Case reports

The role of hyperbaric oxygen treatment in a case of pyomyositis

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Abstract

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Pyomyositis is a serious bacterial infection of the skeletal muscles, usually treated with antibiotics and surgical drainage. The success of medical or surgical treatment is often delayed or less effective when tissue hypoxia is present. Hyperbaric oxygen therapy (HBOT) is currently being studied as a helpful additional treatment for various conditions, especially those involving complications of tissue hypoxia. In this case report, we describe a 29-year-old male who developed chronic pyomyositis and a right lower leg ulcer after failure of multiple surgeries, including fasciotomy, debridements, skin grafts and antibiotics to treat compartment syndrome and tuberculosis of the right knee. HBOT was administered for 80 sessions at 243 kPa (2.4 atmospheres absolute) for 90 minutes. The patient showed significant clinical improvement, as evidenced by the development of healthy granulation tissue, reduction in swelling and discharge, and better mobility. This case highlights the potential of HBOT as an additional treatment option for complex soft tissue infections such as pyomyositis caused by tuberculosis, especially in cases where traditional treatments have been ineffective.

Introduction

Pyomyositis is conventionally characterised as a suppurative infection of the skeletal muscles, mainly observed in tropical climates.[1] The disease predominantly affects males and often presents with one or multiple intramuscular abscesses. The most common causative organism is *Staphylococcus aureus*, in up to 90% of cases of primary muscle abscess in tropical, and 70% in temperate areas. The complete pathogenesis of this dreaded infection is not completely understood. Treatment comprises systemic antibiotics and debridement and drainage of abscesses. In instances with massive inflammation, compromised perfusion, or in the presence of comorbidities, response to standard therapy is usually poor.[2–4]

Hyperbaric oxygen therapy (HBOT) involves breathing 100% oxygen under increased atmospheric pressure. It improves oxygen delivery to hypoxic tissues, enhances leukocyte function, and promotes wound healing. While well-documented for necrotising soft tissue infections, clostridial myositis, and myonecrosis,[5] HBOT is rarely reported in cases of pyomyositis. Here, we present a case of pyomyositis in the leg that was resistant to initial treatments and was successfully managed with the addition of adjuvant HBOT.

Case report

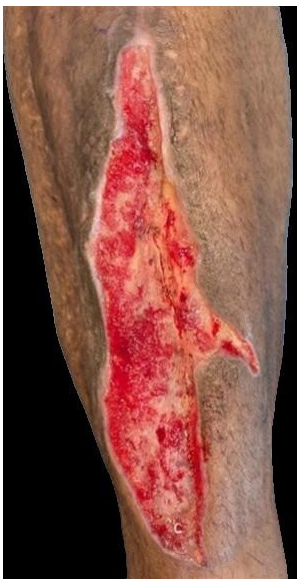
The patient provided written consent to publication of deidentified case details and images.

A 29-year-old male with a history of tuberculosis of the right knee and a previous episode of compartment syndrome in the right leg, for which he underwent fasciotomy, presented to our centre with a six-week history of intermittent high-grade fever, a non-healing ulcer, and swelling in the right leg.

The patient had previously undergone arthroscopic reconstruction of the right anterior cruciate ligament using a quadriceps tendon graft after an injury sustained during physical activity. He underwent multiple aspirations from the right knee due to recurrent swelling, which yielded sero-sanguinous fluid. He was also investigated for tuberculosis of the right knee with the interferon gamma release assay and the Mantoux test, which indicated the presence of *Mycobacterium tuberculosis*. The patient completed an 18-month course of anti-tubercular therapy, however, during treatment he developed compartment syndrome in the right leg and required emergency fasciotomy. Wound debridements and vacuum-assisted closures, along with secondary suturing of fasciotomy sites, were performed over

Figure 1
Wound prior to hyperbaric oxygen therapy

Figure 2
Wound after 40 sessions of hyperbaric oxygen therapy



multiple sessions before discharge. A month later, the patient returned with wound dehiscence and serous discharge; again, he was managed conservatively with intravenous antibiotics and saline dressings. However, the wound evolved into a non-healing ulcer over the surgical scar, requiring grafting and reconstruction (Figure 1). Radiological investigation with contrast-enhanced magnetic resonance imaging (MRI) of the right lower limb revealed intramuscular collection involving tibialis anterior muscle and extending along the interfascial plane. There was an increase in intramuscular oedema within the fibres of the tibialis anterior muscle and the extensor digitorum longus muscle, with an increase in subcutaneous oedema along the anterior aspect of the right leg.

