

## Case Report

# Hyperbaric oxygen therapy as an adjunctive treatment for pyoderma gangrenosum: a case report

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## ABSTRACT

Pyoderma gangrenosum is an uncommon inflammatory dermatosis associated with chronic wounds. Diagnosis and management can be challenging to clinicians due to the relapsing nature of the disorder, atypical presentations, and exclusion of other conditions before diagnosis. Hyperbaric oxygen therapy is not a mainstay of treatment for pyoderma gangrenosum, but it is used for non-healing wounds associated with diabetes and vascular insufficiency due to its primary mechanism of tissue hyperoxia, resultant angiogenesis, and reduction of edema and inflammation. This case report presents two patients with pyoderma gangrenosum who were provided adjunctive therapy with hyperbaric oxygen with favorable outcomes.

**Keywords:** Pyoderma gangrenosum, Hyperbaric oxygen therapy, Hyperbaric oxygenation, Refractory wounds

## INTRODUCTION

Pyoderma gangrenosum is an uncommon dermatosis that can present diagnostic and treatment challenges for clinicians. The pathophysiology of the disorder is unclear, but it presents as a neutrophilic inflammatory disorder and has been associated with other systemic inflammatory diseases, like inflammatory bowel and arthritic diseases.<sup>1</sup> Cutaneous presentations typically start as a lower extremity painful, tender papule, pustule, or vesicle that rapidly progresses to a larger ulcerative wound. Traditional therapy includes steroids, nonsteroidals like cyclosporine, and synthetic wound dressings. Additional agents like immunoglobulins and biologics can be used as well.<sup>1</sup> Surgical evaluation and debridement are a mainstay of chronic wound care but surgery is typically avoided in pyoderma gangrenosum due to the possibility of worsening the ulcers or creating new ones due to pathergy. Untreated the affected areas can expand and persist leading to debilitating pain for some patients.<sup>2</sup> Hyperbaric oxygen therapy is an

adjunctive therapy option for patients with pyoderma gangrenosum who fail to heal despite traditional wound therapy. The following is a presentation of two patients with pyoderma gangrenosum who received hyperbaric oxygen therapy with successful outcomes.

## CASE REPORT

Two patients were treated in an outpatient hyperbaric oxygen therapy facility with pyoderma gangrenosum. The first patient was a 68-year-old diabetic female that was not referred to the hyperbaric center initially for the pyoderma gangrenosum. She was referred for hyperbaric oxygen treatment to treat her chronic osteomyelitis of her left shin. Her pre-existing medical conditions included type-2 diabetes, hypertension, depression, chronic back pain, and osteoarthritis. Prior to consultation, she had been previously hospitalized to treat her leg wound and expanding cellulitis that progressed to magnetic resonance imaging (MRI)-confirmed osteomyelitis. The chronic wound was located on her left lower leg, had

been present for approximately one year, and measured 15×17×0.5 cm. The wound was extensive and deep enough to expose the underlying tendon sheath. She had the wound debrided multiple times and taken oral antibiotics with limited success.

At time of consultation, the patient was experiencing severe pain in the leg that was made worse with ambulation and required her to use a wheelchair at times. The patient was under the care of her primary care provider, and rheumatology, vascular and dermatology physicians. A biopsy was performed, and she received a diagnosis of pyoderma gangrenosum. Her medical treatment plan was switched to treat the pyoderma gangrenosum and cyclosporine and oral prednisone were initiated. Other medications she was taking included glipizide, effexor, trazodone, metoprolol, and oxycodone.

After consultation, the patient began hyperbaric oxygen therapy for 90-minute sessions with three five-minute air breaks at 2.4 ATA for 40 sessions. The goals of therapy were defined as to promote healing of the wound and osteomyelitis, to improve quality of life by reducing the patient's pain, and to improve ambulation. The patient had a good response to therapy and was extended to an additional 20 sessions, for a total of 60 hyperbaric oxygen therapy sessions in total. Measurements and photography were utilized to monitor progress. At conclusion of therapy the wound achieved greater than 50% closure. At one-year follow-up the patient had only a 2 cm in diameter wound that was being maintained on cyclosporine. Patient reported no pain in the area, was no longer using pain medications, and had no difficulty with ambulation.



