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STUDY OF ERYTHROCYTE SEDIMENTATION RATE AND WHITE BLOOD CELL COUNT VALUES IN A CLINICAL LABORATORY

Khaled Alhomsi*

Alsham Private University (ASPU), Damascus, Syria.

Corresponding Author: Khaled Alhomsi
Alsham Private University (ASPU), Damascus, Syria.
Email ID: k.a.foph.lat@aspu.edu.sy,

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ABSTRACT

Objective: This research was conducted to show the relation between two of the most common inflammatory markers and how they interact with each other. **Materials and Methods:** This study was a retrospective study of 88 patients of who we studied their white blood cell (WBC) count results compared with their concomitant ESR (Erythrocyte Sedimentation Rate) results of the patients who reviewed Alhomsi Clinical Laboratories between January 2018 to March 2019. **Results:** All cases with a WBC count $\geq 15\times10^3$ /mm^3 whole blood had an abnormal ESR, while only 4 cases (25%) of cases with a WBC count $<15\times10^3$ /mm^3 whole blood had a normal ESR compared to 75% with a WBC count$<15\times10^3$ /mm^3 whole blood and >normal had an abnormal ESR. 58% of all cases with a normal WBC count had abnormal ESR, which could be related to different factors discussed below. None of the cases with a normal WBC count had an ESR of >50 mm/hr. **Conclusion:** High WBC count almost always accompanies high ESR as indication of inflammation, however, some cases could have a high ESR with normal WBC count and these should be carefully examined to exclude the causes and different comorbidities.

KEYWORDS: Erythrocyte Sedimentation Rate, White blood Cell Count, Inflammation, Laboratory Assessment.

INTRODUCTION

Inflammation is the immune system's response to harmful stimuli, such as pathogens, damaged cells, toxic compounds, or irradiation,[1] and acts by removing injurious stimuli and initiating the healing process.[2] Inflammation is therefore a defense mechanism that is vital to health.[3] Usually, during acute inflammatory responses, cellular and molecular events and interactions efficiently minimize impending injury or infection. This mitigation process contributes to restoration of tissue homeostasis and resolution of the acute inflammation. However, uncontrolled acute inflammation may become chronic, contributing to a variety of chronic inflammatory diseases.[4]

At the tissue level, inflammation is characterized by redness, swelling, heat, pain, and loss of tissue function, which result from local immune, vascular and inflammatory cell responses to infection or injury.[5] Important microcirculatory events that occur during the inflammatory process include vascular permeability changes, leukocyte recruitment and accumulation, and inflammatory mediator release.[2,6]

Various pathogenic factors, such as infection, tissue injury, or cardiac infarction, can induce inflammation by causing tissue damage. The etiologies of inflammation can be infectious or non-infectious.[1] In response to tissue injury, the body initiates a chemical signaling cascade that stimulates responses aimed at healing affected tissues. These signals activate leukocyte chemotaxis from the general circulation to sites of damage. These activated leukocytes produce cytokines that induce inflammatory responses.[7]

The inflammatory response is the coordinate activation of signaling pathways that regulate inflammatory mediator levels in resident tissue cells and inflammatory cells recruited from the blood.[8] Inflammation is a common pathogenesis of many chronic diseases, including cardiovascular and bowel diseases, diabetes, arthritis, and cancer.[9]

MATERIALS AND METHODS

This study was a retrospective study of 88 patients of who we studied their white blood count results compared with their concomitant ESR (Erythrocyte Sedimentation Rate) results of the patients who reviewed Alhomsi Clinical Laboratory between 1 January 2018 to 31 March 2019. This study included 88 cases. WBC count is between $4.5\text{-}10.5\times10^3$ /mm^3 whole blood and ESR range is between 6-11 mm/hr. Informed consent was taken from all the participants either personally or by phone. To ensure the privacy, only the authors collected all the data and all the names and personal information were blinded. Statistical analysis was done using SPSS 25.0.

RESULTS

Table 1: Distribution of WBC count and ESR values in our study.

	Value	N	%
ESR	Normal	33	37.5
	<30 mm/hr	12	13.6
	30-50 mm/hr	28	31.8
	>50 mm/hr	15	17.0
WBC count	Normal	69	78.4
	<15 ×10^3 /mm^3 whole blood	12	13.6
	≥15×10^3 /mm^3 whole blood	7	8.0

