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Management of diabetic Foot Ulcers Using Hyperbaric oxygen therapy and Electrical stimulation

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Abstract

Diabetic foot ulcers (DFU) are the most costly and devastating complication of diabetes, affecting 15% of people with diabetes at some point in their lives. Based on strategies from the National Institute for Health and Clinical Excellence, early and effective management of DFU can reduce the severity of complications, such as avoidable amputation and possible death, and improve overall quality of life. Quality can be improved. Management of DFU should be optimized using a multidisciplinary team as it requires a holistic approach to wound management. Based on research, glycemic control, wound debridement, advanced dressings, and offloading modalities should always be part of DFU management. Moreover, in some cases, surgery to heal chronic ulcers and prevent recurrence should be considered an integral part of treatment. Additionally, hyperbaric oxygen therapy, electrical stimulation, negative pressure wound therapy, bioengineered skin, and growth factors can be used as adjunctive therapies for rapid healing of DFU. It is therefore suggested that appropriately educated patients should be encouraged to receive regular foot care to prevent DFU and its complications.

Keywords: Diabetes mellitus; Wound management; Diabetic foot ulcer; Amputation; Foot care

Introduction

Diabetes mellitus (DM) is one of the major problems in the healthcare system and a global public health threat that has increased dramatically over the past two decades [1,2]. According to epidemiological studies, the number of DM patients increased from approximately 30 million in 1985 to 177 million in 2000 and 285 million in 2010. It is estimated that over 360 million people will become DMs in the future. Patients with DM are prone to multiple complications such as diabetic foot ulcers (DFU). DFU is a common complication of DM and has shown an increasing trend over the past decades. Overall, it is estimated that 15% of diabetics will become DFU at some point in their lives. Although it is difficult to obtain precise figures on the prevalence of DFU, the prevalence of this complication ranges from 4% to 27% [3,4].

To date, DFU is recognized as the leading cause of morbidity and hospitalization in diabetic patients. It is estimated that approximately 20% of hospital admissions for DM patients are due to DFU [5]. In fact, DFU can lead to infection, gangrene, amputation and even death if the necessary care is not provided. DFU, on the other hand, increases the risk of ulcer progression and can ultimately lead to amputation. Overall, the rate of leg amputation in DM patients is 15 times higher than in non-diabetic patients. It is estimated that about 50% to 70% of all lower extremity amputations are due to his DFU [6]. In addition, it is reported that one leg is amputated every 30 seconds worldwide by DFU. Additionally, DFU causes significant emotional and physical distress, as well as lost productivity and financial losses that affect quality of life. Previous literature indicates that it costs about $17,500 (1998 USD) to heal a single ulcer. If a lower extremity amputation is required, medical costs are even higher, ranging from $30,000 to $33,500. These costs do not represent the total economic burden, as indirect costs associated with lost productivity, preventive efforts, rehabilitation, and home care must be taken into account. Taking all of this into account, 7% to 20% of total diabetes spending in North America and Europe could be attributed to her DFU [7,8].

Recent studies have identified several risk factors associated with the development of DFU. These risk factors are: gender (male), duration of diabetes over 10 years, age of older patients, high weight index, and retinopathy, diabetic peripheral neuropathy, peripheral vascular disease, glycated hemoglobin levels (Other comorbidities such as HbA1C), foot deformity, high sole pressure, infections, inadequate foot care habits. Many diabetes-related risk factors have been identified in the literature that contribute to leg ulceration and amputation, but to date, most DFU are caused by ischemic, neuropathic, or combined neuroischemic abnormalities. It is Pure ischemic ulcers probably account for only 10% of DFUs, and 90% are due to neuropathy alone or with ischemia. The incidence of neuroischemic problems has increased in recent years and neuroischemic ulcers are now the most common ulcers seen in most UK diabetic podiatry clinics [9].

Overall, the most common pathways of foot problems that develop in diabetics are peripheral sensorimotor and autonomic neuropathy, which results in high foot pressure, foot deformity, and gait instability, resulting in ulcers increases the risk of developing it [10]. Many studies today show that elevated sole pressure is associated with foot ulcers. In addition, foot deformities and gait instability have been shown to increase sole pressure and cause foot ulcers.

