

Association of body mass index with severity of retinopathy in patients with type 2 diabetes mellitus

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Abstract

Background: Increased body mass index has been found to be associated with microvascular as well as macrovascular complications of diabetes. Factors like insulin resistance, hypertension and dyslipidemia, are found to be strongly associated with elevated BMI and obesity; which in turn contribute to microvascular changes leading to the development of retinopathy. The objective is to study the association between Body mass index and the severity of retinopathy in patients with type 2 diabetes mellitus.

Methods: This study will be conducted in the Department of ophthalmology at Saveetha Medical College and Hospital, Thandalam. All diabetic patients above 30 years of age whose fundus can be visualized will be taken for the study after taking informed consent. A total of 100 patients will be included in the study.

Results: With increasing severity of retinopathy the proportion of patients contributing to highest tertile of BMI rises. Non-Diabetic (22.75±3.82), No Retinopathy (23.21±4.86), Mild Retinopathy (23.79±4.87), Moderate Retinopathy (27.9±6.77), Severe Retinopathy (28.21±7.12).

Conclusion: This study observed a positive association of BMI with increasing severity of retinopathy. Larger studies keeping in mind the role of genetic predisposition and race might help in determining the role of body mass index in diabetic retinopathy.

Keywords: Body mass index, Diabetes Mellitus, Diabetic Retinopathy.

Introduction

Diabetic retinopathy is one of the microvascular complications of diabetes and is a leading cause of visual morbidity. The prevalence of diabetic retinopathy is 17.6%.^(1,2)

Body mass index (BMI) is a measure of obesity, which is a risk factor for diabetes.⁽³⁾ However the role of obesity in diabetic retinopathy is not clearly defined.^(3,4) Indian studies also have found conflicting reports regarding the relation of body mass index and retinopathy.^(5,6)

The present study was undertaken to assess the link between body mass index and increasing severity of retinopathy in the rural areas in and around Thandalam.

Materials and Methods

This cross sectional study was done in and around the rural areas of Thandalam. The study was approved by the Institutional Ethics Committee and conformed to the tenets of the declaration of Helsinki. A written informed consent was obtained from all patients.

A total of 100 patients from the ophthalmology outpatient department were enrolled from January 2014 to May 2014. Of the total sample, 79 patients were diabetic, among whom, those with retinopathy were grouped into mild, moderate and severe retinopathy based on the modified ETDRS classification.⁽⁷⁾ 21 patients were non-diabetic, who presented with non-contributory symptoms like headache, refractive errors, dry eye symptoms etc.

Complete history and ocular examination was done for all patients. A dilated fundus examination with a

Goldmann three mirror fundus contact lens was done in all patients. General clinical examination including blood pressure was recorded. The patients were grouped under- group A (non-diabetics), group B (diabetics without retinopathy), group C (mild retinopathy), group D (moderate retinopathy) and group E (severe retinopathy). None of the patients in this study had proliferative retinopathy. Patients in whom fundus could not be visualized were excluded.

Anthropometric Parameters: Body mass index (BMI) was calculated as weight in kilograms divided by square of height in meters (kg/m²). Weight was measured using a balance-beam scale and height was measured using a wall-mounted stadiometer. Recommended values of BMI were considered as a normal range of 18.50- 24.99 kg/m², overweight range as 25.00- 29.99 kg/m² and more than or equal to 30.00 kg/m² as obese.

Statistical analysis: Parameters were presented as mean ± standard deviation. The data was analyzed using SPSS software version 11.5. Descriptive statistics were followed by an unpaired t test that was used to compare the groups with and without diabetic retinopathy. Analysis of variance test (ANOVA) was used for comparison between the groups for continuous variables. Multiple comparisons were conducted between the study groups by applying a post hoc test following ANOVA. The test used to compare the groups was Dunnett's test (2 sided) with a confidence interval of 95%. A p value of <0.05 was considered significant.

Results

A total of 100 patients were part of this study of which 79 were diabetics. The mean age of diabetic patients was 56.71 ± 9.2 with a range of 36- 75 years. The non- diabetics had an age range of 36- 75 years,

with a mean of 58.95 ± 10.78 . The diabetic patients consisted of 38 males and 41 females. Among the non-diabetics, males were 10 whereas females constituted the remaining 11.

Table 1: Represents the distribution of patients over the study groups

	Non Diabetics (A)	No Retinopathy (B)	Mild Retinopathy (C)	Moderate Retinopathy (D)	Severe Retinopathy (E)
Number of patients N (%)	21 (21)	19 (19)	21 (21)	22 (22)	17 (17)

The distribution of patients in the study groups is depicted in Fig. 1

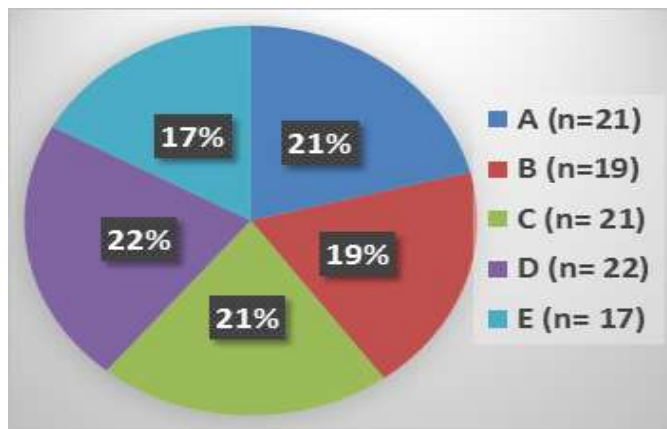


Fig. 1: Prevalence of types of Retinopathy

ANOVA test was used to determine whether body mass index and severity of retinopathy were associated. P value was <0.01 and indicated that BMI is strongly associated with retinopathy. (Table 2)

