Section: General Medicine

Original Research Article

CORRELATION OF HAEMATOLOGICAL PARAMETERS WITH GLYCEMIC PARAMETERS IN PATIENTS WITH TYPE 2 DIABETES MELLITUS- A CROSS SECTIONAL STUDY

Prakash B C[1], ShreeLakshmi[2], Rohini R[3]

[1]*Associate Professor, Department of General Medicine, BMCRI, India.*
[2]*Professor, Department of Pathology, BMCRI, India.*
[3]*Post Graduate, Department of General Medicine, BMCRI, India.*

Received *: 06/07/2024*
Received in revised form *: 02/09/2024*
Accepted *: 16/09/2024*

Corresponding Author:
Dr. Rohini R,
Post Graduate, Department of General Medicine, BMCRI, India.
Email: raghavendra40878@gmail.com

DOI: 10.70034/ijmedph.2024.3.133

Source of Support: Nil,
Conflict of Interest: None declared

Int J Med Pub Health
2024; 14 (3); 745-748

ABSTRACT

Background: Prevalent in 422 million people worldwide, diabetes mellitus has emerged as one of the most prevalent diseases of the twenty-first century.[1] Haematological abnormalities are associated with diabetes mellitus (DM) and are a key cause of micro- and macrovascular problems associated with diabetes.[2]

Materials and Methods: A cross-sectional observational study involving 112 individuals diagnosed with type 2 diabetes was carried out. We gathered and examined data on outcomes, biochemical indicators, precipitating variables, clinical aspects, and demographics.

Results: The mean age of the patients was 58.4 ± 11.24 years, with a female preponderance (64.28%). Among the 112 diabetic patients, 10 of them were newly detected, 7 were on exclusively Insulin therapy. 20 of them were having HBA1C >8. Among the various hematological indices measured, mean RBC Count was 4.8 mean Hb 12.5, mean WBC count 10571±4710, mean Platelet count 6.01, mean MCHC 31.8±3.21, mean Neutrophil percentage 74.30 ±10.19. There was significant correlation between glycemic control and MCHC with p value <0.0001, as well as between glycemic control and WBC count, glycemic control and percentage of neutrophils.

Conclusion: The observation of various hematological parameters in Type 2 Diabetes Mellitus concludes that uncontrolled Diabetes Mellitus is a pro inflammatory state with neutrophilic leucocytosis, reduced MCHC. These hematological disturbances itself can trigger micro and macro vascular complications of Diabetes Mellitus.

Keywords: Diabetes Mellitus; HBA 1C; Glycemic Control; Hematological Parameters.

INTRODUCTION

Currently there are no guidelines or recommendations for regular testing of hematological parameters in type 2 diabetes mellitus. Diabetes mellitus (DM) refers to a group of common metabolic disorders that share the phenotype of hyperglycemia.[3] Patients with poorly controlled diabetes show a significant alternation in various parameters including Cellular, immunological and hematological. Prolonged hyperglycemia leads to increased production of reactive oxygen species and formation of Advanced Glycated End products which causes endothelial damage and oxidative stress. Oxidative stress causes tissue damage hematological alterations such as red blood cell dysfunction, platelet hyper activation and endothelial dysfunction. Insulin resistance causes increased White blood cell count triggering vascular complications.

Since blood's cellular components are suspended in plasma, it is categorised as a connective tissue. Blood cell disruption and its indicators are exacerbated by elevated blood glucose levels in type

2 diabetes 4. The primary suggestion for preventing the onset of complications from diabetes is to maintain good glycaemic control. Early glycemia normalisation has been proposed to prevent pathogenic processes such increased oxidative stress and glycation of cellular proteins and lipids that are caused by hyperglycemia.[5] Consequently, as a long-term management strategy, it is imperative to gradually optimise HbA1c levels to the recommended range of 6.5% to 7% in order to lower the occurrence of macro- and micro-vascular problems in patients with diabetes.[6]

Thus hematological parameters should be regularly tested for early diagnosis and proper management of diabetes related macro and micro vascular complications.

Aims and Objectives

1. Assessment of various hematological parameters in type 2 diabetes mellitus
2. To Correlate the haematological parameters with glycemic parameters in patients with type 2 Diabetes mellitus.