Unfortunately, often patients are in denial of their disease and fail to take ownership of their illness along with the necessary steps to prevent complication and to deal with the many challenges associated with the management of DFU. However, numerous studies have shown that proper management of DFU can greatly reduce, delay, or prevent complications such as infection, gangrene, amputation, and even death [11,12].

The main therapeutic goal of DFU is to close the wound as

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soon as possible. Because diabetes is a systemic multi-organ disease, multidisciplinary teams need to address any comorbidity that impairs wound healing for optimal results with DFU [13]. Based on the National Institute for Health and Clinical Excellence strategy, DFU management is with general practitioners, nurses, educators, orthopedic specialists, foot practitioners, and other specialists such as vascular surgeons and infectious diseases. It should be done quickly by an interdisciplinary team consisting of consultations. Disease specialists, dermatologists, endocrinologists, nutritionists, orthopedists. Many studies today show that interdisciplinary teams can reduce amputation rates, reduce costs, and improve the quality of life for DFU patients [14,15]. The American Diabetes Association has concluded that prevention teams, defined as interdisciplinary teams, can reduce the risk associated with DFU and amputation by 50% to 85%. When applying this approach, it is recommended to adopt appropriate DFU management strategies to reduce the severity of complications, improve overall quality of life, and extend patient life expectancy.

Hyperbaric Oxygen Therapy

Hyperbaric oxygen therapy (HBOT) has shown promise in treating severe cases of non-curing DFU that are resistant to other therapies. HBOT typically provides 100% oxygen intermittently in daily sessions. During each session, the patient breathed her 1.4-3.0 absolute barometric pressure pure oxygen three times for her 30 min (90 min total) in a hyperbaric chamber where he was inserted at 5 min intervals. Today, his RCTs of numerous studies report beneficial effects of HBOT. A recent study by Londahl et al. conducted a double-blind RCT that showed significantly improved outcomes in the intervention group, as treated patients were more likely to be cured within 12 months. 25.48 (52%) vs 12.42 (29%) P = 0.03] [16]. In addition, in a systematic review by Kranke et al., treatment with HBOT had a significantly higher rate of cured DFU than treatment without HBO (relative risk 5.20; 95% CI: 1.25-21.66). P = 0.02). In another systematic review conducted by O'Reilly et al. However, RCT evidence did not show a significant effect on amputation rates, and quality studies showed no difference between the HBOT group and the standard wound care group. The exact mechanism of HBOT is not yet well understood. In some studies, HBOT improves wound tissue hypoxia, improves blood flow, and reduces edema, down regulates inflammatory cytokines, fibroblast proliferation, collagen production, and angiogenesis. Has been reported to promote. In addition, HBOT has been shown to stimulate the recruitment of angioplastic stem cells from the bone marrow and recruit them to skin wounds. Despite reports of increased cure rates and decreased amputation rates when using HBOT, the adjuvant use of this method in DFU remains a controversial issue [17]. HBOT does not replace antibiotic therapy, topical moist therapy, or debridement of surgical wounds. In addition, HBOT is expensive [typically $50,000 (Medicare) to $200,000 (private) for full treatment in the US] and time-consuming (average total 60 hours), making it available to only a few communities.

Electrical Stimulation

Electrical stimulation (ES) has been described in recent literature as a complete adjunct therapy to cure DFU. Currently, there is important work to support the effectiveness of ES for DFU healing. A randomized, double-blind, placebo-controlled trial conducted by Peters et al. A significant difference in the number of healed ulcers performed in 40 patients with DFU (65% in the treatment group vs. 35% in the control group) was seen after 12 weeks.

Based on literature reviews, it has been suggested that ES may improve common defects associated with DFU wound healing defects [18]. Poor blood flow, infections, defective cellular responses. This treatment is a safe, inexpensive and simple intervention to improve wound healing in DFU patients.

Conclusion

Foot ulcers in diabetic patients are common and often lead to lower extremity amputation if a prompt and rational multidisciplinary therapeutic approach is not pursued. Hyperbaric oxygen therapy and electrical stimulation these approaches should be used whenever possible to reduce the high morbidity and risk of serious complications resulting from foot ulcers.

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