

Point-of-care Diabetic Retinopathy screening with a low-cost portable retinal camera, artificial intelligence and staged mydriasis in a rural, underserved area

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Abstract

Purpose : The use of mydriasis may discourage attendance at diabetic retinopathy (DR) screening initiatives. However, low gradeability decreases the efficiency of non-mydriatic programs. We performed a retrospective, observational clinical study to assess the gradeability of retinal imaging obtained with a non-mydriatic handheld retinal camera.

Methods : We included 968 persons with diabetes (PWD) followed at the primary care level from a rural, semiarid setting in Northeast Brazil; 65.9% were women. Mean ($\pm$ SD) age and diabetes duration were 60.3 ± 14.2 years of age and 8.0 ± 7.2 years, respectively. A trained technician obtained ocular images in darkened rooms initially without pupil dilation and then evaluated image quality. Referable DR, defined as nonproliferative severe or proliferative DR or the presence of diabetic maculopathy, was detected automatically by a previously validated artificial intelligence (AI) system, embedded in the device. Patients with inadequate images underwent pupil dilation and then new evaluation; those with ungradable images even after mydriasis, along with cases of referable DR, were sent for ophthalmological evaluation. Exclusion criteria were corneal opacities that precluded DR classification. The main outcome measure was image gradeability. Statistical analysis included Mann-Whitney test, chi-square test and t-test.

Results : Of 986 PWD, 64.2% had systemic hypertension; 17.7% used insulin; 28.5% had undergone fundus examination in the past; 20.6% were illiterate and 50.6% had only elementary education level; only 3.4% had health insurance. Gradeability was possible for 858 individuals (88.6%), 85 of whom (9.9%) presenting with referable DR; ungradeability was associated with older age ($p=0.000$) and longer diabetes duration ($p=0.000$). Among patients with gradable images, 81% did not require pupil dilation; need for pharmacological mydriasis was associated with older age ($p=0.000$), longer diabetes duration ($p=0.000$), higher rates of hypertension ($p=0.002$) and more severe DR ($p=0.000$).

Conclusions : A staged mydriasis strategy with a low-cost portable camera and AI attained a gradeability rate of almost 90% in a real-world, low-resource setting; pupil dilation was not required for 81% of patients with gradable images. Avoiding unnecessary pupil dilation contributes to increased adherence of DR screening programs.

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