MATERIAL AND METHODS

Study Design and Setting A prospective observational study was conducted at Victoria Hospital, Bangalore Medical College and Research Institute (BMCRI), Bangalore, India, from August 2023 to August 2024. The study was carried out in the Department of Internal Medicine.

Sample size was calculated based on the prevalence in the study by Farooqui R, Afsar N, Afroze IA. Role and significance of hematological parameters in diabetes mellitus. Annals of Pathology and Laboratory Medicine. 2019;6(3) which amounted to sample size of 112.7

Inclusion and Exclusion Criteria: Patients aged more than 18 years who met the diagnostic criteria for type 2 diabetes as per ADA guidelines and were willing to provide informed written consent were included in the study. Patients below 18 years of age, those unwilling to provide informed written consent, and those Malignancy, HIV HbsAg Alcoholic liver disease Pregnant women were excluded from the study.

Data Collection and Methodology: After obtaining approval and clearance from the institutional ethics committee, patients fulfilling the inclusion criteria were enrolled in the study after obtaining informed consent. Investigations were performed, and data were collected as per the study proforma. The hematological parameters such as hemoglobin, platelet count, MCHC, WBC count, Neutrophil percentage were studies and co elated with the glycemic control the outcome measures were studied.

Outcome Measures The primary outcome of the study were the hematological parameters such as MCHC, WBC count, Platelet count, MCV, Hemoglobin, percentage of Neutrophils observed in T2DM patients. The secondary outcome of the study was to showed the correlation of glycemic status with the hemtological parameters

Statistical Analysis Data were collected using Microsoft Excel and analyzed using SPSS (Statistical Package for Social Sciences) version 29.0. Descriptive statistics, including frequency analysis and percentage analysis, were used for categorical variables, while mean and standard deviation were used for continuous variables. The student T test was used to assess the association of significance in categorical data. A probability value of 0.05 was considered as the significance level. Data were presented in the form of tables, figures, and graphs wherever necessary. Any other necessary tests found appropriate were dealt with at the time of analysis based on data distribution.

