Role of Total Leucocyte Count and Differential Leucocyte Count in Patients with Type 2 Diabetes Mellitus

[1]Dr. Usha M, Assistant professor, Department of Pathology, Ramaiah Medical College, Mathikere, Bangalore.

[2]Dr. Sujithra T, Postgraduate, Department of Pathology, Ramaiah Medical College, Mathikere, Bangalore.

[3]Dr. Rashmi K, Assistant professor, Department of Pathology, Ramaiah Medical College, Mathikere, Bangalore.

[4]Dr. Wilfred CD, Professor, Department of Pathology, Ramaiah Medical College, Mathikere, Bangalore.

Corresponding Author: Dr. Sujithra T, Postgraduate, Department of Pathology, Ramaiah Medical College, Mathikere, Bangalore.

How to citation this article: Dr. Usha M, Dr. Sujithra T, Dr. Rashmi K, Dr. Wilfred CD, "Role of Total Leucocyte Count and Differential Leucocyte Count in Patients with Type 2 Diabetes Mellitus", IJMACR- March - 2023, Volume – 6, Issue - 2, P. No. 438 – 441.

Type of Publication: Original Research Article

Conflicts of Interest: Nil

Abstract

Introduction : Diabetes Mellitus (DM) is a metabolic disorder leading to hyperglycemia. Although there is increased prevalence of both Type 1 and Type 2 diabetes, prevalence of Type 2 diabetes is increasing rapidly because of rise in obesity, reduced activity levels, more industrialization and aging of population. The pathogenesis of Type 2 DM is characterized by low grade systemic inflammation. The adipocytes produce inflammatory markers like Interleukin-6 and C Reactive Protein (CRP) which can lead to insulin resistance in obese patients. Several studies have shown that Total Leucocyte Counts (TLC) are increased in Type 2 DM and can be used to predict development of micro and macro vascular complications.

Objectives : The objective of the study is to investigate the role of Total Leucocyte Count and Differential Leucocyte Count (DLC) in patients with Type 2 diabetes.

Methods: The study was conducted on 153 Type 2 DM patients with increased Glycated hemoglobin levels (HbA1C). Patients with hypertension, coronary artery disease, pregnancy and other acute illness were excluded from the study. TLC and DLC were assessed from venous blood samples collected in EDTA vacutainer.

Result: Results showed that the patients with Type 2 DM had increased Total Leucocyte Count and neutrophilia with relative lymphopenia. There was no variation in Monocyte, Basophil and Eosinophil count.

Conclusion: TLC and neutrophils are increased in patients with Type 2 DM indicating that Diabetes Mellitus is a inflammatory state which can lead to insulin resistance.

Keywords: Diabetes Mellitus, Differential Leucocyte Count, Total Leucocyte Count

Introduction

Diabetes Mellitus (DM) is a metabolic disorder leading to hyperglycemia. According to WHO, Diabetes ranks 9th among the top 10 causes of death with a significant increase of 70% since 2000. At the global level, 7 of the 10 top causes of death is because of non-communicable disease. It has also shown that incidence of diabetes is more among the upper and middle income groups and the number has statistically increased compared to the year 2000.[1] Although there is increased prevalence of both Type 1 and Type 2 diabetes, prevalence of Type 2 DM is increasing rapidly because of rise in obesity, reduced activity levels, more industrialization and aging of population.[2] Type 2 Diabetes accounts for 90% of all diabetes worldwide.[3] The pathogenesis of Type 2 DM can be explained by impaired insulin secretion, insulin resistance, excessive hepatic glucose production, ab normal fat metabolism and low grade systemic inflammation. Also, obesity and metabolic syndrome comprises a cluster of disease where subacute chronic inflammation is common and is thought to be contributing to development of type 2 DM. The adipocytes produce biological substances such as Interleukin-6, tumour necrosis factor (TNF-α), leptin, resist in and adiponectin. These adipokines produce an inflammatory state which can lead to insulin resistance and islet inflammation.[2] Several studies have shown that Total Leucocyte Counts (TLC) are increased in Type-2 DM and can be used to predict development of micro and macrovascular complications.[4] The objective of the study is to investigate the role of Total Leucocyte count and Differential Leucocyte Count (DLC) in patients with Type 2 diabetes.

Materials and methods

This cross-sectional study conducted on 153 patients (Males = 78, Females = 75) with Type 2 Diabetes Mellitus. All the patients with Type 2 DM patients with increased Glycated hemoglobin levels (HbA1C >5.4%) were included in the study. Patients with hypertension, coronary artery disease, pregnancy and other acute illness were excluded from the study.Blood samples were collected in a vacutainer containing ethylene di-amino tetra acetic acid (EDTA) as a anticoagulant. Total leucocyte count and Differential leucocyte count were determined using automated blood cell counter (Beckman-Coulter).
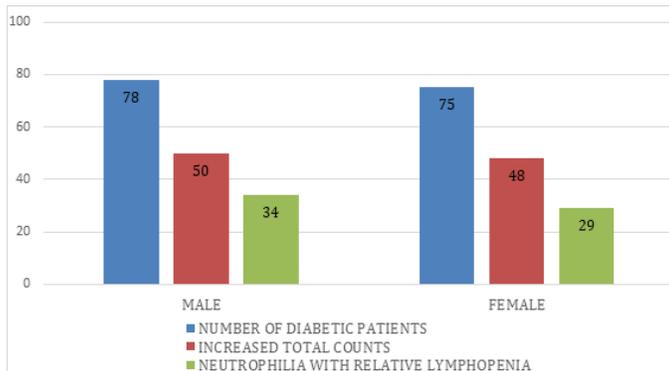
Results

Among the 153 Types 2 diabetic patients included in the study, 98 patients had increased TLC (> 11, 000 cells/mm 3) and 63 of these 98 patients had neutrophilia with relative lymphopenia (Neutrophils - >80%, Lymphocytes - < 20 %). There was no variation in monocyte, eosinophil and basophil counts. Among the 78 male patients, 50 had increased TLC and 34 of these 50 males had increased neutrophil count. Among the 75 female patients, 48 had increased TLC and 29 of these 48 females had increased neutrophil count.

