CLINICAL CHARACTERISTICS AND ANALYSIS OF HEMATOLOGICAL VARIATIONS IN BREAST CANCER PATIENTS FROM PUNJAB PROVINCE, PAKISTAN

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Abstract

Introduction: Cancer is characterized by the uncontrolled proliferation of abnormal cells, capable of invading surrounding tissues. Breast cancer is very common in females, about 25%. The Complete Blood Count is a standard diagnostic assessment routinely ordered by physicians to assess various diseases.

Objectives: The purpose of this work was to investigate clinical characteristics with significant role of hematological parameters in breast cancer patients.

Materials and methods: Seventy cases were enrolled, with 15 subjects in the control group and an additional 25 women diagnosed with breast cancer serving as the case group. Hematological indices were studied by Sysmex KX-21N™ automated analyzer tool.

Results: Among all patients, males comprised 3.33%, while females accounted for 96.67%. The mean and standard deviation of people with clinical details show age as 41.7 ± 6.67. All patients were diagnosed with Invasive Ductal Carcinoma. Various hematological parameters were examined. The mean and standard deviation of people for hematological indices among control was 3.45 ± 4.22 and breast cancer patients was 7.5 ± 10.77. Hemoglobin, mean corpuscular volume, mean corpuscular hemoglobin, platelets count, and monocytes exhibited no statistical significance ($p > 0.05$), while others exhibited significance. The mean $\pm$ standard deviation of HCT, MCV, MCH, and MCHC among controls were 4.32 ± 5.25, 7.57 ± 9.28, 2.72 ± 3.33, and 0.89 ± 0.99, respectively. In contrast, among breast cancer patients, these values were 35.05 ± 5.92, 82.16 ± 9.02, 26.96 ± 3.58, and 32.6 ± 2.46, respectively.

Conclusion: In conclusion, a higher proportion of females were diagnosed with breast cancer, and all cases were identified as Invasive Ductal Carcinoma. Hematological profiles differed between the control and affected groups. Further studies are needed to thoroughly investigate hematological variations between these groups.

Keywords: Cancer, Breast cancer, Clinical, Hematology, Pakistan

Introduction

Cancer refers to conditions characterized by uncontrolled division of abnormal cells, capable of infiltrating surrounding tissues (1). Breast cancer specifically develops in the tissues of the breast, typically in the ducts (conduits for milk transport) and lobules (milk-producing glands) (2). It is noteworthy that breast cancer affects both genders, although occurrences in men are uncommon. In the industrialized world, breast cancer (BC) is very dominant disease in females.

On global scale, BC stands the common disease in females, constituting 25% of all cancers affecting women (3, 4). In 2012, the United States witnessed 226,870 new cases and 39,510 fatalities related to breast cancer (5). Approximately 12.8% of women face the risk of developing breast cancer during their lifetime (6). This invasive cancer exhibits a considerable global mortality rate, ranking as the 2nd reason of mortality in females by BC (7, 8). Forecasts indicate a projected increase in the prevalence of breast cancer to 45% in developed countries by 2025 (9). In Iran, BC was 12.5% then all cancer types in females and stands as the 6th important reason of mortality in the country (10).

The Complete Blood Count (CBC) is a standard assessment frequently requested by physicians for the diagnosis of various conditions, including anemia, acute diseases, bleeding disorders, allergic infections, cancer, immune disorders, health screenings, and preoperative valuations. This test yields crucial information about different cell types, particularly red blood cells (RBCs), white blood cells (WBCs), and platelets (PLTs) (11, 12). Notably, CBC, being a routine and cost-effective diagnostic tool, offers valuable insights into various malignancies (11). Hematological factor evaluation stands out as a reliable paraclinical approach for disease diagnosis (13). and these parameters hold prognostic significance in patients with breast cancer (14). Consequently, CBC emerges as a vital investigation for individuals with BC prior to initiating any cure (15). Recent attention has been directed towards the assessment of red blood cells distribution (RDW), neutrophils lymphocyte ratio (NLR), and platelets lymphocyte ratio (PLR) as key contributors to systemic infections and cancer biology, playing roles in cancer recognition, development, and existence diagnosis (16). This study explores the clinical characteristics and pivotal role of hematological parameters in breast cancer detection, also aims to assess these parameters as valuable markers for distinguishing among individuals with BC and those who are healthy.

Materials and methods

Site and Population

A cross-sectional investigation was conducted to examine the clinical characteristics and certain hematological parameters of breast cancer women below 50 years of age, both at Jinnah Hospital Lahore and a daily clinic in the Punjab province. This study also included male breast cancer patients for comparative analysis, with healthy individuals serving as the control group. The clinical data of approximately 30 patients were gathered during the research period.

Hematological studies were carried out using blood samples obtained from 25 females with BC and 15 healthy people in January 2023 and March 2024.

