DOI: 10.5958/2319-5886.2015.00029.6

International Journal of Medical Research & Health Sciences

www.ijmrhs.com Volume 4 Issue 1 Coden: IJMRHS Copyright @2014 ISSN: 2319-5886

Received: 2nd Dec 2014 Revised: 19th Dec 2014 Accepted: 31st Dec 2014

Research article

COMPARATIVE STUDY OF ERYTHROCYTE FRAGILITY IN DIABETES MELLITUS AND NON DIABETES MELLITUS

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ABSTRACT

Introduction: The present study has examined the effect of elevated glucose levels on osmotic fragility of erythrocytes. Osmotic fragility determines the rate of hemolysis of erythrocytes. Blood glucose is the sole energy source for erythrocytes. Diabetes mellitus (DM) is a metabolic disorder characterized by hyperglycemia and has become a major public health problem globally. Diabeties is the risk factor for osmotic fragility. **Aim:** the aim of the present study is to describe erythrocyte osmotic fragility changes from type II diabetes to non diabetes. **Materials and methods**: The osmotic fragility test is a measure of the resistance of erythrocytes to hemolysis by osmotic stress. The study was conducted on (n=60) aged between 50-55 years, case group will include 30 type II diabetes who were randomly selected from outpatients of the Malla Reddy Hospital, Suraram. Control group involves 30 non diabetic individuals. Parameters selected for study are initial hemolysis, complete hemolysis, median corpuscular hemolysis, haemoglobin, haemoglobin A1c, Fasting blood sugar, post prandial blood sugar and respective parameters were compared in both the groups. **Results & discussion:** In this study when type II diabetics were compared with non diabetic individuals, there was a significant change in osmotic fragility of type II diabetics when compare to non diabetic controls. **Conclusion:** Hyperglycemia causes structural changes in red cell corpuscles which lead to osmotic stress. Hence, it is necessary to rule out investigations of pathogenic mechanisms induced by red cell fragility to prevent complications of diabetes mellitus.

Keywords: Type II diabetes, Osmotic fragility, Heamoglobin A1c, Blood glucose levels

INTRODUCTION

The International Diabetes Federation (IDF) estimated in 2011 that 366 million adults, aged 20 - 79 years, of the world's 7 billion population have Diabetes mellitus[1]. The association between erythrocyte fragility and type II diabetes is well documented. Patients with type 2 diabetes have a significantly higher erythrocyte mechanical fragility than matched nondiabetic subjects, and that fasting plasma glucose is the strongest correlate of increased mechanical fragility of erythrocytes in the patients group[2] anaemia is relatively common in patients with Diabetes mellitus. Anaemia is defined by the World Health Organization as a haemoglobin concentration below the following threshold Women (>15 years) <12.0 g/dl and Men (>15 years) <13 g/dl. Generally, anaemia in chronic disease like Diabetes mellitus is normocytic normochromatic type, although in a few cases, microcytosis and hypochromia also occur[3].

Osmotic fragility of erythrocyte was greater in type 2 diabetic subjects, which is positively correlated with glycosylated haemoglobin. Diabetic patients had significantly increased risk of cell hemolysis on start of hemolysis [4]. Type 2 diabetic patients have a significantly higher erythrocyte mechanical fragility than matched nondiabetic subjects, and that fasting plasma glucose and anaemia are also strongest correlate of increased mechanical fragility of erythrocytes in patients group[5].

MATERIALS AND METHODS

The study was conducted on type II diabetic subjects of both the sex groups (n=60) aged between 50-60 years. The criteria for selection of diabetics were 10 years exposure of diabetes. Cases are selected from the outpatient ward of Malla Reddy Hospital, Hyderabad. Age matched non diabetic subjects were selected as controls for study from general population of same region. The present study includes erythrocyte fragility changes in diabetics and nondiabetics. To compare the results of the above two groups and study the effect of diabetes on erythrocytes, the subject's detailed history was taken. Each subject was medically examined and their past medical history was carefully evaluated solely aimed at excluding hypertension. Thus, unhealthy subjects were excluded and the only suitable subjects were accepted for this study prior to the study, each subject was informed in detail of research protocol and methods to be used. Their consent was obtained prior to the study and Ethical committee clearance has taken.

