



A STUDY ON AQUEOUS HUMOR GLUCOSE CONCENTRATION WITH VARYING HbA1c IN RAPIDLY CORRECTED HYPERGLYCEMIC CATARACT.

Biochemistry

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ABSTRACT

Backgrounds: No study in Indian population have demonstrated the changes in aqueous humor glucose level with the varying degree of glycemic control as reflected in the changes in the HbA1c in rapidly corrected hyperglycemic cataract.

Methods: Aqueous glucose level and HbA1c were measured of 202 cataract patients of previously undiagnosed hyperglycemia who were made normoglycemic by intensive anti diabetic medications within 7-10 days after diagnosis and were operated for cataract within 10-14 days of diagnosis.

Results: Cataract patients with HbA1c of greater than 7.5% have got significantly high aqueous glucose concentration (64 ± 2.6 mg/dl and above) despite having normal fasting and post prandial plasma glucose.

Conclusions: Glycemic control must be ensured by monitoring HbA1c to the extent of 7.5% before proceeding for cataract surgery.

KEYWORDS

Aqueous humor glucose concentrations, HbA1c, Diabetes, Cataract.

INTRODUCTION

The presence of sight impairing opacification of natural lens of the eye is termed as cataract.¹ Diabetes mellitus is one of the major cause of cataract.^{2,3} Generation of sorbitol from glucose is responsible for the development of diabetic cataract by hyper osmotic effect.⁴

Aqueous humor is formed by diffusion, ultrafiltration and active secretion from plasma.⁵ Aqueous humor provides nutrition to lens, helps in the formation & stabilization of the anterior and posterior chambers of the eye.⁶ Reference interval of aqueous humor glucose concentration is 50 ± 2.6 mg/dl.⁷ Aqueous humor glucose concentrations in cataracts are higher in diabetes than non diabetes patients.⁸

There are wide diurnal fluctuations of blood glucose due to food ingestion, exercise, and other factors. HbA1c, which is the nonenzymatic addition of sugar to amino groups of Hemoglobin (Hb), remains relatively stable with time hence directly proportional to the blood glucose concentration over the preceding 8 to 12 weeks. Thus it directly correlates with glycemic control.⁹ There was positive correlation of Glycated Hb with fasting & post prandial plasma glucose.¹⁰ Cataract extraction should be performed with absolute glycemic control of the patient to prevent the post operative complications. But no study in Indian population have demonstrated the changes in aqueous humor glucose level with the varying degree of glycemic control as reflected in the changes in the HbA1c in rapidly corrected hyperglycemic cataract. Hence our study will try to explore the changes in aqueous glucose level with varying glycemic control by measuring HbA1c in rapidly corrected hyperglycemic cataract.

MATERIALS & METHODS

A total of 256 cataract patients attending the outpatient department of a medical college in Kolkata, West Bengal, were diagnosed to have hyperglycemia (Fasting ≥ 100 mg/dl or post prandial ≥ 140 mg/dl or both) for the first time on routine biochemical examination. 202 cataracts including 109 males and 93 females became normoglycemic (Fasting < 100 mg/dl and post prandial < 140 mg/dl) after 7-10 days of intensive anti diabetic treatment and had undergone cataract extraction under local anesthesia within 10-14 days of detection of hyperglycemia. Cataract was diagnosed after doing visual acuity, intraocular pressure measurement and slit lamp examination after dilation of pupil. The age of patients ranged from 52 to 62 years. The institutional ethics committee approved the one year long cross sectional observational study and informed consent was obtained from all the study populations, in accordance with the Declaration of Helsinki. A detailed questionnaire on family history, social status, and dietary habits, including other habits such as smoking, alcohol intake, history of systemic diseases, and drug history (steroid, diuretics), radiation exposure, ocular history (trauma or infection or inflammation) was completed by all the study subjects. Cardiovascular

disease, renal disease, liver disease, known diabetes, serum electrolyte disturbance as well as traumatic & inflammatory cataract were ruled out in the present study based on the biochemical tests apart from the questionnaire.

Collection of aqueous humor

All cataract patients were prepared for the surgery by maintaining the required asepsis. Peribulbar block was performed with the injection of 0.3 cc of lignocaine mixed with hyaluronidase. 0.4 c.c of aqueous humor was collected from the anterior chamber by using a 26 gauge needle and an insulin syringe intra operatively without touching the corneal endothelium & anterior lens capsule & without dislodging the needle. The anterior chamber was reformed with ringers lactate solution through the same needle and the cataract surgery was then continued in its regular way.⁷ Aqueous humor glucose concentration is estimated by glucose oxidase-peroxidase method in the semi-automated analyzer provided by ERBA diagnostics from the reagent provided by Coral.¹¹

Three (3) cc of venous blood was collected from anti-cubital vein of forearm by venepuncture into EDTA vial for HbA1c estimation. HbA1c were measured using a Bio-Rad D-10 HPLC instrument, whose compliance with the latest Diabetes Control and Complications Trial (DCCT) reference method has been documented by the National Glycohemoglobin Standardization Program (NGSP).¹²

RESULTS

Cataract patients with HbA1c of greater than 7.5% have got significantly high aqueous glucose concentration (64 ± 2.6 mg/dl and above) despite having normal fasting and post prandial plasma glucose. (Table: 1)

DISCUSSIONS

It was well established that HbA1c directly correlates with glycemic control⁹ and it also correlates with fasting & post prandial plasma glucose.¹⁰ But our study showed that normoglycemia does not ensure normal glucose level in aqueous humor as all patients in this study were normoglycemic but with different aqueous glucose value. More over the patients having HbA1c value of greater than 7.5% were having mean aqueous glucose concentration significantly higher than those having HbA1c value lesser than 7.5% (Table 1). However aqueous glucose value did not change significantly with the change in the HbA1c value up to the extent of 7.5%.

In conclusion we could say that mere normoglycemia does not ensure the normal aqueous glucose value and rapid correction of plasma glucose does not guarantee similar changes in aqueous humor glucose. Future study must be done to see the effect of glycemic control on the outcome of the surgery by monitoring HbA1c to the extent of 7.5% before proceeding for cataract surgery.

Conflict of interest: Nil.

Table: 1. Aquous humor glucose concentration with varying HbA1c

HbA1c%	<5.7	5.7-6.4	6.5-7.5	7.6-8.5	8.6-9.5	>9.6
Aquous glucose (mg/dl)	56.7(2.1)	58.1(2.1)*	59.4(2.1)*	64(2.6) [†]	66(2.6) [†]	68(2.6) [‡]
Number of cases	35	32	33	35	31	36

*' P>0.5 in response to HbA1c <5.7

'†' P<0.05 in response to HbA1c <5.7, 5.7-6.4 & 6.5-7.5

'‡' P<0.005 in response to HbA1c <5.7, 5.7-6.4 & 6.5-7.5

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