we used tropical ozone therapy and autohemotherapy (blood ozone therapy) for 2 months. Zinc supplementation (50 mg) was also administered daily during the treatment. The DFU was clearly healed with diminishing inflammation and wound closing, and there were no side effects. Additionally, the C-reactive protein level was obviously decreased during the treatment indicating effective suppression of infection. This way indicates a helpful new intervention approach to the treatment of DFU.

Keywords: Autohemotherapy, C-reactive protein, diabetic foot ulcers, ozone therapy

Address for correspondence: Dr. Layasadat Khorsandi, Cellular and Molecular Research Center, Medical Basic Sciences Research Institute, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran, Department of Anatomical Sciences, Faculty of Medicine, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran.

E-mail: khorsandi_cmrc@yahoo.com

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INTRODUCTION

Diabetes mellitus (DM) is an important public health problem in the world that is determined by impaired carbohydrate metabolism, protein, and fat due to unstable and resistant insulin secretion. Diabetes is associated with an increased risk of death, different complications, and imposing a massive financial burden on the person, families, national health care systems, and economies. Diabetic foot ulcer (DFU) is considered to be the main cause of lower extremity amputation among diabetic patients. Although DFU is difficult to treat, and some patients are still forced to amputate, there are several treatments and management options.^[1] Currently, low-dose

ozone has been recognized as one of the best antifungal, antiviral, and bactericidal agents, and it has also been used clinically as a treatment for chronic wounds, for instance, trophic ulcers, and ischaemic ulcers.^[2]

Minerals deficiency such as zinc has important roles in wound healing. Zinc deficiency affects all phases of wound healing and causes a reduction in mature B-cells.^[3]

Expression of C-reactive protein (CRP) elevates during DFU. CRP, a hepatic-derived serum protein, is a key element of any inflammatory reaction that its serum level clearly enhances after infection or tissue damage. CRP plays a critical role in

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Figure 1: DFU condition during intervention. (a) Wound on the first day before the treatment; (b) Wound after 45 days of zinc and ozone therapy; (c) wound after 2 month of the treatment

host responses to infection including cytokine production, particularly tumor necrosis factor- α and interleukin-6.^[4]

In this report, we used ozone therapy and zinc supplementation for the treatment of a 65-year-old person with DFU.

CASE REPORT

A 65-year-old man with a neuropathic ulcer came to Ahwaz Wound Clinic, a month after his wound had not healed. The patient had neuropathy in the lower limb. Based on Wagner's scoring system, the wound was in grade IV with infection and osteomyelitis. Cellulitis around the wound, exposure of tendon and bone, as well as nail growth disorder was observed. The body cell mass of the patient was 24.5 Kg/m². He does not feel pain due to a previous injury (diabetes-induced neuropathic). Laboratory wound culture showed staphylococcus aureus sensitive to linezolid. DFU was located on the third, fourth, and fifth tarsus, and metatarsals of the right foot. Its size was length 9 cm, width 4 cm and depth was 2 cm. Wound edges were macerated, odor positive, and had a high exudate. The skin around the wound was macerated, red, and warm.

Initial examinations revealed that the DFU had not been well managed. Atrophic color doppler ultrasound showed atherosclerotic, and calcified arteries in the foot. The patient's wound secretions were controlled with an absorbent pad (calcium alginate). DFU treatment procedure was continued by controlling the secretions of infection, odor, and biofilm removal. The patient's foot edema was controlled with physiotherapy and exercise in the distal foot. He was also visited by an infectious disease specialist and received antibiotics based on wound culture. In addition to the routine treatment program, two new methods of tropical ozone therapy and autohemotherapy (blood ozone therapy) were used. At first, the wound was washed with normal saline and placed in a bag containing 60 μ g ozone for 20 minutes for 20 days. For autohemotherapy, the patient's blood was ozonated twice a week with 100 cc blood containing 50 μ g ozone. In addition, 50 mg zinc was daily administered during the treatment. Finally, after 2 months of routine treatment and additional ozone therapy and zinc supplementation, the wound was obviously improved [Figure 1]. We measured serum CRP by a human ELIZA kit (Abnova, Cat number: KA3148; sensitivity less than 0.3 mg/dl) during the treatment [Figure 2]. After 2 months of the treatment, the CRP level was significantly diminished.

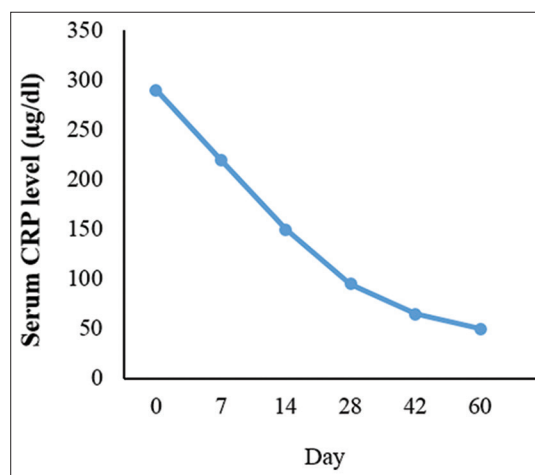


Figure 2: Serum CRP level of the patient at different days during the treatment

DISCUSSION

The present study showed that the use of ozone therapy with zinc supplementation significantly accelerated the healing process of DFU. The ozone treatment can activate inflammatory molecules and increase inflammatory processes, so increases cell repair, and wound healing. Improving vascular function, and increasing blood flow to the damaged tissues is another mechanism in ozone therapy. Besides, ozone enhances the healing process of wound infection.^[2] Interestingly, the CRP was obviously reduced after ozone therapy. Weigelt *et al.*^[5] found that acute DFU and its severity were associated with a significant increase in CRP.

Pickwell *et al.*^[4] suggested that elevated CRP levels can be considered as a risk factor for amputation in DFU subjects.

As mentioned above, the ozone therapy was accompanied by zinc supplementation (50 mg/day) for the management of the DFU'S patient. In a previous study, zinc deficiency was presented in 26.9% of DFU patients.^[6] In a randomized control trial study, zinc supplementation was associated with significant reductions in ulcer size in 60 patients with DFU.^[3]

In a meta-analysis study, the impact of zinc supplementation on plasma CRP concentrations was investigated and suggested that zinc supplementation attenuates the serum CRP, particularly at doses equal to 50 mg/d (12).^[7]

In conclusion, zinc supplementation concurrent with ozone therapy can effectively improve DFU. This method has no

side effects and can be used for DFU patients if confirmed in randomized clinical trial studies.

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Conflicts of interest

There is no conflicts of interest.

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