Effectiveness of Hyperbaric Oxygenation Therapy in the Management of Chronic Diabetic Foot Ulcers: a Systematic Review

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Keywords: Hyperbaric Oxygenation Therapy and Diabetic Foot Ulcers

Abstract: To assess the efficacy and safety of hyperbaric oxygenation (HBO) therapy as adjunctive treatment for diabetic foot ulcers with a systematic review of the literature. The literature review was conducted through Scopus, MEDLINE, EMBASE, and the Cochrane Library were searched to find relevant articles published up to April 20, 2012, without restriction as to language or publication status. All controlled trials that evaluated adjunctive treatment with HBO therapy compared with treatment without HBO for chronic diabetic foot ulcers were selected. Based on the results of journal studies, Thirteen trials (a total of 624 patients), including 7 prospective randomized trials, performed between January 1, 1966, and April 20, 2012, were identified as eligible for inclusion in the study. Adverse events associated with HBO treatment were rare and reversible and not more frequent than those occurring without HBO treatment (P=0.37). On the basis of these effects, we believe that quality of life could be improved in selected patients treated with HBO.

1 BACKGROUND

Hyperbaric oxygenation (HBO) has been proposed as an adjunctive treatment for diabetic foot ulcers and has been reported to reduce the incidence of major amputations in diabetic patients with ischemic foot ulcers. The value of HBO therapy, however, remains controversial because of conflicting data in the literature. Treatment is often prolonged and is sometimes unsuccessful, and the patients are prone to serious complications. Traditional management is based on cleansing, debridement, and eliminating infections; many different interventions have been proposed to accelerate the healing process, but few have been subjected to strict evaluation.

If outcomes from the same patients were published in multiple articles with different follow-up periods, we extracted the outcomes from the first study and the outcomes of the follow-up studies from the later reports. When studies from the same institution reported the same outcomes at similar follow-up periods, either the better quality or the most informative reports were selected. Two reviewers independently extracted data from each study, including study title, first author, publication year, institution, population demographics, study design, follow-up period, inclusion and exclusion criteria, and main outcomes (healing percentages, major or minor amputations, adverse events, quality of life, and cost-effectiveness).

2 METHODS

We conducted a systematic literature search of MEDLINE (1966 to April 20, 2012), EMBASE (1974 to April 20, 2012), and the Cochrane Library (2012) for studies reporting on HBO therapy of diabetic foot ulcers. The primary clinical outcome of interest was the effect of HBO therapy on ulcer healing defined as complete epithelialization of the wound. Secondary outcomes included major or minor amputations. Duplicate reports were merged.

3 RESULTS

We identified a total of 89 relevant articles comparing adjunctive HBO therapy and conventional therapy for treatment of chronic diabetic foot ulcers. All included articles scored B (moderate quality). In addition, because of the various trial designs and follow-up periods (from 30 days to 3 years), we compared subgroups with various follow-up periods to reduce heterogeneity.
The most serious complication (ie, major amputations, defined as amputations above the ankle joint) was assessed in 11 trials, which found that there were significantly fewer major amputations in patients undergoing HBO therapy compared with conventional therapy without HBO.

4 DISCUSSION

Diabetic foot ulcers are notoriously prone to complications and resistant to therapy. Even with the best conventional treatment, which includes improved glycemic control, pressure off-loading, and local and appropriate systemic antibiotics if clinically infected, many ulcers remain unhealed. There are many reasons why ulcers in patients with diabetes do not heal, including edema, anemia, and poor perfusion, all of which impede normal wound healing. Hyperbaric oxygenation therapy has been reported to decrease tissue hypoxia and has been proposed as treatment for chronic foot ulcers for at least 45 years. However, despite promising in vitro and in vivo findings in animal models, the effectiveness of HBO therapy in healing of chronic ulcers has remained controversial.

5 CONCLUSION

This meta-analysis demonstrates that adjunctive treatment with HBO increases the likelihood of healing in diabetic foot ulcers and reduces the need for major amputations. In addition, adverse events are rare and acceptable. Therefore, we believe that the long-term quality of life of patients treated with HBO therapy could be improved by its judicious application.

REFERENCE