

Prevalence of Type-II Diabetes Mellitus and Diabetic Retinopathy: The Gaddap Study

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ABSTRACT

Objective: To determine the frequency of type-II Diabetes mellitus (DM) in the endogenous population of Gaddap town and also to evaluate the status of Diabetic retinopathy (DR) in this group.

Study Design: Descriptive study.

Place and Duration of Study: Isra Postgraduate Institute of Ophthalmology, Al-Ibrahim Eye Hospital, Karachi, from January 2006 till December 2008.

Methodology: This community based study of subjects of either gender was carried out in the Gaddap town. Three primary eye care centres were established in the existing primary health care (PHC) facilities, to screen the target Population aged 30 years and above, and who met other inclusion criteria for DM and DR respectively. Patients requiring intervention were managed accordingly. Data was entered and analyzed using Microsoft Visual Basic 6 and Microsoft Access.

Results: Out of the cohort of 19211 subjects, 1677 patients were found Diabetic, giving the prevalence of DM in Gaddap town at 8.73%, with 1258 (6.55%) known and 419 (2.18%) newly diagnosed cases. DR was seen in 460 (27.43%) of the Diabetic cases with 126 (7.51%) patients requiring urgent intervention for vision threatening complications.

Conclusion: The result validates the importance of early screening of DR in people suffering from DM for possible management and prevention of sight threatening complications in the early stage of the disease and advocates the inclusion of primary eye care as a part of PHC system.

Key words: *Diabetes mellitus. Diabetic retinopathy. Screening. Laser treatment. Pars plana vitrectomy. The Gaddap study.*

INTRODUCTION

According to the International Diabetic Federation (IDF) database on Diabetics, Pakistan currently stands at number seven in the list of countries with the highest number of Diabetic cases. The Diabetic population in Pakistan was estimated at 6.9 million in 2007 and it is projected to reach 11.5 million by the year 2025 with Pakistan ranking 5th in the IDF list.¹

The National Blindness Survey carried out in 2002-2004 estimated the prevalence of blindness at 1% across Pakistan with 1.5 million blind people.² Out of those, less than 0.5% suffered from Diabetes-related ocular comorbidities. However, global data support the assumption that Diabetic retinopathy (DR) will be one of the most important cause of blindness in the future.³⁻⁸ DR is a major cause of blindness in around 4% of patients suffering from type-I Diabetes, and 1.6% of those suffering from type-II Diabetes.^{9,10}

In numerous studies carried out by the Diabetic Association of Pakistan, 10% of the general population

aged 30 years or above is said to be suffering from Diabetes type-II.^{11,12} Undiagnosed Diabetes and related retinopathy due to virtually non-existent primary eye care centres are common in the general population and is associated with impaired visual status of the community, especially in the third world countries like Pakistan, where resources are limited and budgetary allocation to health is inadequate. In this scenario, this study carries a huge implication for integrating Primary Health Care (PHC) as a Primary Eye Care (PEC) facility. Very few studies have been carried out to evaluate the role of Diabetes related blindness (DRB) in the context of the local population.

The main objective of this study was to determine the frequency of type-II Diabetes mellitus in the endogenous population of Gaddap town and also to evaluate the status of retinopathy in the target group.

METHODOLOGY

The protocol of the study was reviewed and approved by an ethics committee at the study centre and supported by Sightsavers International. The study was carried out in accordance with the declaration of Helsinki of 1975 as revised in 1983.

Subjects who had given informed consent, aged 30 years and above of either gender with established diagnosis of Diabetes by two consecutive base line random blood sugar (RBS) reports of > 200 mg/dl were

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included in the study. This was confirmed with the laboratory result to reduce any recruitment bias. These investigations were closely monitored and supervised by diabetologist affiliated with Diabetic Association of Pakistan and World Health Organization (WHO) collaboration centre, Karachi. Patients with a history of type-1 Diabetes mellitus, RBS > 400 mg/dl with ketonuria and further with an evidence of retinopathy or visual loss unrelated to Diabetes were excluded.

On the first visit by the participants at PHC unit, a detailed history followed by two consecutive baseline blood samples for RBS were carried out. Further investigations including fasting blood sugar (FBS) and Glycosylated hemoglobin (HBA1c) were obtained to confirm DM. Once confirmed, all patients were referred to the primary eye care (PEC) centre situated at PHC, and had their detailed medical history taken with complete ocular examination including best corrected visual acuity (BCVA), bio-microscopic examination of anterior segment with Goldman applanation tonometry and dilated fundus examination with +90 Diopter lens. This was supplemented with indirect ophthalmoscopy when required.