Table 2: BMI presented as mean \pm SD for the study groups

	Non Diabetic (A)	No Retinopathy (B)	Mild Retinopathy (C)	Moderate Retinopathy (D)	Severe Retinopathy (E)	p value
Mean BMI	22.75 \pm 3.82	23.21 \pm 4.86	23.79 \pm 4.87	27.9 \pm 6.77	28.21 \pm 7.12	0.001

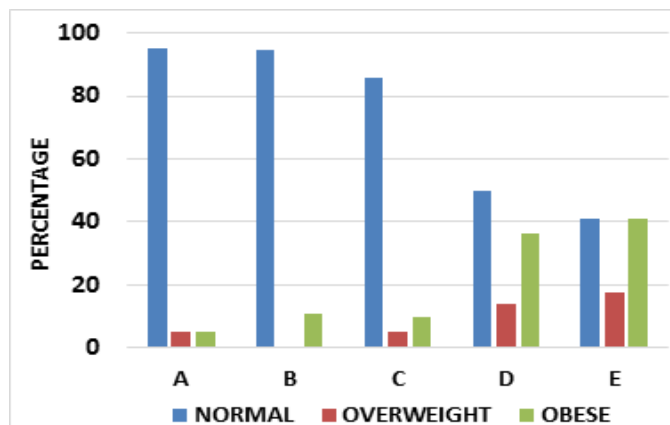


Fig. 2 Distribution of patients under BMI subgroups

Fig. 2 depicts the percentage distribution of each group into three categories based on BMI values.

With increasing severity of retinopathy the proportion of patients contributing to highest tertile of BMI rises. The percentage of patients with normal BMI decreases with severity of retinopathy on relative comparison.

Multiple comparisons were conducted between the study groups by applying a post hoc test following ANOVA. The test used to compare the groups was Dunnett's test (2 sided) with a confidence interval of 95%. P value of <0.05 was considered significant. It was found that the significance of association was stronger with moderate and severe retinopathy than mild or moderate retinopathy.

Discussion

Diabetic retinopathy is a microvascular complication of diabetes which also serves as a major cause of blindness and visual morbidity worldwide. Obesity and diabetes share a complex relationship. The role of body mass index, which is a measure of obesity, is an often debated subject.

Increased body mass index has been found to be associated with microvascular as well as macrovascular complications of diabetes. Elevated BMI is associated with increased levels of adipokines and pro-inflammatory cytokines which lead to oxidative stress and eventually endothelial damage. It is also associated with increased platelet function and increased blood viscosity. Factors like insulin resistance, hypertension and dyslipidemia, are found to be strongly associated with elevated BMI and obesity; which in turn contribute to microvascular changes leading to the development of retinopathy.

The present study has shown a positive association of body mass index with increase in severity of retinopathy, with the highest tertile of BMI values mostly constituted by higher grades of retinopathy.

Some studies have found that BMI is strongly associated with severity of retinopathy,⁽⁸⁾ regardless of other factors like dyslipidemia and hypertension. BMI may serve as a predictive factor of visual loss in diabetics.⁽⁹⁾

A study that assessed the severity of retinopathy 10 years following diagnosis, found BMI to contribute positively to retinopathy.⁽¹⁰⁾ Patients receiving early diagnosis and treatment had a strong link between BMI and retinopathy.⁽¹¹⁾ Tuomilehto et al have shed light on the importance of controlling BMI to slow down the progression of the disease.⁽¹²⁾

However, this finding has to be confirmed as different studies have reported varying degrees of association of retinopathy with BMI.^(13,14) The difference in these findings could be due to relatively higher genetic predisposition and prevalence of obesity in the Indian sub-continent.⁽¹⁵⁾ Franz et al suggested that obesity with a genetic predisposition is more likely to

cause diabetes and its complications rather than patients without genetic predisposition.^(14,15)

Some Indian studies found an inverse association between diabetic retinopathy and BMI.⁽¹⁶⁾ Elevated BMI was found to offer a protective role in diabetic retinopathy.^(17,18) A few studies have even noted a link between high prevalence of retinopathy in diabetics with small body mass.^(19,20) One of the reasons for the disparity in these results could be that the weight of a patient tends to rise before development of diabetes and fall once diabetes sets in.^(21,22)

Although the involvement of obesity is well researched in the development of diabetes, its role in the development and progression of complications both microvascular and macrovascular remains in doubt. The strength of this study lies in its well matched population and the uniformity of the socioeconomic background and of course the race and ethnicity of patients. The limitation of this study would be the lack of adjustment for factors like treatment- duration effect on the patient's weight.

Conclusion

This study observed a positive association of BMI with increasing severity of retinopathy. Larger studies keeping in mind the role of genetic predisposition and race might help in determining the role of body mass index in diabetic retinopathy.

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