Population Based Assessment of Diabetes and Diabetic Retinopathy in South Kerala-Project Trinetra: An Interim Report

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Abstract

Aim: To assess the prevalence of diabetes and diabetic retinopathy in a community based screening programme in south kerala.

Methods: Between July 2007 and June 2008, 160 screening camps were conducted in 5 southern districts of Kerala. The target population underwent blood examination, comprehensive eye evaluation including dilated examination, counseling and those with vision threatening problems were referred to the base hospital for management.

Results: 7321 out of 37174 people screened (19.9 %) had diabetes including 18.9 % new diabetics. 16.2 % of diabetics had diabetic retinopathy including 4.3 % of new diabetics. Out of 1532 gradable eyes, 86.8 % had NPDR and 13.9 % PDR. Vision threatening retinopathy was seen in 39.5 % eyes. FFA was advised in 34.1 % patients. 38.9 % eyes required laser treatment and 3.5 % eyes vitreoretinal surgery. Health education was imparted to all 37174 participants.

Conclusion: Nearly 1/5th of study population had diabetes and this alarmingly high prevalence is likely to pose a public health burden in our state. Nearly 40 % of eyes have a potential to go blind and hence a concerted effort to screen and treat these eyes and spreading awareness about the disease is the need of the hour and this project is a successful effort in this direction.

Key words: Diabetic Retinopathy, Blindness, Eye Camps, Prevalence, Kerala

Introduction

Diabetic retinopathy is a major cause of visual impairment particularly in the working age group\(^1\,^2\) and develops in more than 75 % of diabetics within 15-20 years of diagnosis \(^3\,^4\). It is estimated that 57 million people in India may become diabetic by 2025 \(^5\) and this poses a major public health problem in our country especially as rural areas in India are rapidly urbanising. Moreover compared to the west, diabetes appears at a younger age \(^6\), is less associated with obesity \(^7\), and genetic factors appear to be stronger in our population \(^8\).
These clinical differences and rising prevalence of diabetes in India\textsuperscript{9} warrant well-conducted epidemiologic studies on diabetes-related complications including eye problems to assess the health service burden due to diabetes. However there is a paucity of data on the prevalence of diabetes-related eye diseases in our country. Though there are a few related studies in our country, a true picture of prevalence of this disease is not evident because of various anomalies—some studies are clinic based \textsuperscript{10}, some amongst self reported diabetics \textsuperscript{11}, rural-urban differences and differences in examination techniques—direct ophthalmoscopy\textsuperscript{12}, indirect ophthalmoscopy\textsuperscript{12,13}, photography\textsuperscript{10}, teleophthalmology screening etc. Thus the reported prevalence of diabetic retinopathy among diabetics range from 20.8 % to 34.1 %\textsuperscript{10,11,12,13}. Also due to diverse cultural differences, dietary patterns and religious beliefs, the prevalence of diabetes and therefore diabetic retinopathy(DR) may be different in different parts of the country. The state of Kerala, though it boasts of a high life expectancy and literacy rate, has a high prevalence (16.3 %) of diabetes\textsuperscript{14,15} and therefore possibly diabetic retinopathy. One study on self-reported diabetic subjects revealed retinopathy prevalence of 26.8 %\textsuperscript{11}. There are however no large scale population based studies on prevalence of diabetes and diabetic retinopathy among our population. This study was done to assess the prevalence of diabetes and diabetic retinopathy in a community based screening programme in south kerala.

**Materials and Methods**

The study area included 5 districts in South Kerala—Trivandrum, Kollam, Alleppey, Ernakulam and Kottayam. Chaithanya Eye Hospital and Research Institute along with World Diabetic Foundation a Denmark based foundation initiated this project called project TRINETRA. A total of 160 screening camps were conducted between July 2007 and June 2008. There were 2 kinds of camps—blood screening and awareness camps where eye examination was not done, and blood screening, awareness and comprehensive eye screening camps.

All the subjects underwent random blood glucose measurement. An individual with no past history of diabetes with a random blood glucose measurement >180 mg/dl was considered a diabetic. All subjects who were diagnosed to have diabetes in the past (old diabetics) or those new patients who satisfied the above said criteria (new diabetics) were examined for diabetic retinopathy.

Demographic details, diabetic history and treatment details were recorded. Ophthalmic examination included vision testing, IOP measurement and dilated fundus examination. A trained ophthalmologist performed retinal examination with direct and indirect ophthalmoscopy. Diabetic retinopathy was categorized using the modified ETDRS classification. Retinopathy was classified as Mild, Moderate and Severe nonproliferative diabetic retinopathy (NPDR), early proliferative diabetic retinopathy (PDR), high risk PDR, advanced PDR. The presence of clinically significant macular edema (CSME) was assessed using indirect and direct ophthalmoscopy. Eyes where posterior segment examination was not possible was defined as ungradable eyes. All the above information was recorded into a proforma at the camp site which was later entered into a computerized data base created at the project office in the base hospital.