Inclusion and exclusion criteria

Participants without breast cancer were excluded from the study, and only individuals diagnosed with breast cancer were included. The study specifically focused on patients aged below 50 years, while those aged 50 years and above were excluded from the analysis.

Ethical concern and consent of participation

This study was conducted according to the Declaration of Helsinki, and signed consent forms were acquired from all participants. Research was approved by the Institutional Review Board of University of Okara. The sample size was obtained in collaboration with Jinnah Hospital Lahore.

Clinical characteristics

A questionnaire form was created to collect comprehensive information about patient's backgrounds, with details such as age, gender, tumors size, TNM stages, cancers type, subtypes, and ER or PR and HER-2 grade. Tumors were characterized on the status of Estrogen receptors (ER), Progesterone receptors (PR), and human epidermal growth factor receptors 2 (HER-2) (17). Any missing information that occurred during the study was excluded from the analysis.

Hematological parameters

Blood samples of 5 milliliters were collected from female patients and control. Three milliliters were dispensed into EDTA bottles, while the remaining 2 milliliters were distributed into 0.5 ml sodium citrate tubes to estimate erythrocytes sedimentation rates (ESR). Various trials were conducted on EDTA specimens, including packed cell volume (PCV), white blood cells count (WBC), red blood cells count (RBC), platelets count, and lymphocytes count, utilizing an Auto Hematology Analyzer. The experiments were performed following the guidelines provided in the manual. The Erythrocytes sedimentation rates (ESR) was obtained using the standard Westergren method (18).

Statistical Analysis

The obtained data was subjected to statistical analysis using the Students-t test to link the data derived from cases and controls, employing SSPS software. The outcomes were presented as mean and standard deviation, with a significance level (i.e., $p < 0.05$) indicating a significant differences among two groups.

Results

The work was conducted in Jinnah Hospital Lahore to assess clinical characteristics with hematological variations among breast cancer patients.

Clinical characteristics of patients

Hematological parameters are frequently employed in standard tests to diagnose various conditions, including infections, anemia, immune disorders, cancer, and numerous other illnesses. Blood count profiles in individuals with breast cancer exhibit abnormalities compared to those of controls. This study reveals that the mean± SD of WBC count, RDW, and MPV values were elevated in patients than controls. However, the mean± SD of RBC count, Hb, HCT, MCV, and MCH values in cases were lower than those in the controls.

Table 1: Clinical features of patients with breast cancer

Features	Number	frequency
No. of Patients	30	
Age (mean and standard deviation)	41.7± 6.67	
Confidence Level (95.0%)	2.49	
Breast Cancer Type	Invasive Ductal Carcinoma	
Gender		
Male	1	3.33
Female	29	96.67
TNM		
I	0	0.00
II	14	46.67
III	15	50.00
IV	1	3.33
ER status		
Positive	20	66.67

Negative	10	33.33
PR status		
Positive	20	66.67
Negative	10	33.33
HER2		
Positive	9	30.00
Negative	21	70.00
Tumor site		
Left side	20	66.67
Right side	8	26.67
Both	1	3.33

Comparison of hematological indices

The hematological parameter results from 25 female BC cases and 15 controls are presented in Table no 1. A comparison of the mean and standard deviation (Mean±SD) of hematological parameters between breast cancer patients and controls was directed. The (Mean±SD) of hematological parameters among control was 3.45±4.22 and among breast cancer patients was 7.5±10.77.

The Student t-test revealed differences in means between both groups. These show significant variances in mean RBC count, hematocrit or PVC, MCHC, WBCs count, neutrophils, lymphocytes, and eosinophils. However, hemoglobin, MCV, mean corpuscular hemoglobin (MCH), platelet count, and monocytes exhibited no significant differences ($p > 0.05$), as illustrated in Table no 2.

Distribution of HCT, MCV, MCH and MCHC in study group and controls

Among controls, the mean and standard deviation of hematocrit (HCT), mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH), and mean corpuscular hemoglobin concentration (MCHC) were 4.32±5.25, 7.57±9.28, 2.72±3.33, and 0.89±0.99 respectively. In contrast, among breast cancer patients, these values were 35.05±5.92, 82.16±9.02, 26.96±3.58, and 32.6±2.46 respectively, as depicted in Table 2. Additionally, hemoglobin (Hb) was 1.34±1.79, red blood cell count (RBC) was 0.48±0.65, white blood cell count (WBC) (TLC) was 0.84±1.05, and platelet count was 104.89±160.77 among controls, while among breast cancer patients, these values were 11.21±1.92, 4.21±0.6, 7.19±3.13, and 284.6±109.71 respectively.

