Case Report

Ischemic Scleroderma Wounds Successfully Treated with Hyperbaric Oxygen Therapy

Y. MICHAEL MARKUS, MARY J. BELL, and A. WAYNE EVANS

ABSTRACT. Hyperbaric oxygen therapy (HBOT) has been used to treat refractory wounds for the last several decades, with the majority of research focusing on wounds secondary to arterial insufficiency. We describe 2 patients with scleroderma with intractable bilateral extremity ulcers. Local ischemia was identified using transcutaneous oximetry. Each patient then underwent 30 treatments of HBOT at a relative depth of 2.4 ATA with resulting wound healing. This is the first reported successful use of HBOT to treat scleroderma ulcers, and may represent an unrecognized treatment option for these notoriously difficult chronic wounds. (J Rheumatol 2006;33:1694–6)

Key Indexing Terms:
DIFFUSE SCLERODERMA
HYPERBARIC OXYGENATION
LIMITED SCLERODERMA
WOUND HEALING

Scleroderma presents a unique challenge to wound care practitioners, as the ulcers that can develop are multifactorial, and often refractory to traditional wound care management techniques. Cutaneous manifestations of the disease include both digital ulcers that result from progressive Raynaud's phenomenon, as well as extremity ulcers, usually found on bony prominences such as the olecranon, malleolus, and calcaneus[1]. Scleroderma ulcers differ pathophysiologically from other ischemic ulcers, in that patients with scleroderma are prone to vasospastic episodes, which are more common in the digital vasculature, but can affect larger vessels of the upper and lower limbs.

Hyperbaric oxygen therapy (HBOT) has been used successfully to treat chronic non-healing ulcers since the 1960s[2,3]. Non-healing ulcers of differing etiologies tend to share a final common pathway that is tissue hypoxia, usually related to impaired local circulation. The benefit of HBOT results from significant elevations in oxygen tension in the damaged tissues to promote angiogenesis and wound healing. Studies have shown that in conjunction with proper wound care, it can be a valuable therapeutic tool. We discuss 2 cases of intractable ulcers secondary to scleroderma that illustrate wound healability based on transcutaneous oximetry measurements. The patients were started on a 30-treatment course of HBOT with positive treatment outcomes in formerly intractable wounds. This is the first reported successful use of HBOT to treat locally ischemic scleroderma ulcers.

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CASE REPORTS

Case 1. A 37-year-old man initially presented with early manifestations of scleroderma in 1986 with diffuse truncal skin tightening. He later developed trophic ulcers of the fingertips that progressed to chronic infections from severe Raynaud's disease, resorption of the tufts of the 2nd and 3rd digits bilaterally, and pulmonary disease. Serology confirmed antinuclear antibody positivity with a nucleolar homogenous pattern at a titer of 1/320, and SCL-70 positivity. The patient had recurrent ulceration over the medial malleoli bilaterally (Figure 1), which was initially treated conservatively with dressings and intra-site gel. This technique was employed with only limited success over a period of at least 10 years. In March of 2002, following referral by his primary rheumatologist, the patient elected to undergo treatment with HBOT.

The initial HBOT consultation consisted of determining this patient's healability using transcutaneous oxygen measurement ($TcpO_2$). The ulcers were noted to involve tissue overlying the medial malleolus bilaterally, measuring 10 mm × 15 mm on the right ankle, and 55 mm × 35 mm on the left ankle. Oximeter leads were placed on the dorsal surfaces of the patient's feet bilaterally in order to measure the $TcpO_2$ distal to the ulcers on the malleoli, and the results confirmed that this patient was an appropriate candidate for HBOT. Treatments involved compression to a maximum depth of 2.4 ATA in a monoplace chamber for 90 minutes. This was carried out 5 days per week for 6 weeks. Followup $TcpO_2$ at 4 months showed increased perfusion to the distal extremities. There were no complications associated with the treatment regimen of 2655 minutes of hyperbaric oxygen therapy. The wounds had completely healed, and 6 months post-consultation, there was no evidence of ulcer recurrence.

