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Incidence of cataract in type 2 diabetes mellitus among Rural people

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Abstract

Cataract is a leading cause of blindness worldwide and a major public health problem. Ageing populations and the increasing prevalence of diabetes mellitus create an ever increasing prevalence of cataracts and health care demands. To meet this challenge, it is necessary to know more about the association between diabetes and the different subtypes of lens opacities. Thus, we aimed to study the epidemiology and risk factors of cataract subgroups in type 2 diabetes mellitus in a defined geographical area compared with an age- and gender matched control population from the same geographical area. Subjects in the rural people with a diagnosis of type 2 diabetes mellitus and a control group participated in the study. Lens opacities were graded with Lens Opacities Classification System II in all participants. Lens Opacities Classification System score ‡2 was considered as significant lens opacity. Anthropometric and blood chemistry data were collected for all participants in connection with the eye examination. For the diabetic population, yearly updated information on glucose control, blood pressure and body mass index was available through medical records from diabetes diagnosis until the time of the eye examination. The prevalence of significant cortical, posterior subcapsular and nuclear cataract was 65.6%, 42.2% and 48.30%, respectively, in the type 2 diabetes population in rural population. Cortical lens opacity was also associated with a diagnosis of diabetes ($p < 0.0001$), posterior subcapsular lens opacity with nuclear lens opacity with female gender. In the diabetic population, all types of cataract were likewise strongly associated with age ($p < 0.0001$), posterior subcapsular cataract with nuclear cataract with female gender ($p = 0.0002$). Our study shows that cortical cataract is associated with diabetes mellitus, not necessarily defined by glucose control, whereas posterior subcapsular cataract is associated with glucose levels. Nuclear cataract is not associated with diabetes mellitus, but is more frequent in women and is also associated with higher heart rate.

Keywords: Cataract, Type 2 Diabetes mellitus, Adilabad, Lens, capsular.

INTRODUCTION

Cataract has been a major cause of visual impairment among senior citizens worldwide. According to data provided by the World Health Organization (WHO), cataract is responsible for nearly 50% of blindness across the world (WHO, 1985). With the coming of aging society, the prevalence of cataract increases rapidly. The importance of risk factors identification for cataract is therefore evident. In the past decades, researchers have performed numerous in-depth epidemiologic studies to understand the pathogenesis of cataract (Arnarsson et al, 2002), many of which indicated that hypertension plays an important role in the development of cataract (Hennis A et al, 2004 and Zargar et al, 2000). As the prevalence of type 2 diabetes mellitus (DM) is on the rise, more so in India (Prasad et al, 2001) it is important to study the prevalence of cataract in this select population. Also, in a clinical setting, a mixed cataract—a combination of nuclear, cortical, and subcapsular cataract—is more common than just a single entity (SN-DREAMS, 2011).

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Therefore, the association between diabetes and mixed cataract would be of great interest in an epidemiologic study. The present study was undertaken to help in understanding how the interplay of clinical and biochemical variables influence the development of cataract and its subtypes, including mixed cataract. So far, this aspect has not been studied extensively. The aim of the study was to identify the prevalence of diabetic cataract in type 2 diabetic patients among rural population of Telangana.

MATERIALS AND METHODS

Study area:

The study subjects were recruited from the rural areas of the Adilabad district, Telengana State. Telangana is an ongoing epidemiologic study involving a representative population of Adilabad, in southern India, with a population of approximately as per 2001 census is 24,79,347 of which the rural population accounts for 18,23,004 or 73.52% of the total, while the urban population accounts for 6,56,343 forming 26.48 % of the total population. The increase in population during decennial ending 1991 over 1981 is 26.85 %, which is higher that of the state. The female population is less namely, 980 females for every 1000 males. A local diabetes register created at the private health care center and is continuously updated as new patients with diabetes are found.

Cross-sectional survey:

An ophthalmologist examined all individuals during the time period from 1st January 2013 to 31st December, 2015. Lens gradings were based on the Lens Opacities Classification System II (LOCS II) (Chylack et al. 1989) and performed with direct reference to photographic standards at the slit lamp, under dilatation. All levels of lens opacities were recorded. The criteria did not consider whether there was another type of cataract also present in the same or contralateral eye. If there were lens opacities of the same type in both the eyes, the worst eye was considered. If only one eye could be judged, this has been considered to be the worst eye. All participants of the study were asked to answer a questionnaire. Among the questions asked were smoking habits and if and why eye surgery had been performed. Data on type of diabetes treatment were recorded from the diabetic patient's files at the private health care centre in Adilabad at the time of the cross-sectional examination.

