

Objectives

1- Definition of anaemia

2- Identification of RBC indices

3- What are the clinical consequences of anaemia?

4- How you approach a patient with anaemia?

5- What are the important symptoms and signs for some causes of anaemia (IDA, Haemolytic anaemia, Megaloblastic anaemia)?

DEFINITIONS

Anaemia defined as a reduction in one or more of the major red blood cell (RBC) measurements obtained as a part of the complete blood count (CBC): haemoglobin concentration, haematocrit (HCT), or RBC count. In practice, however, a low haemoglobin concentration or a low haematocrit is most widely employed for this purpose.

Haemoglobin the major oxygen-carrying molecule in whole blood. Values may be expressed as grams of haemoglobin per 100 mL of whole blood (g/dL) or per liter of blood (g/L).

Haematocrit – (HCT), also called packed cell volume (PCV), is the packed spun volume of blood that consists of intact RBCs, expressed as a percentage. HCT can be measured directly following centrifugation of a blood sample or calculated ($HCT = [RBC \times MCV]/10$).

RBC count – RBC count is the number of RBCs contained in a specified volume of whole blood, usually expressed as millions of cells per micro L of whole blood.

Normal ranges for haemoglobin/HCT

A haemoglobin <13.5 g/dL (<135 g/L) or a HCT <41.0 percent represents anaemia in men, and a value <12.0 g/dL (<120 g/L) or <36.0 percent, respectively, represents anaemia in women.

Red blood cell indices — The RBC indices describe the size, shape, and haemoglobin content of RBCs, as well as the uniformity of the RBC population.

MCV – Mean corpuscular volume (MCV) is the average volume (size) of the patient's RBCs. It can be measured or calculated ($MCV \text{ in femtoliters [fL]} = 10 \times HCT[\text{in percent}] \div RBC[\text{in millions/micro L}]$).

MCH – Mean corpuscular haemoglobin (MCH) is the average hemoglobin content in a RBC. It is calculated ($MCH \text{ in picograms [pg.]/cell} = \text{hemoglobin [in g/dL]} \times 10 \div RBC [\text{in millions/microL}]$). A low MCH indicates decreased haemoglobin content per cell, and is typically reflected in hypochromia on the peripheral blood smear .

Red blood cell indices; continue

MCHC – Mean corpuscular hemoglobin concentration (MCHC) is the average haemoglobin concentration per RBC. It is calculated as (MCHC in grams [g]/dL = haemoglobin [in g/dL] X 100 ÷ HCT [in percent]).

Red cell distribution width (RDW) is a measure of the variation in RBC size, which is reflected in the degree of anisocytosis on the peripheral blood smear. A high RDW implies a large variation in RBC sizes, and a low RDW implies a more homogeneous population of RBCs. RDW is calculated as the coefficient of variation (CV) of the red cell volume distribution (RDW = [standard deviation/MCV] x 100)

Reticulocytes can be enumerated manually after supravital staining of a blood sample with dyes such as new methylene blue. The normal range (i.e., percent of RBC with positive staining) in adults is 0.5 to 2.0 percent. Reticulocytes can be appreciated on a standard blood smear stained with Wright-Giemsa as RBC with a blue tint (polychromatophilia) that are larger than mature RBC, with irregular borders and a lack of central pallor.

CLINICAL CONSEQUENCES

with each gram of haemoglobin capable of carrying 1.3 mL of oxygen. Thus, approximately 20mL/dL (or 20 volumes percent) can be carried by 15 g/dL of haemoglobin at full saturation.

Symptoms related to anaemia can result from two factors:

1-decreased oxygen delivery to tissues

2-in patients with acute and marked bleeding, the added insult of hypovolemia.

oxygen delivery can be maintained at rest at a haemoglobin concentration as low as 5 g/dL

Symptoms will occur when the haemoglobin concentration falls below this level at rest, at higher haemoglobin concentrations during exertion, or when cardiac compensation is impaired because of underlying heart disease.

Exertional dyspnea, dyspnea at rest, fatigue.

S/S of the hyperdynamic state such as bounding pulses, palpitations, and a roaring pulsatile sound in the ears.

More severe anaemia may lead to lethargy, confusion, and potentially life-threatening complications such as congestive heart failure, angina, arrhythmia, and/or myocardial infarction.

EVALUATION OF THE PATIENT

Anaemia is one of the major signs of disease. It is never normal and its cause(s) should always be sought

The workup should be directed towards answering the following questions concerning whether one or more of the major processes leading to anemia may be operative:

- Is the patient bleeding (now or in the past)?
- Is there evidence for increased red blood cell (RBC) destruction (either intravascular or extravascular)?
- Is the bone marrow suppressed?
- Is the patient iron deficient? If so, why?
- Is the patient deficient in folate or vitamin B12? If so, why?