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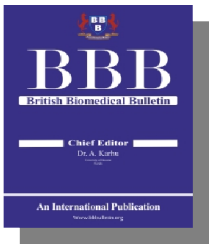


Original

# Platelet Satellitism: A Culprit for Spurious Thrombocytopenia

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A R T I C L E  I N F O

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A B S T R A C T

Platelet satellitism ("adherence of platelets") is a unique, infrequent phenomenon characterized by formation of platelet rosettes around polymorphonuclear leucocytes seen in peripheral smear prepared from EDTA-mixed blood. Platelets may interact occasionally with polymorphonuclear leucocytes forming complexes in particular conditions that may lead to spurious thrombocytopenia. This phenomenon appears to be induced or enhanced by presence of EDTA, commonly used anticoagulant. It is not associated with any definite disease process. The etiology may be immunological or non-immunological. EDTA-dependent pseudothrombocytopenia has no pathologic significance other than potentially placing a patient in jeopardy for inappropriate treatment of thrombocytopenia that does not exist.

## Introduction

Platelet satellitism, or satellitosis, is an unusual phenomenon in which platelets surround and appear to adhere to the surface of polymorphonuclear leukocytes (polymorphs). A factitiously low platelet count is often the result of this *in-vitro* platelet aggregation. It is a rare phenomenon, may be seen in any age; mostly individuals are asymptomatic. It has been seen in association with pregnancy, autoimmune disorders, Behcet's disease, thromboembolism and malignant conditions like mantle cell lymphoma[1]. This unique phenomenon was first described by Field and Macleod in 1963 in peripheral blood collected in EDTA[2].

Classic about platelet satellitism is that platelet phagocytosis occurred only in the presence of EDTA and was strikingly absent with other anticoagulants such as citrate, ACD, and heparin and in finger-stick preparations[3]. It is observed mainly around polymorphonuclear neutrophils but may be seen around eosinophils, basophils, lymphocytes and monocytes as well.

In this phenomenon, there is no relation to functional abnormalities of blood, patient's clinical conditions, or to any drug intake. The exact mechanism of this platelet adhesion to neutrophils is not completely understood but evidence suggest the presence of autoantibody directed to the glycoprotein IIb/IIIa complex on platelet membrane as well as against the neutrophil Fc receptor[4].

Platelet satellitism is not related to the pathologic condition that brought the patient to the hospital. It is not associated with any systemic disorder but has been found incidentally in various disease states as well as in normal individuals[5]. In this case report, we describe the peripheral smear in a patient presenting with platelet satellitism and discuss the possible mechanism to better understand its nature.

## CASE REPORT

A 33 year old healthy male patient underwent complete blood count for routine check- up. Platelet count was found to be very low and exact count could not be given on smear examination. Blood count showed the following parameters:

ESR: 1mm/hr
Hemoglobin: 18.8 gm/dl
Hematocrit: 56.0%
Total leucocyte count: $6.2x10^3$cu.mm
Platelet count: $54x10^3$ / cu.mm
Biochemical examination:
Uric acid (serum): 7.5 gm/dl (Normal: 2.5-6.5 gm/dl)
Other parameters: within normal limits

A blood smear made from EDTA anticoagulated blood showed many polymorphonuclear leucocytes to be surrounded by platelet in a rosette-like fashion, most of which were apparently adherent to leukocytes, sparingthe other cells of myeloid series including eosinophils, basophils, monocytes (figure 1).

It was apparent that the thrombocytopenia was spurious. We then reviewed the complete blood counts (CBC) done on Coulter LH 750 hematology analyzer (Beckman Coulter, Fullerton, CA). The platelet histogram revealed a peak around 20 fl and merger with RBC histogram, suggesting that these aggregates were counted in RBC histogram.

The sample was warmed to 37 degree centigrade for 30 minutes and a repeat smear was examined. The platelet count had marginally increased. A repeat blood sample with heparin or citrate as anticoagulant was requested for an accurate platelet count estimation. In absence of any significant finding, serial monitoring was advised for the patient.

## DISCUSSION

The most common cause of pseudothrombocytopenia is platelet clumping or formation of platelet rosettes around neutrophils[6]. The phenomenon of platelet satellitism was seen by light microscopy only in blood smears made from EDTA anticoagulated blood. It did not occur in smears made from non-anticoagulated blood or if citrate or heparin were used. The platelets were seen to surround and adhere to polymorphonuclear leukocytes and sometime appeared to be engulfed by leukocytes. Platelet adherence to other cells was not seen[3]. Individual platelet and leukocyte showed normal morphology when examined under light microscope.