Classification of Diabetes population:

All inhabitants in rural areas were diagnosed with type 2 diabetes before 1 January 2015 were invited to participate in the study. The diagnosis of diabetes was accepted if the 1985 World Health Organization (WHO) criteria (WHO Study-Group 1985) were fulfilled. Data from the type 2 diabetic population were collected both from the time of diagnosis of the diabetes, over time and, as mentioned earlier, at the cross-sectional examination. The longitudinal information consisted of continuously collected measurements of fasting blood glucose, systolic and diastolic blood pressure and BMI values from the time of diabetes diagnosis until the cross-sectional examination. These data were assembled from the patient files at the private health care center in Adilabad. Yearly mean values for these variables were summarized into a total mean value (total mean fasting blood glucose, total mean systolic blood pressure, total mean diastolic blood pressure and total mean BMI) from diabetes diagnosis until end of follow-up at the cross-sectional survey.

Clinical and Biochemical Studies:

Anthropometric measurements including weight, height, and waist measurements were obtained using standardized techniques. The body mass index (BMI) was calculated by the usual formula: weight in kilograms divided by height in meters squared. Blood pressure was recorded in the sitting position in the right arm to the nearest 2 mm Hg with a mercury sphygmomanometer. Two readings were taken 5 minutes apart, and the mean of the two was taken as the final blood pressure reading of the individual. A fasting blood sample was taken after ensuring 8 hours of overnight fasting for estimation of plasma glucose.

Study Participants:

A total of 275/550 subjects had a diagnosis of type 2 diabetes mellitus. They consisted of all, except one, known type 2 diabetic patients, representing a crude prevalence of 3.9%. They were all included in the study but did not participate in all parts; 33/66 patients with type 1 diabetes, aged 15 years or more, were not enrolled in this study. The eligible control subjects numbered 275/550. No control subject was chosen for a 24-year-old diabetic person because he was first considered to have type 1 diabetes. The negative result of the islet antibody test that rendered him a type 2 diabetes diagnosis arrived after the examinations of the control subjects were completed. As 19/38 subjects, who at first had accepted to participate as controls, could not participate, most often because of an acute disease afflicting themselves or close members of their family, 256/502 control subjects were finally slit lamp examined for cataract. Thus, 531/1062 residents of rural Adilabad, were enrolled in the study. Of the 531/1062 subjects, anthropometric data were missing for 16/32 patients and 10/20 control subjects. Twenty-six patients (26/42) in the diabetes group and 17/34 subjects in the control group left a questionnaire regarding smoking and eye surgery unanswered. Reasons for the missing data were mainly high age and concomitant severe disease such as dementia, terminal malignant disease or sequels of cerebrovascular disease.

Statistical Analysis:

The data were analyzed on computer (SPSS for Windows, ver. 10.0; SPSS Science). Results are expressed as the mean + SD. Student's t-test was used

to compare continuous variables, and the X2 test was used to compare proportions among groups. The 95 % confidence interval was calculated. Results were considered significant if $p < 0.05$.

RESULTS

Characteristics of the study participants:

The characteristics of the study participants are shown in Table 1. Mean age at the time of examination by ophthalmologist was 69 years in the diabetes group (range 24–91 years) and 70 years in the control group (range 36–93 years). The male:female ratio in the two groups was very similar, 1.20 in the diabetes group and 1.13 in the control group. Significant differences between the two groups consisted of lower total cholesterol and HDL cholesterol and higher fasting blood glucose, triglycerides, weight, BMI, systolic blood pressure and heart rate among the patients with diabetes. In the diabetes group, 38% had diet only as their diabetes treatment, while 36% had one or more oral hypoglycaemic agents and 26% insulin with or without hypoglycaemic agents at the cross-sectional survey. The mean diabetes duration was 9 years (range from less than half a year to 47 years). A total mean fasting blood glucose value of 7.9 mm, total mean systolic and diastolic blood pressure of 156 versus 87 mmHg and a total mean BMI of 29.2 kg ⁄ m2 represented the longitudinal data. 23/46 subjects in the diabetes population and 18/36 in the control population ($p = 0.6$) had one or both crystalline lenses removed.

