TABLE 77-1 LABORATORY TESTS IN ANEMIA DIAGNOSIS

- I. Complete blood count (CBC)
  - A. Red blood cell count
    - 1. Hemoglobin
    - 2. Hematocrit
    - 3. Reticulocyte count
  - B. Red blood cell indices
    - 1. Mean cell volume (MCV)
    - 2. Mean cell hemoglobin (MCH)
    - 3. Mean cell hemoglobin concentration (MCHC)
    - 4. Red cell distribution width (RDW)
  - C. White blood cell count
    - 1. Cell differential
    - 2. Nuclear segmentation of neutrophils
  - D. Platelet count
  - E. Cell morphology
    - 1. Cell size
    - 2. Hemoglobin content
    - 3. Anisocytosis
    - 4. Poikilocytosis
    - 5. Polychromasia
- II. Iron supply studies
  - A. Serum iron
  - B. Total iron-binding capacity
  - C. Serum ferritin
- III. Marrow examination
  - A. Aspirate
    - 1. M/E ratio[a]
    - 2. Cell morphology
    - 3. Iron stain
  - B. Biopsy
    - 1. Cellularity
    - 2. Morphology

[a]M/E ratio, ratio of myeloid to erythroid precursors.

TABLE 77-2 RED BLOOD CELL INDICES

Index	Normal Value
Mean cell volume (MCV) = (hematocrit × 10)/(red cell count × 10^6)	90 ± 8 fL
Mean cell hemoglobin (MCH) = (hemoglobin × 10)/(red cell count × 10^6)	30 ± 3 pg
Mean cell hemoglobin concentration = (hemoglobin × 10)/hematocrit, or MCH/MCV	33 ± 2%

TABLE 77-3 CHANGES IN NORMAL HEMOGLOBIN/HEMATOCRIT VALUES WITH AGE, SEX, AND PREGNANCY

Age/Sex	Hemoglobin, g/dL	Hematocrit, %
At birth	17	52
Childhood	12	36
Adolescence	13	40
Adult man	16 (±2)	47 (±6)
Adult woman (menstruating)	13 (±2)	40 (±6)
Adult woman (postmenopausal)	14 (±2)	42 (±6)
During pregnancy	12 (±2)	37 (±6)

Source: From RS Hillman et al: *Hematology in Clinical Practice*, 5th ed. New York, McGraw-Hill, 2010.

FIGURE 77-3 Normal blood smear (Wright stain). High-power field showing normal red cells, a neutrophil, and a few platelets. *(From RS Hillman et al: Hematology in Clinical Practice, 5th ed. New York, McGraw-Hill, 2010.)*

will be able to identify minor populations of large or small cells or hypochromic cells before the red cell indices change.

Peripheral Blood Smear The peripheral blood smear provides important information about defects in red cell production (Chap. 81e). As a complement to the red cell indices, the blood smear also reveals variations in cell size (*anisocytosis*) and shape (*poikilocytosis*). The degree of anisocytosis usually correlates with increases in the RDW or the range of cell sizes. Poikilocytosis suggests a defect in the maturation of red cell precursors in the bone marrow or fragmentation of circulating red cells. The blood smear may also reveal *polychromasia*—red cells that are slightly larger than normal and grayish blue in color on the Wright-Giemsa stain. These cells are reticulocytes that have been prematurely released from the bone marrow, and their color represents residual amounts of ribosomal RNA. These cells appear in circulation in response to EPO stimulation or to architectural damage of the bone marrow (fibrosis, infiltration of the marrow by malignant cells, etc.) that results in their disordered release from the marrow. The appearance of nucleated red cells, Howell-Jolly bodies, target cells, sickle cells, and others may provide clues to specific disorders (Figs. 77-3 to 77-11).

Reticulocyte Count An accurate reticulocyte count is key to the initial classification of anemia. Reticulocytes are red cells that

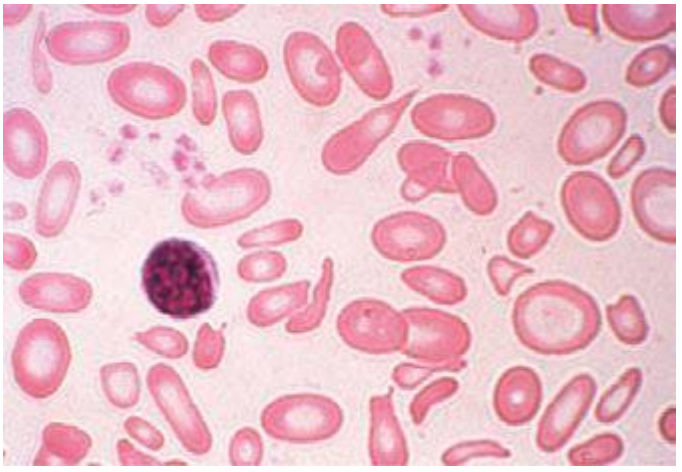

FIGURE 77-4 Severe iron-deficiency anemia. Microcytic and hypochromic red cells smaller than the nucleus of a lymphocyte associated with marked variation in size (anisocytosis) and shape (poikilocytosis). *(From RS Hillman et al: Hematology in Clinical Practice, 5th ed. New York, McGraw-Hill, 2010.)*