

Comprehensive Evaluation of Peripheral Blood Count Parameters in Donor Deferral: Its Utility as a Quality Control Tool in Blood Banking

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ABSTRACT

This study assessed the role of peripheral blood counts in donor deferral and its utility as a quality control measure in blood banking. It was conducted retrospectively at the Department of Haematology, Combined Military Hospital, Lahore, Pakistan, from April 2023 to September 2023. The study included data from 5,515 donors aged 18-50 years, with weight >50 kg, pulse 60-100/minute, and normal blood pressure per AABB criteria. Donors with HBV or HCV positivity were excluded from donation. CBC analysis showed that 704 donors (12.7%) were deferred due to abnormal CBC results, with anaemia (46.3%)—primarily hypochromic-microcytic anaemia—being the leading cause. Thrombocytopenia and neutropenia were other significant parameters, followed by elevated mixed cell and total leucocyte counts. Most deferred donors did not return, emphasising the need for strategies to improve donor haematologic health and retention.

Key Words: Blood banking, Peripheral blood parameters, Donor deferral.

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Blood donation plays a pivotal role in healthcare by supplying essential components for medical treatments and emergency interventions. Ensuring the safety and suitability of donated blood is crucial for maintaining the integrity of the transfusion process. One key aspect of donor eligibility assessment is the complete blood count (CBC), which provides a comprehensive analysis of various blood components.¹ To ensure safe blood supply, Pakistan's blood banks follow strict donor deferral policies to exclude individuals at risk of infection or with conditions that could compromise blood quality.² This study underscored the importance of these protocols in managing peripheral blood counts and their impact on donation practices, helping to evaluate donor deferral rates and overall health status, and guiding future policies and health programmes to maintain a healthy donor pool.

This observational study was conducted from April 2023 to September 2023. Data were retrospectively collected from donor questionnaires covering demographics, donation history, medical history, and physical examination. Each donor provided detailed information, including name, age, contact number, residence, and donation type.

The inclusion criteria included age 18-50 years, with weight >50kg, pulse 60-100/minutes, and normal blood pressure (systolic 110-130 and diastolic 70-90 mmHg), following AABB criteria. All the donors with a recent blood transfusion were deferred for the respective period. The donors who did not meet the inclusion criteria based on history and examination were deferred from blood donation. Venous blood samples were collected from all potential donors in EDTA vials and analysed using the Sysmex KX-21 for CBC parameters.

The peripheral blood count parameters used for donor deferral in the blood bank were as follows: haemoglobin (Hb) 12.5-16 g/dL, haematocrit (HCT) 35-45%, total leucocyte count (TLC) $4-10 \times 10^9/L$, platelets (PLT) $150-400 \times 10^9/L$, neutrophils 45-70%, lymphocytes 20-45%, and mixed cells <10%. Each parameter was categorised as high or low for analysis. Data were analysed using SPSS (version 22). Quantitative variables were expressed as range, mean and standard deviation, while qualitative variables were reported as frequencies and percentages.

In this study, 5,515 male donors visited the blood bank. Of these, 37 (0.66%) were excluded based on history and physical examination. The majority were replacement donors (5,431; 98.5%), comprising 2,613 (48.11%) non-related and 2,818 (51.89%) related donors, while only 83 (1.5%) were voluntary donors. Among all donors, 781 (14.1%) were deferred due to positive HBV or HCV serology or abnormal blood counts. Specifically, 68 (1.2%) tested positive for HBV and 9 (0.16%) for HCV. CBC tests were performed only for donors who were negative for HBV and HCV serology. A total of 704 (12.7%) donors were

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deferred because of deranged blood counts, as mentioned in the inclusion criteria.

Deferred patients were divided into two groups based on whether the values were lower or higher than the accepted values for each parameter (Table I). Anaemia was the leading cause of deferral, affecting 349 (46.3%) donors. The most common type of anaemia was microcytic hypochromic, with 491 donors (69.7%) showing low MCV and 209 (29.7%) having low MCH. Macrocytosis was noted in 73 (10.4%) of the deferred donors.

Deferred donors were categorised based on peripheral count parameters. Low PLT count ($<150 \times 10^9/L$) was seen in 153 (21.7%) donors, followed by low neutrophil count (20.5%), high mixed count (15.5%), and increased TLC (14.5%), as shown in Table II.

Table I: Categories of red blood cell parameters in deferred donors.

