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Case Report

Platelet Puzzles – Platelet Satellitism Masquerading as Eosinophilia. A Case Report

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Abstract

Introduction: Platelet satellitism is a phenomenon characterized by the adherence of platelets to polymorphonuclear leukocytes or other blood cells, resulting in a rosette-like appearance on peripheral blood smears, particularly with ethylenediaminetetraacetic acid (EDTA) anticoagulated whole blood samples [1]. The precise underlying mechanism of platelet satellitism remains to be fully elucidated but the current explanations include an immunologic mechanism, characterized by EDTA-dependent binding of serum IgG antibodies to both the platelet glycoprotein IIb/IIIa complex and neutrophil Fc gamma-receptors [2,3]; and a non-immunologic adherence mediated by thrombospondin or another alpha-granule protein [4].

Case Description: This report highlights two instances from a clinical laboratory where platelet satellitism led to misleadingly elevated eosinophil counts during automated blood count analysis. A peripheral blood smear review confirmed the spuriously elevated eosinophil count in both cases and a manual WBC differential count was performed to give accurate results for both the cases.

Conclusion: This article underscores the diagnostic challenges and the necessity for laboratory professionals to recognize and address anticoagulant-related artifacts to ensure accurate results. Platelet satellitism presenting as eosinophilia is an uncommon but important diagnostic consideration. Awareness of this artifact amongst laboratory staff is crucial to prevent misdiagnosis and avoid unnecessary patient investigations.

Keywords: Platelet Satellitism; Ethylenediaminetetraacetic Acid (EDTA); Spurious Result; Eosinophilia

Introduction

The widespread use of hematology analyzers has enabled laboratories to produce quick and accurate results in most instances. However, there are occasions when clinical laboratories encounter spurious results attributable to preanalytical variables. These instances can be due to changes induced by the anticoagulant used in the collection tubes or the methodology used by the counting platforms amongst other factors.

An erroneous or spurious result, unless identified and correctly reported by the laboratory, would lead to unnecessary additional evaluation of patient by the clinician. This leads to wastage of valuable time and resources, in addition to unwarranted anxiety and inconvenience for the patient.

A well-documented and commonly encountered artifact in any clinical laboratory is EDTA associated platelet satellitism. The main clinical relevance of this condition resides in its frequent

association with pseudo thrombocytopenia and occasionally pseudo neutropenia on automated blood count analyzers. The laboratory staff are well aware about these associations, able to identify such cases and issue corrected accurate results. Platelet satellitism presenting as pseudo eosinophilia (falsely high automated eosinophil count) is an infrequent and under documented association. Few cases are found reported in literature on this specific association.

The reported case series showcases two cases presenting as eosinophilia due to platelet satellitism, which is an uncommon and unusual presentation of this phenomenon; hence could be overlooked by even the most trained or experienced laboratory staff. The report emphasizes on the importance of awareness among laboratory professionals to ensure accurate diagnoses and prevent unnecessary patient intervention and investigations.

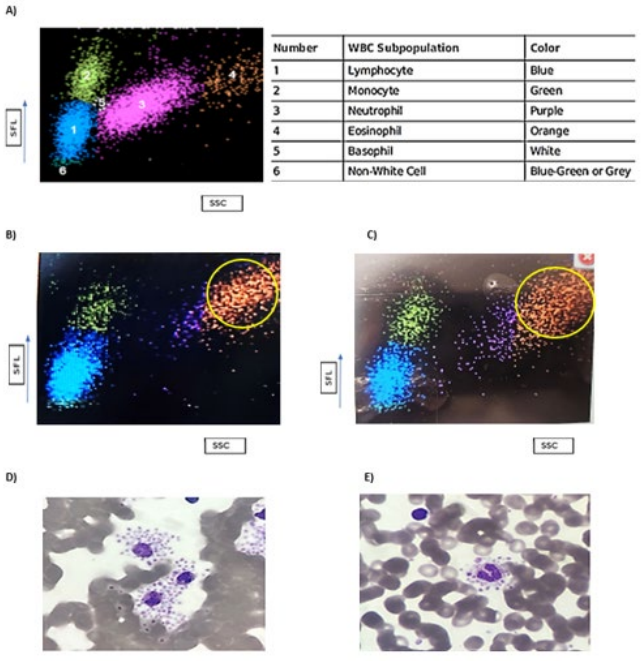
Case history

Case 1

A 31-year-old female underwent pre-employment screening, which included complete blood count and differential test. The analysis revealed a total white blood cell (WBC) count of 5.15 x 10^3/µL (normal range: 3.6-11 x 10^3/µL), an absolute neutrophil count of 0.31 x 10^3/µL (normal range: 2-7 x 10^3/µL), and an absolute eosinophil count of 2.40 x 10^3/µL (normal range: 0.0-0.50 x 10^3/µL). The platelet count was within the normal reference interval. The automated analyzer flagged the results for 'Abnormal Diff, Suspect Diff, NE/EO overlap, and Large Cells' with an abnormal scatter gram (Figure 1B).

Result

A peripheral smear was examined in view of observed instrument flags and the unusual scatter plot. The smear showcased extensive platelet adherence to white blood cells, specifically neutrophils (figure 1D). A manual differential count revealed a neutrophil count of 2.08 x 10^3 cells/µL and eosinophil count of 0.10 x 10^3 cells/µL confirming the spuriously elevated eosinophil count on the analyzer. No other abnormality was observed on the blood smear and the counts derived from manual examination were reported.



