EDUCATIONAL COMMENTARY – BLOOD CELL IDENTIFICATION

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

- Describe morphologic features of normal peripheral blood leukocytes.
- Identify characteristic morphologic findings of immature granulocytes.

The photographs presented in this testing event represent both normal and abnormal white blood cells that may be seen in the peripheral blood of a patient with a preliminary diagnosis of Acute Myelocytic Leukemia (AML). Although these photographs are representative of various leukocytes, also note the absence of platelets in many of the photographs. Patients with AML often do have a decreased platelet count. In this particular case, the patient’s platelet count was only 29,000.

BCI-15 illustrates a normal monocyte. Monocytes are large cells, ranging in diameter from 15-22 µm. When identifying any cell, it is important to consider cell size, cytoplasmic features, and nuclear characteristics. The cytoplasm in monocytes may appear rough or, as is often described in references, looks like “ground glass.” The cytoplasm is generally a blue-gray color and is abundant. Cytoplasmic extensions, resembling pseudopods, are often seen. It is not unusual to see vacuoles in monocytes, as seen in this particular cell. Monocytic nuclei often assume a variety of shapes, such as oval, round, kidney-shaped, or even lobulated. Close observation of the nucleus shows chromatin that is a light shade of pink or purple and is generally fine with little clumping; no nucleoli are visible in mature monocytes.

BCI-16 shows an eosinophil. Numerous red-orange cytoplasmic granules are unique to this cell. The nucleus in an eosinophil stains a deep purple and, as a mature cell, is dense and clumped. Eosinophils generally have two round or oval nuclear lobes.

A normal, mature lymphocyte is depicted in BCI-17. This particular example is considered a small lymphocyte. It should be noted, however, that lymphocytes are quite variable in size. In small lymphocytes, the nuclei are relatively large when compared to the scanty ring of blue cytoplasm. In fact, it is difficult to see the cytoplasm in the cell shown here. Sometimes, although not seen in this cell, small, light purple or reddish granules may be seen in the cytoplasm. In contrast to monocytes, the normal, small lymphocytes generally show no variation in nuclear shape, appearing simply round, oval, or only slightly indented. The nuclear chromatin is dense, clumped, and appears a dark purple. Nucleoli may sometimes be present, but often are not visible.
A band neutrophil, as illustrated in BCI-18, is similar in size to the eosinophil shown previously. The band is the earliest precursor of neutrophil maturation that might normally be seen in the peripheral blood. This patient demonstrated 1% bands in the differential cell count. Bands are distinguished by a nucleus that is shaped like a sausage or the letters C or U. The indentation is greater than half the diameter of the nucleus. The chromatin is fairly dense and clumped. The cytoplasm contains numerous small specific granules that stain pink, tan, or violet.

BCI-19 shows a metamyelocyte. It is not normal to see this cell in the peripheral blood. Metamyelocytes characteristically have a nucleus that is slightly indented, often referred to as kidney-shaped. The indentation is less than half of the diameter of the hypothetical round nucleus, in comparison with the band cell shown in BCI-18, whose indentation is more than half of the possible round nucleus. The metamyelocyte is also a post-mitotic cell, so the nuclear chromatin is clumped and dense. Numerous pink, tan, or violet specific granules fill the cytoplasm. Some darker staining primary granules may sometimes be seen.

BCI-20 is a picture of a myelocyte, the maturation stage immediately preceding a metamyelocyte. Likewise, it is not normal to see this cell in the peripheral blood and is an indicator of a possible pathologic process. The myelocyte is the last stage capable of mitosis, but the first in which the pink, tan, or violet specific granules appear. Again, some darker, nonspecific or primary granules may still be evident. The nucleus is often eccentrically located within the cell and is generally a round or oval shape; nucleoli are not usually seen. The chromatin is beginning to clump, but lighter areas of parachromatin may still be seen. Many times a clear area, or hof, is adjacent to the nucleus and represents the Golgi body of the cell.

BCI-21 shows a blast cell. The high percentage of these cells identified on the differential cell count is cause for the preliminary diagnosis of Acute Myelocytic Leukemia. Several features characterize blast cells. Generally, they are large cells, with a high nucleus to cytoplasmic ratio and, consequently, a small amount of cytoplasm. The cytoplasm is usually very blue and contains no granules. The nucleus is round or oval in shape with loose, open chromatin. In some blasts, especially myeloblasts, prominent nucleoli may be seen. Because blast cells of different cell lines are so similar in appearance, it is not always possible to classify the cells only by viewing them with a Wright's stain. Additional classification techniques to include cytochemical staining and determination of cell surface markers are necessary.

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