CBC Parameters	Groups	Frequencies (n)	Percentages
HB	$<12.5g/dL$	326	46.3%
	$>16g/dL$	87	12.4%
RBC	$<4 (10^{12}L)$	122	17.3%
	$>5.2 (10^{12}L)$	95	13.5%
HCT	$<35\%$	202	28.7%
	$>45\%$	60	8.5%
MCV	$<76fL$	491	69.7%
	$>96fL$	73	10.4%
MCH	$<29pg$	209	29.7%
	$>32pg$	91	12.9%

HB: Haemoglobin; RBC: Red blood cell count; HCT: Haematocrit; MCV: Mean corpuscular volume; MCH: Mean corpuscular haemoglobin; CBC: Complete blood count.

Table II: Deferred donor's categorisation based on PLT, TLC, and differential counts.

CBC Parameters	Groups	Frequencies (n)	Percentages
PLT ($10^9/L$)	<150	153	21.7%
	>450	104	14.0%
TLC ($10^9/L$)	<4	6	0.9%
	>11	102	14.5%
Neutrophils (%)	$<45\%$	144	19.9%
	$>70\%$	19	2.6%
Lymphocytes	$<20\%$	26	3.7%
	$>45\%$	97	13.8%
Mix count %	$>10\%$	115	15.5%

CBC: Complete blood count; PLT: Platelets; TLC: Total leucocyte count.

Blood donation is a crucial process that requires careful screening of donors to ensure safe blood transfusion practices. This study focused on donor deferrals, providing valuable insights into the demographic characteristics and health status of the donor population, as well as the underlying reasons for exclusion from donation.

In this study, 12.7% (704 donors) were deferred based on peripheral blood counts. Similar donor deferral rates have been reported in earlier studies conducted in Pakistan and Japan.³

Haemoglobin levels were among the most important CBC parameters in donors assessment. According to WHO, a Hb concentration of at least 12.5 g /dL is required for blood donation. Anaemia was the most prevalent cause of donor deferral in

this study, accounting for 46.3% of all cases. Several studies have highlighted the importance of low Hb as a temporary, yet correctable, cause of deferral.⁴

In this study, microcytic hypochromic anaemia was observed in 69.7% of deferred donors, which is consistent with a study conducted in Southern Pakistan that reported a prevalence of up to 60%. However, the prevalence of macrocytic anaemia among deferred donors in this study was 10.4%, markedly higher than their deferred population (2.4%).³

In this study, deferred donors were also categorised based on PLT count, TLC, neutrophil, lymphocyte, and mix count percentages. These categories helped identify donors at risk for certain conditions and guide decisions regarding their eligibility for donation. Low PLT counts ($<150 \times 10^9/L$) were observed in 21.7% donors, while high TLC was found in 14.5% donors. A study conducted by Hanif *et al.* reported a donor deferral rate of 13.6% when taking $100 \times 10^9/L$ as a lower threshold for PLT count.⁵ However, no international studies have described low or high TLC counts as a cause of donor deferral.

Deranged TLC, differential count, and PLT count may result from underlying systemic infections, allergies, or medication use. The AABB has not yet defined the acceptable ranges for TLC and differential leucocyte count (DLC).⁶

Limitations of this study included the unavailability of the female population, failure to follow up deferred patients, and no defined criteria for TLC and DLC. Nutritional education and health campaigns may improve donors' health. Deferred donors should be followed up to boost future donation rates, and more women should be encouraged to donate blood. Further studies are needed to refine the thresholds for blood count to minimise deferrals and to prevent transfusion reactions.

This study has reported anaemia to be the leading cause of donor deferral, followed by low PLT and neutrophil counts. Many deferred donors often do not return for follow-up, resulting in the loss of potential donors. To address this, an efficient follow-up system and baseline investigations for anaemia are needed, along with dietary and lifestyle recommendations to improve haemoglobin levels. Additionally, encouraging greater participation of female donors may also enhance blood banking services.

ETHICAL APPROVAL:

Ethical approval was obtained from the Institutional Review Board (IRB), Combined Military Hospital Lahore (CMH Lahore) (IRB495/2023; dated: February 12, 2024).

COMPETING INTEREST:

The authors declared no conflict of interest.

AUTHORS' CONTRIBUTION:

HMR: Conception and design of the study, data collection, statistical analysis, and result compilation.

ZM, NAR: Data collection, results, discussion, and literature review.

IA, SI, AWM: Discussion and literature review.

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