Experimental protocol: All the biochemical tests done in the central lab of Malla Reddy Institute of Medical Sciences, Hyderabad. Haemoglobin estimation measured using symx Kx 21 fully automated hematology analyser, Haemoglobin A1c % measured using Nycocard Reader[2], Fasting Blood Sugar, Post Prandial Blood Sugar, were measured using Chemwell Auto Analyser. The osmotic fragility test is useful because it is inexpensive and causes minimum discomfort to the subject.5ml blood sample was collected under aseptic condition and the blood sample was used for Initial heamolysis, Complete hemolysis, Median heamolysis. The osmotic fragility test was done by Dacie's method on the subjects within 30 minutes of collection of blood. The study was conducted in accordance with the Declaration of Helsinki and under the terms of local relevant local legislations.

Statistical methods: Data was presented as mean and standard deviation (mean ± SD). Means are compared between two groups by unpaired student 't'test . A p value of < 0.05 was considered statistically significant. Descriptive statistical analysis was carried out in the present study by using SPSS, 17 version software. Results on continuous measurement were presented on mean ± SD. Student't' test was used to find the difference of the present study parameters between two groups.

RESULTS

Table: 1.Comparision of various parameters of diabetes & erythrocyte fragility among test group and control group

Variable	Type II diabetes	Non Diabetes	P values *
Heamoglobin (gm/dl)	9.33±0.7	11.5±1.2	<0.0001
Hb A1c(%)	6.75±0.8	5.22±0.08	<0.0001
FBS (mg/dl)	112±30	89.86±5.3	<0.0001
PPBS (mg/dl)	151±20	114±3.9	<0.0001
Initial heamolysis (Conc of NaCl)	5.45±0.5	4.55±0.24	<0.0001
Complete hemolysis (Conc of NaCl)	4.55±0.6	3.42±0.19	<0.0001
Median heamolysis (Conc of NaCl)	6.38±0.4	4.44±0.29	<0.0001

*P values comparison with diabetics vs. non diabetics showing ^ highly significance

DISCUSSION

Diabetes is a metabolic disorder characterized by hyperglycemia, either due to insulin deficiency or insulin resistance. Despite some progress in the development of new anti-diabetic agents, the ability to maintain tight glycemic control in order to prevent complications of diabetes without adverse complications still remains a challenge[6]. The osmotic effects of hyperglycaemia and glycosylation of haemoglobin and erythrocyte membrane proteins may play important role in the deformability of RBC in the diabetic state. These effects may be exaggerated in poorly controlled diabetes. The study aimed to determine the fasting blood sugar levels (FBS), glycated haemoglobin (HbA1c) and osmotic fragility of red cells (MCF) in diabetics and non-diabetics.

Hyperglycaemia alters the membrane properties of the red cells leading to increased osmotic fragility of the red cells[7]. Na+/ K+ ATPase levels are significantly decreased, which may cause disturbance of intracellular ion balance and thereby acceleration of cellular ageing. This further leads to an increase in cell size and osmotic fragility, which contribute to the disturbances in microvascular circulation observed in diabetes mellitus. Alterations in membrane lipid-protein The oxidative stress due to high glucose concentrations causes damage to the erythrocyte membrane proteins, even in a relatively short exposure time[8]. Peroxidation of membrane lipids can result in the inactivation of enzymes and cross linking of membrane lipids and proteins will cause increased membrane osmotic fragility and in cell death. Glucose induced lipid peroxidative damage can cause changes in the properties of the RBC membrane[9].It is well known that, RBCs have to be squeezed and deformed to pass in blood capillary vessels of diameter smaller than that of RBCs itself, the degree of squeezing of RBCs depend mainly on their membrane elasticity. Therefore, the decrease of the RBCs membrane elasticity will lead to the increase of the blood capillary resistance for RBCs passage to the body cells for carrying normal metabolism and hence it may lead to toxicity[10].

CONCLUSION

Our study demonstrated that osmotic fragility of erythrocyte is greater in type 2 diabetic subjects compared to nondiabetic controls and red blood cell fragility was positively correlated with increased duration of exposure of diabetes for 10 years.

Acknowledgement: The authors would like to thank management, department of physiology, Mallareddy institute of medical sciences & Hospital, Suraram, Hyderabad, for their support throughout the study.
Conflict of Interest: Nill.

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