(e) ISSN Online: 2321-9599

(p) ISSN Print: 2348-6805

ORIGINAL ARTICLE

Assessment of HbA1c concentrations among diabetic patients with and without diabetic complication: A Biochemical Study

Shakti Agarwal[1], Parul Chandra[2]

[1]Assistant Professor, Department of Biochemistry, Saraswathi Institute of Medical Sciences, Hapur, UP, India;
[2]Assistant Professor, Department of Anaesthesia, Saraswathi Institute of Medical Sciences, Hapur, UP, India

ABSTRACT:
Background: Diabetes mellitus (DM) is a chronic disease of hyperglycemia associated with metabolic syndrome, which is characterized by insulin resistance. Diabetic foot complications are contributing to both mortality and morbidity among the diabetic population leading to substantial physical, physiological and financial burden for the patients and community at large. Hence; the present study was planned for assessing and coring the HbA1c concentrations among diabetic patients with and without diabetic complication. **Materials & methods:** A total of 25 diabetic patients with diabetic foot complication and 25 diabetic patients without diabetic foot complication were enrolled in the present study. Complete clinical examination of all patients was carried out. Blood samples were obtained from all the patients and mean HbA1c concentration was analysed and compared. **Results:** Mean HbA1c concentration among patients with and without diabetic foot complication was 8.75% and 10.19% respectively. Mean FBS concentration among patients with and without diabetic foot complication was 101.9mg/dL and 114.3mg/dL respectively. Mean RBS concentration among patients with and without diabetic foot complication was 119.4mg/dL and 129.5 mg/dL respectively. Mean HbA1c, FBS and RBS concentrations among the patients with diabetic foot complication was significantly higher among the patients without diabetic foot complication. **Conclusion:** HbA1c levels are significantly altered in patients with diabetic foot complications.
Key words: Diabetic foot complication, HbA1c

Corresponding author: Dr. Parul Chandra, Assistant Professor, Department of Anaesthesia, Saraswathi Institute of Medical Sciences, Hapur, UP, India

This article may be cited as: Agarwal S, Chandra P. Assessment of HbA1c concentrations among diabetic patients with and without diabetic complication: A Biochemical Study. J Adv Med Dent Scie Res 2016;4(4):230-232.

INTRODUCTION

Diabetes mellitus (DM) is a chronic disease of hyperglycemia associated with metabolic syndrome, which is characterized by insulin resistance. Long-standing DM affects many organs leading to severe complications of retinopathy, nephropathy, and neuropathy. Plasma glycosylated hemoglobin (HbA1c) is as an index of average glycemic control over the previous 2–3 months and indicates poor diabetic control; furthermore, increased HbA1c concentration is the most important risk factor for predicting DM complications.[1-3]

Diabetic foot complications are contributing to both mortality and morbidity among the diabetic population leading to substantial physical, physiological and financial burden for the patients and community at large. It is estimated that 24.4% of the total health care expenditure among diabetic population is related to foot complication.[4]

Foot ulceration is a preventable condition, where simple interventions can reduce amputations by up to 70%through programs that could reduce its risk factors. Identifying the role of risk factors contributing to this condition will enable health providers to set up better prevention programs that could result in improving patients' quality of life and henceforth, reducing the economic burden for both the patient and the health care system.[5-7]

Hence; the present study was planned for assessing and comparing the HbA1c concentrations among diabetic patients with and without diabetic complication.

MATERIALS & METHODS

The present study was conducted in the department of biochemistry of the Saraswathi Institute of Medical Sciences, Hapur, UP, India. It included assessment and comparison of the HbA1c concentrations among diabetic patients with and without diabetic complication. Ethical approval was obtained from institute ethical committee and written consent was obtained after explaining in detail the entire research protocol. A total of 25 diabetic patients with diabetic foot complication and 25 diabetic patients without diabetic foot complication were enrolled in the present study. Complete clinical examination of all patients was carried out. Blood samples were obtained from all the patients and mean HbA1c concentration was analysed and compared. All the results were compiled in Microsoft excel sheet and were analysed by SPSS software.

RESULTS

In the present study, a total of 50 diabetic patients were enrolled. Mean age of the patients with diabetic foot complication was 42.1 years while mean age of the patients without diabetic foot complication was 39.4 years.

In the present study, mean HbA1c concentration among patients with and without diabetic foot complication was 8.75% and 10.19% respectively. Mean FBS concentration among patients with and without diabetic foot complication was 101.9mg/dL and 114.3mg/dL respectively. Mean RBS concentration among patients with and without diabetic foot complication was 119.4mg/dL and 129.5 mg/dL respectively. Mean HbA1c, FBS and RBS concentrations among the patients with diabetic foot complication was significantly higher among the patients without diabetic foot complication.

