

Correlation of Diabetic Macular Edema (DME) with Glycosylated Haemoglobin

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Abstract: ***Purpose:** To correlate between central macular thickness measured by OCT and HbA1c in diabetics. **Method:** Hospital based observational study of 65 patients of Diabetic Retinopathy with and without DME. Dilated fundus examination was done and cases identified with DME were evaluated by Optical Coherence Tomography (OCT) of macula, which were then compared with Glycosylated Haemoglobin (HbA1c) level. **Results:** 65 eyes of 65 patients were included in the study. The HbA1c level (8 or over) showed a significant ($p < 0.001$) and positive association with macular thickness in OCT. **Conclusion:** So, close monitoring of HbA1c level is necessary for the management and also for knowing the prognosis of the cases of DME.*

Keywords: Diabetic macular edema, glycosylated haemoglobin, optical coherence tomography

1. Introduction

According to the World Health Organization (WHO), more than 180 million people worldwide have diabetes.¹ The number of diabetic patients in India is expected to reach 60.9 million by 2025.^{2,3} PDR is more common in type 1 diabetes than type 2, while diabetic macular edema is more common in type 2 diabetes (prevalence after 15 years of disease: type 1 vs type 2 = 15% vs 25%).⁴ The overall prevalence of DR in north east india was found to be 30.0% with vision-threatening retinopathy and maculopathy being 10.00% and 4.49%, respectively.⁵

Diabetic retinopathy (DR) is one of the most painful complications of diabetes mellitus (DM). It is the leading cause of blindness in adults of working age.⁶ The Early Treatment Diabetic Retinopathy Study (ETDRS) has identified criteria for diabetic retinopathy diagnosis and staging.⁷

Diabetic macular edema (DME), which is characterised by increased vascular permeability and hard exudate deposition at the central retina, can occur at any stage of DR. Causes poor visual acuity in diabetic patients. DME is diagnosed as clinically significant macular oedema using an ophthalmoscope. The most commonly used parameter to evaluate DME for management and prognosis is central macular thickness (CMT).⁸ Macular thickness is measured objectively and also the progression of DME is tracked by using optical coherence tomography (OCT).⁹

Periodic glycosylated haemoglobin (HbA1c) measurements can reflect long-term hyperglycemic control. Few studies have found a link between HbA1c and the various grades of diabetic retinopathy. HbA1c (glycosylated haemoglobin) is a predictor of the onset and progression of diabetes.¹⁰ The most important risk factor for the development of diabetic complications, such as retinopathy and maculopathy, is an elevated HbA1c level.¹¹

Intensive glycemic control has been shown to be effective in lowering the incidence rate of DR development and

progression in type 1 and type 2 diabetics, as demonstrated by the Diabetes Control and Complications Trials¹² and the United Kingdom Prospective Diabetes Study.¹³

Purpose of the study

The purpose of this study was to evaluate the relationship between HbA1c and Central Macular Thickness (CMT) measured by OCT in patients with diabetes.

2. Methodology

- Type of Study: Hospital based observational study.
- Sample: 65 patients of Diabetic Retinopathy with and without Diabetic Macular Edema (DME).
- Dilated fundus examination was done 5-15 minutes after instillation of mydriatic-cycloplegic eye drop with direct ophthalmoscope followed by bimanual Indirect Ophthalmoscope using Volk +20D aspheric lens and Slit Lamp examination with Volk +90D Lens.
- Cases identified with macular edema were then evaluated by doing OCT macula. Digital Fundus Photograph (DFP) and Fundus fluorescein angiography (FFA) were done whenever indicated.
- Diabetic macular edema was graded based on Central macular thickness (CMT) values obtained from OCT.
- Blood investigations like fasting blood sugar (FBS), postprandial blood sugar (PPBS) and Glycosylated haemoglobin (HbA1c) levels were done.
- We then tried to find the relationship between HbA1c levels and Diabetic Macular Edema

Statistical Analysis

Results on continuous measurements were presented as mean \pm standard deviation and compared using T-test while categorical data was represented as percentage. The statistical significance was fixed at 5% level (p value < 0.05) which using chi square test and post hoc analysis.

