

# Diabetic retinopathy screening and treatment in Myanmar: a pilot study

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## ABSTRACT

**Background/aims** The goals of this pilot study were (a) to demonstrate the feasibility of identifying patients with vision-threatening diabetic retinopathy (DR) in a provincial area of Myanmar and treating them with portable lasers and (b) to gather data specific to Myanmar to help design larger cross-sectional studies of DR prevalence in Myanmar.

**Methods** 97 consecutive patients with diabetes mellitus (DM) were identified by local ophthalmologists over a period of 1 month in Pinyinmana, Myanmar and were referred to the pilot screening programme. Patients' demographics were recorded and their eyes were examined. Those with vision-threatening DR were treated with panretinal photocoagulation (PRP).

**Results** Of the 97 patients with DM, 33 (34%) had evidence of DR, 23 (23.5%) had evidence of vision-threatening DR including 13 (13.5%) with proliferative DR and 33 eyes in 23 patients (23.5%) had PRP with portable green wavelength laser. Hypertension was a significant cofactor in the development of vision-threatening DR ( $p < 0.01$ ). The average time since diagnosis of DM was 6.0 years in patients with vision-threatening DR.

**Conclusions** This study demonstrates the feasibility of identifying and treating patients with vision-threatening DR in a provincial area of Myanmar and provides initial data to plan a larger study to assess true prevalence, a prerequisite for establishing broader screening/treatment programs.

## INTRODUCTION

Diabetes mellitus (DM) is a rapidly growing, worldwide epidemic. In Myanmar, a country of 60 million people, the prevalence of DM has been reported variously as 6.6%<sup>1</sup> and over 10%.<sup>2</sup> For comparison, the prevalence of DM in India and China, Myanmar's immediate neighbours where DM prevalence has been studied extensively, is 8.7%<sup>3</sup> and 11.6%<sup>4</sup> respectively. As elsewhere in Asia, by 2030 the prevalence of DM in Myanmar is projected to grow by more than 100%.<sup>5</sup> Globally, 34.6% of diabetics are estimated to have diabetic retinopathy (DR), a potentially blinding diabetic complication.<sup>6</sup> With the predicted growth in DM comes an equally great increase in DR. This

## Key messages

- ▶ There is virtually no screening or treatment for diabetic retinopathy (DR), a potentially blinding condition, for the 45 million people who live outside of Myanmar's two largest cities. The prevalence of DR in Myanmar is unknown. This pilot study found a high incidence of vision-threatening DR in a provincial area of Myanmar. The study also demonstrated the feasibility of identifying and treating patients with vision-threatening DR in Myanmar. This information should help in the design of a more definitive study of the prevalence of DR in Myanmar. Such a study is a prerequisite for a broad-based programme to screen for and treat DR in the country.

predicted increase is of great concern because DR is a leading cause of vision loss in middle-aged populations.

The goals of this pilot study were (a) to demonstrate the feasibility of identifying patients with vision-threatening DR in a provincial area of Myanmar and treating them with portable lasers and (b) to gather data specific to Myanmar that can help in the design of larger cross-sectional studies; there are presently no reliable prevalence data for DR in Myanmar.

## METHODS

Permission to participate in the clinical care of patients in Myanmar was secured through the Sitagu International Buddhist Missionary Association and the Sitagu Ayudana Hospital in Sagaing Hills, Myanmar and through the Myanmar Ministry of Health. Permission to record data from the screening study was also approved by these institutions and by local health officials. The study was performed in accordance with the tenets of the Declaration of Helsinki. This pilot study took place at the Sangha Hospital in Pinyinmana, a working city of nearly 100 000 people 2 miles west of the capital city Naypyidaw and was performed in conjunction with local



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**Table 1** Demographic data of patient population with diabetes mellitus (DM)