RESULTS

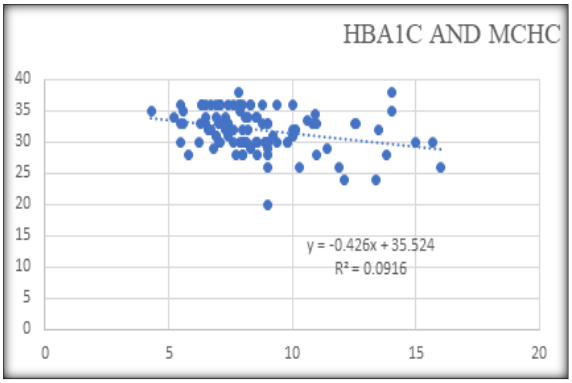

Figure 1: Correlation between HBA1C and MCHC

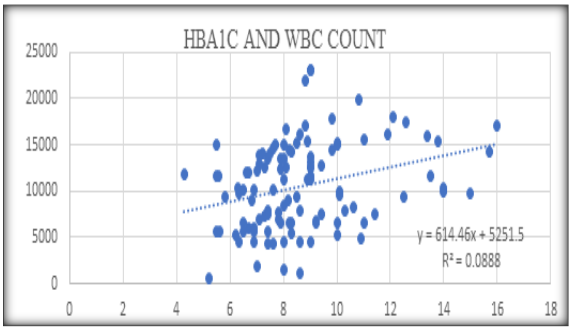

Figure 2: Correlation between HBA1C and WBC Count

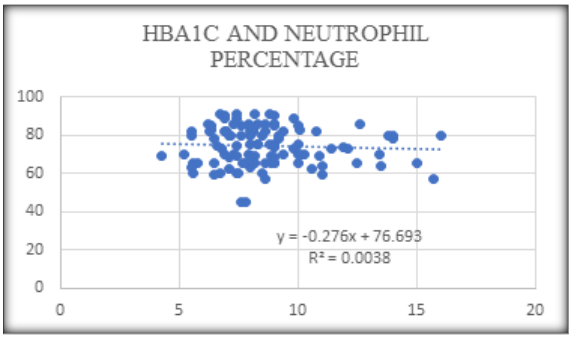

Figure 3: Correlation between HBA1C and Percentage of Neutrophils

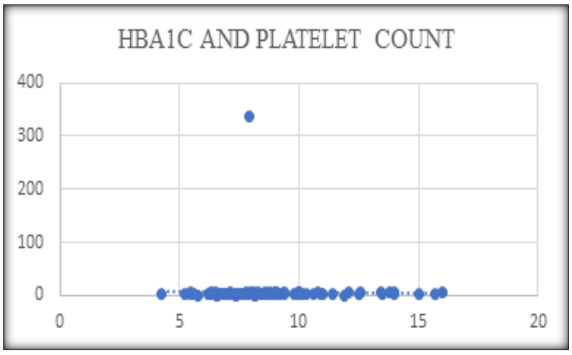

Figure 4: Correlation between HBA1C and Platelet Count

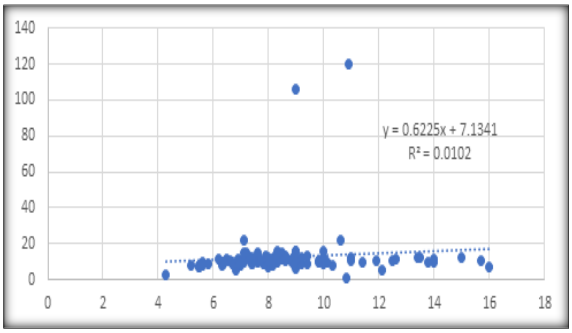

Figure 5: Correlation between HBA1C and HB

The study included 112 patients with diabetic mellitus The demographic characteristics of the patients are presented in Table 1. The mean age of the patients was 58.4 ± 11.24 years, with a female predominance 72 (64.2%) patients and 40 (35.7%) male patients.

Table 1 represents the age distribution and sex distribution among the study participants.

The majority of the study population was between age 46-60 with 55 patients (49.1%), around 44 patients i.e., 39.2% were elderly aged > 60 , 12 patients were between age 31-45 i.e.,10.7% and 1 patient was between the age of 18-30 years. Among the patients, 10 i.e., 8.9% were newly detected T2DM. 7 of them were on exclusive insulin therapy and 2 of them were not on any medication.

The mean HBA1C among the study population was 8.65±2.28. The patients who had HBA1C more than 8 were considered as poor glycemic control. There were 60 patients with HBA1C greater than 8.0%.

The mean hemoglobin of the study population was 12.52± 14.07. 5 of them had severe anemia.

The mean WBC count was 10571.82± 4710. Among the WBCs the mean percentage of neutrophils are 74 ±10.

The mean platelet count was 6.0±31.88. On the analysis of hematological parameters and it's co relation with glycemic control measured using HBA1C there was significant association between HBA1C and WBC count with p value <0.001. There was significant association between HBA1C and MCHC with p value <0.0001. There was significant association between HBA1C and HB with p value 0.002.

There was no significant association between HBA1C and platelet count (p value 0.19).

Table 1: Demographic characteristics of patients with type 2 diabetes mellitus (n=112)

Characteristic	Number
Age (years)	
18-30	1
31-45	12
46-60	55
>60	44
Mean age ± SD	44.7 ± 14.3
Gender	
Male	40
Female	72

DISCUSSION

Hyper glycemia in type 2 diabetes affects haematological indices and, when combined with known risk factors, may result in degenerative consequences. Proinflammatory cytokines induce WBC maturation and differentiation in diabetic individuals whose liver, muscles, and adipose tissue are all affected by insulin, resulting in a chronic inflammatory state. The present study aimed to study the hematological parameters such as hemoglobin, platelet count, MCHC, WBC count, Neutrophil percentage and to correlate the glycemic control with hematological parameters in patients admitted to a tertiary care center. The study included 112 patients, with the mean age of the patients was 58.4 ± 11.24 years, with a female predominance 72 (64.2%) patients and 40 (35.7%) male patients. The majority of the study population was between age 46-60 with 55 patients (49.1%). Among the patients, 10 i.e., 8.9% were newly detected T2DM. 7 of them were on exclusive insulin therapy and 2 of them were not on any medication.

On the analysis of hematological parameters and it's co relation with glycemic control measured using HBA1C there was significant association between HBA1C and WBC count with p value <0.001. There was significant association between HBA1C and MCHC with p value <0.0001. There was significant association between HBA1C and HB with p value 0.002.

