

## PATIENT TREATMENT CASE DESCRIPTION IN THE CENTRE FOR HYPERBARIC OXYGEN AND WOUND TREATMENT IN BYDGOSZCZ

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### ABSTRACT

This article presents a description of a case of a patient diagnosed with complicated inflammation of the tibia bone, who was treated hyperbarically, in order to underline the advantages of this method of treatment used not as an alternative to antibiotics and surgery, but as a supportive method.

**Key words:** hyperbaric oxygen therapy, bone fracture, skin infection, supportive treatment, bone and marrow inflammation.

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## INTRODUCTION

Ever since hyperbaric oxygen therapy has been recognised as a treatment method its popularity has grown throughout the various branches of medicine. It is focused not only on saving lives but also on supporting treatment of complicated diseases connected with long and multiple (recurrent) hospitalisations.

The advantages of hyperbaric oxygen therapy are connected with medical aspects such as aiding the recovery of an individual's health and saving lives, as well as economic aspects that allow for reductions of costs. Attempting to analyse the effectiveness of this method we have to be focused on advantages connected with reduction of technical, social and human costs.

In this piece of work, the case of a patient who suffered inflammation of the bone and marrow as a result of complications following orthopaedic surgery on the tibia is presented. The hyperbaric oxygen therapy was used as a supportive treatment with good results.

## HYPERBARIC OXYGEN THERAPY

Hyperbaric therapy may bring about beneficial therapeutic effects when it is accompanied by the administration of various breathing mixtures during the body's exposure to increased pressure.

Hyperbaric oxygen therapy is concerned with the influence of clean, 100% oxygen on the body during periods of exposure to increased atmospheric pressure. [1] Hyperbaric oxygen therapy is the administration of an increased amount of oxygen to damaged tissue and organs. In normobaric conditions, plasma transports as little as 0.003ml of oxygen per litre of blood, but during administration of 100% oxygen in a hyperbaric chamber this value increases to as much as 0.68ml [2].

Hyperbaric oxygen therapy is used as a basic form of treatment while dealing with some diseases, while being used as a supportive or alternative form of treatment with the majority of others [1].

The increased amount of oxygen in the tissue and organs of patients suffering from bone and medulla inflammation brings beneficial results. The increased amount of oxygen in the serum increases its availability to tissue and organs, particularly the ones with decreased perfusion.

Hyperbaric treatment decreases the area of damage as well as necrosis, stimulates the synthesis of collagen, while also having a bactericidal effect due to the formation of free radicals. Contraction of blood vessels takes place during therapy, which leads to reduced swelling as well as limited adhesion and degranulation of leukocytes.

## CASE DESCRIPTION

A patient aged 57 was directed to the Centre For Hyperbaric Oxygen and Wound Treatment due to inflammation of the tibia. In 2007, the patient underwent orthopaedic surgery for a left knee endoprosthesis implantation.

Since then, she underwent numerous surgeries because of inflammation in that region. In 2012, she underwent a left knee revision surgery, accompanied by arthrodesis of the joint with the use of an external apparatus, Synthes.

Since then, records indicate further stays in the orthopaedic clinic because of periarticular purulent inflammation with a leak caused by scar dehiscence on the front knee surface as well as in the stabiliser region.

After a subsequent stay at the orthopaedic clinic because of inflammation, the patient was directed to the Centre For Hyperbaric Oxygen and Wound Treatment in Bydgoszcz in order to be subjected to the therapeutic process of hyperbaric oxygen therapy.

After admission, the issues were found to relate to the external stabiliser of the left knee joint, accompanied by considerable deformation of the joint. Moreover, inflammation of soft tissue around the stabilizer with sero-purulent exudate was confirmed.



Fig. 1. Picture of the condition during admission. Source: personal materials.

In addition, arterial hypertension was confirmed during the examination. Due to strong pain syndromes (8 points on the NRS scale) the patient was chronically administering analgesic drugs - tramadol with paracetamol.

During tomography of the limb, near complete destruction of the joint with deformation of joint surfaces was confirmed. Bone marrow cavities of the femur and tibia

were 'open' equally at the residual articular gap level. Around the base of the tibia, an area of osteolytic lesions suggestive of inflammation was observed. Moreover, features of soft tissue inflammation were confirmed - without visible liquid gatherings.

During laboratory research, increased parameters of inflammation were recorded - CRP - 78.6 mg/l; OB 50.

During the inoculation of the wound swab as well as the stabiliser regions, *Staphylococcus aureus* was found to be sensitive to all antibiotics in the antibiogram, including amoxicillin with clavulanic acid and ciprofloxacin.