Case 2. A 41-year-old woman initially presented in the mid-1980s with joint symptoms and was subsequently diagnosed with an overlapping syndrome of systemic lupus erythematosus (SLE) and limited scleroderma. She had skin

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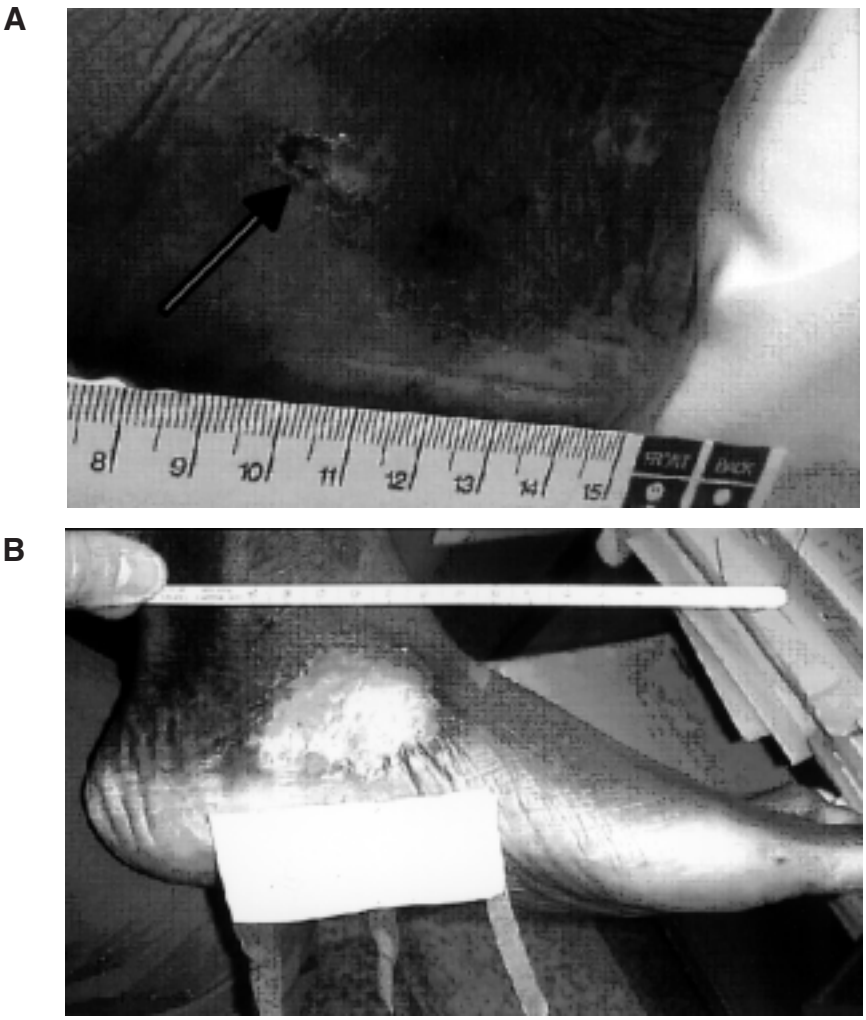

Figure 1. Case 1. Site of ulceration over the right medial malleolus (A); left medial malleolus (B).

tightness of the distal extremities and face, and investigations revealed mild interstitial lung disease and anti-centromere antibody positivity. There was recurrent ulceration to the tips of the 2nd and 3rd digits of her right hand, and the tip of the 3rd digit of her left hand (Figure 2A). Previous wound care included repeated hospital admissions for intravenous (IV) antibiotics and IV prostacyclin, as well as use of multiple oral and topical vasodilators.

During the preliminary HBOT consultation, we determined healability of the patient's digital ulcers, using transcutaneous oximetry by placing the oximeter leads over the dorsal surfaces of the patient's hands. The ulcers were noted to be located on right 3rd digit and left 3rd digit, measuring 11 mm × 7 mm and 11.5 mm × 11 mm, respectively. The patient underwent a series of 30 compressions as described in Case 1. Adverse effects experienced were minor, including only mild initial unilateral otic barotrauma. Following completion of the HBOT, there was total resolution of the wound on the right 3rd digit, and wound attenuation to 4 mm × 4 mm on the left 3rd digit (Figure 2B). Six months post-consultation, there was no recurrence of ulceration to the right 3rd digit, although she continued to have ulceration on the left 3rd fingertip. Followup $TcpO_2$ at 6 months showed increased perfusion to the distal extremity bilaterally.