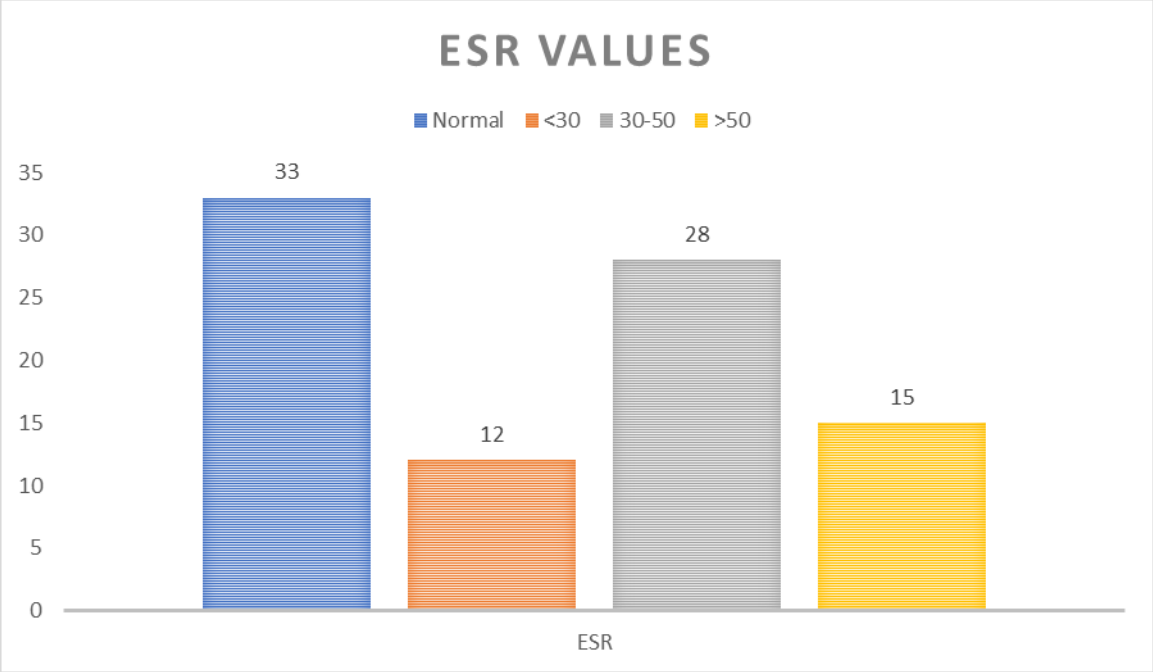

Figure 1: ESR values.

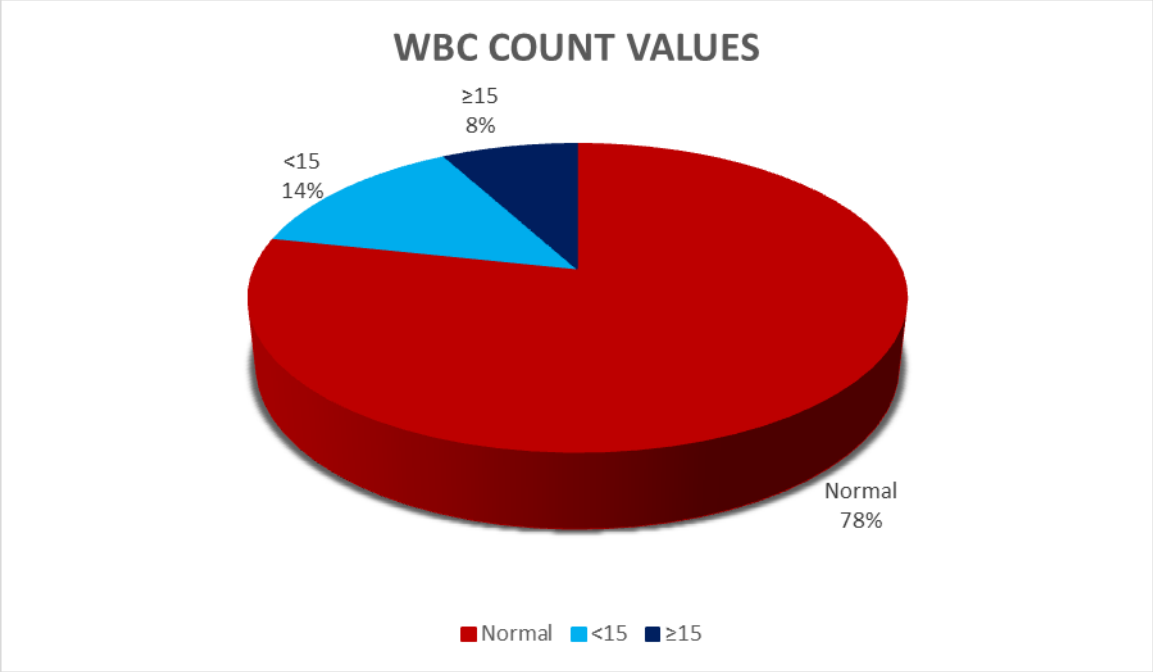

Figure 2: WBC count values.

Table 2: Correlation between WBC count and ESR values.

			WBC Count
Kendall's tau b	ESR	Correlation Coefficient	.192*
		Sig. (2-tailed)	.046
		N	88
*. Correlation is significant at the 0.05 level (2-tailed).			

Table 3: ESR levels related to WBC count.

