Case Report

GOAP Dermatology

Hyperbaric Oxygen in Intractable Psoriatic Leg Ulcer: Case Report and Literature Review

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Abstract

Psoriasis is a chronic, remitting and relapsing, immune-mediated inflammatory skin disorder with a strong genetic predisposition. It is also associated with other serious health conditions, such as diabetes, heart disease and depression. The high morbidity in patients with psoriasis results from severe clinical manifestations and/or adverse effects of treatment. The Undersea and Hyperbaric Medical Society and Federal Medicare and Medicaid Services have approved the use of hyperbaric oxygen for more than 15 indications, including wound healing, infections and late effects of radiation, which are largely unresponsive to conventional treatments. In the literature data have been reported showing that the hyperbaric oxygen has anti-inflammatory effects and other positive influences on the immune system, laying the foundations for the rationale of psoriatic cutaneous wound treatment with hyperbaric oxygen therapy. Here we present the case of a patient with intractable psoriatic leg ulcer, and failure of the conventional therapy. Interestingly he exhibited a marked improvement and a complete “restitutio ad integrum” with the use of hyperbaric oxygen. No adverse effects were identified. The hyperbaric oxygen therapy may possess potential therapeutic efficacy in the management of psoriatic ulcers. We hope, for the near future, that this will provide a basis for elucidating the mechanisms of action and consequently paving the way for further and larger controlled studies.

Keywords: Hyperbaric oxygen, Psoriasis, Leg ulcer, Unconventional therapy

Introduction

Psoriasis is a chronic, remitting and relapsing, immune-mediated inflammatory skin disorder with a strong genetic predisposition related to the genes HLA-CW6 and HLA-DR7 that causes raised, red, scaly patches to appear on the skin. It typically affects the outside of the elbows, knees or scalp, though it can appear on any location. Some people report that psoriasis is itchy, burns and stings. It is also associated with other serious health conditions, such as diabetes, heart disease and depression. It often appears between the ages of 15 and 25, but can develop at any age. It is among the most common immune-mediated diseases in humans, affecting 2-3% of the world population according to the World Psoriasis Day Consortium and it has significant social and economic impact. Current topical therapies used to manage psoriasis include steroids, vitamin D derivatives, retinoids, immunosuppressants, anthralin, coal tar ointment, and several other agents [1-5]. These drugs often have adverse effects that may be poorly tolerated. Light therapy includes ultraviolet B phototherapy or psoralen and ultraviolet A photochemotherapy (PUVA). However, increased rates of non-melanoma skin cancer have been observed following PUVA therapy. Systemic therapies for psoriasis include methotrexate, cyclosporine, oral retinoids, and biologic therapies [6]. Ulcers in patients with psoriasis heal more difficultly due to the underlying psoriatic inflammatory tissue.

Hyperbaric oxygen therapy (HBOT) is defined as breathing pure (100%) oxygen under conditions of increased atmospheric pressure. This results in elevated arterial oxygen tension to 2,000 mmHg or greater,
which provides tissues with abundant oxygen. Possible complications of the HBOT include barotrauma, oxygen toxicity (affecting the central nervous system and lungs), claustrophobia and anxiety, and ocular effects such as myopia and cataract. HBOT promotes proliferation of fibroblasts, epithelial cells, and blood vessels in a wound. It can increase the killing ability of leukocytes and is lethal to certain anaerobic bacteria. Furthermore, it inhibits toxin formation by certain anaerobes, increases the flexibility of red cells, reduces tissue edema, and conserves intracellular adenosine triphosphate (ATP).

The Undersea and Hyperbaric Medical Society and the Federal Center for Medicare and Medicaid Services have approved the use of HBOT in 14 indications including gas gangrene, necrotizing soft tissue infections, diabetic foot ulcer, compromised grafts and flaps, bone infection, intracranial abscess, anemia and blood loss, crush injury, carbon monoxide and cyanide poisoning, radiation complications, decompression sickness, and gas embolism. HBOT has potential effects on mediators of inflammation and the immune response. Many recent reviews [7-9] support the contention that HBOT has anti-inflammatory and immune-modulating properties. These features make this treatment a potentially useful intervention that should be tested in the management of psoriasis and psoriatic ulcers.

### Case Report

Here we present the case of a 65-year-old male patient suffering from severe psoriasis (more than 10 percent of the body surface) and affected with a painful psoriatic leg ulcer non-responsive for conventional therapies (Figure 1).