	Total	Sex		Age (SD, range)	Current treatment of DM				
		Male	Female		No DM treatment	One oral agent	Two oral agents	Insulin	Herbal medicine
No of patients with DM	97	33 (34%)	64 (66%)	Average 59.2 years (11.3 (36–82))	28 (29%)	50 (52%)	17 (17%)	1 (1%)	1 (1%)

ophthalmologists. All patients with DM examined by local ophthalmologists over the prior 1-month period were referred for the screening programme. During the 3-day screening programme, all patients had a full ophthalmic evaluation including slit-lamp and dilated fundus examinations by the authors (SP, RMK, AP) who are retinal disease specialists. Other data collected included: age, gender, years since diagnosis of diabetes, diabetic medications, brief medical history, history of smoking or betel nut consumption, spot blood glucose and blood pressure. Patients with DR were identified and classified according to the International Clinical Diabetic Retinopathy Disease Severity Scale.<sup>8</sup> Other vision-threatening pathologies were also recorded. Patients diagnosed with vision-threatening DR (ie, severe non-proliferative or proliferative DR) had same-day panretinal photocoagulation (PRP) using a portable diode laser (Ellex, Australia) with indirect ophthalmoscopic delivery system. PRP treatment has for decades been accepted as safe and the most effective treatment for proliferative diabetic retinopathy (PDR).<sup>9</sup> In addition, PRP has been shown to be a very cost-effective treatment for vision-threatening DR.<sup>10</sup>

### Data analysis

Prevalence and percentages were calculated and descriptive data are presented. Additionally, stratified and bivariate analyses are presented as Odds Ratios and associations with appropriate p values using Fisher's exact test. Epi Info 3.5.3 (Center for Disease Control, Atlanta, GA, USA) was used for all data analysis. Patient records were dropped from bivariate analysis for missing data.

## RESULTS

### Diabetes and diabetic retinopathy

Ninety-seven referred patients with DM were entered into this pilot study. The average age was 59.2 years

(SD 11.3). Thirty-three patients (34%) were male (table 1).

The average time since diagnosis of DM was 6.0 years (range 0.1–25 years), with 23 patients (24%) having been diagnosed within 1 year or less. The average spot blood sugar was 224 mg/dL (SD 102); longer-term control data, such as haemoglobin A1c levels were not available. With respect to medical therapy, 28 patients (29%) were not being treated for their diabetes. Fifty patients (51%) were being treated with the single oral agent metformin, while 17 patients (17%) were being treated with a combination of metformin and an oral hypoglycaemic. Only one patient (1%) was being treated with insulin, and one patient (1%) was taking a traditional oral herbal therapy alone (table 1).

The average visual acuity was 0.87 logMAR (SD 0.69, range (0–2)). The average intraocular pressure (IOP) was 17.0 mm Hg (range 10–52). Of the 97 patients with DM, 36 (37%) had evidence of DR; 23 (24%) had evidence of vision-threatening DR including 10 (10%) with severe non-proliferative DR and 13 (13%) with PDR (table 2). Thirteen (13.5%) patients had diabetic macular oedema.

Thirty-three eyes in 23 patients (23.5%) had PRP with portable green wavelength laser for PDR or severe non-proliferative diabetic retinopathy. Four of the 25 patients (16%) diagnosed with DM within 1 year required PRP laser, whereas 19 of 71 patients (26%) diagnosed with DM greater than 1 year required PRP laser (p value 0.22) (table 3). While those with DM for at least 10 years were twice as likely to require PRP when compared with those having DM less than 10 years, the difference was not statistically significant (p value 0.10).

The type of DM treatment of the patients did not correlate with the need for PRP. Of the DM patients not currently being treated, six of 27 (22%) required

**Table 2** Diabetic retinopathy (DR) status of patients with diabetes mellitus (DM)

Total patients with DM	No DR	Mild/moderate non-proliferative DR	Severe non-proliferative DR	Proliferative DR
97 (100%)	61 (63%)	13 (13.5 %)	10 (10%)	13 (13.5 %)

Severe non-proliferative DR and proliferative DR are considered to be vision-threatening DR.

PRP. Of the patients using a single agent, 16 of 54 (30%) required PRP. Of the patients using two oral agents, two of 15 (8%) required PRP. The difference in PRP requirement among these three groups was not statistically significant.

