



Case report

Ozone therapy in the treatment of the neuroinfectious diabetic foot. Case report

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Abstract

Given the proven therapeutic effects of the medical ozone in Diabetes Mellitus (DM) especially in the management of neuroinfectious diabetic foot as adjuvant treatment, it is chosen as a first-line therapy to treat the case of a female patient with a neuroinfectious diabetic foot with osteomyelitis and in sepsis.

The biological effects of ozone therapy at clinical level are already well known; among its main properties are: to combat oxidative stress, the immunomodulatory effect and the germicidal effect against bacteria, viruses, protozoa and fungi. On the other hand, it is known that among the complications of the diabetic patient are neuroinfectious diabetic foot, immunodeficiency and septic state which in this case seriously compromised the life of the patient object of this report.

The female patient entered the clinic in a state of semi-consciousness, confused, erratic and diagnosed with neuroinfectious diabetic foot, with septic lesions and necrosis of the fourth finger and dorsal side of the right foot through which emanated fetid pus in abundant quantity. Bone, tendons and muscles were visualized. Her general condition was very compromised, in sepsis. She was treated with antibiotic therapy, combined with systemic ozone therapy treatment, using ozonized saline solution (SSO3) at high doses twice a day, and ozone bag at high concentrations twice a day with catheter placement in the dorsal fistula of the right foot, through which the bone was directly ozonized. Once the sepsis and metabolic state were under control the following step was to apply daily rectal insufflations, in combination with local therapy with ozone bags, as well as the topical application of IP 800 ozonated oil, obtaining satisfactory results, from the systemic point of view of its septic disorder as local.

The patient evolved satisfactorily, saving herself from imminent death and safe the amputation of the limb. She was discharged after six months with complete restoration of her injuries and absolute control of her diabetes. The treatment was performed on an outpatient basis.

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Introduction

Diabetes is a multifactorial condition that includes: deep peripheral venous insufficiency, peripheral motor and sensitive neuropathy, immunosuppression, oxidative stress and post-translational modifications, characterized by insulin deficiency, hyperglycemia and other alterations in the metabolism of carbohydrates and lipids, which can cause multiple complications at the micro and macrovascular levels.¹

The diabetic foot is defined as the clinical alteration of neuropathic etiology, and induced by sustained hyperglycemia, in which with or without coexistence of ischemia and previous traumatic trigger produces injury and / or ulceration of the foot.¹

Diabetes is increasing around the world associated with an increase in obesity and unhealthy life changes. The latest estimates expect an increase to 592 million by 2035. They are really alarming figures that constitute diabetes as a medical emergency disease and a serious public health problem.²

It is established that patients with Diabetes Mellitus (DM) present a significant increase in oxidative stress. These patients are factory of free radicals, being greater the oxidative stress in those that present own complications of the pathology, characterized by a diminution in the activity of the antioxidant systems and an increase of the products of oxidation, such as formation of reactive oxygen species (ROS), oxidative damage of the mitochondria, autooxidation of glucose, glycation of proteins and essential fatty acids (EFA), oxidative products through the pathways of glycolysis and sorbitol.³

We consider that one of the patients that can benefit the most from ozone treatment is the diabetic. Ozone acts by improving the metabolism of oxygen, improves the permeability of cell membranes to glucose, something that is achieved with the help of the stimulation of the pentose phosphate pathway and aerobic glycolysis (which is depressed in diabetes) which allows the reduction of hyperglycemia thanks to a better oxygen input into the tissues. By modulating the oxidative stress, ozone protects against neuropathy, increases the production of ATP (adenosine triphosphate) with the consequent stabilization of ATP dependant mechanisms, increases nitric oxide production, improves tissue perfusion and tissue oxygenation, has an anti-inflammatory action and locally applied, either as ozonized oil or in a bag, acts as a broad spectrum germicide.^{1,3-5}

Presentation of the case

This is a 48-year-old female patient, with a history of decompensated type 2 Diabetes Mellitus, of two years of evolution, in treatment with oral hypoglycemic agents.

Background: Ulcerative lesion in the right foot with necrosis of the 4th finger of 20 days of evolution with indication of supracondylar amputation of the right foot by osteomyelitis of the 4th metatarsus of the right foot visualized by Rx. The patient refused surgical management and sought a second opinion.

In the physical examination, a febrile patient was found, who babbles, confused, not well oriented in time or space, important pallor of the mucous membranes, dehydration and hippocratic facies, with vital signs: FC 102 beats / min, FR 21 breaths / min , temperature 38 ° C, TA 120/80 mmHg. Glucometry: 339 mg / dL (Fig 1).

In right lower limb: 4th finger necrosis with irregular ulceration that covers the entire back of the fistulated foot towards the plantar area and exit of foul-smelling purulent material. Intense pain on palpation Edematous foot and perilesional skin with inflammatory changes (edema, flushing and heat). Popliteal pulses, pedio and posterior tibial were present, but very weak, detected only by doppler.

