Original Article

The Association Between Elevated Foot Skin Temperature and the Incidence of Diabetic Foot Ulcers: A Meta-Analysis

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Javier Ena, MD[1], Juani Carretero-Gomez, MD[2], Jose Carlos Arevalo-Lorido, MD[2], Carmen Sanchez-Ardila, MLS[3], Antonio Zapatero-Gaviria, MD[4], and Ricardo Gómez-Huelgas, MD[5,6]

Abstract

Prior to the appearance of any foot ulcer, there is an increase in the local temperature due to the presence of an underlying inflammatory process. The use of thermometry to identify inflammation could make patients increase preventive measures until the inflammation disappears. We carried out a meta-analysis to determine the effectiveness of the daily measurement of the foot temperature in 6 points to prevent the occurrence of foot ulcers in patients with diabetes. Patients with temperature differences >4°F (2.2°C) between left and right corresponding sites should reduce activity and increase preventive measures until temperature is normalized. We searched the literature in MEDLINE, EMBASE, Cochrane Library, Web of Knowledge, and clinicaltrials.gov. We have only included randomized clinical trials where individuals were assigned to receive enhanced care (temperature measurement and standard care) versus standard care (education, self-care practices, and periodic clinical visits). We found 4 trials comprising 462 patients from the United States and Norway that met our inclusion criteria. The duration of follow-up varied from 4.5 to 15 months. Overall, 18 (7.9%) subjects in the enhanced foot care group and 53 (22.6%) in the standard foot care group developed foot ulcers (pooled risk ratio = 0.37; 95% confidence interval = 0.21-0.66; $P = .0008$; percentage of heterogeneity [I^2], 25%; $P = .26$). The number needed to treat was 7 (95% confidence interval = 5-11). The results were robust after analysis by subgroups according to the potential risk of bias in the studies and the duration of follow-up.

Keywords

foot ulcer, thermometry, wound skin temperature measurements, wound assessment, diabetes

Introduction

The prevalence of foot ulcers in patients with diabetes is between 4% and 10%, and the risk of developing a foot ulcer throughout life can be as high as 25%.[1] The main causes of the appearance of foot ulcers are the presence of diabetic neuropathy accompanied by repeated local trauma.[2,3] With adequate care, which involves skin debridement, pressure discharge, treatment of infection, and vascular reconstruction, if necessary, 77% of ulcers healed after 1 year.[4] Approximately 40% of patients will have a recurrence of the ulcer in the following year after healing.[5] Patient education, daily foot inspection, self-care, and the use of orthopedic material prevent the risk of ulcer recurrence.[6]

Prior to the appearance of any foot ulcer, there is an increase in the local temperature due to the presence of an underlying inflammatory process.[7] The identification of the inflammatory phenomenon, which appears well in advance of the development of the ulcer, allows establishing preventive measures until the inflammation has disappeared. However, the identification of early inflammatory signs by physical examination is difficult for patients and sometimes even for clinicians. The recent commercialization of infrared ray thermometers has facilitated the detection of subtle inflammatory signs such as an increase in temperature in local areas of the feet.[8] The procedure is simple: the tip of the infrared ray thermometer is applied at 6 different points in each foot (first toe, first, third, and fifth metatarsal heads, middle foot, and heel). Temperature readings are compared

[1]Hospital Marina Baixa, Alicante, Spain
[2]Hospital de Zafra, Badajoz, Spain
[3]Universidad Miguel Hernández, Elche, Alicante, Spain
[4]Hospital Universitario de Fuenlabrada, Madrid, Spain
[5]Hospital Regional Universitario de Málaga, Malaga, Spain
[6]Universidad de Málaga, Málaga, Spain

Corresponding Author:
Javier Ena, Servicio de Medicina Interna, Hospital Marina Baixa, Av Alcalde Jaime Botella Mayor, 7 Villajoyosa, Alicante 03570, España.
Email: ena_jav@gva.es