

The Effect of Type-2-Diabetes-Related Vascular Endothelial Dysfunction on Skin Physiology and Activities of Daily Living

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Abstract

A common factor contributing to organ damage in type 2 diabetes mellitus (T2DM) is impaired tissue blood flow caused by damage to vascular endothelial cells (VECs). Damage can occur even before the clinical diagnosis of diabetes. It can be caused by both a high average blood glucose concentration and/or large daily spikes in blood glucose. While much of the present literature focuses on the damage to VECs and organs from these large glucose excursions, this review will focus on the consequence of this damage, that is, how endothelial cell damage in diabetes affects normal daily activities (e.g., exercise, reaction to typical stimuli) and various treatment modalities (e.g., contrast baths and electrical stimulation therapy). It is important to understand the effects of VEC damage such as poor skin blood flow, compromised thermoregulation, and altered response to skin pressure in designing diabetes technologies as simple as heating pads and as complex as continuous glucose monitors. At the simplest level, people with diabetes have poor circulation to the skin and other organs. In the skin, even the blood flow response to locally applied pressure, such as during standing, is different than for people who do not have T2DM. Simple weight bearing on the foot can occlude the skin circulation. This makes the skin more susceptible to damage. In addition, endothelial damage has far-reaching effects on the whole body during normal activities of daily living, including an impaired response to local heat, such as hot packs and contrast baths, and higher body temperatures during whole body heating due to impaired blood flow and a reduced ability to sweat. Finally, because of multiple organ damage, people with T2DM have poor balance and gait and impaired exercise performance.

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Abbreviations: (ENOS) endothelial nitric oxide synthetase, (HbA1c) hemoglobin A1c, (PI3K) phosphoinositide 3-kinase, (T2DM) type 2 diabetes mellitus, (TRPV) transient receptor voltage vanilloid, (VEC) vascular endothelial cells

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