The Influence of Aging and Diabetes on Heat Transfer Characteristics of the Skin to a Rapidly Applied Heat Source

Abstract

BACKGROUND:

Numerous studies have examined the blood flow of the skin at rest and in response to sustained heat and shown that, in older people and people with diabetes, the skin blood flow response to heat is diminished compared to younger people. It is not sustained heat, however, that usually causes burns; it is a more rapid application of heat.

SUBJECTS AND METHODS:

Ten younger subjects, 10 older subjects, and 10 subjects with diabetes were examined before and after applying a water-filled thermode to the skin above the quadriceps muscle to observe the changes in skin temperature and skin blood flow and the ability of the skin to absorb heat after a 2-min heat exposure with water at 44°C.

RESULTS:

Skin temperature rose from 31.2°C at rest to 38.3°C after 2 min of heat application in all subjects (P > 0.05 between groups). The calories required in the younger group of subjects was 2.26 times the calories required in the older group of subjects for the same change in skin temperature and 13.8 times the calories needed to increase skin temperature in the subjects with diabetes. Furthermore, the blood flow at rest was lower in people with diabetes than older subjects and both groups less than that seen in younger subjects. The blood flow response to heat was slower in the subjects with diabetes compared to the older subjects and much slower than that seen in the younger subjects.

CONCLUSIONS:

Reduced skin blood flow of older and subjects with diabetes, decreased thickness of the dermal layer, and increased subcutaneous fat, as well as damage to transient receptor potential vanilloid 1 receptors, may account for some of the differences between the groups.