Number	WBC Subpopulation	Color
1	Lymphocyte	Blue
2	Monocyte	Green
3	Neutrophil	Purple
4	Eosinophil	Orange
5	Basophil	White
6	Non-White Cell	Blue-Green or Grey

Figure 1: Normal peripheral blood scatter gram with reference key for WBC subpopulations (A). Abnormal White Blood Cell scatter gram in case 1; the orange cloud within yellow circle represents the larger cells resulting from adherence of the platelets to neutrophils overlapping with eosinophils (B). similar abnormal White Blood Cell scatter gram plot for case 2 (C). peripheral blood smear from case 1 showing neutrophils surrounded by platelets (D) peripheral blood smear from case 2 showing a neutrophil surrounded by a rim of platelets (E).

SFL: Side Fluorescence Light; SSC: Sideward Scatter.

Case 2

A 31-year-old male, in good health, underwent an asymptomatic health screening, which included a full blood count with differential. The CBC showed neutropenia with an absolute neutrophil count of 0.23 x 10^3/µL (normal range: 3.6-11 x 10^3/µL) and eosinophilia with an absolute eosinophil count of 1.66 x 10^3/µL (normal range: 0.0-0.50 x 10^3/µL). The results were flagged for 'Abnormal Diff, Suspect Diff, and Large Cells' with an abnormal scatter gram (Figure 1C).

Result

Peripheral blood smear examination was performed in accordance with the laboratory's result review policy and it revealed widespread platelet rimming around neutrophils (Figure 1E). No other morphological abnormality was observed on the slide. Manual WBC differential count performed on the smear revealed an absolute neutrophil count of 1.89 x 10^3 cells/µL and corrected eosinophil count of 0.12 x 10^3 cells/µL. The counts derived from manual examination were finally resulted.

Discussion

Platelet satellitism and EDTA anticoagulants

Platelet satellitism is a rare *in vitro* phenomenon presenting with platelets rosetting around polymorphonuclear neutrophils seen in EDTA anti-coagulated samples. However, it has also been rarely reported in heparin and sodium citrate samples [1]. The mechanism behind this observation is not well-understood but there is evidence that immunoglobin autoantibodies directed against the glycoprotein IIb/IIIa complex of the platelet membrane and the neutrophil Fc gamma receptor (Fcγ receptor III) play a role. EDTA may cause some alterations in the proteins in platelet and neutrophil membrane resulting in bridge formation between the two [2,5]. Alternatively, it has also been suggested that the autoantibodies recognize the same epitopes in the membrane of platelets and neutrophils. It may be possible that some cryptic epitopes in these cells may get exposed by EDTA and not by other anticoagulants [6].

A non-immunologic mechanism has also been proposed by Christopoulos., *et al*. [4] which state that thrombospondin (or other α-granule proteins such as P-selectin) in presence of an activation stimulus is rapidly expressed on platelet surface favoring adhesion to neutrophils. More commonly seen in normal subjects, this phenomenon has also been observed in patients with vasculitis, lupus, mantle cell lymphoma, marginal zone B-cell lymphoma [7] and chronic liver disease [8], although a causal relationship is yet to be well-established.

Diagnostic challenges

Platelet satellitism typically manifests as thrombocytopenia or neutropenia on automated blood cell analyzers. This phenomenon is well-recognized and-aptly managed by laboratory professionals. Considering that pseudo-eosinophilia is an infrequent and unusual presentation of platelet satellitism, recognizing it can be challenging for laboratory staff and it could be overlooked or missed. Awareness of this spurious result is crucial to prevent misdiagnosis and avoid unnecessary patient investigations.

WBC differential counting mechanism and the WBC scatter gram

For blood cell analysis, each large sized particle (greater than the size of a PLT) that is not destroyed by hemolytic agents will be identified as a WBC on most hematology analyzers. After enumeration, and according to the type, impedance with low- and high-frequency electromagnetic or direct current, laser light scattering (at one or at various angles), or peroxidase staining intensity are used, either individually or together, to generate a five-, six-, or even seven- part differential. It is not in the scope of this report to study how the various WBC are classified but it must be kept in mind that scatter grams generated by the analyzer to display the WBC differential must be fully understood by operators. In many instances, WBC scatter grams allow the detection of abnormalities related to spurious counts and/or help to explain them.

Using the basic principles of flowcytometry, a scatter gram depicts the blood cell based on the sideward scatter (SSC; X-axis) and the side fluorescence light (SFL; Y-axis). The SSC represents the size of the cell, the SFL represents its metabolic activity. Compared to a normal white blood cell scatter gram (Figure 1A) the scatter gram of the two cases showed an increased SSC and FSL in the neutrophil -eosinophil region generating instrument flags for large cells &Neutrophil-eosinophil overlap (figure 1 B and 1C).

In both cases, aggregation of platelets around the neutrophils had resulted in larger cell quantifications and erroneous eosinophil counts manifesting as abnormal scatter grams and instrument flags.

Other causes of pseudoeosinophilia

Pseudoeosinophilia has also been reported earlier in some cases of malaria [9]. It is feasible that the Spurious eosinophil count observed in these cases was attributable to hemozoin containing white blood cells. Hemazoin is the pigment that is produced by the breakdown of hemoglobin by malarial parasite. This pigment,

when engulfed by the monocytes and neutrophils, is responsible for the abnormal WBC scattergram causing interference in the WBC differential count.

Conclusion

Platelet satellitism presenting as eosinophilia is an uncommon but important diagnostic consideration. Medical Laboratory Technologists should be aware of this phenomenon and its implications for accurate interpretation of hematological parameters. Recognition of this phenomenon can prevent unnecessary investigations and interventions in affected individuals.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Ethical Approval

This case report was approved by the Institutional Review Board of Mohammed Bin Rashid university of medicine and health sciences (MBRU-IRB), Dubai U.A.E.

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