		WBC count			Total
		Normal	<15 ×10^3 /mm^3 whole blood	≥15×10^3 /mm^3 whole blood	
ESR	Normal	29	4	0	33
	<30 mm/hr	17	3	1	21
	30-50 mm/hr	23	3	2	28
	>50 mm/hr	0	2	4	6
Total		69	12	7	88

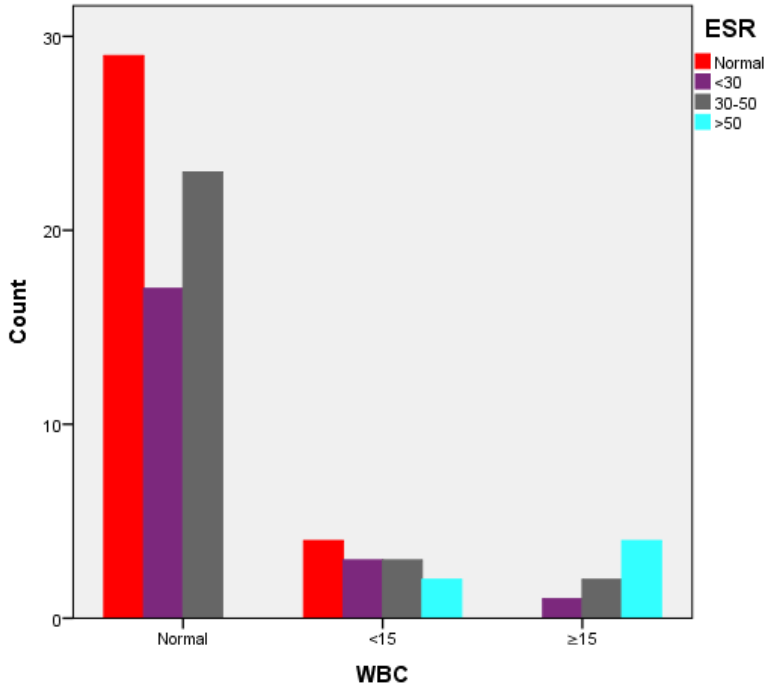

Figure 3: WBC count and ESR values in our study.

Regarding ESR, 33 patients (37.5%) had a normal value, 12 patients (13.6%) had a value of <30 mm/hr, 28 patients (31.8%) had a value of 30-50 mm/hr and 15 patients (17%) had a value of >50 mm/hr. (Figure 1, Table 1).

69 patients (78.4%) had a normal WBC count, 12 patients (13.6%) had a WBC count <15 ×10^3 /mm^3 whole blood and 7 patients (8%) had a WBC count ≥15×10^3 /mm^3 whole blood. (Figure 2, Table 1).

All cases with a WBC count ≥15×10^3 /mm^3 whole blood had an abnormal ESR, while only 4 cases (25%) of cases with a WBC count <15×10^3 /mm^3 whole blood had a normal ESR compared to 75% with a WBC count<15×10^3 /mm^3 whole blood and >normal had an abnormal ESR. 58% of all cases with a normal WBC count had abnormal ESR, which could be related to different factors discussed below. None of the cases with a normal WBC count had an ESR of >50. (Figure 3, Table 3).

DISCUSSION

White blood cells count (WBC count), or leukocytes, are one of three types of blood cells (other two include platelets and erythrocytes) that make up about 45% of whole blood (55% is plasma), which account s for about 7% of an average human adult's body weight.[10,11] Important functions of certain WBC count include, but are not limited to, destruction of virus-infected cells, directing the immune response through cytokine secretion, secretion of antibodies for phagocytosis detection (lymphocytes), destruction of pathogens by phagocytosis (neutrophils), and transformation into macrophages (monocytes).[12] The specific properties and functions of the innate and adaptive immune systems

have been described in detail elsewhere.[13] It is important to note that elevations in WBC count can represent a normal response to infection and wound healing.[13]

An important component of the immune system is the inflammatory response to injuries or insults. Cytokines are a type of chemoattractants synthesized by macrophages with the capacity to activate other WBC count. They can act as second messengers and induce the expression of adhesion molecules on endothelial cells that promote attachment and transmigration of leukocytes.[14,15] Again, this is a necessary mechanism for proper wound healing and for combatting infections. However, concern is warranted when insults or injuries that increase inflammatory levels or WBC count become chronic over time.

Erythrocyte sedimentation rate (ESR) remains as one of the most reliable tests in clinical practices. Yet its use is time consuming and requires a large blood sample. The aim of this study was assessing a faster and reliable method of ESR estimation.[16]

Erythrocyte Sedimentation Rate (ESR) is one of the most commonly requested laboratory tests prescribed by physicians.[17] Its rate is dependent on various physiologic and pathologic factors including hemoglobin concentration, ratio of plasma proteins, serum lipid concentration, and plasma pH.[18] This limitation has not yet reduced the use of this test in different clinical settings. It is still often used to indicate different diseases severity.

Compliance with Ethical Standards

Funding: This study was not funded by any institution.

Ethical approval: The names and personal details of the participants were blinded to ensure privacy.

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