Diabetic Foot: The Importance of Hyperbaric Oxygen Therapy in Patients with Serious Injuries

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ABSTRACT

This article aims to analyze the use of hyperbaric oxygen therapy in the treatment of complex wounds, such as diabetic foot. A bibliographic investigation was carried out in order to show some recognized alternatives for the treatment of serious lesions. It also addresses the effects of the hyperbaric chamber, as well as the performance of the professionals responsible for its monitoring. The results of this study show that even when it is a therapy that has not yet been studied and explored in the scientific field, hyperbaric oxygen therapy is still among the most viable treatment alternatives in cases of wounds that are difficult to heal.
Keywords: Hyperbaric Oxygenation, Hyperbaric Chamber, Diabetic Foot, Healing, Injury, Complex Wounds.

1. Introduction

Diabetes mellitus is among the main health problems in Brazil, and one of its main complications is related to a high rate of amputation in most patients, since it is capable of developing lesions that can occur jointly or isolated in the feet and lower limbs that are difficult to heal, better known as diabetic foot syndrome.

In turn, the treatment of complex wounds is considered a major challenge for health professionals, especially when the diseases that cause these injuries are aggravated over time. However, the evolution of some medical procedures have led to the emergence of alternative and quite effective therapies in the treatment of ulcerative lesions. Hyperbaric oxygen therapy is one of them, the therapeutic method that allows the inhalation of 100% pure oxygen through a hyperbaric chamber operated by health professionals, such as nurses and nursing technicians, is increasingly recommended and common among professionals specialized in hyperbaric medicine.

2. Treatment of diabetic foot

The number of diabetic patients is increasing every year in Brazil, such growth caused a high rate of amputation rate and consequently an increase in economic and social costs. Diabetic foot, one of the complications caused by diabetes mellitus, is considered the most common cause among long-term hospitalizations, the syndrome depicts deep cutaneous lesions with neuropathic, vascular and orthopedic alterations. The International Consensus on Diabetic Foot (2011) reports that the syndrome is still considered a major social and economic problem, due to prolonged hospitalization, rehabilitation, and a greater need for home care and social assistance.

Treatment of ulcerative lesions is costly, and wounds usually take from six to fourteen days on average to heal, although in cases of deeper infections and grangena, the solution is hospitalization and, consequently, a longer time to that the wounds can heal.

Diabetic foot lesions are easy to heal in most cases, when undergoing appropriate treatment (LEITE, 2010). Among the forms of treatment for foot ulcers, the use of therapeutic footwear, well hydrated feet, are efficient recommendations for patients suffering from severe injuries. However, prevention in an educational way is still considered the best way to prevent the onset of ulcerative wounds.

Treatment of diabetic foot starts from rigid glycemic control, LDL level and also blood pressure in cases
of painful neuropathic symptoms, duloxetine or pre-gabaline are medicated indicated for the relief of pain. However, patients with edema and liver disease are prohibited from using these medications.

Attention should be redoubled in cases of ulceration infection. The treatment used in this case concerns the debridement of the devitalized tissue which includes surrounding callus. This repetitive debridement together with meticulous care of the lesion and relief of ulcer pressure are considered essential in this recovery process. (INTERNATIONAL CONSENSUS ON DIABETIC FOOT, 2001, p.59).

In the case of superficial ulcers without residual ischemia, the treatment indicated may be on an outpatient basis, with repeated debridement and the use of oral antibiotics. Already in ulcers that delay healing in a period of two to four weeks, alternative therapies should be considered, as well as biomechanical surgical reconstruction in order to minimize the risk of ulceration. Therefore, diabetic patients should inspect their feet frequently, perform gentle cleaning of the affected area, and thus with such care, prevent the onset of diseases such as diabetic foot.

Over time, various forms of diabetic foot treatment were developed, among these forms, have gained scientific prominence, negative pressure therapy and hyperbaric oxygen therapy in the treatment of this syndrome.

The negative pressure stands out because it is a non-invasive therapy, which uses the method of exposing wounds to subatmospheric pressure. According to Lima (2017) such therapy would be performed through an interface material (foam or gauze), by means of which the subatmospheric pressure is applied and the exudate is removed. The material is in contact with the wound bed in order to cover its entire length, including tunnels and cavities. The TPN, as it is known, can be submitted to the patient both at home and hospitalized. The exchange of the dressings should be carried out between 48 hours and 72 hours, since this exchange time is exceeded, there is a huge risk of saturation of the foam and the gauze, which reduces drainage capacity and thus, the efficiency of the treatment.

Another method that still generates controversy for its treatment and that has positive effects and contraindications in certain diabetic patients, is hyperbaric oxygen therapy. It is believed that the emergence of therapy dating back to 1622 was created by the physician Henshaw, and later, it expanded in the nineteenth century with Junod (1834) and Pravaz (1837) when used in the treatment of various diseases. According to Andrade and Santos (2016), OHB consists of "administering an inspired fraction of oxygen close to one (pure or 100% oxygen) in an environment with a higher pressure (usually two to three times) at atmospheric pressure at sea level. This increase in pressure results in an increase in blood pressure and tissue oxygen (2000 mmHg and 400 mmHg, respectively), which is the basis of most of the physiological and therapeutic effects of this therapy."
Hyperbaric oxygen therapy provides several positive effects for the healing process. In Brazil, it was regulated in 1995 by the Brazilian Medical Council. Among the recommendations given for the use of this treatment, the monitoring of the hyperbaric chamber is carried out by the professionals specialized in the health area (nurses, nursing technicians) and everything followed according to the safety and quality guidelines of the Brazilian Society (SBMH) of Hyperbaric Medicine.

3. The hyperbaric chamber and complex wounds

In Brazil, the hyperbaric chamber was first used in 1930 on the supervision of Dr. Osório Augusto de Almeida, and after a few years, in 1986 the first HBO center of the country emerged.