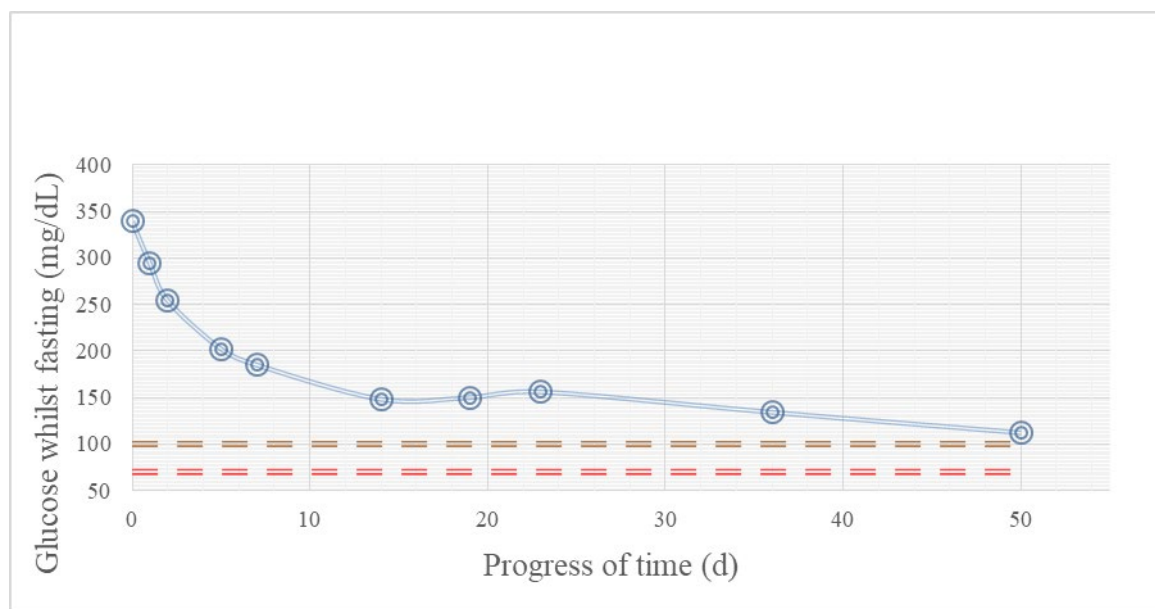


Figure 1. Evolution of blood glucose concentration. Values determined between March 1, 2017 to April 7, 2017. The red bar represents the minimum of the normal reference range 70 mg / dL and the brown bar the maximum of the normal reference range 100 mg / dL.

Using the classification of ulcers of Dr. Meggite Wagner which is based on the state of the lesion according to the severity and depth of the ulcer, the degree of the infection that presented, gangrene, is classified March 14, 2017 in the grade IV of Wagner.⁶

Method

Her closest relatives (brother and sister) signed the informed consent, as the patient was no in a condition of conscience to sign it.

Ozone therapy was applied by 2 ways using a generator Ozonobaric P (SEDECAL, Spain), with CE certification and classification IIb.

Systemic route: Ozonized saline solution at 5 µg / mL saturation concentration. The patient received 2 µg / mL. Number of sessions, twice a day, during the first 3 days.¹ Once stabilized the septic state, the sessions were spaced to a daily application and the concentration was reduced to 3 µg / mL saturation concentration. The patient received 0.8 µg / mL of concentration.

Local route: Jet wash with ozonated saline solution at high concentrations (80 µg / mL), thus guaranteeing the debridement of loosed necrotic tissue and purulent exudate. Afterwards, ozonization was performed in bag,¹ leaving a catheter in the fistula to guarantee the ozonization of the bone with osteomyelitis at a concentration of 80 µg / mL for 10 min. Frequency: twice a day. Finalizing the cure with 800 IP ozonated oil application soaking gauze in the oil.

Antibiotic therapy I.V. Ceftriaxone 2 g / day, for 7 days. After 14 days and under regional block, the 4th toe of the right foot was resected and the bag was ozonated immediately. After surgery, daily rectal ozone therapy was continued, which according to improvement was limited to 3 x week, dose: (1.5-2.5) mg. All the procedures were carried out according to the guidelines of the Madrid Declaration on Ozone Therapy (ISCO3, 2nd. ed., 2015). <https://aepromo.org/en/madrid-declaration-on-ozone-therapy-2nd-edition/>

Results

Infectious bone control with direct ozonization to the bone and bag in combination of systemic ozone therapy allowed the elimination and eradication of the infectious agent involved in the case, with negative culture, ending with the healing of the entire wound and the control of hers metabolic complications.



Picture 1
Initial state: Necrosis of the 4th
finger with irregular ulceration on
the back of the right foot.



Picture 2
Two weeks after the start of
treatment, the 4th toe of the right
foot was resected.



Picture 3
Two months after the start of
treatment.



Picture 4
Injury to the back of the right foot
after six months of treatment.

Discussion

Diabetic foot is the result of the interaction of systemic or predisposing factors, such as neuropathy, macroangiopathy and microangiopathy,^{1,4} on which external environmental factors or triggers such as lifestyle, local hygiene, inadequate footwear or others. It is a very common complication in patients with DM2, presenting clinical manifestations such as ulcers, infections, osteomyelitis and necrosis, which in most cases ends in amputation,^{5,7} which leads the patient to a psychosocial burden as it affects his style of life in general.

Changes in the lesion before and after the ozone therapy are shown, the evolution of the same reflects that ozone therapy at high doses in a septic state, have a germicidal effect and a stimulating effect in the release of growth factors which promote the tissue repair,^{3-5,7} findings that agree with what has already been reported in the literature by different researchers about the biological effects of ozone therapy on tissue protection in different pathological situations.

In this case of neuroinfectious diabetic foot treated with ozone, what was already described by the different authors about the effects of ozone therapy was appreciated as a complementary tool in the improvement of quality of life in patients with neuroinfectious diabetic foot.⁷

CONCLUSION

The use of ozone therapy in this case was effective and safe. The ozone therapy in this case was used as a first line treatment avoiding the imminent death of the patient (due to her septic general condition) and the supracondylar amputation in case of survival.

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