

ASSOCIATION OF DIABETES MELLITUS (DM) WITH PRIMARY OPEN ANGLE GLAUCOMA (POAG), THE STUDY OF 1000 SELECTED CASES

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ABSTRACT

Objective: To determine the association between DM and POAG on one hand and relationship of known cases of POAG with DM on the other-hand (vice versa).

Study Design: Correlation Study.

Setting & Duration: We conducted a correlation prospective study from June 2007 to December 2008 at two institutions in Karachi, Department of Ophthalmology, Dow University of Health Sciences and Civil Hospital, and Sindh Government Qatar Hospital, Orangi Town.

Methodology: All cases of known DM and POAG coming from the different areas of Karachi were included in the study fulfilling fixed criteria for selection. The diagnosis was made mainly on the basis of history, clinical examination and investigations (applanation tonometry, direct ophthalmoscopy, automated perimetry, gonioscopy and blood sugar levels).

Results: Total of 1000 patients, from 30 to 90 years age, dividing them into two groups as Group I (Known Diabetic Patients) and Group II (Known POAG Patients), were included in the study. In group I (Known Diabetic Patients) out of a total of 500 patients of both sexes, 44 were found to have POAG (8.8%). In group II (Known POAG Patients) out of a total of 500 patients of both sexes, 17 were found to have DM (3.4%).

Conclusion: There is a definite association between DM and POAG. It has shown that people with diabetes are more prone to POAG. These findings conform to the findings of several other studies in other parts of the world.

KEY WORDS: Diabetes mellitus (DM), Primary open angle glaucoma (POAG), Intraocular pressure (IOP), Non-insulin dependent diabetes mellitus (NIDDM), Cup disc ratio (C/D ratio), Diabetic retinopathy (DR).

INTRODUCTION

Diabetes mellitus is the most common endocrine disease.¹ Its incidence has increased rapidly in the last few decades throughout the world.^{2,3} It affects 3% of global population and about 2% of the population in developed countries.⁴ It has become a major global public health problem.⁵ It is increasing alarming in the developing

and newly industrialized countries.² The estimated number of 80 million sufferers in 1990 is expected to rise to a staggering 350 million affected individuals by 2025.⁶ The surveys carried out locally, also suggest its increase in our society.⁷⁻¹⁰ It has been found that 50% cases of NIDDM are undiagnosed at the time of presentation.^{11,12} Its complications such as Diabetic Retinopathy (DR) is emerging as an important cause of permanent blindness in many countries.^{2,13} Primary open angle glaucoma (POAG) has also been found to be the second most important cause of permanent blindness in the Asia-Pacific region.¹⁴ The most recent studies by WHO¹⁵ suggest that over 100 million people are glaucoma suspect, over 20 million suffer from the disease and over 5 million people are blind as a result of glaucoma. Approximately 70% of global glaucoma are found in developing countries. It has also been suggested that

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50% or more POAG cases in any community are not under medical care.¹⁶

Many studies have been carried out internationally to show the association of POAG and DM.¹⁷⁻²¹ It is beyond doubt in the light of these studies that the two blinding conditions co-exist in definite association. According to Kanski²² "DM has high prevalence of POAG than Non-Diabetics. Conversely about 10% of patients with POAG have either frank diabetes or abnormal OGTT". "POAG is reported to be three times more common in adult Diabetics than Non-Diabetics".²¹ Abdullah and Hashmani¹¹ found that the "association of glaucoma in diabetics appeared very strong. It was found that 7.5% of the Diabetics have Glaucoma". There is scant available literature and research work in Pakistan on this important subject. Therefore, the present study designed to provide an opportunity to determine and reaffirm possible association of DM with POAG in our society.

METHODOLOGY

The study was conducted at the Department of Ophthalmology, Unit I, Dow University of Health Sciences and Civil Hospital, Karachi and Sindh Govt. Qatar Hospital, Karachi over a period of eighteen months from June 2007 to December 2008. The selected patients were included in the study from those visiting the OPD as well as admitted in the Indoor department for various purposes.

Criteria for the patient's selection. The patients with age ranging between 30 to 90 (mean age 50) years were included in the study. Both male and female patients were included in the study, as both DM and POAG are prevalent in both sexes equally. All races and communities were included as it is well known that both DM and POAG are common among certain races and communities. All classes of people, upper, middle and lower, working in different fields of life were included in the study as it was known in the past that DM affects upper class people (rich people) more than the lower class people (poor people mostly belonging to labourer class).