Diabetes was diagnosed on the following set criteria as defined by world health organization (WHO) in 1999 and revised in 2006.¹³

Three primary eye care centres were established in the current PHC facilities in the Gaddap town locality. They were accommodated with a refractonist, a fully trained ophthalmologist, a physician and a lady health worker (LHW). The area authorities were taken into confidence about the project. Extensive training with workshops along with mass media campaign was initiated to raise the awareness among the town people and local physicians regarding DM and its potential harmful effects on vision.

The classification of subjects was done according to the status of Diabetes, type of DR, management, age and gender (Table I). If the subject underwent several medical checkups during the study period, the latest data were used for analysis. The occurrence of DM and DR were the ratio of persons with DM and that of DR respectively. The type of DR was classified with regard to severity, into non-proliferative Diabetic retinopathy (NPDR), proliferative Diabetic retinopathy (PDR) or advanced proliferative Diabetic retinopathy, associated either with or without macular edema.¹⁴ The management options were follow-up for those with stable NPDR, without any presence of clinical significant macular edema (CSME).¹⁵ Those patients with CSME, either with NPDR or PDR, only PDR, or advance PDR were subjected to the laser treatment or pars plana vitrectomy (PPV) respectively. The subjects were divided into the five age groups of 30-40 years, 41-50 years, 51-60 years, 61-70 years and > 70 years.

Table I: Distribution of participants according to age, gender, Diabetic status and type of Diabetic retinopathy (DR).

Characteristics of patients	No. of patients	Frequency (%)	Management
Age group (years)			
30-40	11204	58.32	
41-50	4530	23.58	
51-60	2213	11.52	
61-70	999	5.20	
> 70	265	1.38	
Sex			
Male	5438	28.31	
Female	13773	71.69	
Diabetic Status*			
< 200 mg/dl (non-diabetic and pre-diabetic)	17534	91.27	Life style modification
> 200 mg/dl (Diabetic)	1677	8.73	Appropriate
Known Diabetic	1258	6.55	symptomatic
Fresh Diabetic	419	2.18	treatment
Type of DR			
NPDR [∞]	334	72.61	Follow-up (72.61%)
PDR [^]	96	20.87	Laser (25.65%)
NPDR+CSME ^{**}	10	2.17	
PDR+CSME ^{**}	12	2.61	
Advanced PDR [^]	08	1.74	VR surgery (1.74%)
Total	460	27.43	100 (27.39% need treatment)

* Diabetic status as confirmed by Gluco-meter reading compared with standardized RBS test from Laboratory.

For the sake of simplicity non-Diabetic and pre-Diabetic have been placed in the same group.

[∞] Non-proliferative Diabetic retinopathy

[^] Proliferative Diabetic retinopathy.

^{**} Clinical significant macular edema.

All the data were analyzed in custom developed software of Microsoft Visual Basic - 6 and Microsoft Access. The results were evaluated using frequencies, proportions and group means. Alpha level of 0.05, power of 0.8 and confidence interval of 95% was selected for the analysis. The frequencies and percentages were calculated for all the qualitative data including gender, age group, DM and type of DR. The stratification was done with respect to the age to see the frequency of DM.

RESULTS

A total of 5438 (28%) males and 13773 (72%) females, aged between 30 and 90 years (mean age 42 years) participated in the study. The male to female ratio was 1 to 2.5. Among the total subjects examined, the overall prevalence of Diabetes was found at 8.73%. The distribution of the participants are shown in Table I.

Out of the total 1677 diagnosed cases of DM type-II, 1258 (75%) were already known whereas, 419 (25%) were newly diagnosed. The prevalence of DM type-II increased with the age, and was the highest in the age group 41-50 years at 6%, with 515 known and 154 newly diagnosed cases. The age wise prevalence of DM with known and freshly diagnosed cases is shown in Table II. The majority of the Diabetics, 334 (72.61%) in number, suffered from non-proliferative Diabetic retinopathy (NPDR) without CSME, requiring follow-up for close monitoring

of their visual and retinal status. While 126 (26.39%) patients had advance retinopathy with potentially vision threatening CSME and required immediate intervention. Out of those 126 patients, 96 (20.87%) suffered from PDR, 10 (2.17%) had NPDR+CSME and 12 (2.61%) patients had PDR+CSME, all requiring laser treatment to stabilize their vision from further deterioration. Eight (1.74%) patients had advanced PDR and required PPV. The overall prevalence of DR was 27.43%, out of the total number of Diabetics, with approximately 7.5% requiring urgent intervention to prevent them from permanent visual loss. The prevalence of DR with type and the treatment offered is shown in Table I.

Table II: Age wise prevalence of DM. The table also shows number of fresh cases diagnosed with DM on screening.

