



MEDICA

MANAGEMENT BRIEF

How Automation is Revolutionizing White Cell Differential Analysis



Introduction

“Confidence building becomes a real issue when a laboratory technologist generalist must classify abnormal white blood cell differentials at 3 a.m.,” said a technologist at a major city hospital. That’s just one of the concerns hospital hematology laboratories face today as they confront staffing, productivity, and quality of care issues.

Performing manual white blood cell differentials in a hospital hematology lab can be a laborious and subjective process. The manual differential method employed in almost all labs today is conducted using microscopy and the technologist’s judgment. In practice, samples are first run on a flow counter that performs a complete blood count (CBC). CBC results may indicate the existence of an abnormality. Depending on the institution, this occurs on 20% to 40% of the CBCs. In the case of an abnormality, a blood smear is made from the sample and then stained according to a fixed protocol. The slides are then viewed under a microscope — a process that averages 8 minutes per sample or up to 12 minutes for smears exhibiting particularly low white blood cell counts or elevated numbers of nucleated red blood cells (NRBCs).

While white blood cell differential methodology has changed little over the years, the pressures on hospital hematology labs continue to build. Cost reductions, staff shortages, and rising patient expectations are driving laboratory leadership to explore new solutions that improve productivity as well as the quality of care.

A new technology, *automated cell image analysis*, promises to help surmount these concerns. The automation of time-consuming manual white cell differentials offers attractive operating, financial, and patient care benefits. It significantly reduces review times, while helping the technologist to achieve improved efficiency, accuracy, and precision. Today, even the small- to mid-volume hematology lab can afford this easy-to-use and simple-to-maintain technology.

Grappling with multiple concerns

The dynamic health care environment has hospital hematology laboratories grappling with multiple concerns that impact quality of care and productivity. For starters, laboratory staffs have been reduced and skilled hematology technologists are hard to find. Most facilities have only a few technologists who are specialists in reading abnormal white cell differentials. As a result, much of this work, particularly on weekends and third shifts, is performed by generalists who are also performing chemistry, coagulation, and other testing.

The lack of specialized technologists also leads to another issue — the need for competency assessment. Standardized cell classification is difficult to administer and evaluate in laboratories using manual cell differential methodology. Consequently, there may be differences in the way cells are interpreted from tech to tech and shift to shift. A lack of standardized cell classifications and processes can affect the consistency and quality of analysis. Ask any two technologists about their laboratory’s standards for band and segmented neutrophils. If you get different answers, then there could be a standardization problem.

Leaner staffs and higher workloads put pressure on productivity and turnaround time objectives. Most laboratories are asked to do more with fewer resources while maintaining the quality of care. As a result, the need for second opinions between technologists and outside pathologists is growing. Traditional forms of slide transportation, such as hand delivery and overnight mail, don't facilitate timely technologist/physician interaction or satisfy patient anxiety around waiting for test results.



New technology serves as technologist's "assistant"

Many of these problems and concerns can be addressed by employing new advanced cell image analysis systems as "laboratory assistants." These analyzers support hematology technologists by automating and simplifying substantial parts of the manual white blood cell differential process. The technology incorporates advanced imaging and pattern recognition software to automatically locate white cells on a blood smear, digitally store the images, preclassify them, then present them for review by the technologist — grouped by cell type — on an LCD display.

Cells not falling in any normal category are placed in the "Other" category. The technologist then can review the abnormal cells and reclassify them. The analyzer also presents images of red cells and platelets, enabling red cell morphology evaluation and platelet estimates. All of the results are stored in digital form and are easily accessible for visual review.

In short, technologists don't need to find the cells on the slide — as they did in the manual differential process — the analyzer does it for them. And the analyzer suggests the classification of most of the cells located. Now, the technologists only need to quickly review the cell preclassifications, which better utilizes their skills and expertise.

Matching capabilities to laboratory workflow

Because these advanced cell image analyzers essentially serve as laboratory assistants, it's important that their capabilities closely match laboratory workflow. When evaluating the new technology, lab managers should be aware of the following issues:

- Some analyzers have expensive features that are not required by the small- to mid-volume laboratory. For example, automated abnormal cell preclassification is a costly option that is not necessary because a pathologist will always review these slides.
- The analyzer should have clear digital images with the resolution necessary to clearly classify abnormal white blood cells. Some analyzers, such as Medica's EasyCell assistant, have sophisticated optical pattern recognition software that enhances their ability to accurately locate and preclassify cells for the technologist.