Diagnosed cases of DM were included in the study irrespective of the type and duration of their disease. The nature of the treatment (diet restriction alone or medical or both) was not considered as criteria for inclusion or exclusion. Already diagnosed cases of POAG (elevated IOP, Optic disc cupping and visual field defects) were included in the study without considering the nature and duration of treatment.

Exclusion Criteria:

The patients were excluded from the study if found

outside the age group specified, previous ocular surgery (not glaucoma), ocular inflammations or any other disease, or patients with glaucoma other than POAG numbers of the patient participated in the study a total of one thousand one hundred and ten (1110) patients were registered for the study. However, 110 patients were excluded from the study for different reasons. The participating patients in the study were divided into two groups:

1. Group I or group of Known cases of DM. This group included all the known cases of DM. Five hundred and eighty patients were registered in the study. For various reasons not fulfilling inclusion criteria, 80 (12%) patients were excluded from the study (Remaining 500 patients were analyzed).
2. Group II or group of known cases of POAG. This group included all the known cases of POAG. Five hundred and thirty patients were registered in the study. For various reasons, not fulfilling inclusion criteria, thirty (5%) patients were excluded from the study (Remaining 500 patients were analyzed).

RESULTS

One thousand one hundred and ten (1110) patients were recruited. After exclusion of 110 patients for various reasons, 1000 patients were included in this study 500 in Group I and 500 in Group II. Results were recorded on a Performa.

DM and POAG were seen equally prevalent in both sexes. In age group between 51-70 years, the number of known diabetics was more in males as compared to females. Similarly there were more males with POAG than females in the same age group. Frequency of POAG is shown in Table I. Out of a total of 500 patients of both sexes, 44 were found to have POAG (8.8%). Age wise grouping showed that highest percentage of diabetics suffering from POAG were in age group of 51-60 years (5%). Lowest number of cases of POAG in diabetics was seen at extreme of age group i.e. 30-40 years (0.2%) and 81-90 years (0.2%).

Table II shows the number and percentage of diabetics in known cases of POAG. Out of a total of 500 patients of both sexes, 17 were found to have DM (3.4%). Stratification by age showed that highest frequency of DM was in age group of 51-60 years (1.4%). Age group 61-70 years also has higher percentage of DM (1.0%). As we know that POAG is not known to occur in younger age group (30-40 years), similarly DM (NIDDM) is known to occur in this age group. Lowest numbers of cases of DM were seen in age groups 71-80 years

| Age Groups | Total No. of Subject | No. of Subject with POAG | Percentage |
|--------------|----------------------|--------------------------|------------|
| 30-40 Years | 20 | 1 | 0.2 |
| 41-50 Years | 146 | 7 | 1.4 |
| 51-60 Years | 175 | 13 | 2.6 |
| 61-70 Years | 130 | 12 | 2.4 |
| 71-80 Years | 26 | 10 | 2.0 |
| 81-90 Years | 3 | 1 | 0.2 |
| Total | 500 | 44 | 8.8 |

Table I. Group I: Frequency of POAG in known diabetes

(0.2%). Table III demonstrates a comparison of this study and other studies.

DISCUSSION

Extensive literature is available on epidemiological studies of POAG and DM and ocular effects of diabetes.^{2-4,23-27} Only a few studies, however, are available which show association between these two important blinding diseases.¹⁷⁻²¹ Previously, it was suggested that association of DM and POAG was controversial.²⁸ In various studies later on, it was pointed out that people with DM have been seen to have higher frequency of POAG than those without diabetes.¹⁷⁻²¹

This study was designed to determine the possible association between DM and POAG and vice versa in our population. As far as the literature in Pakistan is concerned, no such study is available on this important topic. Hence, to our knowledge, this study is the first of its type and has shown association between these two conditions. The figures are alarming to warrant as these two syndromes being one of the major public health hazards.⁵ Previously, POAG has been reported to be three times more common in adult diabetics than non-

diabetics.²¹ It has been suggested that the association of POAG in diabetics appeared very strong. It was found that 7.35% of diabetics have glaucoma.¹⁰ Wilensky²⁹ has reported that a curious but unexplained association exists between DM and POAG. There is an increased incidence of POAG among diabetics and similarly there is an excess of DM among POAG sufferers.

