

Accuracy of Digital Images for Assessing Diabetic Retinopathy

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Abstract

Background:

To determine the accuracy of diabetic retinopathy status assessments with and without pupil dilation using digital fundus photographs acquired by a clinic staff person and interpreted remotely by ophthalmologists.

Method:

Using early treatment diabetic retinopathy study (EDTRS) grading criteria, diabetic retinopathy status assessments were made by an experienced (nonphysician) retinal grader (NPG) based on seven standard field 35-mm stereoscopic slides acquired by an experienced ophthalmic photographer. These assessments were compared with those of the same eyes made by two ophthalmologists and the NPG using digital photographs acquired by a clinic staff person using a high-resolution (800 × 600) digital color camera system.

Results:

Based on 35-mm slides, 38% of 244 diabetic patients had ETDRS ≥ 35 in at least one eye and 5% had vision-threatening diabetic retinopathy (ETDRS ≥ 53 or macular edema). The proportion of ungradable images was significantly greater for nonmydriatic than mydriatic assessments (30% versus 10% ungradable as determined by the NPG). For ETDRS level ≥ 35 , specificity ranged from moderate to high (0.70 to 0.96) for the three graders, while sensitivity was poor to moderate (0.38 to 0.71), and the area under the receiver-operating characteristic curves was less than satisfactory (0.67 to 0.71).

Conclusions:

The low sensitivity of the digital assessments indicates a significant proportion of patients in need of referral would not have been referred. These findings suggest that implementation of a simplified screening system using nonphotographer clinic staff acquiring nonmydriatic images, with interpretation by an ophthalmologist, should take place with an understanding of potential limitations.

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Abbreviations: (AUROC) area under the receiver-operating characteristic, (DR) diabetic retinopathy, (ETDRS) early treatment diabetic retinopathy study, (NPDR) nonproliferative diabetic retinopathy, (NPG) nonphysician grader, (VTDR) vision-threatening diabetic retinopathy

Keywords: diabetic retinopathy, screening, sensitivity and specificity, telemedicine

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