Novel Parameters in Blood Cell Counters

Thomas Pierre Lecompte, MD*, Michael Pierre Bernimoulin, MD

KEYWORDS

• Complete blood cell count • Hematology analyzers • Schistocytes • Anemia
• Thrombocytopenia • New parameters

KEY POINTS

- Recently developed automated hematology analyzers (HA) incorporate technological improvements that provide more accurate complete blood cell counts and novel parameters.
- Several new red blood cell parameters are potentially useful in the differential diagnosis of anemias with abnormal hemoglobinization, especially of iron-restricted erythropoiesis.
- Schistocytes, a hallmark of thrombotic microangiopathies, can be identified or at least suspected by modern HA: the fragmented red cell flag has a low specificity, but the negative predictive value of its absence is good.
- The proposed new platelet parameters are mainly intended to help in the diagnosis and management of thrombocytopenias; they include the immature platelet fraction, new methods for the assessment of the platelet volume, provide insights on the contents of platelets.
- Careful examination of platelet volumes (results of HAs and of microscopic examination) is important to suspect and diagnose inherited thrombocytopenias.

Recently developed automated hematology analyzers (HA) incorporate technologic improvements yielding novel parameters or determining those of the complete blood count with better accuracy. These newer instruments are, in alphabetical order of the manufacturers,[1] Sapphire (Abbot Diagnostics Cell Dyn),[2] LH750 and UniCel DxH 800 (Beckman Coulter), Pentra (Horiba Medical),[3] BC 6800 (Mindray),[4] Advia (Siemens),[5] and XE and now XN series (Sysmex).

Most of the recently introduced or improved parameters are listed in **Table 1**. The determination of what can be considered to be recent is rather arbitrary, and new does not necessarily mean novel. Many of these parameters are often derived from established technologies using new algorithms with improved data processing.

Disclosure: None.
Haematology Division, Faculty of Medicine, Hôpitaux Universitaires de Genève, Geneva University, Rue Gabrielle-Perret-Gentil 4, Geneva 14 CH-1211, Switzerland
* Corresponding author.
E-mail address: ThomasPierre.Lecompte@hcuge.ch

Clin Lab Med 35 (2015) 209–224
http://dx.doi.org/10.1016/j.cll.2014.11.001 **labmed.theclinics.com**
0272-2712/15/$ – see front matter

Abbreviations

BSS	Bernard-Soulier syndrome
CKD	Chronic kidney disease
HA	Automated hematology analyzers
HSC	Hematopoietic stem cells
IDA	Iron deficiency anemia
IRE	Iron-restricted erythropoiesis
ITP	Immune thrombocytopenia
MPV	Mean platelet volume
MYH9-RD	MYH9-related diseases
PDW	Platelet distribution width
RBC	Red blood cell
RDW	Red cells distribution width
TMA	Thrombotic microangiopathies
WBC	White blood cell

Only a few are the result of actual improvements of the testing procedure, such as the use of new fluorescent dyes. Not all new parameters are already available for clinical use; many are designated by the manufacturer as "for research use only." Many new parameters seem theoretically useful, but their clinical utility sometimes remains poorly documented. External quality control is not always possible, and even internal quality control may not be available. The reproducibility among the same kind of instruments used in every day practice and in different sites is known only for well-established parameters, such as cell counts through external quality assurance scheme exercises; the external control of volumetric parameters remains a worrisome problem.

It is important to remember that parameters with the same name, or with closely resembling names, or with different names but the same aim, are often not interchangeable because of marked differences in measurement principles, calibration, and algorithms. The most conspicuous example is the mean platelet volume (MPV), which has been available for years, but the clinical use of which remains problematic. Clinical guidelines that rely on a parameter that can be obtained only with one kind of instrument from one manufacturer cannot be implemented by most laboratories that do not use those instruments.

Formal validation of a laboratory parameter should include the following steps: metrologic characteristics, diagnostic performance, and clinical utility in daily practice. In addition, the preanalytical aspects should have been properly addressed. Only very few new parameters have successfully fulfilled all these steps during the past years. Moreover, the assessment of diagnostic performance can be challenging when the reference method is cumbersome, barely reproducible, and sometimes even notoriously prone to inaccuracy, or even obsolete. Regarding the clinical usefulness, the challenge can be even greater, for instance when it is difficult to adequately classify patients with complex disorders, such as "anemia of chronic disease" associated with iron-restricted erythropoiesis (IRE), or a disease for which there is no gold-standard laboratory test, such as autoimmune thrombocytopenia.

Generally speaking, the improvements of the instruments and methods aim at lowering false-positive alarms for fragmented red blood cells (RBCs), abnormal white blood cells (WBCs), and platelet clumps, thus limiting unnecessary and time consuming blood film examinations; providing sensitive detection and accurate enumeration of abnormal cells or cells not normally present in peripheral blood; and providing genuinely novel parameters of potential clinical relevance.