Integrating Hyperbaric Oxygen Therapy Into Multidisciplinary Management Of Diabetic Finger Infection: A Case Report

Diyabetik parmak enfeksiyonunun multidisipliner tedavisine hiperbarik oksijen tedavisinin entegre edilmesi: Bir olgu sunumu

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ÖZET

Alt ekstremiteleri yaralanı diyabet mellitusun en ciddi ve sık komplikasyonlarından biridir. Bununla birlikte, el enfeksiyonları, nadir olmasına rağmen, hastalığın diğer önemli sorunlarından diyalaktik ayak enfeksiyonlarının tedavisinde multidisipliner yaklaşımın etkinliği kantandırılır. Hiperbarik oksijen tedavi ile ilgili olan yaralanın tedavisinde sıkılık kullanılan yardımco tedavi modullerinden birisidir. Bu yazının amacı parmak enfeksiyonu olan bir diyabet hastası multidisipliner yaklaşımı ek olarak kullanılan hiperbarik oksijen tedavisinin faydalarının rapor edilmesidir.

Anahtar Kelimeler: Diyanet, Yara bakım, Enfeksyon, Üst ekstremiteler, Hipoksia

ABSTRACT

Lower extremity wounds are one of the most frequent and serious complications of diabetes mellitus. However hand infections, though rare, are another challenging aspect of the disease. Multi-disciplinary approach has proved efficacy in the treatment of diabetic foot infections. Hyperbaric oxygen therapy is one of the adjunctive treatment modalities frequently used in patients with non-healing wounds. The objective of this paper was to report the additive effect of hyperbaric oxygen therapy in the management of a finger infection in a diabetic patient.

Key words: Diabetes, Wound care, Infection, Upper extremity, Hypoxia

Introduction

Lower extremity wounds and related infections are one of the most frequent and serious complications of diabetes mellitus that leads to significant morbidity and mortality. It is estimated that every 30 seconds a lower limb is amputated as a consequence of diabetes throughout the world. However hand infections, though rare, are another challenging aspect of the disease (1-4). Multi-disciplinary wound management is regarded as the treatment approach of choice in diabetic foot ulcers (5). One of these disciplines; the hyperbaric oxygen (HBO) therapy has proved efficacy as an advanced wound therapy protocol in selective problematic and intractable wounds (6,7). Published literature on hand infections in diabetic patients is scarce and data on HBO therapy in hand infections is even more limited. The objective of this paper was to report the successful use of HBO therapy as an adjunct in the management of a finger infection in a diabetic patient.

Case report

A 54-year-old woman with insulin-dependent diabetes of 8 year’s duration presented to our clinic 20 days after a traumatic finger wound caused by a slammed door. She reported that the wound failed to heal although her initial wound care management and anti-microbial treatment and that consequently she was advised to have amputated her finger at the distal phalanx level. She didn’t accept the procedure and applied to our clinic.

Her physical exam revealed necrotic tissue within the wound bed with a purulent discharge and foul odor on her 4th finger of the left hand (Figure 1). She reported a deterioration in her blood sugar following the trauma but it was adjusted and kept regular right after she was switched to a four times daily insulin dose regimen.
HbA1c was 6.3%. Doppler ultrasonography of her left upper extremity showed heavy calcifications in the vessel walls. Laboratory examination at admission revealed WBC: 9.8*10^3 /L, erythrocyte sedimentation rate: 74 mm/h and C-reactive protein (CRP): 56mg/dL. Deep tissue specimen revealed Staphylococcus aureus and Pseudomonas aeruginosa, so she was switched to i.v. ampicillin-sulbactam 1.5 gr bid and ciprofloxacin p.o. 500mg bid. HBO therapy was combined to the therapy protocol which included antimicrobial therapy, metabolic control, and daily debridement and wound care. HBO therapy was performed in a multiplace hyperbaric chamber at 2.4 absolute atmospheres for 120 minutes daily, 5 days/week. Within one week she began to show progression toward healing, the wound bed was less purulent with a newly forming granulation layer. On day 5 the CRP had fallen to 32mg/dL. Her control deep tissue specimen revealed no growth at day 12 and she was switched to levofloxacin p.o. once daily regimen for one week. HBO therapy was ceased at the end of 20 sessions when the wound bed was totally free of discharge and a well granulated wound bed without necrotic tissue was achieved. She didn’t need any further debridement. She was called for regular follow-up appointments. Complete epithelization of the wound was achieved at two months (Figure 2).

Discussion

There is little information about the prevalence and incidence of hand infections and there isn’t any classification system or any published therapy guidelines regarding hand infections in diabetics.

Diabetes mellitus significantly complicates hand infections. Houshian et al., in a study of 418 patients with hand infections, reported a 6-fold increase in complications in the diabetic group compared to the non-diabetics (8). An increased frequency is also reported for gram-negative organisms cultured in patients with diabetes mellitus compared to non-diabetics (1,2,8). Digits seem to be the predominant site of infection and are involved in 50% to 60% of the cases (2,9). Amputations are the most feared complication of the diabetic hand infections. The rate of amputation varies between 14% to 35% in previous case series (1,3,4).

Early recognition of the situation, timely intervention and a multidisciplinary team work is essential in the management of hand infections in diabetic patients. Daily wound care, culture driven antibiotic therapy, and strict glycemic regulation should be optimized as fundamentals of diabetic wound care management. In addition, adjunctive wound healing modalities such as HBO therapy should be considered in selected patients. Literature on the use of HBO in hand infections is limited. Korpinar and Boynuk reported of a successful use of HBO in the treatment of a felon in a diabetic patient (10). Our patient was admitted to our department for HBO therapy after her wound failed to improve despite adequate wound care for three weeks. Her wound dramatically improved after integrating HBO therapy into the treatment protocol.

HBO therapy is widely used as an adjunct modality of treatment in the management of diabetic foot ulcers and infections. The rational for HBO therapy in problem wounds/ulcers of diabetic patients which are usually associated with infections is well described. HBO therapy increases the amount of oxygen dissolved in plasma and consequently delivers more oxygen to all tissues. It is well known that hypoxic wounds frequently fail to heal and become infected.

HBO therapy enhances wound healing by increasing the growth of new capillaries, collagen synthesis and maturation, and fibroblast replication (11,12). Hypoxia impairs the oxygen dependent defense system of the host, which makes the hypoxic wound more vulnerable to microorganisms. The bacterial killing of the neutrophils via oxygen is NADPH-oxidase dependent. NADPH-oxidase uses oxygen as a substrate to generate high amounts of oxidants to kill microorganisms. The activity of this enzyme is controlled with the availability of the substrate, namely oxygen.
While a partial oxygen pressure (pO₂) between 45 and 80mmHg halves its activity, at a pO₂ of 300mmHg the activity of the enzyme rises to 90% (13). In addition, HBO exerts bactericidal effectiveness against anaerob bacteria by increasing the production of reactive oxygen species (14). Another role for HBO in infections is its synergistic action with a number of antibiotics such as aminoglycosides, sulfonamides, trimetoprim, fluorokinolons and vankomisin (15).

Taken together, optimal oxygen partial pressures at the wound site is of paramount importance to combat infection and promote wound healing in diabetic patients and HBO therapy favorably interferes various steps of wound healing by increasing tissue pO₂. In closing, the management of hand infections in diabetic patients may be challenging and HBO should be considered as a potential adjunct in these patients when conventional treatments fail.

References


