Platelets

The Few, the Young, and the Active

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KEYWORDS

• Automated platelet counting • Reticulated platelets • MPV

KEY POINTS

- Many cell counters use novel approaches, ranging from the use of fluorescent dyes to monoclonal antibodies, to improve the accuracy and precision of the platelet count in patients with severe thrombocytopenia.
- The determination of the percentage of immature platelets (immature platelet fraction) can be helpful in the determination of the underlying cause of a low platelet count.
- Several companies are developing new cell counters based on digital image analysis; these instruments may allow better platelet analysis, especially in cases with platelet clumping.

INTRODUCTION

Circulating platelets are produced from megakaryocytes primarily in the bone marrow. Megakaryocytes, like all other blood cells, develop from a master stem cell.[1] All hematopoietic progenitors express cell surface markers CD34 and CD41; commitment to the megakaryocyte lineage is indicated by the expression of CD61 (integrin β3 and GP111a) and elevated CD41 (integrin α11b, GP11b) levels.[1]

There is evidence that megakaryocytes are also found in mammalian lungs and that the lungs are sites for thrombopoiesis.[2]

Unlike other maturing blood cells, megakaryocytes develop by a mechanism of internal cell growth, known as *endomitosis*. During this process, the megakaryocyte begins the mitotic cycle but without dissolution of the nuclear membrane and without cytokinesis resulting in doubling of the cell DNA content. Most megakaryocytes undergo at least 3 endomitotic cycles to attain a DNA content of 16N.[1] During the final stages of development, the megakaryocyte cytoplasm undergoes reorganization

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Abbreviations

CBC	Complete blood count
CNS	Central nervous system
EDTA	Ethylenediaminetetraacetic acid
GP	Glycoprotein
ICSH	International Council for Standardization in Haematology
IPF	Immature platelet fraction
ISLH	International Society for Laboratory Hematology
L-PLT	Large platelet
MPC	Mean platelet component
MPV	Mean platelet volume
NRBC	Nucleated red blood cell
PCDW	Platelet component distribution width
PCT	Plateletcrit
PDW	Platelet distribution width
PLT	Platelet count
PLT-F	Fluorescent platelet count
PLT-I	Impedance platelet count
PLT-O	Optical platelet count
PMP	Platelet microparticles
POC	Point of care
RBC	Red blood cells
rPLT	Reticulated platelets
WBC	White blood cells

into beaded cytoplasmic extensions called proplatelets, which then develop into platelets. Young immature platelets like reticulocytes contain intracellular inclusions, such as RNA, that is gradually lost as they circulate.[1] Green and colleagues[3] (2014) have stated that "it is widely believed that younger, newly made platelets have greater functional capacity than those that have been in circulation for at least 1 day." Mature platelets, although small in size, normally between 2 and 20 μm, when compared with red blood cells or white blood cells (WBC), play an important role in both the body's inflammatory response and with the rapid response in primary hemostasis.

Recent research has demonstrated that both megakaryocytes and platelets release microparticles (PMP).[4] PMP are heterogeneous in size ranging from 0.1 to 1.0 μm and share the common glycoprotein receptors chiefly GP11b-111a (integrin α11bβ3) and GP 1b/1X. PMP are thought to be rich in membrane receptors for coagulation factors and play an important role in blood coagulation and inflammation. Elevated levels of PMP have been detected in patients with disseminated intravascular coagulation, coronary heart disease, transient ischemic attacks, cancer, and diabetes mellitus.[5] Several flow cytometry methods for the measurement of PMP have been published; but although there are a large number of publications, the lack of standardization makes comparison between methods difficult. There is now an appreciation that cells other than platelets, such as endothelial cells and leukocytes, shed microparticles and not all methods may distinguish the cell of origin.[5]

HISTORY OF PLATELET COUNTING TECHNIQUES

Platelet size initially eluded them to being included in the early automated technology. However, this has now been overcome by setting thresholds for different cells; there is now a reference method for platelet counting recommended by both the International Council for Standardization in Haematology (ICSH) and the International Society for Laboratory Hematology.[6]