Graph 1: Percentage of patients with increased total counts and neutrophilia among the total number of type 2 diabetic patients
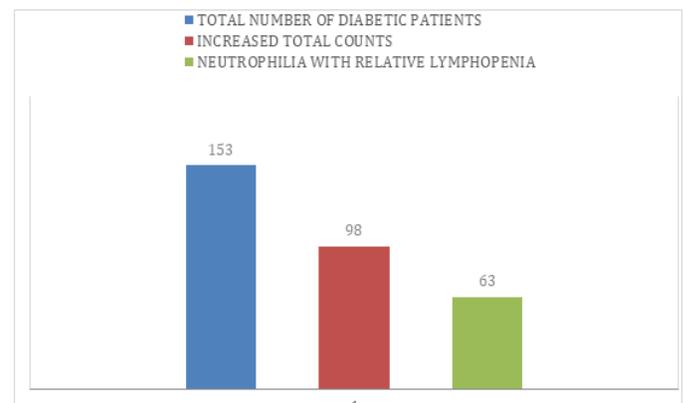
Graph 2: Percentage of patients with increased total counts and neutrophilia among the male and female groups

Discussion

DM is a group of metabolic diseases characterized by chronic hyperglycemia resulting from defects in insulin secretion, insulin action, or both. The severity of symptoms depends on the type and duration of diabetes. Some of the diabetic patients are asymptomatic especially those with type 2 DM during the early days of the disease. Some patients present with marked hyper glycemia showing features of polyuria, polydipsia, polyphagia, weight loss, and blurred vision. Un controlled diabetes may lead to stupor, coma and if not treated death, due to ketoacidosis or from nonketotic hyper osmolar syndrome

Inflammatory cytokines are produced by different cell types and secreted into the circulation, where they regulate different tissues through their local, central and peripheral actions. Adipose tissue is now regarded as a source of pro-inflammatory mediators which may contribute to vascular injury, insulin resistance (IR), and atherogenesis.[5]

Hotamisiligil et al., in1993 has explained the role of tumor necrosis factor alpha which is released during inflammation in development of insulin resistance. Insulin resistance is the major factor contributing to Chronic hyper glycemia associated with DM and can result in end organ dysfunction and failure which can involve the retina, kidneys, nerves, heart and blood vessels. Insulin resistance in type 2 DM increases the demand for insulin in insulin-target tissues. Insulin secretion decreases with the increased demand for insulin due to the gradual destruction of β cells that could transform some of type 2 diabetes patients from being independent to become dependent on insulin.[6]

Current study shows that in 153 Type 2 DM patients, Total leucocyte count (>11,000/mm3) is increased in 98, indicating leucocytosis. Neutrophils are increased (> 80%) and lymphocytes are decreased (<20%) indicating neutrophilia with relative lymphopenia in 63 of these 98 patients. In our opinion leucocyte count can be done for all diabetic patients because it is a simple test and which is helpful in predicting complications.

Sedigheh Moradi et al., has shown higherleucocyte counts were associated with both macrovascular and microvascular diabetes complications. Retinopathy and cardiac events in the group with higher leucocyte levels were three times more prevalent.[7]

Tong et al has shown in his cross-sectional study on 3776 patients, leukocyte count was independently related to both micro and macro vascular com plications.[8] The basic conclusion from all of these studies is that a rise in leucocyte count, even within the normal range, can predict the severity of and the number of complications in patients with type 2 DM.

Conclusion

The increasing prevalence of diabetes makes it imperative that research should focus on its prevention as well as its treatment.

An improved understanding of mechanisms linking inflammation to diabetes and related complications has stimulated interest in targeting inflammatory pathways

as part of the strategy to prevent or control diabetes and its complications.

References

1. World Health Organization, The top 10 causes of death, 2020,

2. Jameson, JL. et al., (eds.), Harrison's principles of internal medicine: Diabetes Mellitus: Diagnosis, Classification and patho physiology, 20th edn., McGraw-Hill education, 2018, pp. 2850-2858.

3. International Diabetes Federation, IDF Diabetes Atlas, Belgium, International Diabetes Federation, 2019.

4. Biadgo, B. et al., 'Hematological indices and their correlation with fasting blood glucose level and anthropometric measurements in type 2 diabetes mellitus patients in Gondar, Northwest Ethiopia', Diabetes Metab Syndr Obes, vol. 9, 2016, pp. 91-99.

5. Tsalamandris, S. et al., 'The Role of Inflammation in Diabetes: Current Concepts and Future Perspectives', Eur Cardiol, vol. 14, no. 1, 2019, pp. 50-59.

6. Hotamisligil, GS. et al., 'Increased adipose tissue expression of tumor necrosis factor-alpha in human obesity and insulin resistance', J. Clin. Invest, vol. 95, 1995, pp. 2409–2415.

7. Moradi, S. et al., 'Association between diabetes complications and leukocyte counts in Iranian patients', J Inflamm Res, vol. 5, 2012, pp. 7-11.

8. Tong, PC. et al., 'White blood cell count is associated with macro- and microvascular complications in Chinese patients with type 2 diabetes', Diabetes Care, vol. 27, no. 1, 2004, p. 216–222.