Deep Learning Classification of Early Normal-Tension Glaucoma and Glaucoma Suspects

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ABSTRACT

We aimed to classify early normal-tension glaucoma(NTG) and glaucoma suspect(GS) using Bruch's membrane opening-minimum rim width(BMO-MRW), peripapillary retinal nerve fiber layer(RNFL), and the color classification of RNFL based on a deep-learning model. Discriminating early-stage glaucoma and GS is challenging and a deep-learning model may be helpful to clinicians. NTG accounts for an average 77% of open-angle glaucoma in Asians. BMO-MRW is a new structural parameter that has advantages in assessing neuroretinal rim tissue more accurately than conventional parameters. A dataset consisted of 229 eyes out of 277 GS and 168 eyes of 285 patients with early NTG. A deep-learning algorithm was developed to discriminate between GS and early NTG using a training set, and its accuracy was validated in the testing dataset using the area under the curve(AUC) of the receiver operating characteristic curve(ROC). The deep neural network model(DNN) achieved highest diagnostic performance, with an AUC of 0.966 (95% confidence interval, 0.929-1.000) in classifying either GS or early NTG, while AUCs of 0.927–0.947 were obtained by other machine-learning models. The performance of the DNN model considering all three OCT-based parameters was the highest(AUC, 0.966) compared to the combinations of just two parameters. As a single parameter, BMO-MRW(0.959) performed better than RNFL alone(0.914).