The hyperbaric chambers may be single-chamber, where only one patient and the multipatient can accommodate several patients. The effect of the hyperbaric chamber allows the oxygen to dissolve about 17 times more in the plasma than under natural conditions and is still able to promote an increase in blood oxygen pressure by up to 22 times, diffusing this gas into denser tissues.

The protocol that governs the use of HBO is quite strict, since the therapy should not be indicated in cases of patients who have neurological syndromes or their sequelae. Clothing worn during sessions should be appropriate, no use of metals and electronic equipment, or any type of accessory inside the chambers. Another recommendation considered important is related to patient feeding, which in turn needs to be well fed so that it does not go bad during the hours inside the hyperbaric chamber.

In this way, oxygen therapy plays an important role in the treatment of wounds, as well as in the reduction of amputations caused by ulcerative lesions. OHB allows oxygen inhaled by patients during the sessions in the hyperbaric chamber to re-activate cellular and hormonal functions and provide an environment that can combat complex infections and wounds. The lack of oxygen in the body does not work as expected, is what occurs with wounds difficult to heal, because the tissue needs to have sufficient oxygen for the cells to function and especially the tissue recomposition.

Another important factor on hyperbaric oxygen therapy is related to restoration of organic defense and phagocytic capacity over some bacteria. The hyperbaric treatment promotes a hyperoxygenation of the tissues of the injured bodies, and thus the healing of the lesions occurs when the inhaled oxygen arrives through the bloodstream at the injured site.

Although OHB collaborates with several researches that seek to discover the treatment for serious and complex injuries, due to its positive effects, it is not free of contraindications. The use of hyperbaric oxygen therapy needs to be carefully evaluated, so the excess of hours in which the patient inhales oxygen during the sessions, essentially the variation of pressure inside the chamber, can cause the patient
to develop barotraumatic or tympanic lesions. In some patients, inhalation of hyperbaric oxygen can cause signs of cortical irritation and also oxidative stress (BARBOSA, ET. AL. 2010, p.629).

Patients submitted to HBV may also suffer from hyperbaric myopia, and seizures due to toxicity in the nervous system. In addition, there is evidence that patients with pulmonary emphysema exposed to hyperbaric treatment may develop hypertensive pneumothorax during decompression of the hyperbaric chamber.

Although OHB has its positive effects, it is still in the exploration phase, due to the results obtained during its use in patients. Treatment with complex wounds is considered a challenge for health professionals, particularly when it refers to difficult healing. HBOT stands out with the advancement of research as a complementary therapeutic method in the treatment of serious injuries.

4. The performance of nursing in hyperbaric chamber treatment

The safety and quality guidelines were the basis in 2003 for hyperbaric chambers to be operated by health professionals. The Brazilian Society of Hyperbaric Medicine made possible the standardization of work considered intellectual and manual by nurses and nursing technicians (ALCANTARA, ET. AL. 2010).

Health professionals need to be alert to the decision-making, management and coordination of their teams, so monitoring also requires greater technical difficulty and superior scientific knowledge. The training of these professionals is something that needs to be explored by the academy, the lack of training by higher courses, makes it impossible for technicians and nurses to have a greater contact with the practice in the use of therapy.

It was thinking about this difficulty that the Brazilian Navy pioneered the technicians and nurses, health professionals, to specialize in hyperbaric medicine in 2001, with the creation of the first special course of hyperbaric nursing in the country.

It is worth mentioning that the professionals responsible for the operations performed in the hyperbaric chambers should provide assistance to patients from the beginning of the procedure to the exit. It is necessary to pass information in an educative way, that can prepare the patient with regard to the recommended care in the therapeutic environment. In turn, the environment where the OHB is performed must always be clean, and have equipment, lighting and temperature always regulated.

The care with regard to the procedures adopted is something that is always highlighted in the literature, therefore the nurse or technician responsible for the camera in particular, must know how to control the dosages of oxygen inhalation so that it does not cause pulmonary toxicity in the patients. The role of the
The duly qualified nursing professional has a very important role in the use of oxygen therapy in the treatment of diabetic foot, since it is up to the health team to perform the observation of the patients, to monitor the patients' condition and to make the necessary interventions, has its role in the primary treatment providing easy-to-understand communicative means to the patient and secondary means of glycemic medication analyzing normal or abnormal parameters, always aiming to avoid complications. (SILVEIRA, ET. AL. 2016, p.195-196).

Humanization is another factor of professional responsibility, since it needs to stimulate and encourage its patients to perform the therapy, and that they can feel at ease, well treated, humanized in all the processes performed during the sessions in the therapeutic environment. In addition, humanization must also consider the valuation of professionals, with salaries that match their performance; with working conditions, since they are responsible for all monitoring steps of the hyperbaric chamber.

Final considerations

From the analysis of the use of HBOT in the field of medicine, it is noted that the use of this therapy in the treatment of complex wounds, such as diabetic foot, has been shown to be one of the most viable alternatives with positive results in relation to tissue healing patients.

Although hyperbaric oxygen therapy has demonstrated favorable effects in the therapeutic environment, therapy is not without contraindications, therefore there is little research on its use of HBOT in cases with complex wounds, and what it may cause over time with its sessions. It is known that there are problems that can be developed with the inhalation of a great quantity of oxygen, mainly with the variations of atmospheric pressure.

However, HBOT, even with side effects during procedures in the hyperbaric chamber, is still considered one of the most viable alternatives for the treatment of diabetic foot.

It is worth emphasizing that the health professional's performance in the operation of the hyperbaric chamber is extremely important. The technicians and nurses need a training demand to develop their work in a practical and educational way with the patients, equipment and resources used in the treatment.
References