In a study conducted by Vozarova B, Weyer C, Lindsay RS, Pratley RE, Bogardus C, Tataranni PA it was concluded that In Pima Indians, a high WBC indicates a decline in insulin activity and the onset of type 2 diabetes.[8] These results support the theory

that the pathophysiology of type 2 diabetes may involve a persistent immune system activation.

However in our study there was no statistically significant association between HBA1C and Platelet count (p value 0.19). There are various studies correlating the the plalelet count and glycemic control with mixed results. In a study conducted by Kazi Husna Abdul Naeem, Mohammed Abdul Hannan Hazari, Farisa Khatoon, Farah Bahmed, Fariha Mohammedi in Telangana among 200 patients found that diabetics with poor glycaemic control had a greater mean platelet count than diabetics with adequate glycaemic control.[9]

In other study conducted by Rodriguez BAT, Johnson AD. Platelet Measurements and Type 2 Diabetes it was concluded that there was no known consistent association between platelet function, as assessed by aggregation to ADP, collagen, or epinephrine, and diabetes.[10]

Thus, as a crucial long-term management approach, it is essential to systematically adjust HbA1c levels to the suggested range of 6.5% to 7% to reduce the incidence of macro- and micro-vascular complications in diabetic patients.

CONCLUSION

Inadequate management of diabetes mellitus is linked to various diseases such as metabolic, cellular, and hematological abnormalities resulting in micro and macrovascular problems. In our present study there is statistically significant correlation between glycemic control and leucocytosis, percentage of neutrophils, mean corpuscular hemoglobin concentration, hemoglobin levels. But there was no significant statistical correlation between HBA1C and platelet count in this study. The pro and chronic inflammarory state in uncontrolled type 2 diabetes mellitus is responsible for leukocytosis and suppression of globin synthesis resulting in anemia and MCHC. However many studies in near future and required to demonstrate the same.

Thus the evaluation of the haematological alterations in patients with Type 2 Diabetes Mellitus (T2DM) will be crucial in allowing the clinician to make a successful and timely therapeutic intervention to avoid the development of significant problems.

REFERENCES

1. Milosevic D, Panin VL. Relationship between hematological parameters and glycemic control in type 2 diabetes mellitus patients. Journal of Medical Biochemistry. 2019;38(2):164–71.
2. 2.Aynalem M, Getu F, Adane T. Peripheral cytopenia and its associated factors in type 2 diabetes mellitus patients, northwest Ethiopia. Journal of Blood Medicine. 2022; Volume 13:373–83.
3. Loscalzo J, Kasper DL, Longo DL, Fauci AS, Hauser SL, Jameson JL, et al. Harrison's® principles of internal medicine. New York: McGraw Hill; 2022.Page -3094
4. Ziaee A, Ghorbani A, Kalbasi S, Hejrati A, Moradi S. Association of hematological indices with prediabetes: A cross-sectional study. Electronic Physician. 2017;9(9):5206–11.
5. Drzewoski J, Kasznicki J, Trojanowski Z. The role of « in the natural history of diabetes mellitus. Pol Arch Med Wewn. 2009;119(7–8):493–500.
6. Ting DS, Cheung GC, Wong TY. Diabetic retinopathy: global prevalence, major risk factors, screening practices and public health challenges: a review. Clin Exp Ophthalmol. 2016;44(4):260–77.
7. Farooqui R, Afsar N, Afroze IA. Role and Significance of Hematological parameters in Diabetes Mellitus. Annals of Pathology and Laboratory Medicine. 2019 Mar 16;6(3): A158-162.
8. Vozarova B, Weyer C, Lindsay RS, Pratley RE, Bogardus C, Tataranni PA. High white blood cell count is associated with a worsening of insulin sensitivity and predicts the development of type 2 diabetes. Diabetes [Internet]. 2002 Feb 1;51(2):455–61.
9. Naeem A, Abdul M, Khatoon F, Bahmed F, Fariha Mohammedi. Influence of glycaemic control on platelet count in type II diabetics in absence of vascular complications. MedPulse International Journal of Physiology. 2017 Jan 1;5(2):22–4.
10. Rodriguez BAT, Johnson AD. Platelet Measurements and Type 2 Diabetes: Investigations in Two Population-Based Cohorts. Frontiers in Cardiovascular Medicine. 2020 Jul 10;7.