Age groups (years)	Diabetes status	No. of subjects	Frequency (%)	Prevalence (%)
30-40	Known Diabetic	291	2.60	3.79
	Non-Diabetic	10780	96.22	
	Fresh Diabetic	133	1.19	
	Total	11204	58.32	
41-50	Known Diabetic	515	4.60	5.97
	Non-Diabetic	3861	34.46	
	Fresh Diabetic	154	1.37	
	Total	4530	23.58	
51-60	Known Diabetic	315	2.81	3.59
	Non-Diabetic	1811	16.16	
	Fresh Diabetic	87	0.78	
	Total	2213	11.52	
61-70	Known Diabetic	123	1.10	1.43
	Non-Diabetic	839	7.49	
	Fresh Diabetic	37	0.33	
	Total	999	5.20	
> 70	Known Diabetic	14	0.12	0.19
	Non-Diabetic	243	2.17	
	Fresh Diabetic	8	0.07	
	Total	265	1.38	

DM = Diabetes Mellitus.

DISCUSSION

DM has been one of the most common metabolic disorder with the prevalence varied, widely ranging from < 1% to > 50%.¹⁶ Recent studies carried out in Nepal and South Korea noted its occurrence at 25.9 and 13.7 percent respectively.^{17,18} However, the target population of these studies was limited to the elderly aged 60 and above in the study carried out in Nepal, and 40 and above in that carried out in South Korea. The above noted studies also did not estimate the prevalence of DM with respect to the different types of Diabetes. The research work carried out in Pakistan also corroborates the variable prevalence of DM starting from 4-6.3%.^{19,20} However, these results should be interpreted with caution because the criteria used for inclusion of the subjects were non-homogenous with regard to the population concerned and the type of Diabetes. In this study the prevalence of DM type-II was observed around 9% which is line with the study carried out by the

Pakistan National Diabetic Survey where the prevalence of DM type-II was estimated to be 9.2% in men and 11.6% in women.¹¹

The highest prevalence of DM in this study was in the age group of 41-50 years at 6%, with age groups 30-40 and 51-60 years, following on with lesser occurrence. Although, similar findings have also been observed in work carried out by Jamal-ud-din and associates,²¹ in Karachi, however, the sample of population involved apart from being non-representative was also quite small. In the Qatar-based project, which included urban adult population aged 20 and above, the most frequent age group involved was between 40-49 years old, reflecting the same trend as noted in this study.²² The prevalence of DR was 27.43%, which is slightly lower than reported in other studies carried out in other parts of Pakistan. This could primarily be attributed to the different settings and the different base of population involved. In a hospital based study carried out by Rehman and co-investigators,²³ the prevalence of DR was around 55%. This over representation of DR could possibly be due to the selection bias as only those patients who were already known Diabetics and who presented to the medical complex with some clinical relevant problems were included in the study. Similarly, in other studies, the prevalence of different micro-vasculature changes in DM was noted and retinopathy was found to be prevalent in 30% of the population.^{2,24} In a population based study carried out in India by Raman,²⁵ the prevalence of DR in subjects diagnosed with DM was around 18%. Similarly, in other studies across Asia, variable prevalence of DR was observed, with one-in-ten Diabetic subjects suffering from DR in Singapore,²⁶ to one-in-three type-II Diabetics, suffering from DR in Thailand.²⁷

The most common type of DR in this study was NPDR which was prevalent in 72.61% of the Diabetic population. These findings are similar to the results of other Asia-based studies.^{21,26,28,29} The participation in this community based screening program was around 20%, reflecting the poor uptake of available health services which can be due to lack of awareness among the people regarding DM, especially its vision threatening affects. The number of patients suffering from DR requiring intervention of some sort to protect the vision was estimated at 21.39%. The study corroborates the findings of earlier done studies in which the proportion of patients requiring treatment ranged from 21-22%.^{2,30}

All participants in this study were screened for DM, and only then, they were referred for ocular examination; this helped us to remove any selection bias due to the inclusion of non-Diabetics with eye diseases. The population involved in this study was an endogenous one and the sample size was potentially large enough to generalize the results of this study for the whole country

based upon the existing statistics (Table III) to get an idea of the burden of recognized and hidden prevalence of DM and DR in the country. Though the projection has certain limitations as it is based on 1998 census, changes to incorporate certain annual adjustments were attempted.

Table III: Projection for Diabetes and Diabetic retinopathy for Country's total population based on our results.

S. No	Component	No. of people (million)	Projection (%)
1	Population	170	
2	Age group \geq 30	51	30% of No.1
3	Diabetic type-2	4.47	8.73% of No.2
4	Diabetic retinopathy	1.23	27.43% of No.3
5	Needing follow-up	0.89	72.61% of No.4
6	Needing intervention	0.34	27.39% of No.4
	Laser	0.32	94.12% of No.6
	VR Surgery	0.02	5.88% of No.6

Total country's population has been calculated in line with 1998 census and verified independently from non-official sources

CONCLUSION

The results of the study highlight the high prevalence of DM at 8.73% and DR at 27.43% in the local population of Gaddap town and advocate the use of early screening measures for prevention and management of DM and its vision threatening complications.

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