Vondem Borne *et al*[7], in 1986, introduced the idea of cryptic antigens or hidden antigens and described the platelet immunofluorescent test. These antigens occur exclusively on platelets, most notably on the membrane glycoprotein IIb/IIIa complex. As indicated by their name, cryptic antigens normally are not exposed on circulating platelets, but become exposed when the platelet membrane undergoes a conformational change as calcium ions are neutralized by the chelator, EDTA. Bridge formation between platelets and neutrophils may take place through the binding of Fab fragments to the IIb/IIIa platelet glycoprotein and the Fc fragment to the FcγRIII of the PMNs. Autoantibodies may recognize the same epitope in the two structures[4]. The presence of these autoantibodies seems to be a hallmark in persons with EDTA-induced pseudothrombocytopenia, although the mechanism for this autoantibody production is unclear.

A non-immunologic mechanism has also been proposed involving thrombospondin (or other α-granule proteins such as P-selectin) that, when an activation stimulus is present, is rapidly expressed on platelet surface; thus favoring adhesion to neutrophils[8].In most cases of EDTA-dependent phenomena, effects on platelets are greatest at room temperature or colder, and effects may even be eliminated if samples are kept at 37 degree centigrade[9-12].

Electron microscopy studies often help to corroborate the light microscopic findings. Several studies have reported the formation of platelet dendrites and neutrophil pseudopods and, in general, a rather limited contact between the two cell types[3,8,13]. Focal apposition of the plasma membranes of the two cell types with an interposed electron-lucent space is the most frequently observed form of contact. In some instances phagocytosis of a platelet by a neutrophil was apparent. Another study identified a greater number of glycogen particles in platelets participating in rosette formation than in free circulating platelets[14,15]. The ultrastructural studies do not define particular characteristics of the apposed plasma membranes of platelets or neutrophils that might be related to the phenomenon of satellitism[3].

Platelet satellitism is apparently an *in-vitro* phenomenon, the cause of which is not exactly known. It cannot be directly related to EDTA, since thousands of smears made from EDTA mixed blood do not exhibit satellitism. This is not a function of peripheral blood smearing method as this phenomenon was also seen with wet, unstained preparation of EDTA anticoagulated blood.

Although some reports suggest that EDTA-dependent platelet phenomena occur more frequently in ill or hospitalized patients, especially those with thrombotic complications, others have shown that there is no correlation between the presence of disease and this phenomenon[5,9].

In a study, it was observed that phenomenon is time dependent, as

satellitism increased in the smears made from 2-6 hrs, until more than 90% of polymorphonuclear neutrophils was seen forming rosettes with platelets and rosette formation was decreased to 50% thereafter[16].

Platelet satellitism is considered by many to be an *in-vitro* phenomenon caused by the use of EDTA as an anticoagulant, it may also be, in the presence or absence of detectable antiplatelet antibodies, an expression of a person's thrombotic tendencies *in vivo*[13]. This phenomenon has practical significance with respect to diagnosis of thrombocytopenia and in studying the abnormal platelet morphology. The severity of clinical condition is not associated with degree of satellitism. Individuals with this phenomenon have been followed for long duration without showing any ill effects[17].

## CONCLUSION

The phenomenon of platelet satellitism is not an everyday event. When observed, it runs a risk of inaccurate reporting and spurious thrombocytopenia. This eventually leads to unnecessary treatment of thrombocytopenia in patients when actually it is not indicated. This may also lead to undue results and side effects; including diagnostic work up, cancellation of planned surgeries, unnecessary surgery (splenectomy) or even platelet transfusion which might show drastic untoward results. Thus it is incumbent both on the physician and hematopathologist to be aware of spurious thrombocytopenia in clinical practice; with EDTA- induced platelet satellitism being a prime example.

Combined electron microscopic, immunologic and clinical studies contribute towards a better understanding of this rare and curious phenomenon.

