Ozone therapy in veterinary medicine – Literature review

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ABSTRACT

Ozone, in addition to being present in the stratosphere and contributing to the filtration of ultraviolet rays, has been studied for its use in medicinal purposes. This gas has high oxidizing power, bactericidal, fungicidal and viricidal properties. The application of medical ozone is among the most promising due to its low investment and maintenance costs, ease of application and clinical results. The objective of this study was to report and inform the efficiency of ozone therapy as an alternative protocol for several diseases in veterinary care.

Keywords: Ozone, Alternative methods, Ozone therapy.

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INTRODUCTION

Ozone (O3) is a colorless, unstable gas with a characteristic odor, composed of three oxygen atoms and being an allotropic form. It can be found in the stratosphere, where it has the function of filtering the ultraviolet (UV) rays released by the sun. It is formed when oxygen (O2) molecules break down, and the separated atoms individually establish bonds with other oxygen molecules (KIRCHHOFF, 1995).

In 1840, Christian Friedrich Schönbein, a German chemist, discovered, through a characteristic odor and observation, that when oxygen was subjected to an electrical discharge, a different smell was also produced, in which it was named *ozon*, from the Greek *ozein* (odor) (NOGALES *et al*., 2008).

In 1870, in Germany, the first O3 generators were studied for medicinal purposes for the "purification" of the blood. After 23 years, the first water treatment unit based on the application of O3 appeared, despite its name being negatively related, the name "ozonated oxygen" was instituted by Justus Von Liebig in 1935, to make it less offensive (ARAUJO, 2006).

With its discoveries and highly oxidizing properties, ozone has aroused great interest, being used for numerous purposes, such as in ischemic diseases, acute or chronic infections caused by microorganisms, macular degeneration and dental treatments (BOCCI, 2004).

In equine medicine, it has been reported to be used in the treatment of habronemosis, bursitis, ostoarthritis, tendinopathies, ischemic diseases, acute abdomen, otitis media, laminitis, wounds, analgesia, among others (PENIDO *et al*., 2010).

The objective of this study was to inform and update veterinarians on the main functions of ozone therapy.

LITERATURE REVIEW

ORIGIN AND FORMATION OF OZONE

Ozone, originated from the word *ozon*, from the Greek *ozein,* which comes to mean "odor, smell", appropriates the name because it has a characteristic refreshing smell, similar to the odor of the air after an electrical storm. It is blue when subjected to room temperature, and when assigned to disinfection processes, in the colorless presentation. In the aqueous phase, ozone degrades rapidly into oxygen (O2) and root species (Cardoso *et al*., 1999).

Naturally, O3 is produced when thunderstorms occur, and this is created when an O2 molecule receives a large electrical discharge, thus breaking down into two oxygen atoms (O + O). The individual atom reacts with O2 (O + O2), creating an O3 molecule (NOGALES *et al.,* 2008).

The ozone used in the therapy is manufactured from pure medical oxygen, as the concentration of oxygen in the earth varies according to altitude, temperature, and air pollution. In

addition, atmospheric oxygen could exhibit non-medical reactions, especially nitrogen dioxide (N2O2) (NOGALES *et al.,* 2008; BOCCI, 2004).

We can produce it, in addition to its natural forms of creation, through three ways by generating utility in medicine: a) Ultraviolet production system: produces low concentration of O3; b) Electrical discharge system: Produces high concentrations of O3. Oxygen is passed at high voltage (5-13mV), which results in the reaction 3O2 +68,400 cals = 2O3; c) Cold plasma production system: its function is only to purify water and air (BOCCI, 2004; NOGALES *et al.,* 2008).

The ozonated solution should be prepared as soon as it is requested to be used, as the O3 molecule is unstable and easily returns to the O2 form. The average life time is 40 minutes at temperature 20°C – 25°C. The rate of decomposition varies according to the ambient temperature (BOCCI, 2004; NOGALES *et al,* 2008).

MECHANISM OF ACTION

Cunha (2010) described that O3 is present in practically all living beings, due to countless biological substances that can react quickly with this gas. Preferably, this compound reacts with fatty acids, antioxidants and thiol compounds, knowing that it can also be related to carbohydrates, enzymes and genetic material of cells. O3 also helps the release of O2 from oxyhemoglobin, favoring tissue oxygenation and, thus, contributes to the cleaning of toxic cellular metabolites, in addition to acting as an immunomodulator (TRAINA, 2008; CUNHA 2010).

