



## Scientific Comment

# Blood film in the era of streaming cells<sup>☆</sup>



Diego Villa Clé<sup>\*</sup>

Faculdade de Medicina de Ribeirão Preto da Universidade de São Paulo (FMRP/USP), São Paulo, SP, Brazil

### ARTICLE INFO

#### Article history:

Received 31 July 2017

Accepted 31 July 2017

Available online 23 August 2017

The complete blood count (CBC) with leukocyte differential count (LDC) is a powerful tool to diagnose and monitor disease progression and therapy; it is one of the most ordered laboratory tests. Since Dr. Wallace H. Coulter introduced an automated cell counter in 1953,<sup>1</sup> the laborious and time-consuming eye-count method using a microscope and a hemocytometer has been replaced by automated analyzers with faster turnaround times, reduced burden on technologists and laboratory costs, and improved count accuracy and reproducibility.<sup>2,3</sup>

Modern machines incorporating flow cytometry, with or without cytochemical staining, maximize cell recognition and provide reliable LDC results in the majority of cases.<sup>4</sup> Although automated hematology analyzers vary in method, a significant overlap exists. A typical instrument discriminates a cell depending on its size, complexity or staining. If a cell does not fit a predetermined setting expected for neutrophils, lymphocytes, monocytes, eosinophils or basophils (e.g., immature leukocytes, plasma cells, fragmented red cells, platelet aggregates), it is not classified and triggers a flag. A warning flag is present in 10–30% of samples and should prompt the technologist to prepare and review a blood smear using a microscope or a digital imaging device.<sup>5–7</sup>

Blood smear examinations are routine in clinical laboratories to review flags but also crucial to analyze red and white

cell morphology.<sup>8</sup> Poikilocytosis and cytoplasmic inclusions may provide ancillary clues for diagnosis; Sézary cells and prolymphocytes are only detected by morphology. The blood film is also essential to identify dysplastic changes. However, flags are not specific and false positive flags may reach 20% of flagged samples,<sup>7</sup> impacting on laboratory routine by adding unnecessary manual reviews that consume technologist time and resources. Conversely, false negative results (abnormal samples not flagged for review) may jeopardize patient care. Laboratories must, therefore, customize their own smear review rules to minimize false positive and false negative results.

The International Consensus Group for Hematology Review (ICGHR) published a set of 41 rules as criteria for reviewing CBCs of a heterogeneous population from 15 institutions, yielding a false positive rate of 19% and a false negative rate of 2.9%.<sup>5</sup> Comar et al. evaluated these same set of rules in a Brazilian university hospital setting, and found a false positive rate of 23% and a false negative rate of 6.7%, yielding a microscopy review rate of 46% and concluded that the ICGHR rules were not suitable or safe in their setting.<sup>9</sup>

In the current issue of the *Revista Brasileira de Hematologia e Hemoterapia*, Comar et al. propose new sets of arbitrarily and empirically designed criteria for blood smear review following

<sup>☆</sup> See paper by Comar et al. on pages 306–17.

<sup>\*</sup> Correspondence to: Department of Internal Medicine, Faculdade de Medicina de Ribeirão Preto da Universidade de São Paulo (FMRP/USP), Av. Bandeirantes, 3900, 14049-900 Ribeirão Preto, SP, Brazil. Tel.: +55 16 3602 2294.

E-mail address: [diegocle@yahoo.com](mailto:diegocle@yahoo.com)

<http://dx.doi.org/10.1016/j.bjhh.2017.07.003>

1516-8484/© 2017 Associação Brasileira de Hematologia, Hemoterapia e Terapia Celular. Published by Elsevier Editora Ltda. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

automated CBC.<sup>10</sup> A set with wide cut-off limits showed the best relationship between safety and efficacy. However, the proposed rules must be validated in other patient populations before extrapolated to other laboratories with similar patient profiles and instruments. More importantly, this work serves as a guide for clinical laboratories to individualize rules for slide review according to local characteristics.

### Conflicts of interest

The author declares no conflicts of interest.

### REFERENCES

- Green R, Wachsmann-Hogiu S. Development, history, and future of automated cell counters. *Clin Lab Med*. 2015;35(1):1–10.
- Pierre RV. Peripheral blood film review. The demise of the eyecount leukocyte differential. *Clin Lab Med*. 2002;22(1):279–97.
- Buttarelli M, Gadotti M, Lorenz C, Toffalori E, Ceschini N, Valentini A, et al. Evaluation of four automated hematology analyzers. A comparative study of differential counts (imprecision and inaccuracy). *Am J Clin Pathol*. 1992;97(3):345–52.
- Kang SH, Kim HK, Ham CK, Lee DS, Cho HI. Comparison of four hematology analyzers, CELL-DYN Sapphire, ADVIA 120, Coulter LH 750, and Sysmex XE-2100, in terms of clinical usefulness. *Int J Lab Hematol*. 2008;30(6):480–6.
- Barnes PW, McFadden SL, Machin SJ, Simson E. International consensus group for hematology. The international consensus group for hematology review: suggested criteria for action following automated CBC and WBC differential analysis. *Lab Hematol*. 2005;11(2):83–90.
- Novis DA, Walsh M, Wilkinson D, St Louis M, Ben-Ezra J. Laboratory productivity and the rate of manual peripheral blood smear review: a College of American Pathologists Q-Probes study of 95,141 complete blood count determinations performed in 263 institutions. *Arch Pathol Lab Med*. 2006;130(5):596–601.
- Kim SJ, Kim Y, Shin S, Song J, Choi JR. Comparison study of the rates of manual peripheral blood smear review from 3 automated hematology analyzers, Unicel DxH 800, ADVIA 2120i, and XE 2100, using international consensus group guidelines. *Arch Pathol Lab Med*. 2012;136(11):1408–13.
- Tefferi A, Hanson CA, Inwards DJ. How to interpret and pursue an abnormal complete blood cell count in adults. *Mayo Clin Proc*. 2005;80(7):923–36.
- Comar SR, Malvezzi M, Pasquini R. Are the review criteria for automated complete blood counts of the International Society of Laboratory Hematology suitable for all hematology laboratories? *Rev Bras Hematol Hemoter*. 2014;36(3):219–25.
- Comar SR, Malvezzi M, Pasquini R. Evaluation of criteria for manual blood smear review following automated complete blood counts in a large University Hospital. *Rev Bras Hematol Hemoter*. 2017;39(4):306–17.