Community Medicine Section

Prevalence of Diabetic Retinopathy and its Associated Factors in a Rural Area of Villupuram District of Tamil Nadu, India

BALASUBRAMANIAN NADARAJAN[1], GANESH KUMAR SAYA[2], RAMESH BABU KRISHNA[3], SUBITHA LAKSHMINARAYANAN[4]

ABSTRACT

Introduction: There is limited information on prevalence of Diabetic Retinopathy (DR) among diabetic subjects and its associated factors in a rural setting in developing countries including India. The information will be useful for initiating early screening strategies for this group in the community.

Aim: To assess the prevalence and certain associated factors of DR among diabetic subjects in a rural area of Tamil Nadu, India.

Materials and Methods: This cross-sectional study was conducted among 105 Type 2 diabetic subjects in Pakkam and Mandagapattu sub-center area of Kondur Primary Health Center in Villupuram district of Tamil Nadu, India. Data on associated factors which include sociodemographic factors, duration of disease, family history, and frequency of blood test, treatment regularity, hypertension, visual acuity and cataract were collected. Detailed eye examination including visual acuity, direct ophthalmoscope and Non Mydriatic Fundus Camera was done. Data was analysed by univariate analysis and described in proportion or percentages.

Results: The mean age of the study population was 56.69 years. About 47 (44.8%) of the subjects were more than 60 years of age followed by 44 subjects (41.9%) in age group 45-59 years. Fundus examination in at least one eye was seen in 83 people (79.0%). Prevalence of DR in any eye and both the eye was 32.53% (27/83) and 31.58% (24/76) respectively. Severity of DR was moderate (51.9%) followed by mild (44.4%) and severe (3.7%). DR prevalence was more among >60 years age group (p=0.032) and lesser education level (p=0.057). There was no association of DR with duration of disease, family history of diabetes, treatment regularity, presence of hypertension, visual acuity and cataract (p>0.05)

Conclusion: The prevalence of DR was inferred to be high and further larger follow up studies will explore the role of associated factors and its quantification in the causation of DR.

INTRODUCTION

World Health Organization (WHO) has predicted that in India, the number of adults with diabetes will be the highest in the world with the magnitude of the problem from 19 million in 1995 to 80 million in 2030. Although, originally thought to be a disease of an urban population, the prevalence of diabetes mellitus is increasing in rural areas as well [1]. At the same time, diabetes related complications are reaching alarming proportions in developing countries.

Being one of the best examples for iceberg phenomenon of disease, nearly half of the diabetic subjects are not diagnosed or those with diagnosed are not followed up and treated regularly. Several studies have reported the cost effectiveness of screening for DR [2]. It was established that eye screening among diabetic subjects saves vision at relatively low cost, with comparatively lesser disability level and absence of a screening programme may lead to high chances of becoming blind [2].

Very few studies were conducted at community level in India [3,4]. The prevalence of DR in population of Chennai, India was 17.6% [3]. In a clinic based population of hospital cohort of 6792 Type 2 diabetic subjects attending a diabetes centre at Chennai in Southern India, the prevalence of DR was 34.1% [5]. Another Indian hospital study showed prevalence as 28.9% [6] and Chennai urban community based study showed it as 18% [7].

There is a paucity of data in India on associated factors of DR like duration of diabetes, treatment regularity and other modifiable factors. Along with increase in disease burden, the diabetes-related eye diseases are also increasing in developing countries including India, which has the largest number of diabetic individuals in the world. With this background, the present study was conducted in a rural Tamil Nadu in India to determine the prevalence of DR and certain associated factors among diabetic subjects.

MATERIALS AND METHODS

This community based cross-sectional study was carried out in a district of Tamil Nadu from September 2012 to April 2013. The study area included two sub centres namely Pakkam and Mandagapattu attached to Kondur Primary Health Centre which comprises three villages in Villupuram district of Tamilnadu. The population of Pakkam sub-centre area is 4602 (Male-2299, Female-2303) and Mandagapattu sub-centre area is 3125 (Male-1567, female-1558). We selected diabetic subjects from these two sub centre service areas which will cover the required sample size and these two sub centres were chosen randomly using lottery method from among the seven sub centres of the Primary Health Centre.

Considering the prevalence of DR as 18% and required absolute precision at 7% level, the sample size estimated was found to be 116 [3]. There were 125 known Type 2 diabetic subjects in the two sub center areas which include the cases diagnosed previously by registered medical practitioner and out of these, 105 diabetic subjects attending Primary Health Center as per the register available in the Primary Health Center. All these 105 diabetic cases attending and taking treatment from Primary Health Center from these two sub centre areas were included in the study.

