

Characterization of retinal vessels by fractal analysis: its importance in pathology

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Abstract

The retinal circulation is the only part of human circulation that can be directly observed by ophthalmoscopy. By this assessment, a lot of connection between the appearances of retinal microcirculation has been already established. Diabetic microangiopathy observation on retinal circulation or hypertension microangiopathy is already classified and contributes to the diabetes mellitus and hypertension evolution characterization. A more precise assessment could be achieved by measurements of the vessels calibers directly and by characterization of this parameter in health status, and several vascular disorders. Fractal analysis is a method that was already applied to analyze the living organism's parameters, and the human retinal network and branching pattern was demonstrated to have a fractal structure. In this study we analyzed the fractal dimensions characteristics of human retinal vessels associated with various diseases that can contribute to the estimation of cardiovascular and cerebrovascular risk. Fundus photography appearance and formula calculation are described to systematize this novel approach of vascular risk factors based on retinal vessels caliber and branching pattern. This precise measurement could contribute to the diagnosis and evolution characterization of microvascular disorders which affect the retinal vessels.

Keywords:

Retinal Vessels; Fractal Analysis; Vascular Disorders; Diabetes Mellitus; Hypertension