At this juncture, the patient was referred to our HBOT centre and found to be fit to undergo treatment. He underwent 40 sessions at 243 kPa (2.4 atmospheres absolute) for 90 minutes with two air breaks, six days a week, without interruption. Progressive clinical improvement was noticed with reduction of peri-wound oedema, healthy wound base and starting of granulation tissue formation on the extensive raw area of the wound (Figure 2). A repeat contrast-enhanced MRI of the right leg revealed significant reduction of previously noted intramuscular abscesses with features of likely residual myositis in the anterolateral group of leg muscles.

Once a healthy wound base had formed, split-thickness skin grafting was completed (Figure 3). After surgery, he underwent 40 more sessions of HBOT with similar regimen. Adequate healing of the wound was achieved (Figure 4), and the patient was discharged home with advice to follow up after a month.

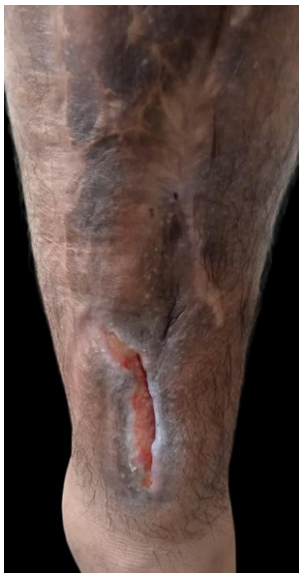
Discussion

Pyomyositis is an infection of the skeletal muscles caused by bacteria, most commonly *Staphylococcus aureus*. It usually affects large muscle groups that are typically resistant to bacterial invasion.[6,7] The etiology and pathogenesis are not fully understood, but the literature describes several known factors, including geographic prevalence, trauma, nutritional deficiencies, and infections. This disease primarily arises in tropical climates, but cases in temperate regions are also reported, often alongside other comorbidities and infections. This disease typically affects large muscles, leading to limitations in physical activity. Commonly involved muscles include the quadriceps, glutei, pectoralis major, serratus anterior, biceps, iliopsoas, gastrocnemius, as well as abdominal and spinal muscles.[4,8] Primary pyomyositis is classified into three stages based on the symptomatology. Stage I, also known as the invasive phase, is characterised by intermittent low-grade fever, localised pain, and swelling. This stage is frequently misdiagnosed as pyomyositis due to its variable symptoms and may resolve on its own without progressing to the next stage. Stage II, also known as the suppurative phase, is the most common stage where this entity is diagnosed. High-grade fever, swelling, and localised muscle pain, as well as systemic symptoms, are more evident and severe, and pus is found in needle aspiration at this stage. Stage III, also known as the late phase, occurs when pyomyositis disseminates from the local site and begins to involve distant organs. This stage is often characterised by signs of septicaemia and shock.[4,9]

Atypical presentation and a wide range of differential diagnoses make early diagnosis, crucial for controlling the spread of this disease, difficult. Laboratory investigations can assist in diagnosis, especially when there is a strong clinical

Figure 3
Wound after split- thickness skin grafting

Figure 4
Wound after 80 sessions of hyperbaric oxygen therapy at the time of discharge from hospital



suspicion. Leukocytosis with a left shift, and with elevated chronic inflammation markers, can occur in advanced stages. Imaging studies, such as local ultrasound, can identify the site and extent of oedema for aspiration. In most cases, MRI is a more effective imaging modality for diagnosing this condition.[10] Treatment of pyomyositis involves the use of antibiotics, wound debridement, and removal of any secondary causes. In the early stage, this approach is effective, but in advanced stages of the disease, recovery becomes difficult, making the condition more severe.[11,12]

HBOT is an adjunctive therapy used in various diseases and is beneficial for some surgical conditions, such as non-healing ulcers, problem wounds with arterial insufficiencies, as well as conditions like clostridial myositis, myonecrosis, necrotising soft tissue injuries, and gangrene.[5] Increasing oxygen at the cellular level causes vasoconstriction and can help reduce oedema. As oedema decreases, blood circulation improves.[13] The rise in oxygen levels at the wound site caused by HBOT interrupts the cascade of events initiated by inflammation and pus formation, along with a significant decrease in β_2 integrin expression on neutrophils, which further accelerates the healing.[14–17] The neovasculogenesis effect drives the growth of capillaries and blood vessels in the wound core, where ischaemia and necrosis have damaged the local blood supply.[18] The side effects associated with it, although relatively rare, include barotrauma, which is the most common, as well as other conditions such as acute oxygen toxicity, claustrophobia, pulmonary oxygen toxicity, and myopia or cataract formation.[19]

LIMITATIONS

Measuring transcutaneous oxygen pressure ($TcPO_2$) of the wound would have quantified the degree of tissue hypoxia and may have assisted in determining an objective end-point for HBOT.

Conclusions

Strong suspicion, early diagnosis, and prompt treatment are vital in managing pyomyositis cases. A multidisciplinary approach is necessary for advanced stages, and HBOT may be beneficial in such situations.

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