DISCUSSION

The diabetic foot syndrome or disease (DFD) includes several pathologies, mainly diabetic peripheral neuropathy and peripheral arterial disease which result in foot ulceration. Diabetic foot ulceration may ultimately lead to amputation, especially when wound infection or osteomyelitis are involved. Diabetic foot ulcer is defined as a full-thickness wound which is present at a level distal to the ankle in patients with diabetes.[7- 10]

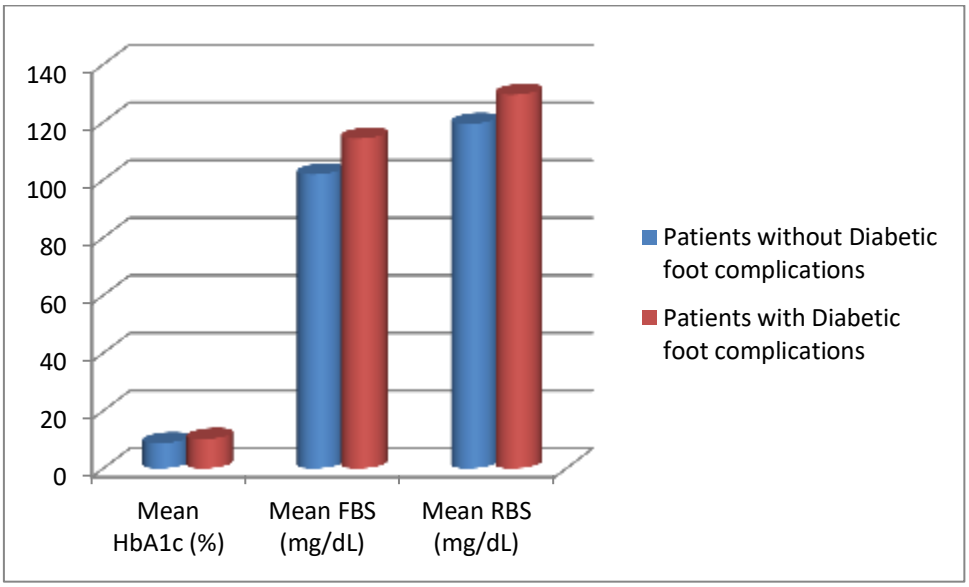
Table 1: Age-wise distribution

Age group (years)	Patients without Diabetic foot complications	Patients with Diabetic foot complications
Less than 40	13	11
More than 40	12	14
Total	25	25
Mean age	39.4	42.1

Table 2: Comparison of HbA1c, FBS and RBS values

Parameter	Patients without Diabetic foot complications	Patients with Diabetic foot complications	p- value
Mean HbA1c (%)	8.75	10.19	0.00
Mean FBS (mg/dL)	101.9	114.3	0.02
Mean RBS (mg/dL)	119.4	129.5	0.01

Graph 1: Comparison of HbA1c, FBS and RBS values



In the present study, a total of 50 diabetic patients were enrolled. Mean age of the patients with diabetic foot complication was 42.1 years while mean age of the patients without diabetic foot complication was 39.4 years. Lee WJ et al investigated risk factors for diabetic peripheral polyneuropathy and their correlation with the quantified severity of nerve dysfunction in patients with diabetes mellitus (DM). A total of 187 diabetic patients with clinically suspected polyneuropathy (PN) were subclassified into 2 groups according to electrodiagnostic testing: a DM-PN group of 153 diabetic patients without electrophysiological abnormality and a DM+PN group of 34 diabetic patients with polyneuropathy. For all patients, age, sex, height, weight, duration of DM, and plasma glycosylated hemoglobin (HbA1c) level were comparatively investigated. A composite score was introduced to quantitatively analyze the results of the nerve conduction studies. The DM+PN group showed a significantly higher HbA1c level and composite score, as compared with the DM-PN group. Increased HbA1c level and old age were significant predictive factors for polyneuropathy in diabetic patients (odds ratio=5.233 and 4.745, respectively). In the multiple linear regression model, HbA1c and age showed a significant positive association with composite score, in order (β=1.560 and 0.253, respectively). Increased HbA1c level indicative of a state of chronic hyperglycemia was a risk factor for polyneuropathy in diabetic patients and a quantitative measure of its severity.[11]