## References


1. Cesca C. Ben-Ezra J. Platelet satellitism as presenting finding in mantle cell lymphoma. *Am J Clin Pathol* 2001; 115: 567-70.
2. Field EJ, McLeod I. Platelet adherence to Polymorphs. *Br. Med. J. 1963:2:388.*
3. Carl R. Kjeldsberg and John Swanson. Platelet Satellitism *Blood,* 1974; 43(6), 831-836.
4. Bizzaro N, Goldschmeding R, von demRorne AE. Platelet satellitism is Fc gamma RIII (CD16) receptor-mediated. *Am J Clin Pathol* 1995; 103:740-4.
5. Alejandro L, Josefa P, Penelope, Penlope RL *et al*. Platelet Satellitism, spurious Neutropenia and cutaneous vasculitis: Casual or casual association? *Am J Hematolog* 2002; 70:246-9.
6. Crisweil KA, Breider MA, Bleavins MR. EDTA-dependent platelet phagocytosis. A cytochemical, ultrastructural, and functional characterization. *Am J Clin Pathol* 2001; 115:376-84.
7. Vondem Borne AE, van der Lelie H, Vos JJ, *et al*. Antibodies against cryptantigens of platelets: characterization and significance for the serologist. *Curr Stud Hematol Blood Transfus*. 1986; 52:33-46.
8. Christopoulos C, Mattock C. Platelet satellitism and a-granule proteins. *J Clin Pathol* 1991; 44:788-9.
9. Bizzaro N. Platelet satellitosis to polymorphonuclears: cytochemical, immunological, and ultrastructural characterization of eight cases. *Am J Hematol*. 1991; 36:235-242.
10. Pegels JG, Bruynes EC, Engelfriet CP, *et al*. Pseudothrombocytopenia: an immunologic study on platelet antibodies dependent on ethylene diamine tetra-acetate. *Blood.* 1982; 59:157-161.
11. Onder O, Weinstein A, Hoyer LW. Pseudothrombocytopenia caused by platelet agglutinins that are reactive in blood anticoagulated with chelating agents. *Blood.* 1980; 56:177-182.
12. Watkins SP Jr, Shulman NR. Platelet cold agglutinins. *Blood.* 1970; 36:153-158.

13. Skinnider LF, Musclow CE, Kahn W. Platelet satellitism: an ultrastructural study. *Am J Hematol.* 1978; 4:179-185.
14. Payne CM. Platelet satellitism: an ultrastructural study. *Am J Pathol.* 1981; 103:116-128.
15. Peters, M., Heyderman, R. S., Klein, N. J., Shahab, N., Evans, M. L. Platelet Satellitism. *NEJM.* 1998; 339: 131-132.
16. Vega B, Hernández-Chavarría F. Tercercaso de satelitismoplaquetario en Costa Rica: Unfenómenopocoreportado. *Rev Cost Cienc Med* 2002; 23; 47-51.
17. Monica Morselli, Giuseppe Longo, GorettaBonacorsi *et al*. Anticoagulant pseudothrombocytopenia with platelet satellitism. *Haematologica* 1999; 84:655.

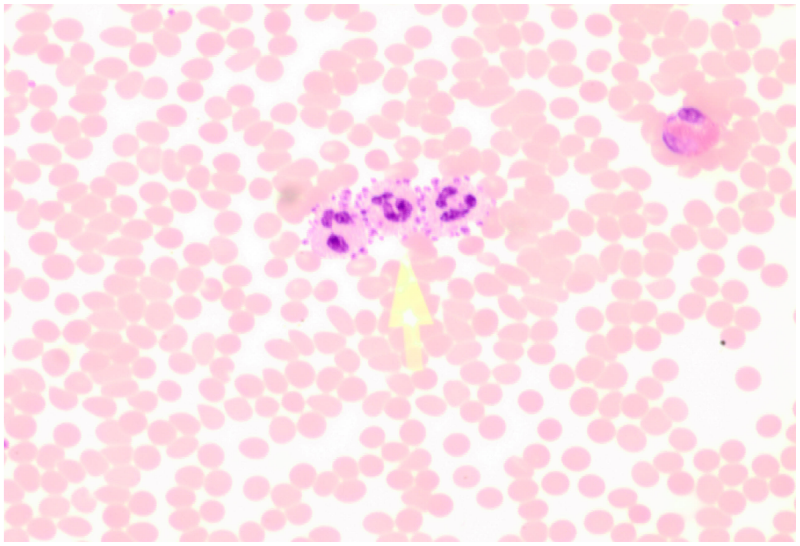

**Figure 1**. Peripheral smear showing platelet satellitosis. Note the rosette-like arrangement of platelets around the neutrophils . (Leishman x400)