Study was approved by Institute Scientific Society and Institution Ethics Committee. Informed written consent was obtained from all the study subjects. This part of the study presented the prevalence and associated factors of DR, while another part of the study on awareness of eye effects among diabetic subjects was presented [8].

Prior written permission was obtained from the District Health Officer of Villupuram District, Tamil Nadu. As a first step, all the address of the diagnosed diabetic subjects was noted down. Initially, they were contacted in their houses. After explaining the purpose and procedure of the study, informed written consent was obtained in their respective houses by the Principle Investigator. Data was collected by interview technique by using a semi structured pre-tested questionnaire in local language (Tamil). The face validity of the questionnaire was assessed based on the two expert's opinion and accordingly minor modifications were done.

Data on contact details, socio demographic factors, duration of Diabetes Mellitus, family history, treatment regularity were collected. Information was given on eye examination date and details of eye care facilities. Wide publicity was given for special eye camp on the scheduled date for the diabetic cases with the help of village leaders, health inspectors and village health nurse in the villages. All the 105 diabetic subjects who were interviewed in the houses were visited the camp held in Primary Health Center.

In-coordination with Tele-ophthalmology Department attached to Ophthalmology department of the institution, eye camp was organized at Primary Health Center, Kondur. The presenting and the best corrected Visual Acuity (VA) using Snellen's chart, pinhole testing, and assessment of refraction, eye examination using Direct Ophthalmoscope and Non-Mydriatic Fundus Camera by the team of ophthalmology doctors were done. The minimum criterion for diagnosis of DR was the presence of at least one definite micro aneurysm in any field photograph. Photographs were assessed and accordingly severity of retinopathy was assessed. Final diagnosis for each subject was determined from the grading of the visualized eye according to the Early Treatment Diabetic Retinopathy Study (ETDRS) criteria for each eye [9]. Based on the fundus findings of Ophthalmoscope examination, cases were referred for further investigations and treatment.

STATISTICAL ANALYSIS

Collected data was entered in Statistical Package for Social Sciences (SPSS) version 19 (IBM PASW STATISTICS-19.0). All categorical data was analysed using proportion and chi-square test. The results were presented as frequencies and percentages. A p-value <0.05 was considered as significant.

RESULTS

The mean age of the entire study population was 56.69 years. A total of 47 (44.8%) of the subjects were more than 60 years of age followed by 44 subjects (41.9%) in age group 45-59. Proportion of females was more compared to males. 59 (56.3%) participants had no formal education. Majority of the subjects were Hindus (70, 66.7%). More than half of the subjects (54, 51.4%) belonged to lower income category (500-1499 rupees) [Table/Fig-1].

105 subjects participated in the study. Out of 105 subjects, fundus examination was done in both eyes for 76 subjects (72.38%) and only one eye for seven subjects (6.7%) due to haziness view of the another fundus. Totally fundus examination in any eye was seen in 83 people (79%). In 22 subjects (20.96%), fundus in both eyes was not seen and hence not evaluated because of the dense cataract causing hazy media which obstructed the fundus visualization. So, DR prevalence was confined to 83 subjects. Prevalence of DR in any eye was found to be 32.5% (27). Severity of DR is moderate (14, 51.9%) followed by mild (12, 44.4%) and severe (1, 3.7%). Out of 76 diabetic subjects among whom both the eyes examined, prevalence of DR in both the eyes was 31.6% (24).

Nearly half (39, 47%) of the subjects were in age group 45-59 years. More than half (45, 54.2%) were illiterate, followed by middle and high school level (18, 21.7%). Nearly 1/3rd (26, 31.3%) are skilled laborers and semi professional. The statistical relation between DR and socio demographic variables was significant for age (p=0.032)

Variables	Number of subjects	Percentage (%)
Age group		
30-44	14	13.33
45-59	44	41.91
≥ 60	47	44.76
Sex		
Male	46	43.80
Female	59	56.20
Education		
No schooling	59	56.20
1st-5th	19	18.10
6th-10th	19	18.10
>10th	8	7.60
Religion		
Hindu	70	66.67
Christian	27	25.73
Muslim	8	7.60
Occupation**		
Unemployed	33	31.43
Skilled	9	8.57
Unskilled	39	37.14
Petty business	10	9.53
Semi professional	14	13.33
Per capita income (rupees)*		
> 3000	13	12.4
1500-2999	31	29.5
500-1499	54	51.42
< 500	7	6.67