The patient was qualified for 60 sessions of hyperbaric therapy. The measurement of oxygen tensions in the skin (TcPO<sub>2</sub>) in the first week of therapy before hyperbaric chamber sessions was 28 mmHg. After the therapy, it was 52 mmHg.

No complications of hyperbaric oxygen therapy were recorded. Due to considerable amounts of exudate from the vicinity of the stabilizer, ciprofloxacin and later cloxacillin were included. The measurement of oxygen tension in the skin (TcPO<sub>2</sub>) in the last week of therapy was

31mmHg before and 60mmHg after oxygen therapy. The patient remained under close supervision of an orthopaedic specialist during the therapy.

The patient underwent 60 sessions and an analgesic effect was obtained (6 points in the NRS scale), as well as an improvement in the knee joint area, in particular

in the vicinity of the stabilizer. Decreased exude was also recorded, accompanied by improvements in the radiological result, which showed no signs of inflammation.

Unfortunately, after 3 months the patient was again admitted to the Centre. This time an abscess was diagnosed in the vicinity of the left knee joint. The leading doctor confirmed the admission of the patient for hyperbaric therapy post orthopaedic surgery - incision and evacuation of the pus. 30 hyperbaric oxygen sessions were prescribed to the patient.

The picture below shows the wound after the orthopaedic surgery of incision and evacuation of the pus. The wound was left open with the intention of closing it during hyperbaric therapy. Unfortunately, because of complications, pain syndromes increased (9 in the NRS scale) and were followed by administration of analgesic drugs, tramadol and paracetamol.



Fig. 2. The wound after the evacuation of the abscess. Source: personal materials.

During the stay in the Centre For Hyperbaric Oxygen and Wound Treatment, the patient, apart from receiving hyperbaric therapy, had her wound treated with the use of highly specialised bandages and dressings. After 10 HBOT sessions, the leading orthopaedist closed the wound with stitches.

After 28 sessions of hyperbaric oxygen therapy, the patient has concluded the therapy and remains under

the close supervision of the leading doctor. Significant improvement of the condition was noted and the radiological results were good enough for the orthopaedist to decide on removing the external stabilizer.

The left knee joint condition after two cycles of hyperbaric oxygen therapy is shown in picture 3.



Fig. 3. Picture of the condition after two cycles of hyperbaric therapy. Source: personal materials.

A small wound with a diameter of 1.5cm remained, with no exude or inflammation signs.

Eventually, the following results were obtained:

- no sign of bone inflammation, which enabled the removal of the stabilizer,
- a significant improvement of the joint condition with no signs of infection,
- significant decrease in pain syndromes (4 points in the NRS scale after the therapy).

## DISCUSSION

Osteitis and osteomyelitis are related to various degrees of disability caused by decreased mobility, pain and in consequence also isolation, fear and depression.

A long therapeutic process lasting often several months requires considerable financial investment. Hyperbaric oxygen therapy remains an important element supporting the treatment of infection – through the direct diminishment of anaerobes as well as the stimulation of bactericidal features of the white blood cells when dealing with aerobic bacteria.

The inclusion of hyperbaric oxygen therapy in the therapeutic process surely decreases the therapy duration and in many cases allows to protect the patient from complications such as amputation and disability.

It is important to underline that hyperbaric oxygen therapy is an assisting therapy and may not be used as an alternative for surgery or antibiotic therapy. Unfortunately, surgeons most often separate the core therapy from the assisting one, such as hyperbaric oxygen therapy.

The presented patient's case serves as a piece of evidence that a strict co-operation between the leading doctor and hyperbaric doctor leads to significant benefits.

After the abscess diagnosis in the knee region, the suggested treatment plan seems to be the optimal solution - administration of 10 sessions before orthopaedic surgery, delayed stitching of the wound and the continuation of hyperbaric treatment yielded a result in the form of substantial improvement of the condition, no signs of infection as well as decreased pain syndromes.

The patient was subjected to numerous orthopaedic surgeries for 8 years. This was associated with pain, disability as well as significant financial expenses. One can speculate that earlier inclusion of hyperbaric oxygen therapy could have decreased the therapeutic process.

Hyperbaric therapy influences the reduction of the number of amputations. It also increases survival rates, including long-lasting survivals.

There is not enough evidence which would allow to confirm or reject the benefits of using HBOT in the treatment of complicated bone fractures.

Research is being undertaken worldwide in order to assess the influence of hyperbaric oxygen therapy on the formation of bone union. [5,6,7].

Unfortunately, the number of results uniformly confirming the substantial role of hyperbaric oxygen therapy in the treatment of complications post orthopaedic surgeries as well as HBOT's influence on bone union formation is inadequate and requires the undertaking of further clinical research.

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