



ORIGINAL RESEARCH PAPER

Physiology

EFFECT OF TYPE 2 DIABETES MELLITUS ON THE OCCURRENCE OF SENILE CATARACT

KEY WORDS: Senile Cataract, Diabetes Mellitus, Age.

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ABSTRACT

Cataract is a leading cause for blindness worldwide. Currently type 2 diabetes mellitus is on increasing scenario. This study is aimed to assess the effect of type 2 diabetes mellitus on the age of occurrence of senile cataract. Study group includes BMI matched, male, bilateral immature senile cataract persons. Among them controls were 50 persons with normal blood glucose levels and cases were 50 patients with newly diagnosed type 2 diabetes mellitus as per ADA criteria. The age factor was compared between the two groups by Student's t test. The mean age was 65.84 years among controls and 58.16 years among diabetics which is 7.68 years earlier, comparing the controls (p value - 0.0001). It is inferred that the occurrence of senile cataract is at an early age in patients with type 2 diabetes mellitus, comparing the normoglycemic persons.

INTRODUCTION

Vision is an essential sense for the normal wellbeing of a person. Visual impairment is a public health issue having profound impact on the society. Out of the estimated 45 million cases of global blindness, India has 12 million blind people.^{1,2} Cataract is one of the leading cause of visual impairment and blindness worldwide. In India, as per the reports of the National Programme for Control of Blindness, the annual incidence of cataract is estimated to be 3.8 million and is responsible for 80.1% of blindness.³

Cataract is the opacification of the natural lens which focusses the light entering the eye on to the retina. Cataract diminishes the vision gradually, leading to blindness. The commonest type is the senile cataract, which is the cataract occurring in people above 50 years of age unrelated to known mechanical, chemical or radiational trauma.

The pathogenesis of senile cataract is multifactorial. The risk factors associated with it are ageing, gender, heredity, socioeconomic status, dietary factor, physical activity, diabetes mellitus, hypertension, smoking, alcohol, irradiations, metabolic syndrome, dehydrational crisis, corticosteroids and abdominal adiposity.⁴

Currently India represents 49 percent of the world's diabetes burden, with an estimated 72 million cases in 2017, which is expected to almost double to 134 million by 2025.⁵ Diabetes mellitus is a known risk factor for ischemic heart disease, stroke and leads on to neuropathy, nephropathy, retinopathy and vascular disorders. Classic diabetic cataract with snow flake cortical opacities occur in the diabetic patients of younger age. Studies have proved that senile cataract occurs earlier in diabetic patients and tends to progress rapidly.

In a developing country like India with increasing ageing population, identification and modification of the risk factors which might influence the incidence and progression of senile cataract is of great importance from a public health perspective. This study is carried out to assess the effect of type 2 diabetes mellitus on the age of occurrence of senile cataract.

METHODS

This is a cross sectional study done in the Institute of Physiology, Madurai Medical College, Madurai in collaboration with the Department of Ophthalmology, Government Rajaji Hospital, Madurai and the Department of Biochemistry, Madurai Medical College, Madurai, after obtaining clearance from Ethical Committee, Madurai Medical College and Government Rajaji Hospital, Madurai.

This study was done on a sample of 100 BMI matched, male, bilateral immature senile cataract persons selected from the Ophthalmology Department, after recording clinical history, anthropometric measurements and doing the general & ocular examination. Controls were 50 senile cataract persons without diabetes mellitus. Cases were 50 senile cataract patients with

newly diagnosed type 2 diabetes mellitus. The mean age of occurrence of senile cataract between controls and cases was compared.

Body Mass Index was computed as the body weight in kilograms divided by the square of the height in meters using Quetelet's Index. Under strict aseptic precautions, two venous blood sample of 2 ml each were collected, after overnight fasting for about 8 hours and 2 hours after meals respectively for fasting and postprandial blood glucose estimation. Blood glucose estimation was done by Glucose Oxidase - Peroxidase method, in the Department of Biochemistry, Madurai Medical College, Madurai. Patients with fasting blood glucose levels ≥ 126 mg/dl and/or 2 hour postprandial blood glucose levels ≥ 200 mg/dl were considered as diabetes mellitus as per ADA⁶ criteria.

INCLUSION CRITERIA:

Male, Senile cataract patients of age > 50 years.

EXCLUSION CRITERIA:

Persons less than 50 years of age, female, smokers, alcoholics, patients with glaucoma, corneal pathology, abnormalities of lens other than cataract, retinal pathology, vitreous disturbances, eye injuries, patients who have undergone any intraocular procedures, hypertension, patients on treatment for diabetes mellitus & intake of drugs that interfere with glucose metabolism like glucocorticoids and patients with other systemic diseases.