Subjects who had any form of PDR or CSME were considered to have sight-threatening retinopathy. Subjects with severe NPDR, CSME and PDR were referred for further investigation and management to the base hospital. Subjects with no or minimal retinopathy were advised to schedule follow-up with their regular ophthalmologists at yearly intervals. An expert counselor focused on awareness creation giving patients information about the disease, treatment facilities, dietary advice etc. An on-site exhibition displaying diabetic retinopathy related posters was part of all these camps. Pamphlets and booklets on the disease were given to all the camp participants.

The data necessary for the present study was extracted from the data base into an excel sheet and analyzed.

**Results**

A total of 160 screening camps were conducted between July 2007 and June 2008. A total of 37174 subjects were screened for diabetes in these camps, an average of 232 per camp. The mean age of study population was 53.2 years and ranged from 20 years to 87 years.
There were 23828 males (64.09 %) and 13346 females (35.9 %) in the study.

Out of the 37174 people screened for diabetes, 7321 were diagnosed to have diabetes (19.69 %). This included both new and old diabetics. Out of the 7321 diabetics, 5939 were old diabetics (81.12 %) and 1382 were new diabetics (18.87 %). The prevalence of diabetes was 19.59 % in Trivandrum, 23.65 % in Kollam, 20.29 % in Ernakulam, 20.33 % in Kottayam and 20.46 % in Alleppey district. (Table 1).

Out of the 7321 diabetics only 5384 patients (comprehensive eye camp patients) underwent a detailed dilated examination. The others who were not included were those who attended only the blood screening and awareness camps. Among the old diabetic subjects the duration of diabetes ranged from 1 month to 38 years. Among the above 5384 subjects, 4307 (79.99 %) were previously aware of their diabetic status. Out of this group, 1647 (38.24 %) were on diet control, 2428 (56.37 %) were on oral medications, and 232 (5.38 %) were on insulin. Out of 4307 subjects who were diagnosed to have diabetes earlier, 13 (0.30 %) had evidence of past laser treatment for diabetic retinopathy. The visual acuity of the subjects ranged from 6/6 to PL.

876 (16.27 %) out of the examined 5384 subjects were identified to have diabetic retinopathy. Thus a total of 1752 eyes had some form of diabetic retinopathy. 220 eyes (12.56 %) although they had some evidence of retinopathy were ungradable due to media opacities including cataract, corneal opacities etc. The grade of retinopathy was defined in 1532 eyes (87.44 %) on indirect ophthalmoscopy. This included 1331 eyes (86.86 %) with NPDR, 213 eyes (13.90 %) with PDR and 392 eyes (25.59 %) with CSME. The classification of retinopathy is detailed in Tables 2 & 3. Vision threatening retinopathy defined as the presence of PDR or CSME was seen in 605 eyes (39.49 %). 6 people (0.68 %) were blind due to diabetic eye disease.

Fluorescein angiography was advised in 299 patients (34.13 %) and laser treatment advised in 596 eyes (38.90 %). The latter group included focal laser treatment for macular edema in 392 eyes (65.77 %) and panretinal photocoagulation in 182 eyes (30.53 %). Vitreoretinal surgery was advised in 31 eyes (3.54 %). 803 eyes were advised cataract surgery (29.83 %).

Among the patients with old diabetes, 52 subjects (2.38 %) had been diagnosed to have diabetic retinopathy in the past including 13 subjects who had undergone laser treatment while 802 subjects (36.72 %) were newly diagnosed to have diabetic retinopathy. Among the subjects with newly detected diabeties, 22 patients (4.33 %) already had some retinopathy. All the 37174 participants received health education related to diabetic retinopathy in the form of either pamphlet / booklets, diabetic retinopathy poster exhibition or expert counseling etc.

**Discussion**

Although the need for a national diabetic retinopathy screening program in India is recognized, national or regional screening initiatives are yet to be launched. Though recent studies indicate that there has been an increase in the prevalence of diabetes only a few studies have attempted to assess the prevalence of diabetic eye...
complications in India\textsuperscript{11,12}. In this study, we report the prevalence of diabetes and diabetic retinopathy in an mixed urban-rural population in south India based on an epidemiologic survey. The prevalence of diabetes in this study was 19.69 \% which is much higher than other population based reports\textsuperscript{12} in the country. Considering the fact that this estimation was based on a single random blood sample value of $> 180$ mg $\%$ the significance of this high prevalence cannot be underestimated. Many borderline diabetics who may have abnormal GTT were not assessed in this study and this would have increased the prevalence further. Also among the subjects with newly detected diabetics, 4.33 \% already had some retinopathy, which indicates that these subjects would have had undetected or uncontrolled diabetes for a considerable period of time. The above facts indicate that diabetes is highly prevalent in this study population.

The prevalence of DR among the diabetics is 16.27 \% in our study. This confirms the findings of earlier studies from India. A recent study where subjects were examined by ophthalmoscopy reported a 22.4 \% prevalence\textsuperscript{12}, whereas a similar study on self-reported diabetics revealed a prevalence of 26.8 \% and another clinic-based photographic evaluation study revealed a prevalence of 34.1 \%\textsuperscript{11}.