In the present study, mean HbA1c concentration among patients with and without diabetic foot complication was 8.75% and 10.19% respectively. Mean FBS concentration among patients with and without diabetic foot complication was 101.9mg/dL and 114.3mg/dL respectively. Mean RBS concentration among patients with and without diabetic foot complication was 119.4mg/dL and 129.5 mg/dL respectively. Mean HbA1c, FBS and RBS concentrations among the patients with diabetic foot complication was significantly higher among the patients without diabetic foot complication. Xu F et al investigate the relationship between glycemic variability and DPN in type 2 diabetes with well-controlled HbA1c (HbA1c < 7.0%). 45 type 2 diabetes with well-controlled HbA1c(HbA1c < 7.0%) and with DPN (DM/DPN group) were recruited in the study, and 45 type 2 diabetes with well-controlled HbA1c and without DPN (DM/–DPN group) were set as controls. The two groups were also matched for age and diabetic duration. Blood pressure, body mass index(BMI), insulin sensitivity index (Matsuda index, ISI), total cholesterol (TC), triglyceride (TG), high density lipoprotein cholesterol (HDLC), and low density lipoprotein cholesterol (LDLC) were tested in the two groups. And all patients were monitored using the continuous glucose monitoring (CGM) system for consecutive 72 hours. The multiple parameters of glycemic variability included the standard deviation of blood glucose (SDBG), mean of daily differences (MODD) and mean amplitude of glycemic excursions (MAGE). The DM/DPN group had a greater SDBG, MODD and MAGE, when compared to the DM/–DPN group ($p < 0.05$). BMI, TC, and LDLC of DM/DPN group were lower than those of DM/–DPN group ($p < 0.05$). The patients with hypoglycemia were comparable between the two groups ($p > 0.05$). Univariate analysis showed DPN was closely associated with BMI, TC, LDLC, SDBG, MODD, MAGE. There was a close relationship between glycemic variability evaluated by MAGE and DPN in type 2 diabetes with well-controlled HbA1c.[12]

CONCLUSION

From the above results, the authors concluded that HbA1c levels are significantly altered in patients with diabetic foot complications. However; further studies are recommended.

REFERENCES

1. Boulton AJ, Vileikyte L, Ragnarson-Tennvall G, Apelqvist J. The global burden of diabetic foot disease. Lancet. 2005;366:1719–1724.
2. Gordois A, Scuffham P, Shearer A, Oglesby A, Tobian JA. The health care costs of diabetic peripheral neuropathy in the US. Diabetes Care. 2003;26: 1790–1795.
3. International Working Group on the Diabetic Foot. Epidemiology of Diabetic Foot Infections in a Population Based Cohort. Noordwijkerhout, The Netherlands; 2003.
4. American Diabetes Association. Consensus Development Conference on Diabetic Foot Wound Care: 7-8 April 1999, Boston, Massachusetts. American Diabetes Association. Diabetes Care. 1999;22:1354–1360.
5. Gordois A, Scuffham P, Shearer A, Oglesby A. The healthcare costs of diabetic peripheral neuropathy in the UK. The Diabetic Foot. 2003;6: 62–73.
6. Katsilambros N, Tentolouris N, Tsapogas P, Dounis E. Atlas of Diabetic Foot. Chichester, UK: Wiley-Blackwell; 2003.
7. Bartus CL, Margolis DJ. Reducing the incidence of foot ulceration and amputation in diabetes. Curr Diab Rep. 2004;4:413–418.
8. Armstrong DG, Lipsky BA. Advances in the treatment of diabetic foot infections. Diabetes Technol Ther. 2004;6:167–177.
9. Sargen MR, Hoffstad O, Margolis DJ. Geographic variation in Medicare spending and mortality for diabetic patients with foot ulcers and amputations. J Diabetes Complicat. 2013;27: 128–133.
10. Williams DR, Airey M. The size of the problem: Epidemiological and economical aspects of the diabetic foot. In: Boulton AJM, Connor H and Cavanagh PR The foot in diabetes, editors. Chichester England; New York: Wiley; 2000. pp. 3–17.
11. Lee WJ, Jang S, Lee SH, Lee HS. Correlation Between the Severity of Diabetic Peripheral Polyneuropathy and Glycosylated Hemoglobin Levels: A Quantitative Study. Ann Rehabil Med. 2016; 40(2): 263–270.
12. Xu F, Zhao LH, Su JB, et al. The relationship between glycemic variability and diabetic peripheral neuropathy in type 2 diabetes with well-controlled HbA1c. Diabetol Metab Syndr. 2014;6(1):139.