RESULTS AND OBSERVATION

TABLE-1: The Mean Age And The Mean Fasting Blood Glucose Levels Among The Senile Cataract Study Groups

STUDY GROUPS	Mean Age (Years)	Mean Fasting blood glucose (mg/dl)
CONTROLS	65.84 + 4.103	83.82 + 7.721
CASES	58.16 + 2.902	135.40 + 19.284

The mean fasting blood glucose level for the controls is 83.82 mg/dl and for the senile cataract patients with diabetes mellitus is 135.4 mg/dl. The mean age of occurrence of senile cataract for the controls is 65.84 years and for the cases is 58.16 years.

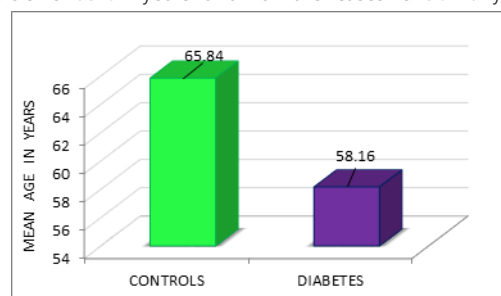


FIGURE -1: Distribution Of Mean Age Among The Senile Cataract Study Groups

COMPARISON OF AGE FACTOR Student's t test was conducted to compare the mean age between the senile cataract study groups using SPSS software version 20. $p < 0.05$ is considered as statistically significant.

TABLE-2: Comparison Of Mean Age Among The Senile Cataract Study Groups

STUDY GROUPS	N	Mean	SD	Mean difference	Std. Error	sig	95% CI	
							Lower Bound	Upper Bound
CONTROLS	50	65.84	4.103	-	-	-	-	-
CASES	50	58.16	2.902	7.680*	.694	.0001	5.88	9.48

The mean age is 7.68 years earlier for the senile cataract patients with diabetes mellitus (Mean = 58.16, Standard Deviation = 2.902) when compared to the controls, which is statistically significant [$p = 0.0001$]. The above details are shown in Table: 2 and Figure: 1.

DISCUSSION

The mechanism for early onset of senile cataract in diabetes mellitus patients is mainly due to osmotic and oxidative stress. Hyperglycemia gets reflected as an elevated level of glucose in the aqueous humour. This diffuses into the lens, gets metabolized by the enzyme aldose reductase into sorbitol⁷. Accumulation of sorbitol causes osmotic over hydration of the lens. This osmotic stress stimulates apoptosis in lens epithelial cells, liquefaction and collapse of lens fibres ultimately resulting in lens opacities.

Also increased levels of glucose in the aqueous humour, induces glycation of lens proteins leading to the production of superoxide radicals and the advanced glycation end products (AGE). Interaction of AGE with the surface receptors in the lens epithelium generates further free radicals⁸ which causes oxidative stress. Moreover diabetic lens has an impaired antioxidant capacity due to inactivation of the antioxidant enzymes like superoxide dismutases¹⁹. This ultimately increases the susceptibility to lens to oxidative stress.

The levels of xanthine oxidase, a prooxidant enzyme, is found to be significantly elevated in serum and lens in diabetic than in non-diabetic persons with senile cataract¹⁰. The up regulated activities of xanthine oxidase, by poor glycaemic control, also contributes to increased oxidative stress in the lens. This initiates an unfolded protein response which leads to generation of reactive oxygen species (ROS). ROS produces oxidative damage to lens fibres by favouring an increase in water insoluble proteins leading onto lens opacities.

In this study, the mean age of occurrence of senile cataract for the controls is 65.84 years and that for diabetes mellitus patients is 58.16 years. The increased blood glucose level has influenced the occurrence of senile cataract by 7.68 years earlier in diabetes mellitus patients comparing the controls.

The results of the present study are consistent with the Framingham eye study¹¹, the Barbados eye study¹², the Blue Mountain Eye Study¹³, studies by Muhammad Shakil et al¹⁴ and an association of diabetes mellitus with senile cataract has been found.

From the above observations, this study supports the view that type 2 diabetes mellitus is an important risk factor influencing the early onset of senile cataract.

LIMITATIONS

Cases were selected from hospital, the study sample may not be the representative of general population. This is a cross sectional study, so strong conclusion cannot be made. To authenticate the results a large scaled longitudinal study is preferable.

CONCLUSION

The results from this study infer that the occurrence of senile cataract is at an early age in the study groups with diabetes mellitus comparing the controls. Type 2 diabetes mellitus, which is on increasing trend in the current scenario is also an important risk

factor for senile cataract. Routine screening, early diagnosis and proper medical management of diabetes mellitus along with life style modifications, can reduce and postpone the development of senile cataract. This can improve the wellbeing of old people and reduce the burden imposed on the medical society by this global visual problem.

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