patients prolonged periods of artificial ventilation and lengthy stays in the intensive care unit may be life saving, most patients still being alive and in remission several years later. We suggest that an APACHE II score of greater than 30, the dysfunction of an increasing number of organ systems, failure to recover marrow function after chemotherapy, and unresponsive malignant disease, particularly in patients who have relapsed, are all indicative of a poor prognosis. Further aggressive supportive treatment in these patients may be inappropriate.

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Non-mydriatic Polaroid photography in screening for diabetic retinopathy: evaluation in a clinical setting

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Abstract

Because of fears that Polaroid colour prints produced with a non-mydriatic fundus camera may not detect important sight threatening lesions in diabetes a study was conducted comparing retinal images obtained on Polaroid prints taken in "field" conditions with those on 35 mm transparencies and fluorescein angiograms. Almost one in five (22/127) Polaroid prints could not be assessed owing to poor quality compared with 3 (2.4%) 35 mm transparencies and 2 (1.6%) fluorescein angiograms. The pick up rate of microaneurysms, haemorrhages, and hard and soft (cotton wool spots) exudates was equivalent for Polaroid prints and 35 mm transparencies of equivalent quality. In two cases with disc new vessels, however, these were not seen on the Polaroid prints.

The widespread use of Polaroid colour prints obtained with a non-mydriatic camera without the necessary operative and interpretive skills further limits the usefulness of the technique.

Introduction

Diabetes remains the leading cause of blindness in people of working age.¹ It is cheaper to detect and treat a patient with diabetic

retinopathy than to look after a blind person.² Thus the argument for a cost effective screening programme is a strong one.³ Polaroid non-mydriatic fundus photography has been advocated as a possible cheap and easy to use screening method in diabetes⁴ but its value is controversial.⁵⁻⁷ Nevertheless, it is increasingly being used clinically, with assessment of the photographs being performed primarily by non-ophthalmologists.

We have assessed the Polaroid prints of 127 eyes retrospectively in an attempt to gauge their usefulness in screening. The prints were compared with fundus photographs taken by using Ektachrome 64 transparencies through a dilated pupil of the same 127 eyes and fluorescein angiograms.

Patients and methods

Patients were selected at random from the diabetic clinic or were newly diagnosed non-insulin-dependent diabetics. All photography was carried out in the medical illustration department at this hospital. Initially patients were photographed by any one of six medical photographers using the Canon CR3 NM (non-mydriatic) retinal camera without mydriasis and with Polaroid 779 instant print material. At no time were any of the photographers aware that their results would later be assessed in the study.

Patients were reviewed a week later, when retinal photographs with use of Kodak Professional Ektachrome 64 film were taken through pupils dilated with 0.5% tropicamide by using the Canon CR3 non-mydriatic camera. Before the colour films all patients had undergone fluorescein angiography after an intravenous injection of 5 ml 20% sodium fluorescein, Ilford FP4 film and a Carl Zeiss (Oberkochen) retinal camera being used. In all angiograms the posterior pole plus a five point survey of one eye were recorded, and a late transit photograph of the other eye was also taken. All the angiograms and Ektachrome transparencies were taken by the same medical photographer.

All assessments were conducted double blind by an experienced ophthalmologist (DJ), the Polaroid prints, 35 mm transparencies, and fluorescein angiograms being presented in a masked fashion. Images were examined and reported according to quality, pathological lesions present, and grade of retinopathy. The quality of the image was graded 1-5 as (1) excellent clarity, (2) definition of most retinal details (defocused/flare), (3) limited definition, (4) gross detail only visible, and (5) no detail visible. Images of grade 3 or worse usually resulted in a negative pathological grading owing to insufficient information.

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Results

Polaroid prints, 35 mm transparencies, and the fluorescein angiograms of 127 eyes were compared. Ranking for quality meant that only those prints and transparencies graded 1 and 2 were considered assessable (table I).

