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AGE-RELATED STRUCTURAL CHANGES IN THE VASCULAR ENDOTHELIUM OF THE LOWER LEG AND FOOT IN DIABETIC ANGIOPATHY

Narbaev Zarifbek Zafar ugli
Andijan state medical institute, Uzbekistan
Email:Khazixzzariff@gmail.com
Alibekov Omadbek Ozodbekovich., PhD
Andijan state medical institute, Uzbekistan

Abstract

Diabetic angiopathy is one of the major causes of vascular damage in the lower extremities and is characterized by progressive structural and functional abnormalities of the vascular endothelium. Persistent hyperglycemia promotes oxidative stress, endothelial dysfunction, basement membrane thickening, and disturbances in microcirculation. Age-related changes in vascular structure may further aggravate these pathological processes, particularly in the vessels of the lower leg and foot.

Objective. To analyze age-related structural changes in the vascular endothelium of the lower leg and foot in diabetic angiopathy and to determine the morphological characteristics associated with progressive microvascular damage.

Materials and methods. A review and comparative analysis of five published scientific studies addressing diabetic microangiopathy, endothelial dysfunction, vascular aging, and structural abnormalities of the lower-extremity microcirculation were performed. Particular attention was given to endothelial integrity, capillary basement membrane thickness, vascular lumen diameter, microvascular density, and age-associated vascular remodeling.

Results and discussion. The analysis of published studies demonstrated that diabetic angiopathy is associated with thickening of capillary basement membranes,

narrowing of vascular lumina, endothelial dysfunction, and pathological remodeling of small vessels. In a histological investigation of diabetic foot microangiopathy, Fiordaliso et al. reported a 22.2% reduction in dermal capillary density, a 2.2-fold increase in capillary basement membrane thickness, and a 57.7% reduction in capillary lumen area compared with non-diabetic controls.

These structural abnormalities may limit tissue oxygenation and impair local microcirculatory regulation. Endothelial dysfunction is also associated with reduced nitric oxide bioavailability, increased oxidative stress, and impaired vascular repair mechanisms.

Age-related vascular alterations include endothelial senescence, decreased regenerative capacity, and impaired angiogenesis. These changes may contribute to increased susceptibility to ischemic injury in older patients with diabetes. Ungvari et al. described the importance of endothelial aging and microvascular remodeling in the progressive deterioration of tissue perfusion.

The reviewed evidence indicates that advanced age and diabetes can contribute to vascular dysfunction through overlapping mechanisms. However, the independent effects of chronological age on structural abnormalities specifically in the lower leg and foot require further age-stratified histological investigation.

Conclusion. Diabetic angiopathy is characterized by structural abnormalities of the vascular endothelium, including capillary basement membrane thickening, reduction of vascular lumen area, and microvascular remodeling. Age-associated endothelial dysfunction and impaired angiogenesis may contribute to the progression of these changes. Detailed morphological and morphometric investigations across different age groups are necessary to clarify their role in lower-extremity vascular injury and diabetic foot complications.

Keywords: diabetic angiopathy, vascular endothelium, lower leg, diabetic foot, aging, microangiopathy, vascular remodeling, morphometry.

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