![Figure 1: Before HBOT.](image1)

After careful cleaning of the ulcer, we noticed granulation tissue on the bottom; the margins of the lesion presented erythematosis and frankly inflamed. A topical therapy of corticosteroids and antibiotics was then applied, associated with systemic administration of oral antibiotics in order to avoid bacterial superinfection: Azithromycin 500 mg/day orally for 3 days; topical application of Triamcinolone and Clortetracycline (Aureocort Crema®) and coverage with fat dressing with Chlorhexidine acetate 0.5% (Bactigras®), as you can see in Figure 2. It was then proceeded to associate 20 cycles of HBOT of 60 minutes at 2.8 atm. At the end of the combined treatment with topical therapy associated to HBOT, the patient achieved a complete «restitutio ad integrum» of the affected skin (Figures 3 and 4) and the resolution of signs and symptoms. A written informed consent was obtained for this publication.

![Figure 2: Application of topical therapy.](image2)

![Figure 3: End of HBOT.](image3)
Figure 4: restitutio ad integrum.

Discussion

The result presented here demonstrates the complete wound healing. No adverse effects were reported during or after treatment with HBOT. Leukocytes, cytokines, and keratinocyte growth or differentiation abnormalities are involved in psoriatic skin lesions. Psoriasis vulgaris is a T-cell driven disease, with type I (interferon-γ-producing) T-cells predominating in skin lesions. A lymphocytic infiltrate in psoriatic plaques consists of a mixture of activated CD4+ and CD8+ T cells; the latter predominate in lesional epidermis and CD4+ cells in the dermis. The therapeutic benefit of immunosuppressive drugs supports the view that activated T-cells are pathogenic effectors of psoriasis. Dendritic cells are found in psoriatic skin lesions, producing interleukin (IL)-12 and IL-23. Cytokine changes in psoriatic lesions consist of elevated levels of interferon-γ, tumor necrosis factor (TNF)-α, numerous interleukins (such as IL-1, IL-2, IL-6, IL-8, IL-12, IL-17, and IL-19), and multiple chemokines (MIG/CXCL9, IP-10/CXCL10, I-TAC/CXCL11, and MIP3α/CCL20). IL-12 p40 mRNA and expression of interferon-γ, inducible nitric oxide synthase, B7-1, and TNF-α are elevated in psoriatic tissue. HBOT also intensifies the suppressive function of T-lymphocytes, normalizes cell-bound immunity, and decreases the serum concentration in immune complexes. Its immunosuppressive effects include suppression of autoimmune symptoms, decreased production of IL-1 and CD4+ cells, and increased percentage and absolute number of CD8+ cells. In addition, longterm HBOT exposure suppresses development of autoimmune symptoms such as proteinuria, facial erythema, and lymphadenopathy. HBOT decreases the CD4/CD8 ratio and proliferation of Figure 3 and Figure 4 lymphocytes, and activates neutrophils to migrate to regions of high oxygen tension. Furthermore it suppresses TNF-α production induced by lipopolysaccharide, lipid A and phytohemagglutinin A [10-13]. A marked decrease in IL-1 and IL-2 production, and a significant decrease in prostaglandin E2 production have been observed.

The positive clinical effects that HBOT has in the treatment of chronic inflammation may relate to its effects on secretion of IL-1, IL-6, and TNF-α. The effects on prostaglandin, nitric oxide, and cytokines involved in wound pathophysiology and inflammation in particular were recently reviewed [7-9]. In this reviews it is evident that it has important effects on the biology of cytokines and other mediators of inflammation. It causes downregulation of cytokines and upregulation of growth factors. It transiently suppresses stimulus-induced pro-inflammatory cytokine production and affects the liberation of TNF-α and endothelins. Vascular endothelial growth factor levels are significantly increased with HBOT, whereas levels of prostaglandin E2 and cyclooxygenase-2 mRNA are markedly reduced. Therefore, the anti-inflammatory and immunosuppressive properties of HBOT might account for its efficacy in the case presented here.

Conclusions

Our case report, although suggestive, do not allow one to conclude that HBOT treatment is certainly useful in the treatment of psoriasis, because this condition can improve spontaneously. We emphasize that the findings presented here require confirmation by further controlled studies before a definitive conclusion may be drawn. We hope that our findings will also stimulate further investigation of the therapeutic potential of HBOT alone or in combination with other modalities in psoriasis. HBOT may have a place, in future, in the management of this complex disease. Further studies including large numbers of patients and involving monitoring cytokines and inflammatory mediators will help us to explore the effect of hyperoxygenation on psoriasis and to elucidate its several mechanisms of action.

Declarations

Authors have neither funding nor conflict of interest to declare. A written informed consent was obtained from the patient for this publication. All authors have contributed significantly and approve the final form of the manuscript for publication.

References


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