Table 2 shows prevalence and type of lens opacities stratified by age groups and gender. Male patients with type 2 diabetes had a significantly higher prevalence of cortical lens opacity ($p = 0.0007$), and female patients

Table-1. Characteristics of the study participants

Characteristics	No diabetes		Type 2 diabetes (%)		p-value (Diabetes Vs no diabetes)	
	Female (n=240)	Male (n=272)	Female (n=250)	Male (n=300)	Female (n=490)	Male (n=572)
	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	p-value	p-value
Age (year)	71+12	69+12	70.5+12.05	68.4+11.21	0.52	0.55
Fasting blood glucose (mM)	4.5+0.47	4.5+0.45	7.3+2.3	8.2+3.5	<0.0001	<0.0001
Systolic blood pressure (mmHg)	149.2+24.5	139.5+19.5	155.8+21.7	151.5+23.5	<0.0134	<0.0011
Diastolic blood pressure (mmHg)	82.2+11	81+9.3	81.1+8.2	85.5+9.0	0.186	0.0801
BMI (Body Mass Index-kg/m²)	26.4+4.18	26.1+3.18	29.2+4.5	28.2+4.9	<0.0001	<0.0001
Total cholesterol (mM)	6.4+1.2	5.9+1.0	6.4+1.2	5.1+1.2	0.256	0.002
Triglycerides (mM)	1.5+0.4	1.6+1.1	2.2+1.3	1.91+1.01	<0.0001	<0.0012

Table-2. Prevalence of subjects with different types of lens opacities (cataract) among patients with type 2 diabetes and control subjects.

Age (yrs)	Type of lens opacity	No diabetes (%)		Type 2 diabetes (%)		p-value (Diabetes Vs no diabetes)
		Female	Male	Female	Male	Both sexes
<54		n=28	n=46	n=26	n=46	n=146
	Cortical	2 (7.2)	2 (4.3)	6 (23.2)	10 (21.1)	0.036
	Posterior subcapsular	0 (0.0)	0 (0.0)	2 (7.8)	2 (4.5)	0.1510
	Nuclear	0 (0.0)	0 (0.0)	2 (7.7)	2 (4.4)	0.1510
	Lens removed	2 (7.21)	1 (4.3)	6 (23.2)	12 (26.5)	0.0190
55-64		n=44	n=44	n=48	n=60	n=196
	Cortical	12 (27.2)	8 (18.2)	24 (51.0)	36 (60.4)	0.0008
	Posterior subcapsular	4 (9.3)	2 (4.6)	10 (21.0)	16 (25.5)	0.0213
	Nuclear	8 (19.1)	6 (14.3)	10 (20.8)	4 (6.7)	0.0695
	Lens removed	20 (46.3)	14 (31.8)	26 (54.4)	42 (71.96)	0.0158
>65		n=168	n=182	n=176	n=194	n=720
	Cortical	126 (75)	102 (56.04)	136 (77.2)	108 (55.6)	0.0008
	Posterior subcapsular	84 (50)	76 (46.9)	116 (65.9)	84 (43.2)	0.0161
	Nuclear	132 (78.5)	114 (62.6)	144 (81.8)	104 (53.6)	0.4660
	Lens removed	150 (89.2)	162 (89.01)	168 (95.4)	162 (83.5)	0.0618

with type 2 diabetes posterior subcapsular lens opacity ($p = 0.0220$), compared with control subjects. We found no difference between the diabetes and the control group regarding nuclear lens opacity. Only age ($p < 0.0001$) was significant for any type of cataract among the type 2 diabetic subjects.

DISCUSSION

Age was, as expected, the strongest risk factor for all types of lens opacities both among patients with type 2 diabetes and a gender- and age matched control group from the same geographical area. Besides age, in multivariate analyses, cortical lens opacity was significantly more common among patients type 2 diabetes. There was also a significant association between posterior subcapsular lens opacity and a higher HbA1c. Having nuclear lens opacity showed, however, no association with a diabetic state or glucose control, but was instead significantly related to female sex and surprisingly to a higher heart rate. In the diabetic population, age was again the dominant significant determinant for all types of cataract. A significant association could also be seen between posterior subcapsular catarac. Nuclear cataract was significantly associated with female sex and higher heart rate. Several studies have shown similar results, although the association between diabetes and different types of cataract is complex. The Framingham study showed an increased prevalence of cataract in patients with diabetes (Porika Raju and Estari Mamidala, 2015 and Thulasiraj et al. 2002). In the Wisconsin Epidemiologic Study of Diabetic Retinopathy, the risk of cataract surgery was higher for persons having type 2 diabetes using insulin (Zarger et al. 2000).

Whether prevention and improved control of diabetes would reduce the burden of cataract remains to be demonstrated. Our data, together with others, indicate a possibility for such a scenario for cortical and posterior subcapsular cataract, but not for nuclear cataract. Future studies on the pathogenesis and epidemiology of cataracts must distinguish between the three types of lens opacities, as they clearly show different patterns.

Ethics statement

Ethics approval was not sought for this article.

Competing interests

The authors have declared that no competing interests exist

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