PERIPHERAL BLOOD SMEAR EXAMINATION

A common task of pathologists is review of peripheral blood. A drop of blood is placed at the edge of a slide and smeared across the slide and then examined under the microscope, typically at 100X. Lab techs may ask the pathologist to review abnormalities they detect or physicians may request this exam during the workup of anemia, thrombocytopenia (decreased platelet count), or white blood cell abnormalities. Rarely, a medical emergency may be detected by this exam e.g. DIC (disseminated intravascular coagulation) or promyelocytic leukemia. Pathologists can be called into the hospital to review “Stat” peripheral smears.

The reviewer should develop a systematic approach to the assessment of the peripheral smear. Red blood cells are the most numerous cells encountered in the smear. Examination includes assessment of size, shape, and color (pallor), and the presence of inclusions. Normal red cells approximate the size of the lymphocyte nucleus, with a diameter of 7- 8 microns and a mean corpuscular volume (MCV) of approximately 90 femtoliters. Alterations in the MCV(cell size) and appearance can help detect the type of anemia e.g. an elevated MCV of > 100 in Vitamin B12 or folate deficiency or a decreased MCV of < 80 in iron deficiency anemia. Fragmented RBCs or schistocytes can be detected in a hemolytic anemia. Sickle cells have a distinctive crescent-shaped appearance in those with sickle cell disease. Malarial organisms may be detected within red cells and should be sought in those patients with fever and recent travel history to endemic areas.

White blood cells typically consist of a mixture of neutrophils, lymphocytes, and monocytes with infrequent eosinophils, basophils. Leukemia is a malignant disease of the white cells that may present with a count that is markedly elevated but may also present with normal or even decreased counts. It takes a careful observer to detect malignant white cells, blasts, that may be present in very low numbers. If detected, work up with bone marrow exam, flow cytometry, and chromosomes can be initiated promptly. Review of the blood smear generally accompanies bone marrow examinations as well. Atypical lymphocytes with a more generous and malleable cytoplasm, often indented by surrounding red cells, can be seen following viral infections such as infectious mononucleosis. An increased absolute number of neutrophilic band forms is called a "left shift", and is most often associated with infection.

Platelets are small, purplish anuclear cells. There is normally at least one platelet visualized per oil-immersion field, and seven platelets per 100-power field; less than this number should alert the observer to possible thrombocytopenia. Review of the smear is particularly important when the platelet count is depressed; pseudothrombocytopenia can be diagnosed by finding large clumps of platelets in smears taken from blood samples anticoagulated with EDTA, but not in samples anticoagulated with heparin or citrate. The presence of a very high platelet count, extremely large platelets, and/or megakaryocyte fragments is abnormal and suggests an underlying myeloproliferative neoplasm, such as essential thrombocythemia or primary myelofibrosis.

Examination of the peripheral blood smear is an inexpensive but powerful diagnostic tool in patients of all ages. It provides rapid, reliable access to information about a variety of hematologic disorders. The smear offers a window into the functional status of the bone marrow, the factory producing all blood elements.

References:

Up to Date: Evaluation of the peripheral blood smear

Williams Hematology, Eighth edition, 2011; p.17-22

Henry’s Clinical Diagnosis and Management of Laboratory Methods, 22nd edition, p.522-31.