Twenty two of the 127 Polaroid prints were unassessable. By contrast,

TABLE I—Comparison of photographic technique and quality of result (percentages in parentheses)

Photographic technique	Quality grade				
	1	2	3	4	5
Polaroid prints (n=127)	60 (47.2)	45 (35.4)	18 (14.2)	4 (3.1)	0
35 mm Transparency (n=127)	116 (91.3)	8 (6.3)	2 (1.6)	1 (0.8)	0

TABLE II—Comparison of rate and type of retinopathy detected in 127 eyes for all three photographic techniques

Photographic technique	No (%) with diabetic retinopathy detected	Type of retinopathy			
		Background	Macular/oedema	Pre-proliferative	Proliferative
Polaroid prints	32 (74.4)	25	2	5	0
35 mm Transparency	38 (88.4)	30	2	5	1
Fluorescein angiograms	43 (100.0)	26	3	12	2

TABLE III—Lesions seen in 127 eyes on fluorescein angiograms, Polaroid prints, and 35 mm transparencies

Photographic technique	Lesions						
	Microaneurysms	Haemorrhages	Hard exudates	Macular oedema	Cotton wool spots	Intraretinal microvascular abnormalities	New vessels
Polaroid prints	5	28	27	2	4	1	0
35 mm Transparencies	9	33	26	2	5	0	1
Fluorescein angiograms	38	19	8	5	12	1	2

retinal images were assessable in 124 transparencies and 125 fluorescein angiograms. After grading for quality all the assessable photographs were examined for evidence of diabetic retinopathy (table II). In assessable photographs the pick up rate of microaneurysms, haemorrhages, exudates, and "cotton wool spots" was initially equivalent for the Polaroid prints and 35 mm transparencies. Not surprisingly, fluorescein angiograms detected a five and eight times greater number of aneurysms compared with 35 mm transparencies and Polaroid prints respectively. Similarly, "cotton wool spots" and macular oedema were seen more frequently on fluorescein angiograms (table III). As expected, exudative lesions were more difficult to diagnose with fluorescein angiography. Almost a third fewer haemorrhagic lesions were noted on fluorescein angiograms compared with 35 mm transparencies and Polaroid prints. Of the two eyes with disc new vessels, these were not seen on either of the Polaroid prints, and one of the 35 mm transparencies was also wrongly evaluated as negative (tables II and III).

Discussion

Diabetic patients go blind as a result of proliferative retinopathy with subsequent vitreous haemorrhage or traction retinal detachment or from macular diseases.⁸ Both forms of sight threatening retinopathy are amenable to treatment by laser photocoagulation if given early enough.⁹

Some people have argued for removing much of the burden of funduscopic screening from the physicians and encouraging the use of existing resources, such as the general ophthalmic services.¹⁰ Alternatively, as some evidence suggests that, as a group, diabetologists are not sufficiently adept at diagnosing proliferative and possibly other forms of diabetic retinopathy,¹¹ many have welcomed the arrival of non-mydiatic cameras as a useful, comparatively cheap, and much needed adjunct to funduscopy.

In our study the technical reason for most failures was poor photographic technique—that is, defocusing and possibly not

allowing enough time for the pupil of the other eye to recover after the bright flash accompanying the first photograph. This is almost twice the number of poorer quality photographs obtained by Williams *et al* in their prospective assessment of non-mydiatic fundus photography in the detection of diabetic retinopathy.¹²

It may well be that better quality photographs are far more likely to be obtained in prospective evaluations by well motivated, research oriented workers^{12 13} than by a busy medical photographer. The extent of this failure rate is especially worrying given that the non-mydiatic camera has been advocated for use by minimally trained personnel in hard pressed diabetic clinics and in the community.¹²

It is clear that of the three methods of photographic evaluation, fluorescein angiography gives the best results.

Quite apart from the financial aspect (Polaroid prints cost on average four times as much to produce as 35 mm transparencies) two very serious drawbacks of Polaroid photography are highlighted by our study. Firstly, roughly one fifth of the Polaroid prints were unassessable. Secondly, and more important, in "assessable" Polaroid prints preproliferative and especially proliferative lesions were not detected. In view of the criticism that some serious disease will be missed by ignoring the retinal periphery,⁵ our findings give rise to concern relating to the detection of sight threatening lesions. In our opinion Polaroid prints obtained with a non-mydiatic camera cannot be considered an alternative to ophthalmoscopic examination with mydriasis. In addition, the camera may even

be a disincentive to proper ophthalmoscopic examination by the attending physician.

Though the camera represents an improvement in some settings, it cannot be relied on to pick up preproliferative and especially proliferative lesions.

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