- The analyzer user interface must be easy and intuitive, permitting rapid installation, learning, start up, and operation. Training and maintenance time should be minimal. The system should integrate seamlessly with the laboratory's workflow and be evaluated with the incumbent staining methodology. Well-defined staining protocols and support should be available from the manufacturer to assure optimal performance. Look for a system with a compact footprint to maximize coveted bench space.
- The analyzer should enable true walkaway automation. Some systems can process up to 30 slides without operator supervision, yet are still highly affordable.
- Remote software is available that can be installed on existing PCs onsite or offsite, transforming them into workstations for remote review of image files. This feature enables collaboration among technologists, pathologists, and hematologists who can view cell images from multiple locations and at the same time.
- A STAT slide port is available on some systems that permits the interruption of the run at any time for immediate processing of a single sample. This feature allows STAT operation without disrupting the slide run in progress.
- For laboratories that do not use bar codes, look for a system that images handwritten labels on sample slides. This feature captures the label associated with each slide for accurate patient identification.

Like having one operator perform all of the differentials

Automated cell image analysis systems provide substantial operating, quality of care, and cost reduction benefits. They are reliable, hardworking additions to the hematology team and are ideal for addressing peak workloads and frequent understaffed periods such as third shifts and weekends.

Standardization of white blood cell differentials may be one of the most important contributions these systems make. The analyzer behaves as though the same technologist performed all of the differentials in the laboratory. The technologist can see all of the white blood cells with exceptional clarity on a single monitor. This capability improves consistency of interpretation across all samples, from technologist-to-technologist and shift-to shift.

Standardization of differential analysis also is enhanced by the system's capability to assist in teaching white and red blood cell morphology to lab staff. With onboard Competency Software, hematology supervisors and pathologists can evaluate and improve technologists' cell classifications across different shifts and sites. This is particularly helpful to newer staff or generalists who are rotating through departments and have less experience in hematology.

Automating the manual differential process results in considerable improvement in productivity for laboratories that need to do more with less. Systems reduce slide review times by 50% over manual microscopy. But more importantly, their true walkaway automation frees up the technologist to perform other duties while the analyzer is processing slides. In addition, the STAT feature allows easy handling of urgent slides from the emergency room without disrupting analyzer workflow.

The systems are easy to maintain. For example, the EasyCell assistant only requires 5 minutes of maintenance a day to assure reliable operation.

The systems' easy-to-use interfaces permit rapid learning and start-up, plus simplified operation. "For staff familiar with white blood cell differentials, training time on Medica's EasyCell assistant should require about 2 hours," said a technologist evaluating the analyzer.

Automated cell image analysis systems provide a permanent record of cell images and morphology. This enables the images to be shared among technologists and outside pathologists for greater collaboration and faster analysis. Now, physicians can benefit from a retrospective review of multiple patient samples over time to evaluate disease progression.

Automating the white blood cell differential also reduces cost. Assuming the technology saves 3 minutes per slide, at a rate of 60 slides per day, about \$25,000 in labor savings would be achieved over a 12-month period.

Conclusion

The advantages of advanced cell image analysis were summarized in a major hospital evaluation that confirmed the efficacy of the EasyCell assistant. Boston Children's Hospital's hematology laboratory evaluated the analyzer without making any changes in their workflow or their existing method for slide preparation and staining.

"The EasyCell assistant's precise cell preclassification enhanced our technologists' confidence in their analyses," said Kyle Riding, medical technologist, Boston Children's Hospital, and lecturer, Department of Medical Laboratory Science, University of Massachusetts Dartmouth. "In addition, the instrument was highly reliable, easy to learn and maintain, and fit well in the laboratory's workflow. You are able to get results faster and in a more consistent manner, which should result in better and faster patient diagnoses."

Riding said that, because comparison of the cell images was easy, they could standardize results. It also was easy to add standardized comments to reports. "The results can be reviewed retrospectively at any time by supervisors and managers to assure competency of technologists. You're able to get results out faster and in a more consistent manner," he said. "This type of technology represents the future of hematology labs."



Sysmex America, Inc.
577 Aptakistic Road
Linkolnshire, IL 60069, U.S.A.
Tel. +1 (800) 379-7639
Fax +1 (847) 996-4397

www.sysmex.com/us



Medica Corporation
5 Oak Park Drive
Bedford, MA 01730-1413 USA
phone: 781-275-4892
fax: 781-275-2731

www.medicacorp.com

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