Its effects on the skin can be observed due to the reaction of O3 with water, present in the tissue, resulting in reactive oxygen species, such as hydrogen peroxide (H2O2), which are rapidly reduced to antioxidants, such as glutathione, superoxide dismutase, catalase, vitamin E, vitamin C, uric acid and ubiquinol (GARCIA *et al.,* 2005).

OZONIOTHERAPY

Ozone therapy is classified as the use of ozone as an active drug, and has been used in the treatment of a wide variety of diseases. Medical ozone is always a homogenization of ozone with oxygen, in quantities and concentrations that vary according to the disease to be treated. Reports that Cuba has used ozone in some patients for more than 22 years in the public health system (KORAD, 2008).

Its application is increasingly common, both due to its low cost of investment and maintenance, easy application and excellent clinical results. Ozone has been shown to be efficient in several circulatory and inflammatory diseases. Blood evidence at low concentrations helped to protect cells from oxidative stress (BOCCI, 2004).

Its administration, according to Bocci (2004), can be done by the following routes: intravenous, oral, urethral, interarterial, intramuscular, subcutaneous, rectal, small autohemotherapy, large autohemotherapy, interarticular, rectal and intramammary insufflation. Ozone gas, on the other hand, can be used in several ways, some of them being: topical, in the form of ozonated water, oil or even gas applied to the desired location in the form of "bags".

In veterinary medicine, ozone therapy emerged during the First World War, when Pelozzi used a mixture of O2 – O3 to disinfect a wound located on a horse's foot (BOCCI, 2004).

In horses, there are reports that its application in motor disorders, such as in the synovitis of the bursa of the navicular bone, in osteoarthritis of the distal interphalangeal joint, in tendinopathy at the site of insertion of the tendon of the deep digital flexor muscle, in the treatment of ischemic processes and in the reduction of the negative effects of aerobic-anaerobic metabolism under conditions of maximum effort in racing animals. There is already talk of its use as an alternative in the treatment of horses affected by acute abdomen, since biochemical priorities induce the modulation of antioxidant enzymes, which leads to a conservative effect of the gastrointestinal tract (HADDAD, 2009).

In the medical outpatient clinic, ozone therapy can be used in some procedures, such as conchectomies, return of anesthesia, trauma, non-parasitic gasta-enteric disorders, otitis media, pain reduction, as adjuvant therapy in laminitis, postpartum metritis, abscesses, sinusitis, synovial sepsis, tissue lesions and wounds (BOCCI, 2004; GARCIA *et al.,* 2008; VIGLINO, 2008).

In major autohemotherapy, which consists of the removal of blood from the patient, treatment of the blood with O3 and then infusion into the patient intravenously (IV). It is indicated for the treatment of arterial circulatory disorders, infections, rheumatic arthritis, immunostimulation and carcinoma treatment in geriatric patients (BOCCI, 2004).

With the same principle as major autohemotherapy, minor autohemotherapy consists of the reinfusion of intramuscular (MI) blood differentiated by the route of application. It is indicated for the treatment of allergies, furunculosis, and as an advisor in the treatment of cancer (NOGALES *et al.,* 2008). It is important to remember that during blood ozonation, the use of sodium citrate as an anticoagulant should be avoided, so that it does not break down calcium and interfere with electrical events.

Finally, the application of ozone therapy can be done topically, consisting of the use of a compress or plastic bag resistant to O3, and is used on external wounds as a bactericide, fungicide and virus inactivator (ARAUJO, 2006).

SIDE EFFECTS

The excess of O3 in mammals is harmful, and instead of therapeutic effects, it can cause damage to nucleic acids (VIGLINO, 2008). However, a study conducted by the Ministry of Health in Chile in 2006 did not mention any relevant adverse effects with the use of ozone therapy. The study also cited data collected through the report made by the *German Medical Society of Ozonetherapy* in 1980, where 385,000 patients were submitted to ozone and only 40 had adverse effects (ARAUJO, 2006).

The toxicity can damage the respiratory system and some side effects may be observed with use, such as irritation in epithelial tissue, rhinitis, migraines, nausea and vomiting, but these effects are reported in less than 0.0007% (NOGALES *et al*., 2008). The eyes are extremely sensitive to ozone, as they have a minimum amount of antioxidants and neutralizers, so they should never come into contact with the gas (BOCCI, 2004).

FINAL CONSIDERATIONS

Ozone therapy is an alternative to animal treatments that link the low cost of the procedure, easy application and excellent results according to the literature. For horses, it can be used in conditions that compromise the motor system; in the outpatient clinic, and can also be used in the hygiene and healing of wounds, due to its oxidative power (BOCCI, 2004; HADDAD, 2009).

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