DISCUSSION

There have been many reported cases of the utility of HBOT for wound healing over the last several decades. Furthermore, randomized control trials have documented the utility of HBOT to improve wound healing in ulcers both of diabetic and non-diabetic etiology[5-7]. There are no reported cases of scleroderma ulcers treated successfully with HBOT. Traditional treatment of ulcers related to systemic scleroderma is generally multi-disciplinary. Often recalcitrant ulcers are treated with a combination of antibiotics, calcium channel blockers, and occasionally a short course of intravenous prostacyclin, combined with local wound care measures such as dressing changes, topical antimicrobial preparations and debridement. In severe cases, below-knee amputation[8] may be necessary. Most of these approaches are supported by minimal evidence. Our case series shows the potential utility of HBOT for scleroderma ulcers by illustrating ulcer healing in 2 patients with scleroderma. There was clear evidence in both patients of reduction in wound size by measurement, increased perfusion by $TcpO_2$, and reduced pain. Moreover, because our patients differed in scleroderma variants and ulcer

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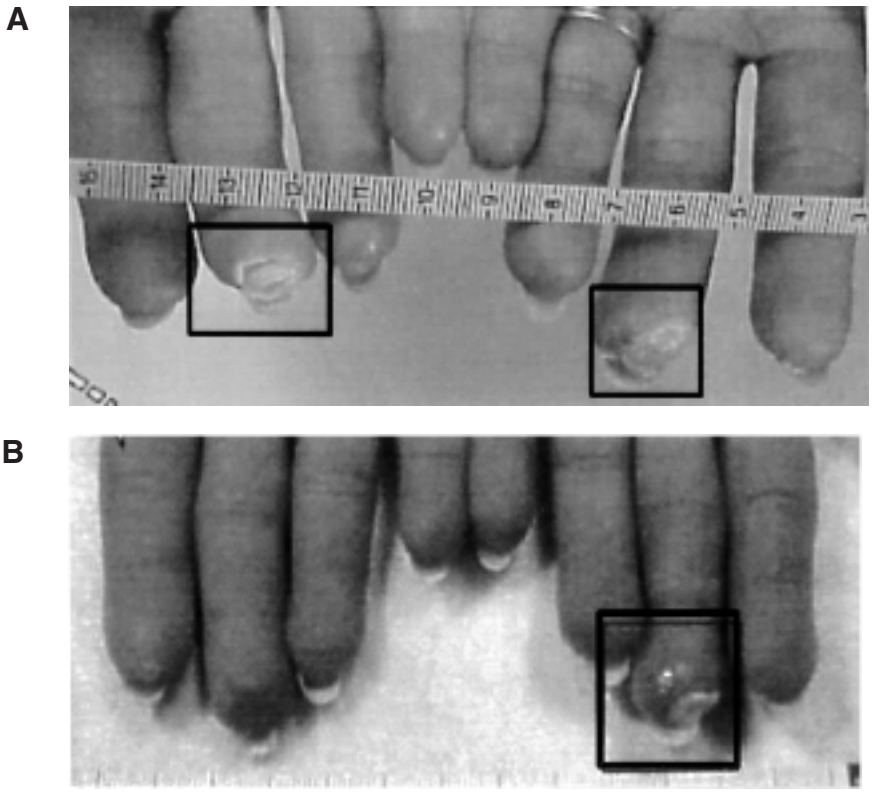

Figure 2. Case 2. Site of ulceration to the 2nd and 3rd digits at pretreatment (A); post-treatment (B).

locations, there is a further suggestion of utility across a wide disease spectrum. Given the intractable and cyclically progressive nature of these lesions, our findings suggest that further research into this area may yield important treatment options in the care of these patients. However, until a randomized controlled trial of HBOT versus traditional wound care techniques is carried out, we will not know if this treatment option is superior and in what context. It is our belief that HBOT should be considered for the treatment of intractable wounds, as part of a greater wound care algorithm.

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