Developing EQA for Automated Cell Imaging Systems

Andrea Teuchert, Barbara De la Salle, Vasilis Rapanakis, Jon Sims

UK NEQAS Haematology, Watford, WD18 8YX, UK

Introduction

UK NEQAS Haematology supplies a comprehensive range of external quality assessment (EQA) programmes designed to support the quality assurance needs of participating laboratories. Automated Cell Imaging Systems are slowly becoming a more integral part of blood sciences laboratories, both in routine and out-of-hours services. At the time of writing, there is no EQA option available for automated digital morphology systems, worldwide. We assessed the suitability of the UK NEQAS Blood Films for Morphology and Manual Differential Counting slides for use with CellaVision technology. The results were sufficiently encouraging for us to invite a group of interested participants to submit differential count results from their Automated Cell Imaging System.

Background

The gold standard for analysis of peripheral blood film morphology is currently manual light microscopy using Romanowsky staining methods. The differing morphology of erythrocytes, leucocytes and platelets is often critical in identifying particular haematological conditions. The disadvantages of this method is that it requires continuous training of staff, it is labour-intensive and has relatively high interobserver variability. As technologies in our laboratories have advanced, so too has the use of Automated Cell Imaging Systems. Digital images of individual cells are classified by an algorithm based on blood cell image analysis parameters such as size, shape, colour, texture and other features. Figure 1 shows a selection of digital images of a variety of blood cells.
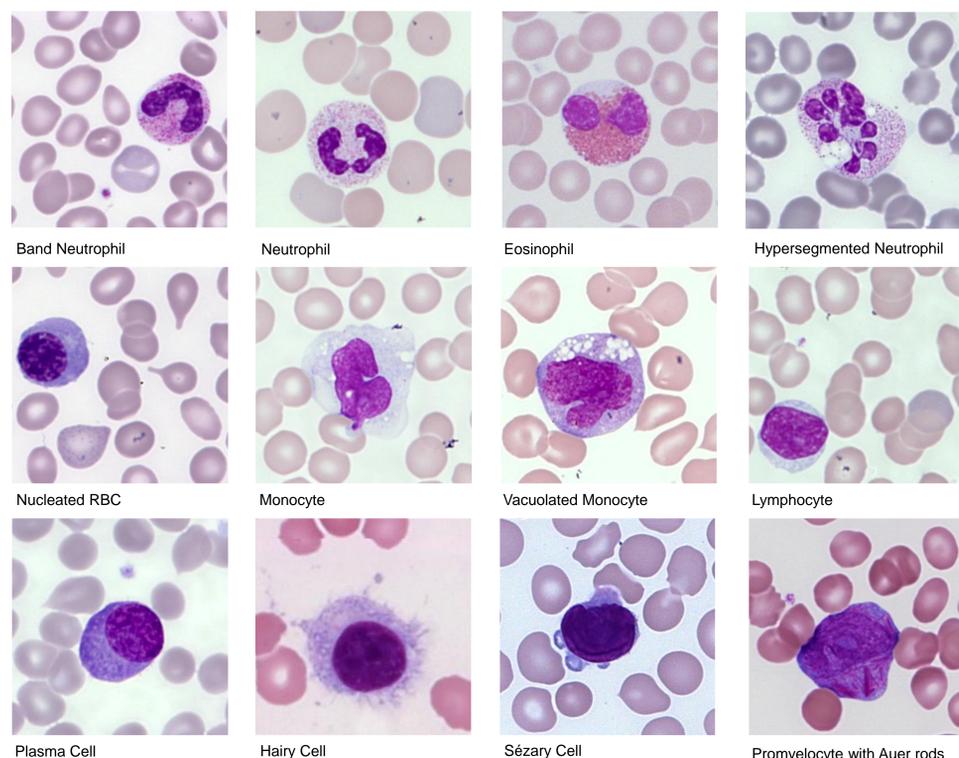

Figure 1 – Examples of different cell lines in peripheral blood

Method

UK NEQAS Haematology currently has 556 participants registered to participate in manual WBC differentials as part of the Blood Films for Morphology programme. 4 cases are released each year, the Automated Cell Imaging System pilot was begun on the second case of 2021. Participants were contacted asking them to express their interest in participating in the pilot, with an explanation as to how to enter results on the website and 35 participants were invited to participate in the exercise. In addition to the manual differential entry, there would be two additional tabs available to enter results, one for Automated Cell Imaging System results pre-classified by the analyser and one for Automated Cell Imaging System results post re-classification by a biomedical scientist (Figure 2). Data was collected and analysed by UK NEQAS Haematology.

Figure 2 – Website result entry page for DF survey

Results

On average, 12 laboratories returned data by the closing date for the past 3 surveys. When statistical analysis was performed on the data there was no clinically significant difference between the means of the variables when compared to each other, using the Student T-test with 95% confidence intervals. The results of the differentials reported by the manual participants and the Automated Cell Imaging System differentials both pre and post classification were consistent and comparable (Figure 3). Three cases have been performed thus far, with additional exercises planned for 2022.

%	2102DF			2103DF			2104DF		
	Manual	Pre	Post	Manual	Pre	Post	Manual	Pre	Post
Neutrophils	40.4	41.5	40.4	55.0	55.3	56.0	67.1	67.0	67.0
Lymphocytes	17.0	13.0	16.6	15.0	11.9	12.2	24.0	25.0	25.8
Monocytes	16.0	16.0	18.9	15.5	15.7	17.0	6.8	7.0	6.5
Eosinophils	2.0	1.5	1.6	1.0	1.0	1.0	1.0	1.0	1.0
Basophils	0.0	2.0	1.0	0.0	0.0	0.0	0.0	0.8	1.0

Figure 3 – Summary results for 2021 DF Surveys

Conclusions

UK NEQAS Haematology prefers a minimum of 20 participants in a pilot programme, for statistical relevance. We are working with the laboratories that are registered for this pilot but did not submit results to improve the statistical robustness of the data and our conclusions. As the use of Automated Cell Imaging Systems has increased in laboratories across the globe, the need to assess their performance has become more pressing. This pilot exercise has demonstrated that the results are comparable between the differential performed manually by a biomedical scientist and those produced by an Automated Cell Imaging System and that the automated systems can be incorporated into the EQA programme. This is good news for laboratories as they expand the utilisation of these new technologies. However, the results do still clearly indicate that there will always be a need for expert, manual morphology skills in the laboratory and that it is important to nurture and encourage these skills in our teams.

Future Developments

✓ Pilot is now open to all interested participants – please get in touch to be added

✓ Harmonise terminology between manual differential and the ACIS'

✓ Move from a pilot to a full programme

✓ Addition of graphs to reports

✓ Introduction of performance scoring