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Present and future of digital morphology (in diagnostic hematology)

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There are several applications of digital morphology in diagnostic hematology. One of them is the application in external quality assessment (ex; UK National External Quality Assessment Service) and education. However, the most influential application could be blood cell image analysis using image analyzers.

In today's healthcare economy, hospital laboratories are asked to reduce costs, speed up testing and improve productivity. Especially for the hematology laboratories, despite a widespread shortage of experts, we should report better and more reliable results. The automated hematology analyzers produce acceptable CBC results except WBC differential count. They provide superior results to manual differential counts when only mature normal cells are present in the samples, however, they are relatively ineffective in properly recognizing important abnormal cells including blasts, and misclassify these cells as one of 5 normal WBCs. Recently, image analyzers are introduced to effectively address these challenges. They automatically take digital images of blood cells on the slides and preclassify WBC into 5 normal cell types and other abnormal cell types including blasts. It rationalizes the work that is traditionally done by laboratory personnel using conventional microscopes. The quality of images is very good. And performance of detecting giant platelets, platelet aggregation and RBC abnormalities is relatively good. However, the results of WBC differential counting are not satisfactory yet and the laboratory personnel in charge should move misclassified cells properly and verify the results. In my laboratory, we should move some WBC in more than half of cases. The ability of accurate differential depends on the size and accuracy of the database that the algorithm used for developing. Although artificial intelligence technology will be introduced in the development of the classification algorithm in the future, it would use supervised learning technology and need enormous data which is accurately produced. It is difficult to get enough images of rare but important cell types. Another problem is that we should consider the overall situation of the slide not only the blood samples' condition but also the patients' state. Therefore, a blood cell image could be classified accurately by considering other images of cells found in the same slide. It could be possible that artificial intelligence considers other cells' images in that slide for classification of one cell in the future. Before that we need many cell images classified by experts and wrapped by case by case.

In summary, advances in digital microscopic image acquisition technic have revolutionized the work in diagnostic hematology area, but not yet satisfactory because of poor output of the algorithm.