[Table/Fig-1]: Socio demographic characteristics of the study subjects.
N=105
*Per Capita monthly Income classification based on Modified Prasad's classification, 2008.
**Occupation classification by International Labour Organisation

and comparatively more among those with lesser education level (p=0.057). Among the DR affected cases, both sexes are equally distributed. A total of 14 DR (46.7%) subjects were in the age group of more than or equal to 60 years. There was no statistical significance between duration of DM and DR cases. 50 subjects (60.2%) were on anti hypertensive along with oral hypoglycemic drugs. 10 subjects (12%) gave history of missing the oral hypoglycemic drugs in the previous month [Table/Fig-2].

Among those with visual acuity of < 6/18, 36.7% had DR and among those with cataract, 39.1% had DR. Prevalence of DR was comparatively lesser among those who availed eye hospital visit earlier, but this was not found to be significant [Table/Fig-3].

DISCUSSION

The present study highlighted the fact that prevalence of DR is high in this rural area. Various studies have shown different findings at country and global level. Some Indian studies were consolidated [Table/Fig-4] on prevalence of DR [4,6,7,10-16]. A study in Kuwait showed the DR in 7.6% newly diagnosed diabetic patients [17]. Few studies have found higher prevalence than our study from other countries [5,18-20]. A recent study in Jamaica showed the frequency of DR as high as 78% [21]. A study on assessment of DR among self reported diabetic subjects by questionnaire in Kerala revealed a prevalence of DR as 26.8% [22]. The varying prevalence in different studies may be due to different factors like the type of diabetes included, areas taken for the survey, methodology adopted, definitions used for the diagnosis and the magnitude of presence of exposure to various risk factors related to DR.

Older age is one of the important associated factors of DR as

Associated factors	Total number of subjects	Number of subjects with DR (%)	χ^2, p-value
Age (in years)			
30-44	14	1(7.1)	
45-60	39	12(30.8)	6.898, 0.032*
> 60	30	14(46.7)	
Sex			
Male	37	13(35.1)	
Female	46	14(30.4)	0.206, 0.65
Education			
No schooling	45	15(33.3)	
1st to 5th	12	7(58.3)	
6th to 10th	18	2(11.1)	7.506, 0.057
> 10th	8	3(37.5)	
Occupation			
Unemployed	14	8(57.1)	
Skilled	26	7 (26.9)	
Unskilled	8	3(37.5)	5.135, 0.274
Petty Business	9	2(22.2)	
Semi Professional	26	7(26.9)	
Family history			
Yes	32	8(25.0)	
No	51	19(37.3)	0.109, 0.741
Duration (in years)			
< 1	10	3(30.0)	
1-5	47	13(27.7)	1.67,0.434
> 5	26	11(42.3)	
Frequency of blood test (months)			
1	15	6(40.0)	
2	32	12(37.5)	
3	28	8(28.6)	2.404, 0.493
4	8	1(12.5)	
Hypertension			
Yes	50	17(34.0)	
No	33	10(30.3)	0.124, 0.725
Dose missed in previous month			
Yes	10	3(30.0)	
No	73	24(32.9)	0.033, 0.856

[Table/Fig-2]: Prevalence of diabetic retinopathy according to associated factors. N=83

Variables	Total number of subjects	Number of subjects with DR (%)	χ^2, p-value
Difficulty in vision			
Yes	68	22(32.4)	1q
No	15	5(33.3)	0.005,0.942
aZ (Visual Acuity in eye)			
Normal (6/6 to 6/18)	53	16(30.2)	
Decreased (<6/18)	30	11(36.7)	0.366,0.545
Cataract			
Yes	23	9(39.1)	
No	60	18(30.0)	0.631,0.427
Previous eye hospital visit			
Yes	36	9(25.0)	
No	47	18(38.3)	1.642, 0.2
Availed eye treatment			
Yes	48	15(31.3)	
No	35	12(34.3)	0.085, 0.771

[Table/Fig-3]: Prevalence of diabetic retinopathy according to other eye conditions and eye care. N=83

Study description	Place	Prevalence of DR among diabetics	Reference Number
Namperumalsamy P et al.,	Theni, Tamil Nadu	12.2%	[4]
Agarwal RP et al.,	Bikaner, Rajasthan	28.9%	[6]
Raman R et al.,	Chennai, Tamil Nadu	18%	[7]
Agarwal S et al.,	Tamil Nadu	6.35%	[10]
Zheng Y et al.,	Indian migrants in Singapore	30.4%	[11]
Vaz NC et al.,	Goa	15.4%	[12]
Raman R et al.,	Tamil Nadu	4.8%	[13]
Vyas U et al.,	Ahmedabad	14.6%	[14]
Potluri R et al.,	India, hospital based	16.3%	[15]
Gadkari SS et al.,	Nationwide population based	21.7%	[16]
Present study	Villupuram district- Tamil Nadu	32.5%	

