ADVANCED BLOOD CELL ID: DISTINGUISHING HYPOSEGMENTED NEUTROPHILS

Educational commentary is provided for participants enrolled in program #259- Advanced Blood Cell Identification. This virtual blood cell identification program includes case studies with more difficult challenges. To view the blood cell images in more detail, click on the sample identification numbers underlined in the paragraphs below. This will open a virtual image of the selected cell and the surrounding fields. If the image opens in the same window as the commentary, saving the commentary PDF and opening it outside your browser will allow you to switch between the commentary and the images more easily. Click on this link for the API ImageViewer™ Instructions.

Learning Outcomes
At the completion of this exercise, the participant will be able to

- identify morphologic features of normal peripheral blood leukocytes,
- describe morphologic findings characteristic of Pelger-Huët neutrophils, and
- discuss distinguishing features of Pelger-Huët cells when compared to other neutrophils.

Case History
A CBC with differential was ordered on a 42 year old male as part of a physical exam. His CBC results are as follows: WBC=6.1 x 10^9/L, RBC=4.50 x 10^12/L, Hgb=13.5 g/dL, Hct=40.5 %, MCV= 90 fL, MCH=29.9 pg, MCHC=33.3 g/dL, Platelet=160 x 10^9/L, RDW-CV=21.9 %.

Educational Commentary
The cells annotated for identification and discussion in this testing event were selected from a patient diagnosed with a benign condition called the Pelger-Huët anomaly. This abnormality is an inherited disorder in which neutrophils fail to completely segment or hyposegment.

The cell chosen for ABI-01 is a hypossegmented neutrophil characteristic of the Pelger-Huët anomaly. The cell is medium-sized and similar in size to normal segmented neutrophils. Likewise, the cytoplasm contains numerous pink, tan, or purple granules as are seen in segmented neutrophils. The differentiating feature in this cell is the presence of only two nuclear lobes connected by a barely visible nuclear filament of chromatin. The nuclear chromatin is condensed and clumped. Hypossegmented neutrophils such as this example have been referred to as “pince-nez” cells since they resemble these types of eyeglasses or spectacles with a noseclip instead of earpieces.

The cell identified in ABI-02 is a neutrophil. This cell appears to have more “segmentations” than the cell selected for ABI-01. Note the size is similar in both cells. Although a few neutrophils with three-lobed nuclei may be seen in cases of the Pelger-Huët anomaly, on average, 80% of the neutrophils will be bi-lobed or non-segmented in this condition.¹ The characteristic pink, tan, or purple granules of a neutrophil are still evident. The nuclear chromatin is dense and clumped.
ABI-03 shows a monocyte. Monocytes are the largest cells that can normally be seen in the peripheral blood. The cytoplasm is abundant and blue-gray, often with vacuoles present. The cytoplasm may appear uneven, rough, or as if it contains fine grains of sand. This cell demonstrates cellular margins that are not even. In fact, it almost looks as if this cell is “pushing” away surrounding RBCs, a feature frequently associated with monocytes. Monocytes also characteristically have a nucleus that is oval, round, kidney-shaped, or lobulated. The chromatin generally shows minimal clumping and stains a lighter pink or purple; no nucleolus is visible.

The cell selected for ABI-04 is another hyposegmented neutrophil. This cell is like the size of the neutrophil chosen for ABI-01. The cytoplasm also has the characteristic pink, tan, or purple granules. The nuclear chromatin is condensed and clumped, as is typical of a mature neutrophil. This particular hyposegmented cell was selected to demonstrate the morphologic variations that may be seen in the Pelger-Huët anomaly. Note that a thin filament connecting the lobes is lacking and the nuclear shape resembles a peanut. This Pelger-Huët variant should not be mistaken for a band neutrophil. The nuclear chromatin is especially coarse and condensed and is not characteristic of an immature cell. Several other features of this case study and peripheral blood smear suggest that a left shift, as may be seen in severe infections, is not present. Note that the WBC for this patient is normal at 6.1x10^9/L. In an apparent left shift or infection, the overall WBC is often increased. Likewise, infectious processes are associated with other morphologic changes in neutrophils, such as toxic granulation and Döhle bodies, which are not evident in any of the neutrophils on this virtual peripheral blood smear. Finally, it would be expected that other immature cells, to include metamyelocytes and possibly even myelocytes, would be seen if a neutrophilic left shift were truly present.

ABI-05 is yet another example of a variant Pelger-Huët neutrophil. As with the neutrophils in ABI-01 and ABI-04, this cell is approximately the same size, contains pink, tan, or purple cytoplasmic granules, and has clumped and condensed nuclear chromatin. The nuclear shape, however, resembles a dumbbell. Again, in the context of other hyposegmented cells seen on this virtual slide, it is important to identify this cell as just another type of Pelger-Huët neutrophil.

The cell chosen for ABI-06 is an eosinophil. Eosinophils are about the same size as mature neutrophils. They are distinguished by their numerous red-orange cytoplasmic granules. These granules are typically large and uniform in size. Eosinophils often have bi-lobed nuclei, as evident in this cell. The nuclear chromatin is dense and clumped.

The last cell selected for annotation in this testing event, ABI-07, is a hyposegmented neutrophil. This cell, more than any of the other hyposegmented neutrophils, illustrates the most classic features of the Pelger-Huët anomaly. The size of this cell, color of cytoplasmic granules, and clumped nuclear chromatin, are typical characteristics and similar to other hyposegmented neutrophils previously
discussed. However, the two nuclear lobes in this particular cell are connected by a single, thin strand of chromatin and are each round, or nearly round. The nuclear lobes in this cell especially resemble the typical pince-nez conformation classic in Pelger-Huët cells. Bi-lobed nuclei, such as in this cell, as well as the hyposegmented cells seen in ABI-01, ABI-04, and ABI-05, are most often associated with the heterozygous form of the Pelger-Huët disorder. A homozygous condition does exist, but is very rare. In the homozygous state, the nuclei are usually unilobed or monolobated, so have no segmentations with a single, round nucleus.

Pelger-Huët Anomaly

The Pelger-Huët anomaly is an inherited but benign condition, that does not affect neutrophil function or cause any additional or unusual hematologic findings. In heterozygotes, the nuclei are generally some type of bi-lobed shape. Occasionally, monolobated nuclei are seen. However, monolobated nuclear forms are most often associated with the rare homozygous state of this abnormality as well as cases of acquired or pseudo-Pelger-Huët.

Pseudo-Pelger-Huët occurs as an acquired condition seen with myeloproliferative neoplasms, myelodysplastic syndromes, leukemias, and sometimes related to chemotherapy. In cases of pseudo-Pelger-Huët, the nuclei may be single and round, with strikingly dense chromatin. Completely segmented neutrophils (with 3-5 lobes) will often be visible in pseudo-Pelger-Huët and not in cases of inherited Pelger-Huët. Likewise, in myeloproliferative neoplasms, myelodysplastic syndromes, and leukemias, abnormalities in erythrocytes and platelets may also be seen and such changes are not associated with inherited cases of the Pelger-Huët anomaly. For example, in myelodysplastic syndromes, hypogranular neutrophils as well as abnormal, dysplastic changes in RBCs and platelets may be seen.

Summary

The cells selected for annotation in this virtual testing event emphasize the various morphologic appearances of neutrophils in the Pelger-Huët anomaly. Although Pelger-Huët is a benign condition that does not affect neutrophil function, it is important that the laboratory professional identify these cells and distinguish them from a neutrophilic left shift or other serious disorders such as myeloproliferative neoplasms, myelodysplastic syndromes, and leukemia.

Reference


Additional Reading