3. Results and Observation

Relationship of OCT based DME with different variables

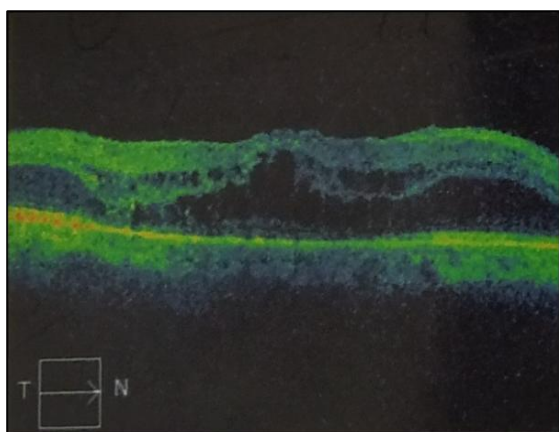
| Variables | DR without DME (n=28) | DR with DME (n=37) | P value |
|------------------------------------|-----------------------|--------------------|---------|
| Mean age | 49.42 ± 7.1 | 60.32 ± 8.8 | 0.0001* |
| Gender | Male | 21 (56.76%) | 0.7518 |
| | Female | 11 (39.29%) | |
| Mean duration of Diabetes Mellitus | 9.66 ± 5.54 yrs | 16.87±5.15 yrs | 0.0001* |
| HbA1c | ≤ 8 | 5 (13.51 %) | 0.0001* |
| | > 8 | 32 (86.49 %) | |
| Mean HbA1c | 9.31 ± 2.72 % | 11.07 ± 2.31 % | 0.0065* |

In our study, we found a significant relationship between DME and age of the patient. The mean age was 60.32 ± 8.8 years. There was no relationship between gender and DME. There was statistically significant relationship between duration of diabetes mellitus and DME. Hba1C more than 8 showed a positive association with DME. The mean Hba1c level in the DME group was found to be 11.07 ± 2.31 % which was to be significant.

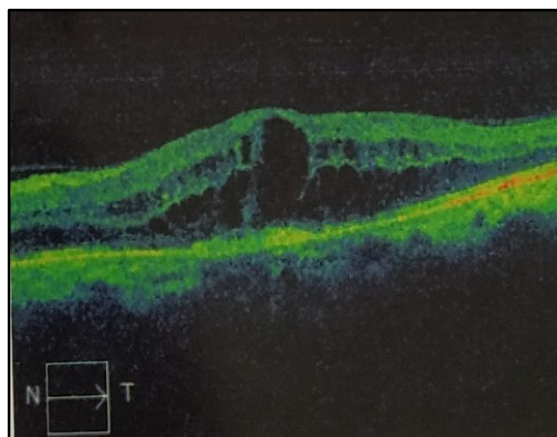
Relationship between Severity of DME based on CMT with HbA1C level

| Severity of DME based on CMT | Number (n = 37) | Percentage (%) | HbA1C (Mean ± S. D.) (%) | p value |
|------------------------------|------------------|----------------|--------------------------|---------|
| Mild (201–300 μm) | 8 | 21.62 | 7.89 ± 0.92 | <0.001 |
| Moderate (301–400 μm) | 18 | 48.65 | 10.81 ± 0.96 | |
| Severe (> 400 μm) | 11 | 29.73 | 13.81 ± 0.72 | |
| Mean CMT | 414.73±118.52 μm | | | |

In present study, we found a significant relationship (p <0.001) between severity of diabetic macular edema based on central macular thickness and HbA1c level.



OCT Image – Diabetic Macular Edema (Right Eye)



OCT Image - Diabetic Macular Edema (Left Eye)

4. Discussion

The goal of this study was to look at the association between HbA1c and OCT-measured Central Macular Thickness (CMT). So, by monitoring HbA1c levels, we can know the patients who are at risk of getting diabetic macular edema and counsel them on the required ophthalmic treatment. In the present study, the mean age was found to be 60.32 ± 8.80 years. Similar results were seen in T-H Chou *et al*¹⁴ and Turgut B *et al*¹⁵. Out of 37 patients of DME, 56.76 % were males and 43.24% were females. Male and female ratio was 1.31: 1. Similar results were seen in Keshav BR *et al*¹⁶ and Koo NK *et al*¹⁷. The mean duration of diabetes in DME patients was 16.87 ± 5.15 years. It was similar to studies conducted by Kim BY *et al*¹⁸ and Acan D *et al*¹⁹ where they found the mean duration of diabetes mellitus to be 17.2±8.4 years and 18.83±5.97 years respectively. In our study, we found a significant relationship (p <0.001) between severity of diabetic macular edema based on central macular thickness and HbA1c level. Majority of the diabetic macular edema patients (86.49%) had HbA1c level of more than 8. The mean HbA1c level found was 11.07 ±2.31%. Kocabora MS *et al*²⁰ also reported similar mean HbA1c level of 11.1 ± 3.8% in patients of diabetic macular edema. Chou TH *et al*¹⁴ in their study stated that patients with HbA1c of 8 or over was associated with an increased risk of CSME in diabetic eyes. In the present study, the mean central macular thickness was found to be 414.73±118.52 μm. This is in line with the study by Flaxel CJ *et al*²¹ where they found the median central macular thickness to be 412 μm. Tsai MJ *et al*²² also reported a similar finding where they found the mean central macular thickness to be 419±102 μm.

5. Conclusion

Our study found a statistically significant relationship between severity of diabetic macular edema and HbA1c levels, with more severe grades of diabetic macular edema occurring in patients with higher levels of HbA1c. So, close monitoring of HbA1c level is necessary for the management and also for knowing the prognosis of the cases of Diabetic Macular Edema.

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