



RELATIONSHIP BETWEEN REFRACTIVE ERROR AND DIABETES MELLITUS

Ophthalmology

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ABSTRACT

PURPOSE: To investigate the change in the refractive status of patients who were recently diagnosed with diabetes mellitus .**METHOD:** The study was performed in the patients diagnosed with recent diabetes using various biochemical tests & clinical examinations. Fasting plasma glucose (FPG) levels were measured along with the refractive errors initially and after four weeks . The difference between the two was evaluated .**RESULTS:** The average value of the initial measurement were as follows :

FPG level - 396 mg/dl , refractive value - +2.0 D

The average values after four weeks were:

FPG level - 202 mg/dl , refractive value - +0.50 D

CONCLUSION: Refractive error is affected in patients with newly diagnosed diabetes mellitus.

KEYWORDS

Diabetes mellitus, Fasting plasma glucose, Refractive error

INTRODUCTION

Diabetes mellitus is a complex metabolic disorder that involves the small blood vessels , often causing widespread damage to tissue , including eyes , kidneys , (end stage renal disease ESRD).^{1,2}

It is one of the systemic diseases that has ocular manifestation. Patients with Diabetes Mellitus can develop various ocular disorders including glaucoma, keratopathy, oculomotor nerve paralysis, non-arteritic anterior ischaemic optic neuropathy, and retinal vasculopathy.

Hyperglycemia is the most frequently observed sign of diabetes and is an important source of diabetic complication in body and eye. The ocular complications generally arise approximately 20 years after the onset of the disease. The loss of the normal homeostatic mechanisms which maintain blood glucose within a narrow physiological range, render the diabetic individual susceptible to wide excursions in blood glucose and the intermittent hazard of metabolic extremes.

Transient refractive changes have been reported during the hyperglycemic period and also during falling blood glucose level during intensive glycemic control .Studies have reported a shift in the hyperopic direction during periods of hyperglycemia.^{3,4}

In cases of acute increase or reduction of blood glucose level in diabetic patients transient cataract are also reported.

Ability to identify these manifestations and the condition causing them will place the clinician in a better position to manage, often counsel or refer for appropriate treatment.

METHODS

The study included 100 adult patients with a new diagnosis of diabetes mellitus who did not have retinopathy. Patients had been diagnosed using laboratory biochemical tests and clinical examination .The age and sex of the patients were recorded. Informed consent was taken .

Each patient was monitored for 4 weeks. Measurements and evaluation was made simultaneously for FPG levels and refractive error . Measurements were taken at the beginning and end of this period (4 weeks). The difference between the first and second refractive measurements was evaluated . All patients were tested for blurred vision. The data was statistically evaluated using Paired Sample t Test. For all analysis, p values <0.05 were considered significant.

RESULT

All the 100 newly diagnosed type 2 Diabetes mellitus patients were taken of which 70 were males and 30 females .The refraction values

and FPG levels were measured twice in all patients. The average values of the initial measurements were as follows FPG level : 396 mg/dl; average Refractive value : +2.0 D (Dioptre). The average end-of-period measurements were FPG : 202 mg/dl; average Refractive value, +0.50 D (Table 1) . All the 100 patients were seen with blurred vision during initial measurements . (Table 3)

TABLE 1 : FPG level & refractive error initially and after 4 weeks

Process	The measurements		The change (%)
	Initially (Mean)	After four weeks (Mean)	
FPG level	396 mg/dl	202mg/dl	48.98
Refractive Error	+2.0D	+0.50D	75

The % change of average FPG levels was 48.98% between 2 measurements. Average refractive values, 75% . These change were statistically significant (p<0.05) (Table 1).

TABLE 2 : Sex wise distribution of FPG level & refractive error initially and after 4 weeks

Process	Males		Females	
	Initial(Mean)	After 4 wk	Initial(Mean)	After 4 wk
FPG level	391mg/dl	196mg/dl	401mg/dl	208mg/dl
Refractive Error	+2.0D	+0.50D	+2.0D	+0.50D

The average values of the initial measurements of males were as follows: FPG level, 391mg/dl; average refractive value, +2.0 D (Dioptre). The average end-of-period measurements were FPG, 196 mg/dl; average refractive value, +0.50 D (Table 2).

The average values of the initial measurements of females were as follows: FPG level, 401mg/dl; average refractive value, +2.0 D (Dioptre). The average end-of-period measurements were FPG, 208 mg/dl; average refractive value, +0.50 D (Table 2).

TABLE 3 : Visual status initially and after 4 weeks

Process	Measurements	
	Initially (Mean)	After four weeks (Mean)
Blurred vision	100 patients	0
Visual acuity(UCVA)	6/18	6/9

Blurred vision in all the patients in the first condition was eliminated with the use of corrective lenses after 4 weeks. The disappearance of blurred vision were statistically significant (p<0.05).There was improvement in the vision in all the patients by the end of 4 weeks (Table 3).

DISCUSSION

Hyperglycemia causes transient refractive changes in diabetic patients. Type 2 diabetes mellitus usually begins after age 40.

The refractive power of the eye depends on the anterior and posterior corneal and lens surface curvatures, the corneal thickness, the anterior chamber depth, lens thickness, and the axial length of the eye as well as the refractive indices of the cornea, aqueous humor, lens, and vitreous body. Transient refractive changes are common during periods of hyperglycemia, or falling blood glucose during intensive glycemic control. Thus, in the analysis of pathophysiology of refractive changes in diabetes, all the above-mentioned parameters need to be considered. Acute changes in plasma glucose level cause either myopia or hyperopia. The change in refractive index of the lens is responsible for the refractive changes. According to studies osmotic changes lead to changes in lens hydration. Hyperglycemia stimulates sorbitol production in the lens. Subacute rise in glucose levels in the aqueous could result in increased production of sorbitol in the lens and over hydration of the lens. On the other hand an acute rise in external glucose levels causes dehydration of the lens in vitro. This causes change in refractive index of lens.

Dyke et al. concluded that hyperglycemia produced myopia and that lowering the blood sugar resulted in hyperopia.⁵

Grant et al. suggested that the change in vision that accompanied chronic changes in glucose paralleled the degree of change in glucose concentration.⁶ This agrees with the result of our study.

Kristian et al. investigated the effect of glycemic control on hyperglycemia induced temporary changes in refractive error in type 1 diabetic patients without retinopathy.⁷ This study is also parallel to our study in terms of investigating the hyperglycemic associated with diabetes mellitus.

Okanoto et al. reported myopia at hyperglycemic levels and on decrease in blood sugar level hyperopic shift was seen which was contrary to our study.⁸

Bozkurt et al. demonstrated the mechanisms by which elevated glucose affects cellular metabolism.⁸

Tatsuyuki et al. studied blurred vision in diabetes mellitus patients. The refractive changes in diabetic patients is unknown, it ranges from 5 to 50 % in untreated or uncontrolled patients.⁹

Giusti hypothesized that the sorbitol production with over hydration of the lens remains the best pathophysiologic account for the phenomenon.¹⁰ He concluded that hyperopic changes are highly dependent on the magnitude of plasma glucose concentrations and rapid correction of hyperglycemia is strictly correlated with complete recovery of refraction.

The exact biological basis of refractive changes in the eyes of people with diabetes has yet to be established and the mechanism of the relationship between plasma glucose concentration and refractive change in person with diabetes remains to be determined.

CONCLUSION

In diabetic patients refraction is affected by blood glucose; therefore, monitoring of this value is important. It is recommended that eyeglasses should not be prescribed for 4 weeks in patients who are newly diagnosed with diabetes mellitus.

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