Population based assessment of diabetic retinopathy in an urban population in southern India

Lalit Dandona, Rakhi Dandona, Thomas J Naduvilath, Catherine A McCarty, Gullapalli N Rao

Abstract

Aim—To assess the prevalence of diabetic retinopathy and the visual impairment caused by it in an urban population in southern India in order to determine its public health significance.

Methods—2522 subjects (85.4% of those eligible), a representative sample of the population of Hyderabad city in southern India, underwent interview and detailed dilated eye examination during 1996–7 as part of the Andhra Pradesh Eye Disease Study.

Results—124 subjects, all ≥30 years old, reported that they had diabetes, an age-sex adjusted prevalence of 7.82% (95% confidence interval (CI) 5.76–9.88%) in this age group. Diabetes was diagnosed at age ≥30 years in all but two subjects. The duration since diagnosis of diabetes was <10 years in 75.6% and ≥15 years in 6.7%. Diabetic retinopathy was present in 28 subjects, 1.78% (95% CI 1.09–2.48%) of those ≥30 years old. Most of the diabetic retinopathy was of the mild (50%) or moderate (39.3%) non-proliferative type; one subject (3.6%) had proliferative retinopathy. Multiple logistic regression revealed that the odds of having diabetic retinopathy were significantly higher in those ≤50 years than in those 30–49 years old (odds ratio 7.78, 95% CI 2.92–20.79).

Conclusion—Visual impairment due to diabetic retinopathy in an urban population in southern India, as part of the Andhra Pradesh Eye Disease Study (APEDS), a population based epidemiology study in the state of Andhra Pradesh in southern India.2 4

Methods

Details of the sampling and methods of APEDS have been reported elsewhere.2 4 This study was approved by the ethics committee of the LV Prasad Eye Institute, Hyderabad, India. The aspects relevant to this report follow.

The total sample for APEDS was determined as 10 000, 2500 each in one urban and three rural areas.7 This sample size was calculated to get 5000 subjects each in the two age groups below and above 30 years because for an actual prevalence of 0.5% for an eye disease in either of these age groups this sample size would estimate it between 0.3–0.8% at the 95% confidence level.2

A multistage sampling procedure was used to obtain the APEDS urban sample representative of the 3.5 million population of Hyderabad city in southern India. The blocks (clusters) of Hyderabad were stratified by socioeconomic status and religion.2 7 The socioeconomic strata were: extreme lower (monthly per capita income in rupees ≤200 ( £3.2)), lower (201–500), middle (501–2000), and upper (>2000). The religion strata were Hindu and Muslim. Twenty four clusters were chosen using stratified random sampling with equal probability of selection.7 The selected clusters were mapped, and every third to fifth household was randomly systematically selected to obtain a similar number of households in the different clusters. Oversampling of those above 30 years of age was done by randomly assigning 10 of the selected clusters to have only subjects older than 30 years eligible, and the other 14 clusters to have all ages eligible.2 7 Aiming for a recruitment rate of at least 85%, a total of 2954 subjects were sampled to obtain a minimum sample of 2500 subjects.

The sampled subjects were interviewed in detail.2 This included systemic history about the diagnosis and treatment of diabetes and ocular history.

Subjects were brought to a clinic specially set up for this study. Written informed consent was obtained from the subjects before examination. The examination was performed by two ophthalmologists and two optometrists who had received special training in the procedures of this study. It included presenting and best corrected distance and near logMAR visual acuity, complete anterior segment examination, and dilatation of pupil unless contrain-
Diabetic retinopathy diagnosed after detailed dilated fundus examination.

In 28 of the 1399 subjects (22.4% of those with diabetic retinopathy), all age-sex adjusted prevalence estimates of diabetes and DR. Design effect of the sampling strategy was calculated from the prevalence in each cluster, and 95% confidence intervals of the estimates adjusted accordingly. The association of age, sex, socioeconomic status, and religion with DR was assessed using univariate \( \chi^2 \) analysis and multiple logistic regression.