**Figure 1: First patient with pyoderma gangrenosum of the lower extremity (a) before hyperbaric oxygen treatment, and (b) after hyperbaric oxygen treatment.**

The second patient was a 55-year-old male with a 20-year history of chronic bilateral, lower extremity ulcer. He had a recurrence of painful bilateral ankle wounds three years prior to consultation. Prior care for the wounds included multiple vascular studies, multiple split thickness skin grafts, skin substitutes and compression bandaging, and multiple episodes of antibiotics usage. Even after these

treatments, a wound by his left lateral malleolus persisted which led to necrotizing vasculitis and a referral for hyperbaric oxygen therapy. At time of consultation, he was under the care of his primary care provider, and rheumatology, vascular, infectious disease, and wound care physicians. He had received a diagnosis of pyoderma gangrenosum 1 year prior to the consultation. His medical history included thalassemia and he was prescribed colchicine, aspirin, vitamin D, folic acid, and silvadene and collagenase topicals. The persistent wound was by his left lateral malleolus and measured 6.3×2.3×0.8 cm with pink granulation tissue lining the wound and there was necrotic and devitalized tissue estimated to be present in most of the ulcer bed with an exposed tendon.

After consultation, the patient began hyperbaric oxygen therapy for 90-minute sessions with three five-minute air breaks at 2.4 ATA for 40 sessions. Goals of therapy were to promote wound healing and avoid the need for additional skin grafts, and to improve quality of life by reducing the patient's pain. After 20 sessions, the patient reported feeling improvement with less pain and swelling. At the conclusion of 50 sessions, his wound reduced significantly in size to 3.2×1.0 cm (Figure 1) with minimal depth to the wound and he was back to work as a high school teacher and able to restart hiking.



**Figure 2: Second patient with pyoderma gangrenosum of the lower extremity, (a) before hyperbaric oxygen treatment, and (b) after hyperbaric oxygen treatment.**

## DISCUSSION

Pyoderma gangrenosum is a chronic condition characterized by single or multiple painful ulcerations of the skin, predominantly located on the lower extremities. The condition is linked to certain systemic inflammatory, hematologic, and rheumatologic disorders, like inflammatory bowel disease and rheumatoid disease.<sup>3</sup> There is a female predominance. The etiology has been associated with immune dysregulation resulting in an accumulation of neutrophils in the skin and cytokine overexpression.<sup>4,5</sup> The goals of treatment are to optimize the wound healing environment by suppressing the dysregulated inflammatory response. Current treatment options for pyoderma gangrenosum include focused

wound care, the use of tacrolimus, and prolonged systemic corticosteroids or other immunosuppressants. Other immunomodulatory drugs like tumor necrosis factor-alpha inhibitor infliximab are treatment options, but are costly.<sup>3,6</sup> Hyperbaric oxygen therapy is a safe and cost-effective therapy option for certain refractory wounds. Tissue hyperoxygenation results in increased collagen production, angiogenesis, and is considered immunosuppressive by impairing macrophage function.<sup>5</sup> Hyperbaric oxygen therapy has been well established in the treatment of select problem wounds, compromised grafts and flaps, and refractory osteomyelitis.<sup>7</sup>

The two cases presented had different pathways to initiating hyperbaric oxygen therapy. One patient was directly referred for adjunctive treatment, and one patient received a diagnosis of pyoderma gangrenosum after consultation for chronic osteomyelitis. Both patients had large lower extremity painful wounds that were actively being treated with conventional treatments at the initiation of hyperbaric oxygen sessions. With the supplementation with hyperbaric oxygen and optimization of the wound healing environment, the patients met their treatment goals.

## CONCLUSION

Caring for wounds associated with pyoderma gangrenosum can be challenging and adjunctive therapy with hyperbaric oxygen therapy may be an option for wounds that are not responsive to traditional therapy. The two patients that received hyperbaric oxygen therapy as part of their interdisciplinary care had favorable outcomes in the healing of their wounds. More research to address the value and efficacy of hyperbaric oxygen therapy's role in the treatment of pyoderma gangrenosum is suggested.

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