### Hypertension comorbidity

Forty-seven (48%) of our subjects reported a history of hypertension. On physical examination however, of the 90 patients whose blood pressure was recorded, 56 patients (62%) were measured with stage 1 hypertension or worse; of these, 24 patients (27%) had stage 2 or worse hypertension. Of the 90 patients whose blood pressure was measured, PRP laser was required in 18 of 56 (32%) patients who had hypertension, but in only three of 34 (9%) patients who did not have hypertension (OR 4.9 (1.31–18.1),  $\chi^2$  6.36, p value 0.01) (table 4).

There was a significant trend as well with respect to the severity of hypertension: three of 34 (9%) without hypertension received PRP, seven of 32 (22%) with grade 1 hypertension received PRP and 11 of 24 (46%) with grade 2 or worse hypertension received PRP ( $\chi^2$  11.5, p value 0.003).

Other factors including age, gender, time from DM diagnosis and spot blood glucose were not correlated with the outcome variable of requiring PRP, and none of these factors affected the association of hypertension and the need for PRP.

### Other ocular diseases

Of the 194 eyes examined, 26 eyes (13%) were pseudophakic. Of the 168 phakic eyes, 50 (30%) had a dense cataract with visual acuity <6/18, and another 35 eyes (21%) had a moderate cataract on examination with visual acuity between 6/12 and 6/18.

With respect to ocular hypertension, 10 eyes (5%) had IOP of 23 mm Hg or greater and only one eye had IOP over 30 mm Hg. Three eyes had immeasurable IOP due to severe hypotony. While the cup-to-disc ratio was not recorded for all patients, 29 eyes of 16 patients (14%) were found to have cup-to-disc ratios of 0.5 or greater. Only 3 of these 16 patients were currently being treated for glaucoma.

Other visually significant abnormalities diagnosed during this pilot study were hypertensive retinopathy (12 eyes), retinal vein occlusions (11 eyes), traction

retinal detachments (nine eyes), age-related macular degeneration (seven eyes), epiretinal membranes (four eyes), diffuse retinal degeneration (four eyes), cystoid macular oedema (three eyes), severe hypotony (three eyes), non-arteritic ischaemic optic neuropathy (two eyes), posterior capsular opacities (two eyes), rhegmatogenous retinal detachments (two eyes), vitreous haemorrhage (two eyes), panuveitis (one eye), retinal tear (one eye) and pseudophakic bullous keratopathy (one eye).

One patient with a peripheral, localised retinal detachment was treated with laser retinopexy. Three eyes of two patients with ischaemic central retinal vein occlusions were also treated with PRP.

### DISCUSSION

Although the true prevalence of DR in Myanmar is unknown, an unusually high prevalence of vision-threatening DR was found in our study patients (23.5%). In comparison, a systematic review and meta-analysis of seven studies in the neighbouring country of India revealed a pooled prevalence of DR of 14.8% in patients age 30 and over and 18.1% in patients 50 and older.<sup>11</sup>

The results of this study highlight the underdiagnosis, delayed diagnosis, and undertreatment of both DM and DR in Myanmar. For example, PRP was performed for vision-threatening DR in 16% of those whose DM had been diagnosed within just 1 year. This fact is remarkable since DR is an advanced complication that only occurs many years after the onset of DM. Thus, delayed treatment of vision-threatening DR can result from either delayed diagnosis of DM or from delayed diagnosis of DR in known diabetics. Additionally, because there is limited treatment beyond metformin available to most diabetics in Myanmar, increased diabetic complications, including DR, are to be expected as a result of such undertreatment.

Hypertension was a significant risk factor for the development of vision-threatening DR in this group of patients. Patients who were diabetic with hypertension were more likely to require PRP than patients who were diabetic without hypertension (p value 0.01), and there was a strong trend correlation with grade of hypertension (p value 0.003). It is known that the incidence of DR is influenced by several important risk factors: poor blood glucose control, delay in diagnosis

**Table 3** Effect of time since diabetes mellitus (DM) diagnosis on need for PRP

	No PRP	Required PRP
1 year or less since DM diagnosis	21 (84%)	4 (16%)
More than 1 year since DM diagnosis	53 (74%)	19 (26%)
p value 0.22		

PRP, panretinal photocoagulation.