**Results**

In all, 2522 subjects (85.4% of those eligible) were interviewed and examined between October 1996 and June 1997. The age range of these subjects was 1 month to 102 years. A total of 1399 (55.5%) were ≥30 years old, and 1347 (53.4%) female; 23 (0.9%) subjects were examined at home. Some 124 subjects, all ≥30 years old, reported that they had been diagnosed to have diabetes, an age-sex adjusted prevalence of 7.82% (95% confidence interval (CI) 5.76–9.88%, design effect 2.15) in those ≥30 years old and 2.44% (95% CI 1.40–3.47%, design effect 2.94) in all age groups considered together. Their mean age was 54 years, median 53 years, and range 31–86 years. The prevalence of self reported diabetes was higher in males than in females ≥30 years old (Table 1). In two subjects diabetes was diagnosed at age 25 and 29 years, respectively, while in the rest at age ≥30 years. Another 32 years old female subject not known to be diabetic had what looked like typical DR, but she refused to have a blood glucose test. However, she was considered to be diabetic based on typical DR. Of the 124 self reported diabetics, 97 (78.2%) were taking oral hypoglycaemic agents, 11 (8.9%) were using insulin, and 16 (12.9%) were not using any medication for diabetes.

No major discrepancy was found between the clinical grading of DR and that assessed by evaluation of the photographs taken as described in the methods section. DR was present in 28 subjects (22.4% of those with diabetes), all ≥30 years old, an age-sex adjusted prevalence of 1.78% (95% CI 1.09–2.48%, no design effect) in those ≥30 years old and 0.56% (95% CI 0.23–0.89%, design effect 1.25) for all age groups considered together. Like self reported diabetes, the prevalence of
The relation between the duration since diagnosis of diabetes and DR is shown in Table 4.

Of the 125 diabetics, fundus could not be examined in either eye in 4 owing to dense cataract or small pupil, and data regarding duration of diabetes were not available for 2. These 6 subjects are not included in this table.

NPDR=non-proliferative diabetic retinopathy; PDR=proliferative diabetic retinopathy.

Percentages do not add up exactly to the total because of rounding.
advanced DR developing which could result in blindness. Increase in duration of diabetes has been shown to be associated with higher risk of blindness which increases particularly after about 15 years of diabetes. In our sample, 87.5% of those with duration of diabetes since diagnosis ≥15 years had DR compared with 18.9% of those with duration <15 years. However, none of those with duration of diabetes since diagnosis ≥15 years had advanced DR which could have resulted in blindness. This could be due to the small number of subjects in this group (eight) or to some other unidentified reason. Another reason for not finding blindness caused by DR in our sample could be that the majority of the diabetes (98.4%) had been diagnosed at ≥30 years of age. It has been reported that diabetes diagnosed at <30 years of age is more common in developed countries, and it is associated with a higher chance of blindness caused by DR. We found with multivariate analysis that subjects belonging to the upper or middle socioeconomic strata had a 86% higher chance of having DR than those belonging to the lower or extreme lower strata though this did not reach statistical significance. One could speculate that this trend could be the result of less predisposition of the lower socioeconomic strata to DR or higher mortality at relatively younger age in these strata before DR can develop or a combination of these two. Further study would be needed for verification of this finding and its implications. A limitation of our study is that all standard photographic fields of the fundus were not photographed and graded by masked observer(s). Although the two ophthalmologists who graded DR clinically were trained specifically for the study, it is possible that some misgrading of DR could have occurred. If any cases of DR were missed, however, these would have most likely been mild NPDR.

In this urban population in southern India 1% had blindness, the causes of which were varied, including cataract, retinal diseases (retinitis pigmentosa, choriotretinitis scar, atrophic macula, myopic degeneration, retinal detachment), corneal diseases, refractive error, glaucoma, and optic atrophy. DR did not contribute to this blindness. In this same population, moderate visual impairment was present in 7.2%, to which DR contributed only a minute fraction (0.01%). In brief, compared with other causes DR contributed very little to visual impairment in this urban population in southern India in 1996–7. However, these results should be interpreted with extreme caution. It is anticipated that the population of India will age over the next few decades—that is, the proportion of older people in the population will increase. It is possible that this would result in increase in the number of years that people would live with diabetes, thereby, increasing the chance of visual impairment due to DR. In addition, there is evidence that the prevalence of diabetes has recently been increasing considerably in urban India. This, along with aging of the population, may increase the predisposition to visual impairment due to DR significantly in urban India over the next decade or two. Therefore, in order to monitor the relative public health importance of visual impairment due to DR and other causes in India, new reliable population-based data will be needed in the future.

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