

Comparison of Central Light Reflex Width-to-Retinal Vessel Diameter Ratio between Glaucoma and Normal Eyes by Using Edge Detection Technique

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Abstract : Glaucoma is a disease that causes visual loss in adults. Glaucoma causes damage to the optic nerve and its overall pathophysiology is still not fully understood. Vasculopathy may be one of the possible causes of nerve damage. Photographic imaging of retinal vessels by fundus camera during eye examination may complement clinical management. This paper presents an innovation for measuring central light reflex width-to-retinal vessel diameter ratio (CRR) from digital retinal photographs. Using our edge detection technique, CRRs from glaucoma and normal eyes were compared to examine differences and associations. CRRs were evaluated on fundus photographs of participants from Mettapracharak (Wat Raikhing) Hospital in Nakhon Pathom, Thailand. Fifty-five photographs from normal eyes and twenty-one photographs from glaucoma eyes were included. Participants with hypertension were excluded. In each photograph, CRRs from four retinal vessels, including arteries and veins in the inferotemporal and superotemporal regions, were quantified using edge detection technique. From our finding, mean CRRs of all four retinal arteries and veins were significantly higher in persons with glaucoma than in those without glaucoma ($0.34 \text{ vs } 0.32$, $p < 0.05$ for inferotemporal vein, $0.33 \text{ vs } 0.30$, $p < 0.01$ for inferotemporal artery, $0.34 \text{ vs } 0.31$, $p < 0.01$ for superotemporal vein, and $0.33 \text{ vs } 0.30$, $p < 0.05$ for superotemporal artery). From these results, an increase in CRRs of retinal vessels, as quantitatively measured from fundus photographs, could be associated with glaucoma.

Keywords : glaucoma, retinal vessel, central light reflex, image processing, fundus photograph, edge detection

Conference Title : ICBEN 2016 : International Conference on Biomedical Engineering and Neuroengineering

Conference Location : Bangkok, Thailand

Conference Dates : August 30-31, 2016