**Table 4** Effect of systemic hypertension status on need for PRP.

Patients requirement for PRP	Patients with DM and hypertension	Patients with DM and without hypertension	Patients with DM and grade 1 hypertension	Patients with DM and grade 2 hypertension
Required PRP	18 (32%)	3 (9%)	7 (22%)	11 (46%)
Required no PRP	38 (68%)	31 (91%)	25 (78%)	13 (54%)
Total	56 (100%)	34 (100%)	32 (100%)	24 (100%)
n=90	OR 4.3 (1.3–13.8), $\chi^2$ 6.41, p value 0.01		$\chi^2$ 11.5. p value 0.003	

PRP, panretinal photocoagulation.

of DM, high blood pressure, obesity and smoking. A National STEPS Survey in 2009 in Myanmar recorded these significant risk factors: the prevalence of hypertension was 31.0% in males and 29.3% in females.<sup>12</sup> Given the high correlation to the spot blood pressure, screening/treatment programs may add extra checkpoints to identify and treat higher-risk individuals and to reduce diabetic complications.

Although vision loss and blindness due to DM is to a large extent preventable with proper care, access to such care in Myanmar is difficult or impossible for most diabetics. Some of these access problems are unique to Myanmar, some not. It is a country made up of 135 national races speaking over 100 languages and dialects and thus has unique challenges due to administrative and cultural divisions. In addition, many people are prevented from accessing medical care by work obligations, personal financial straits, severe weather and transportation difficulties. For these and other reasons, many diabetics have historically turned to traditional forms of healing<sup>13</sup> rather than seeking care from the medical system. Finding ways to address these obstacles, as well as developing a strong educational campaign to improve awareness of the dangers of DR,<sup>14</sup> are therefore prerequisites to the success of a broad-based screening/treatment programme.

Another major obstacle to improving diagnosis and treatment of DR in Myanmar is a shortage of ophthalmologists. There are just 309 ophthalmologists to serve the 60 million people in Myanmar.<sup>15</sup> These ophthalmologists are not able to keep up with the backlog of patients who need cataract surgery, much less keep up with the growing need for treatment of vision-threatening DR. A further impediment is the marked imbalance in the distribution of ophthalmologists between the biggest cities and the rest of the country. The two largest cities, Yangon and Mandalay, have 60% of the country's ophthalmologists, but only about 25% of the country's population.<sup>15</sup> That means for the 45 million people outside of Yangon and Mandalay, there are only 123 ophthalmologists. If Myanmar is to develop an effective programme to prevent blindness

from DR, its goals should be to train more ophthalmologists and to dedicate more resources to establish a robust screening/treatment programme throughout the country. The significant prevalence of other eye pathology in these study patients demonstrates an additional value of such a screening programme.

There are limitations to this pilot study, most notably its small size. In addition, the study was carried out at a single hospital with patients referred by local doctors. This referral process could cause selection bias towards more severe disease. Nevertheless, this pilot study demonstrated a rate of DR (37%) in line with that found around the world (34%).<sup>16</sup> However, the rate of vision-threatening DR among those with DR (64%) in our study population was much greater than commonly reported (33%).<sup>16</sup> This higher than expected rate of vision-threatening DR should therefore be investigated with larger studies. Additionally, given the large and growing number of diabetics in Myanmar, the design of future studies of DR prevalence in Myanmar should take into consideration all current local and regional data.

This pilot study demonstrates the feasibility of locating and treating patients with vision-threatening DR in a provincial area of Myanmar despite the obstacles particular to the country. These results are important because there is at present very inadequate screening/treatment for DR in Myanmar. They suggest that such screening/treatment, if expanded throughout the country, could greatly reduce the burden of diabetic blindness for individuals and for society in general. This pilot study also provides data that can help in the design of a larger cross-sectional study of the prevalence of DR in Myanmar.

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**Competing interests** None declared.

**Patient consent** No information is present in this study identifiable as being from a specific patient. Treatment modality and treatment indications used in the study represent the widely accepted standard of care for diabetic retinopathy.

**Ethics approval** Weill Cornell Medical College IRB.

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