Table 2: The hematological parameters in people

Hematology parameters							
Test	**Normal values**	**Units**	**Control (n=15)**	**Control (n=15)**	**Patients (n=25)**	**Patients (n=25)**	**P-value**
			Mean	**SD**	**Mean**	**SD**	
Hb	**11.5-16**	**g/dI**	1.34	1.79	11.21	1.92	0.159495
RBC	**4--6**	**x10^12/I**	0.48	0.65	4.21	0.6	0.01
HCT (PVC)	**36-46**	**%**	4.32	5.25	35.05	5.92	0.03
MCV	**75-95**	**fI**	7.57	9.28	82.16	9.02	0.74
MCH	**26-32**	**Pg**	2.72	3.33	26.96	3.58	0.13
MCHC	**30-35**	**g/dI**	0.89	0.99	32.6	2.46	0.02
Platelet count	**150-400**	**x10^9/I**	104.89	160.77	284.6	109.71	0.77
WBC count (TLC)	**4—11**	**x10^9/I**	0.84	1.05	7.19	3.13	0
Neutrophils	**40-75**	**%**	1.95	2.34	64.58	8.89	0
Lymphocytes	**20-50**	**%**	7.02	8.13	26.47	8.85	0

Monocytes	2--10	%	0.91	1.11	4.81	2.69	0.19
Eosinophil's	1--6	%	0.84	0.96	2.32	0.93	0

Significance (p < 0.05); Non significance (p > 0.05)

Discussion

In this investigation, out of 30 patients analyzed, males accounted for only 3.33%, whereas females made up 96.67%, suggesting a greater occurrence of breast cancer among women. The entire cohort was under 50 years of age, with average age of 41.7y of cases. Additionally, all cases were diagnosed with the subtype Invasive Ductal Carcinoma. Their study involved eighty participants, comprising 43 individuals diagnosed with BC and 37 without BC. The mean ages for cases and controls were approximately 53.79 ± 11.95y and 53.75 ± 12.92y, respectively (19).

Hematological parameters are frequently employed in standard tests to diagnose various conditions, including infections, anemia, immune disorders, cancer, and numerous other illnesses. Blood count profiles in individuals with breast cancer exhibit abnormalities compared to those of controls. This study reveals that the mean (± SD) of WBCs count, RDW, and MPV values were elevated in cases then controls. However, the mean (± SD) RBCs count, Hb, HCT, MCV, and MCH values in BC patients were less than people without BC (20) .

This statement aligns with findings reported in reference (21). Additionally, they indicated that the mean values of red cells distributions width (RDW), mean platelets volume (MPV), neutrophils lymphocyte ratio (NLR), and platelets lymphocyte ratio (PLR) in BC cases were notably high compared to controls (22). However, others stated an association in elevated level of mean corpuscular volume (MCV) and cancer affecting lymphoid organs i.e., lymph nodes (23). In this study, a significant difference in mean red blood cell count, hematocrit or packed cell volume (HCT, PVC), mean corpuscular hemoglobin concentration (MCHC), white blood cell count, neutrophils, lymphocytes, and eosinophils was observed.

A study established that MCHC in cases with non-small cell lungs cancer serves as an independent predictive feature for existence (24). Another observation noted the correlation between MCHC and mean corpuscular volume (MCV) with cancer occurrence in a Weste Australian people (25). In their investigation, they identified a slight disparity in MCHC among cases and controls (i.e., p < 0.05, and 0.2 < effect size < 0.5). However, they did not explore the link in MCHC and BC occurrence. They conducted studies indicating that hemoglobin (Hb), RBCs count, WBCs count, and platelets count in females with BC were less then to controls. They determined that anemia, leukopenia, and thrombocytopenia should be monitored in BC cases (20). Additionally, they discovered that white blood cells and red blood cells counts in cases were decreased then to the normal range. They asserted that blood parameters, particularly lymphocyte and neutrophil, both crucial tool for stage analysis and monitoring of BC (26). In their study, white blood cell count in cases was observed to be higher compared to controls (i.e., p < 0.05). However, the mean WBCs count in cases remained within the normal ranges (i.e., mean = 6.98). They also noted that cases exhibited significantly elevated levels of Hb, HCT, MCV, and MCH then controls (i.e., p < 0.05) (19). In this study, the mean and standard deviation of HCT, MCV, MCH, and MCHC among controls were 4.32±5.25, 7.57±9.28, 2.72±3.33, and 0.89±0.99, respectively. Conversely, in breast cancer patients, these values were 35.05±5.92, 82.16±9.02, 26.96±3.58, and 32.6±2.46, respectively. Significant differences were observed in HCT and MCHC, while MCV and MCH did not exhibit significant differences.

Conclusion

In conclusion, a higher proportion of females were diagnosed with breast cancer, and all cases were identified as Invasive Ductal Carcinoma. Among the hematological parameters examined, significant differences were observed in hematocrit (HCT), packed cell volume (PVC), mean corpuscular hemoglobin concentration (MCHC), white blood cells count, neutrophils, lymphocytes, and eosinophils, whereas hemoglobin, mean corpuscular volume (MCV), mean corpuscular

hemoglobin (MCH), platelets count, and monocytes show no significant differences. The hematological profiles between the control and affected groups varied. Further studies are required to explore the hematological variations among these groups in more depth.

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