[Table/Fig-4]: Studies on prevalence of diabetic retinopathy in India.

illustrated in this study similar to other studies [23]. This is important in view of increase in proportion of elderly population in India. However, a study in United Kingdom showed that age is a risk factor for progression of DR, but not for its incidence [24]. The variation in age as a risk factor may be due to confounding factors like personality and environmental factors, genetic variation or selection procedure involved while conducting the research study.

Although proportion of males with DR was comparatively more in this study, it was not statistically significant. Some studies showed that DR prevalence is more common among males [25,26], while other studies showed that DR prevalence is more common among females [21]. Similarly risk of DR is comparatively more among those with middle and upper socio economic status group [23]. This study showed varying results with respect to education and occupation classification. The more proportion among unemployed group may be due to confounding effect of age in this study. Since the sample size may be lesser to detect this difference, studies with more sample size may explore the true difference in proportion of DR across these variables.

Various studies highlighted that hypertension is an important risk factor associated with DR [23,26,27]. Although proportion of DR subjects is more among those with hypertension, it was not found to be significant. Retinopathy was also positively associated with moderate visual impairment as observed in Indian study [28] and our study also showed that about 36.7% of the subjects with DR had decreased vision. In view of the above finding that majority of the DR subjects have not any symptoms related to eye, it is important to conduct regular screening of eye among those with apparently healthy diabetic subjects.

The duration of diabetes, however, remained the strongest predictor for the development and progression of DR and its severity. Moreover, such an association has been observed by several other investigators as well [22,25]. While the duration of diabetes was an independent risk factor for DR development, it is also important to know the duration of hyperglycaemia as a risk factor for DR. A study reported that 10% of the individuals with newly diagnosed diabetes did show DR suggesting that these patients would have been undiagnosed or undetected [26]. In other words, the duration of diabetes since diagnosis and the duration of hyperglycaemia are different factors which did not go hand in hand. As this study not included this undiagnosed group, the true prevalence estimate may be more than this in the community.

The presence of eye problems and previous eye visit was not associated with DR. This is mainly because of the fact that outcome had already occurred due to many factors and the contribution of DR for the causation of visual problems varies which can be further explored by analytical studies.

LIMITATION

The prevalence may not depict the true picture of DR in the selected area due to the missing cases (undiagnosed cases). Response rate was marginally less because fundus examination was not done in 22 subjects due to the severity of cataract. This discrepancy could affect the prevalence which can further increase. Although, we could not cover required sample size, based on finding of prevalence of DR in both the eyes as 31.58% and precision proportionately at the same level as before, the minimum sample size was less than the sample size of present study. The absolute precision may be higher than expected while calculating the sample size. In spite of these limitations, it gives valuable information on the magnitude and associated factors of DR from this area which can be utilized by concerned authorities for taking appropriate preventive measures.

CONCLUSION

The prevalence of DRP was inferred to be high especially among older age group. A periodical targeted population based mass survey for diabetic retinopathy screening of all diabetic cases in each PHC area may be recommended in order to assess the magnitude of diabetic retinopathy and to prevent its complications. Further follow up studies will explore the role of associated factors and its quantification in the causation of diabetic retinopathy.

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PARTICULARS OF CONTRIBUTORS:
1. Epidemiologist, Office of Deputy Director of Health Services, Villupuram District, Tamil Nadu, India.
2. Additional Professor, Department of Preventive and Social Medicine, Jawaharlal Institute of Postgraduate Medical Education and Research (JIPMER), Puducherry, India.
3. Additional Professor and Head, Department of Ophthalmology, Jawaharlal Institute of Postgraduate Medical Education and Research (JIPMER), Puducherry, India.
4. Assistant Professor, Department of Preventive and Social Medicine, Jawaharlal Institute of Postgraduate Medical Education and Research (JIPMER), Puducherry, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:
Dr. Ganesh Kumar Saya,
Additional Professor, Department of Preventive and Social Medicine, JIPMER, Puducherry-06, India.
E-mail: sssgan@yahoo.com

FINANCIAL OR OTHER COMPETING INTERESTS: None.