Week 2 - Hematological and Cardiovascular Disorders

Hematological Disorders

- What is anemia?
- Microcytic Anemias
- Macrocytic Anemias
- Normocytic Anemias
- Hemoglobinopathies

Cardiovascular Disorders

- What is Coronary Artery Disease?
- Heart failure
- Heart Valve Disorders

Weekly objectives

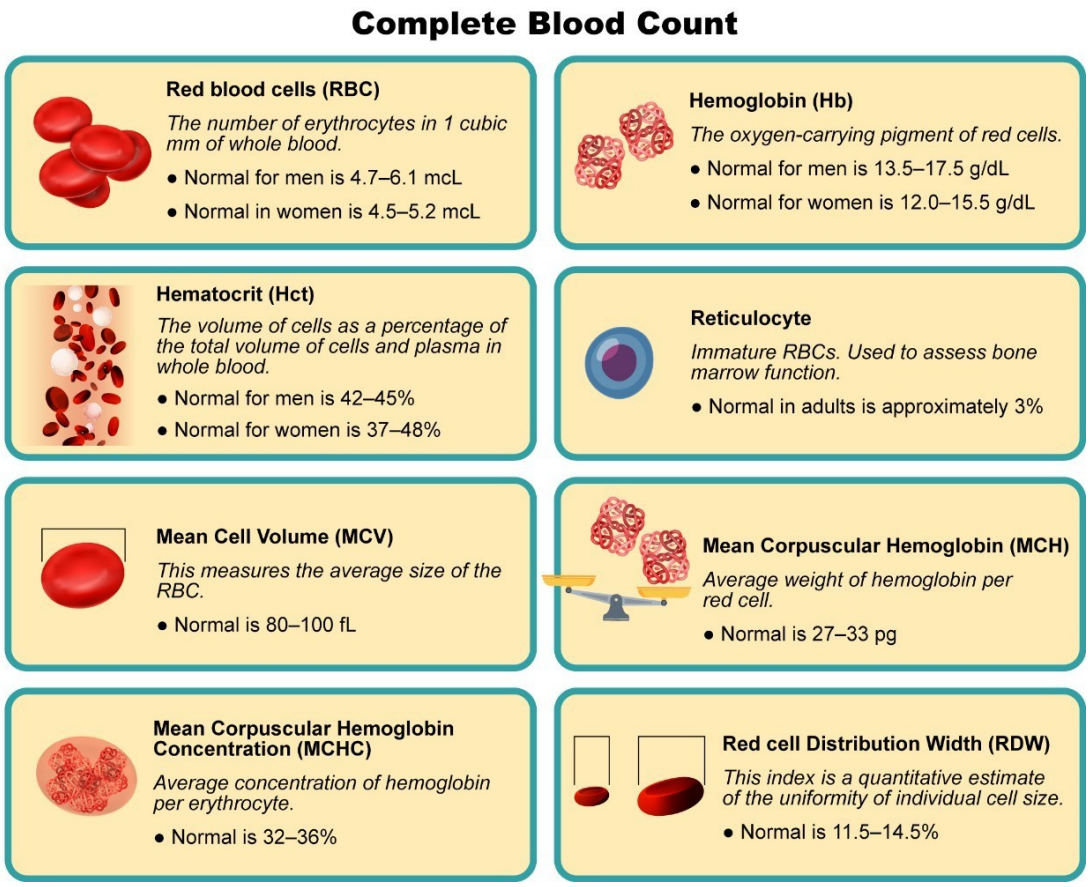
1. WO2.1-Analyze pathophysiological mechanisms associated with alterations in hematologic and cardiac structure process. (CO1)
2. WO2.3- Differentiate between normal and abnormal hematologic structure and function. (CO1)
3. WO2.4- Differentiate between normal and abnormal cardiovascular structure and function. (CO1)
4. WO2.2- Describe outcomes of disruptive or alteration in hematologic and cardiovascular processes. (CO2)

Hematological Disorders

What is Anemia?

Anemia is a hematological disorder characterized by a reduction in the total number of circulating red blood cells (RBCs) and/or a decrease in hemoglobin (Hb) amount or function. Anemia stems from the Greek meaning of “without blood” and refers to the condition whereby the capacity of blood to transport oxygen to the tissues is reduced. Anemia can be caused by 1) impaired RBC production, 2) excessive blood loss, 3) increased RBC destruction OR any combination of the three.

In order to recognize and differentiate the type of anemia that is present, it is important to understand the components that make up the complete blood count (CBC). For the purposes of this content, we will discuss only the components that relate to red blood cells and their production.



Anemia Classification

Anemias can be classified into 3 categories based on the average size of the RBCs (MCV):

- Microcytic anemia (MCV<80 fL) describes RBCs that are small.
- Macrocytic anemia (MCV>100 fL) describes RBCs that are large.
- Normocytic anemia (MCV 80-99 fL) describes RBCs that are normal in size.

Microcytic (MCV<80 fL)	Normocytic (MCV 80-99 fL)	Macrocytic (MCV>100 fL)
Iron deficiency	Anemia of inflammation and chronic disease	B12 deficiency (pernicious anemia)
Sideroblastic	Hereditary spherocytosis	Folate deficiency
Thalassemia	G6PD deficiency	
Anemia of chronic disease	Paroxysmal nocturnal hemoglobinuria	

Anemias can also be classified according to the color of the RBCs:

- Hypochromic anemia describes RBCs with less hemoglobin than normal. As a result, the RBCs appear pale in color (MCHC is low).
- Hyperchromic anemia describes RBCs with more hemoglobin than normal. As a result, the RBCs a ppear a dark hue or red than normal cells (MCHC is high).

- Normochromic anemia describes RBCs that have a normal amount of hemoglobin. As a result, the RBCs appear neither pale nor dark (MCHC is normal).

MCHC is normal in all three types of anemia listed.

Lab Value	Aplastic Anemia	Post-Hemorrhagic Anemia	Hemolytic Anemia
MCV	Normal	Normal	Normal
MCHC	Normal	Normal	Normal
Reticulocyte Count	Low	High	High

Determining the size and color of the RBCs is an important step in identifying the type and source of the a nemia.

Clinical Manifestations of Anemia

Decreased tissue oxygenation from anemia can manifest as signs and symptoms of the following:

- Severe fatigue
- Pallor
- Weakness
- Dyspnea
- Dizziness

Furthermore, the reduction in RBC level will decrease blood volume, activating the renin-angiotensin-aldosterone (RAA) system, which promotes fluid retention and movement of interstitial fluid into the capillaries. This will not only increase plasma volume, but also dilute the plasma further. The dilute blood flows faster, which creates a hyperdynamic state. This “stresses” the cardiac system and can result in tachycardia or even heart failure.

Iron Deficiency Anemia

Iron deficiency is categorized as a microcytic and hypochromic anemia. Iron deficiency anemia (IDA) is the most common type of anemia, affecting almost 20% of the world population. The most common problem contributing to this is the insufficient amount of iron availability.

Causes of IDA include:

- Inadequate dietary intake.
- Chronic and or occult bleeding: hemorrhage, colitis, cirrhosis, GI ulcers, esophageal lesions, or menorrhagia; note that it only takes 2-4 mL (about 1 tsp) of blood loss per day to lose 1-2 mg of iron).
- Decreased ability to utilize Fe for heme synthesis (e.g. transferrin deficiencies and mitochondrial defects). These are a less common cause of IDA.