In the Winconsin Epidemiologic study of Diabetic Retinopathy³⁰, approximately 8% people with older-onset DM had IOP greater than 21mm Hg compared with approximately 3% in a non-diabetic comparison group of slightly older age. The Beaver Dam Eye Study¹⁹ has evaluated the relationship between older-onset DM to open angle glaucoma. The participants were evaluated for the presence of glaucoma. Glycosylated haemoglobin levels were measured and a medical history was obtained. POAG was more common in those with older-onset DM (4.2%) than those without (2.0%). When persons with a history of treated POAG were included, rates were 7.8% in those with DM compared with 3.9% in those without diabetes. It was concluded that the presence of POAG is higher in people with older-onset diabetes.¹⁹ The reason for increased frequency of POAG in diabetics has not been clear. One of the

Table II. Group II: Frequency of diabetes in known POAG

| Age Groups | Total No. of Subject | No. of Subject with POAG | Percentage |
|--------------|----------------------|--------------------------|------------|
| 30-40 Years | 53 | -- | 0.0 |
| 41-50 Years | 125 | 4 | 0.8 |
| 51-60 Years | 150 | 7 | 1.4 |
| 61-70 Years | 148 | 5 | 1.0 |
| 71-80 Years | 24 | 1 | 0.0 |
| 81-90 Years | -- | -- | 0.0 |
| Total | 500 | 17 | 3.4 |

speculations is that diabetes-associated changes in the trabeculum is related to decreased aqueous flow.¹⁹ It has also been suggested in this study that there may be an effect of DM on optic nerve, which is more susceptible to destructive effects of raised intraocular pressure. According to Becker and Scheffer,¹⁹ the susceptibility of optic nerve to DM is due to effects of DM on small blood vessels supplying the optic nerve head, thereby rendering it more prone for glaucomatous damage. The Beaver Dam Eye Study¹⁹ has also found that adding duration of DM to age in years results in frequency and magnitude similar to that found in non-diabetics comparison group.

The Rotterdam study²¹ included a population of 55 years of age and older, it was found that newly diagnosed DM cases and elevated serum glucose levels are associated with a higher mean IOP and high-tension glaucoma. The association between diabetes, blood glucose levels and IOP were the same in both sexes. This study showed a relationship between blood glucose and both IOP and high-tension glaucoma. The mechanism of this observation is not clear. Possibly the elevated glucose levels in DM may induce an osmotic gradient and attract fluid into the intraocular space, which may result in an elevated IOP.²¹ This study has confirmed that DM and blood glucose levels are associated with a higher IOP and with high-tension glaucoma.²¹

The Blue Mountain Eye study²⁰, also explains the association between DM and POAG. Results showed that POAG prevalence was higher in people with DM, the figure being 5.5% compared with those without DM with a ratio of 2.8%. Ocular hypertension was also more common in people with DM (6.7%) compared with those without DM (3.5%). DM was present in 13% of people with glaucoma, compared with 6.9% of those without glaucoma. For those not receiving POAG treatment, IOP was consistently slightly higher in people with DM. The conclusion drawn was that a significant and consistent association between DM and POAG exists, which appeared independent of the effect of DM on IOP, suggesting a real association between these two diseases.²⁰ The study²⁰ showed many interesting results like mode of prevalence and characteristics of DM and POAG among the population. It established an association between DM and POAG. The prevalence of POAG among the diabetics was found to be 5.5% as compared with 2.8% among subjects without diabetes. A similar twofold higher in the prevalence of ocular hypertension was observed for people with diabetes, 6.7% compared with 3.7% for non-diabetics. The prevalence of DM in people with POAG (13%) was twice that for people without POAG or ocular hypertension. This study supports the previously documented clinical association

between DM and POAG and provides data very similar to previous studies like, The Beaver Dam Eye Study.¹⁹ Thus the Blue Mountain Eye Study²⁰, found a real association between these two diseases. However further analysis of other population-based data was suggested. Our study has also confirmed the association between DM and POAG. It has shown that people with DM are more prone to POAG. The maximum number of diabetics having POAG falls in age group 51-70 years. People above 70 have also a fair chance of raised IOP compared to younger and older age groups. The reasons for these variations in younger age group may be that in our society diagnosis of DM at an earlier age is by chance. The life expectancy is lower in our country as compared to the developed countries. Similarly, in group of people with POAG, persons below 51-70 years have higher percentage of DM as compared to other age groups.

CONCLUSION

We conclude that there is a definite association between DM and POAG. It has shown that people with diabetes are more prone to POAG. These findings are conforming to the findings of many other studies in other parts of the world. Thus, this study is an important step towards understanding relationship between DM and POAG and will help Ophthalmologists to take important measures to detect undiagnosed cases DM since 50% cases of NIDDM are undiagnosed. The results of the study would also be important for Diabetologist to take care and exclude POAG in patients suffering from DM to prevent permanent blindness. Though, this study (Two center study) has shown a definite association between DM and POAG and vice versa, we recommend that the scope of this study be widened to include other parts of Pakistan.

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