This study found that 86.86 \% had NPDR, 13.90 \% had PDR and 25.59 \% had CSME. Mild NPDR was seen in 60.48 \%, moderate NPDR in 29.90 \% and severe NPDR in 9.62 \% of NPDR eyes. CSME was seen in 24.34 \% of NPDR eyes. Out of the PDR eyes 47.42 \% had early PDR, 36.15 \% had high risk PDR, 5.63 \% had vitreous hemorrhage and 10.80 \% had TRD. 31.92 \% of eyes with PDR also had CSME. Overall 25.59 \% of the eyes were diagnosed to have CSME. This observation is similar to other studies done in this subcontinent. Narendran et al had reported that 94.12 \% of the patients with retinopathy had NPDR while 6.25 \% had PDR. Of the people with NPDR 62.5 \% had mild NPDR, 32.81 \% had moderate NPDR, 4.69 \% had severe NPDR. CSME was seen in 29.41 \% of affected eyes\textsuperscript{11}. Dandona et al had reported that 50 \% had mild NPDR, 39.3 \% had moderate NPDR, 7.1 \% had severe NPDR, 3.6 \% had PDR and 14.3 \% had CSME\textsuperscript{12}. However these studies did not elaborate on the eyes with vision threatening retinopathy or the type of PDR. The former study reported blindness in 1.47 \% people attributable to diabetes while the latter study found none compared to 0.68 \% in our study. Vision threatening retinopathy defined as the presence of PDR or CSME was seen in 39.49 \% in our study. These eyes have a potential to go blind if left untreated. Many of the subjects had cataract and other causes of ungradable fundi. These patients may have had some form of retinopathy associated with the cataract, which when added would increase the prevalence of diabetic retinopathy and related blindness.

Only 13 out of 876 diabetics with retinopathy (1.48 \%) had undergone evaluation and treatment for diabetic retinopathy in the past. This is less than 6.1 \% of those identified with retinopathy in a study in Tamilnadu\textsuperscript{13}. This indicates the lack of awareness on the disease or the lack of accessibility to specialized eye care facilities in our state. Moreover there is a lack of mass screening strategies in our state compared to Tamilnadu which probably could be a reason for more subjects availing diabetic retinopathy treatment in that state.

The technique of diabetic retinopathy screening used in our study was indirect and direct ophthalmoscopy. Fundus photography is considered the standard screening technique. Though mild retinopathy detection is better on photographic screening than ophthalmoscopy, some studies have reported a significantly higher specificity for ophthalmoscopy compared with nonmydriatic photography for detecting worse than mild retinopathy. Other studies have reported a much higher sensitivity for mydriatic retinal photography compared with ophthalmoscopy for the detection of worse than mild retinopathy\textsuperscript{17,18}. However Rema et al had reported that when photographic screening is used in epidemiological studies all standard photographic fields of the fundus can not be photographed and there is a possibility that some misgrading can occur among the graders even though they are trained\textsuperscript{10}. Thus in our study it is possible that we may have missed some eyes with mild retinopathy but not any of the vision threatening lesions. Although the British Diabetic Association recommends a sensitivity of 80 \% and a specificity of 95 \% for screening tests\textsuperscript{19}, investigators in most developing countries like ours may have to choose direct
or indirect ophthalmoscopy due to the relatively high costs of photography and as mydriatic and nonmydriatic fundus photography is currently not feasible financially. However photography may be ideal for screening high-risk groups within communities, clinic/hospital based screening etc.

Handling of the increasing problem of diabetes and its danger to sight includes effective education and communication with the patients on one hand, and with physicians and allied health professionals on the other. As part of this initiative all the participants in our study received health education including materials related to diabetic retinopathy.

The relatively low prevalence of diabetic retinopathy blindness may suggest that diabetic retinopathy requires less priority and attention than the other major vision impairing diseases in India like cataracts and refractive errors that account for nearly 90% of the current burden of blindness in India. However, it has to be realised that the projected 57 million diabetics by 2025 may drastically alter the existing pattern of blindness in India. Improving healthcare facilities in India will probably translate into a large number of diabetics living longer, and thus more diabetics are at risk for developing retinopathy. Broadening the focus of existing community screening programmes to include screening for diabetic retinopathy should be considered for early detection of retinopathy especially among the underserved populations. Formulating national policy guidelines, aiming at preventing or delaying the onset of diabetic retinopathy will ensure that diabetic retinopathy does not become a major cause for needless visual impairment or blindness in the future. Further studies are required to determine the changing magnitude of diabetic retinopathy and diabetes, as well as to understand the risk factors for diabetic retinopathy and visual loss in this population.

Inspite of certain limitations this study has given an insight into the problem of diabetes and diabetic retinopathy in our state. Nearly 1/5th of study population had diabetes and this alarmingly high prevalence is likely to pose a public health burden in our state. Nearly 40% of affected eyes have a potential to go blind and hence a concerted effort to screen and treat these eyes and spread awareness about the disease is the need of the hour and this project is a successful effort in this direction.

Reference