Digital Morphology: Bridging the Final Gap in Automated Haematology Testing

Sir,

Complete blood count (CBC) is the commonest initial investigation ordered to evaluate the overall health of an individual. Examination of peripheral blood smear (PBS) under the microscope is an integral component of a CBC report. Together, CBC and PBS provide enormous information on several blood and blood related disorders.

Although modern cell counters can keep pace with high test volumes, manual microscopy creates bottlenecks in faster result reporting. It is completely dependent on the availability of skilled morphologists and is a lengthy, strenuous process. More importantly, it is associated with high inter-observer variability and lacks standardisation in terms of repeatability and accuracy.[1] Challenging slides require the physical presence of a morphology expert for a second opinion, resulting in delayed patient care. Hours-long manual microscopy is also a significant cause of staff's eye discomfort and body fatigue.

Digital morphology provides an impeccable solution to traditional manual procedures. By producing an automated workflow, it allows laboratories to function more competently.[2] The digitalised system automatically detects and captures cell images from labelled slides. Thus, uniformity is maintained and bias due to inter-observer variability is eliminated. An exclusive software sequesters cellular characteristics from the images. Red and white blood cells are then classified into sub-types before reviewing by a morphologist. Simultaneous display of all cell types on a single screen allows the staff to easily review the case and sign it out, saving precious time.

Digital morphology, therefore, replaces manual microscopy with a more standardised process. The desired quality is maintained, and patient results are reported with consistent precision and authenticity. Barcoding of slides further eliminates the risk of patient misidentification. Using digital morphology, sample review time can be reduced significantly allowing laboratories to take on a greater volume of samples. It also provides an opportunity to improve connectivity by sharing cell images and consultation from any workstation. Skilled morphologists can provide opinions on difficult smears remotely and final results can be dispatched from a different location. By archiving reference cell images, the accumulated database can be used not only for teaching and learning but for monitoring and promoting staff competency.[3]

A multicentric evaluation has a well-documented efficiency of digital imaging. Total imprecision in the study ranged from 5.21% to 20.60% and the mean evaluation time of 326 ± 110 s with manual microscopy was reduced to 191 ± 68 s with digital morphology.[4] The European Leukemia Net WP10 also experienced substantial improvements in diagnostic accuracy and harmonisation; inter-observer concordance increased from 62.5% to 83.0%.[5]

A couple of drawbacks include very high capital costs and initial staff training to operate software and hardware. Nevertheless, digital morphology qualifies as the filler to one of the remaining gaps in haematology laboratory automation contributing to the delivery of efficient, and reliable service to physicians and patients.

COMPETING INTEREST:
The authors declare no competing interest.

AUTHORS' CONTRIBUTION:
MSS: Conceptualised the manuscript and wrote the initial draft.
MSS, ZAA: Critically reviewed and approved the final version of the manuscript.

REFERENCES

1. Brereton M, De La Salle B, Ardern J, Hyde K, Burthem J. Do we know why we make errors in morphological diagnosis? An analysis of approach and decision-making in haematological morphology. *EBio Medicine* 2015; **2(9)**: 1224-34. doi: 10.1016/j.ebiom.2015.07.020.

2. El Achi H, Khoury JD. Artificial intelligence and digital microscopy applications in diagnostic hematopathology. *Cancers* 2020; **12(4)**:797. doi: 10.3390/cancers12040797.

3. Kratz A, Lee Sh, Zini G, Riedl JA, Hur M, Machin S, *et al*. Digital morphology analyzers in hematology: ICSH review and recommendations. *Int J Lab Hematol* 2019; **41(4)**: 437-7. doi: 10.1111/ijlh.13042.

4. Rin GD, Seghezzi M, Padoan A, Pajola R, Bengiamo A, Fabio AMD. Multicentric evaluation of the variability of digital morphology performances also respect to the reference methods by optical microscopy. *Int J Lab Hematol* 2022; **44(6)**:1040-9. doi: 10.1111/ijlh.13943.

5. Zini G, Barbagallo O, Scavone F, Béné MC. Digital morphology in hematology diagnosis and education: The experience of the European LeukemiaNet WP10. *Int J Lab Hematol* 2022; **44 (Suppl 1)**:37-44. doi: 10.1111/ijlh. 13908.

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