IQRA NATIONAL UNIVERSITY

DEPARTMENT OF ALLIED HEALTH SCIENCES

Final -Term Examination (Spring-202)

Course Title: Hematology (MLT 2nd semester) Instructor: Adnan Ahmad

Time: 6 hours **Max Marks: 50**

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Note:

- **Attempt All(five) questions from this section, all questions carry equal marks.**
- **Use only Blue / Black Ink other than diagrams**
- **Answer Briefly and to the point, avoid un-necessary details**
- **Possession of Mobile Phones is strictly prohibited**
- **Every question must be attempted within one single page of two sided specified in answer book**

ID**Q:1**Discus developmental stages of erythropoiesis.

Q:2 Enlist common causes of poor blood filam(blood smear)

Q:3. Briefly explain Granulupoiesis in detail.

Q:4 What Is iron deficiency Anemia? Also discuss its causes

Q:5. Classify anemia on the basis of morphology with examples.

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DEPARTMENT: BS MLT

SEC: A

PAPER: HEMATOLOGY

ANS 1:

Erytropoisis

is the process which produce red blood cells, whic is the development from erythropoietic stem cells to mature red blood cell. It is stimulated by decreased O2 in circulation, which is detected by the kidneys, which then secrete hormone erythropoietin.

The formation of red blood cells takes place in the red bone marrow.The bone marrow of essentially all the bones produces red blood cells until a person is around five years old.
The tibia and femur cease to be important sites of hematopoiesis by about age 25;
the vertebrae, sternum, pelvis and ribs, and cranial bones continue to produce red blood cells throughout life. Up to the age of 20 years RBCs are produced from red bone marrow of all the bones (long bones and all the flat bones). After the age of 20 years, RBCs are produced from membranous bones such as vertebrae, the sternum, ribs, scapulas, and the iliac bones. After 20 years of age, the shaft of the long bones becomes yellow bone marrow because of fat deposition and Essential for the maturation of red blood cells are Vitamin B_{12} (cobalamin) and VitaminB_9 (Folic acid). Lack of either causes maturation failure in the process of erythropoiesis, which manifests clinically as Rritonuculour, an abnormally low amount of reticulocytesloses the erythropoietic function.

Stages of erythropoiesis

Following are the steps involved in the erythropoiesis:

1. PROERYTHROBLAST (MEGALOBLAST)

-This is the first cell derived from the stem cell (CFU-E). It is also called megaloblast.

-It is very larger in size with a diameter of about 20 microns.

-The nucleus has two or more nucleoli and a reticular network.

-The cytoplasm is basophilic in nature.

2. EARLY NORMOBLAST

This cell is slightly smaller with a diameter of about 1; microns. In the nucleus, the nucleoli disappear. Condensation of chromatin network occurs. The condensed network becomes dense. The cytoplasm is basophilic in nature and stains with basic dyes. So, this cell is also called basophilic erythroblast. This cell develops into intermediate normoblast.

3. INTERMEDIATE NORMOBLAST

This cell is smaller than the early normoblast with the diameter of 10 to 12 microns. The nucleus is still present But, the chromatin network shows further condensation.

This cells develops into late normoblast.

4. LATE NORMOBLAST

The diameter of the cell is further reduced to about 8 to 10 microns. Nucleus becomes very small with very much condensed chromatin network and it is known as ink spot nucleus. Quantity of hemoglobin increases. And the cytoplasm becomes almost acidophilic. In the late normoblast, the nucleus disintegrates and disappears. The process by which nucleus disappears is called pyknosis. The final remnant is extruded from the cell. Late normoblast develops into reticulocyte.

5. RETICULOCYTE

This is otherwise known as immature red blood cell. It is lightly larger than matured red blood cell. The cytoplasm contains the reticular network or reticulum formed by remants of disintegrated organelles. Due to the reticular network, the cell is called reticulocyte

In newborn babies, the reticulocyte count is 2 to 6%, i.e 2 to 6 reticulocytes are present for every 100 red blood cells. The number of reticulocytes is reduced during the first week after birth. During this stage, the cells can enter the capillaries through the capillary.

6.MATURED ERYTHROCYTE

Now the reticular network disappears and the cell becomes the matured red blood cell. The matured red cell is biconcave and it is smaller in size with a diameter of 7.2 microns.

It takes five days for development of reticulocyte. The reticuloctye takes two more days to become the matured red blood cell.

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ANS 2: Causes of poor Blood Filam

a) Drop of blood too large or too small.

b) Spreader slides pushed across the slide in a jerky manner.

c) Failure to keep the entire edge of the spreader slide against the slides while making the smear.

d) Failure to keep the spreader slide at a 300 angle with the slide.

e) Failure to push the spreader slide completely across the slides.

f) Irregular spread with ridges and long tail. Edge of spreader dirty or chipped; duaty slide.

g) Holes in film: slides contaminated with fat.

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ANS 3:

Granulopoiesis

is a complex process by which primitive blood precursors differentiate into fully differentiated, functionally active granulocytes. Studies on the production of neutrophilic granulocytes and other myeloid cells have provided important paradigms for understanding differentiation. In particular, this work has revealed the intricate and often essential roles played by various transcription factors – both those specific to the granulocytic lineage, as well as more widely expressed molecules – in the control of differentiation. Such transcription factors can act both positively and negatively to regulate the expression of a wide range of important genes, including growth factors and their receptors, other transcription factors, as well as various molecules important for the function of the mature cells. In addition, the activity of several transcription factors is controlled by external stimuli, such as cytokines. Finally, there is a complex interplay between all of these factors –

synergistic and antagonistic – which allows for the exquisite control of granulocytic cell production that is observed. When bacteria or viruses cause infection in the body, the body will respond by having the bone marrow create granulocytes to help destroy the infectious microorganisms. Therefore, it is normal for the number of granulocytes to increase during times of infection or inflammation. However, sometimes too many granulocytes will accumulate in the blood stream, which results in granulocytosis (some granulocytes in the blood is good, too many granulocytes in the blood is bad).

Causes:

One of the main causes of granulocytosis involves a type of cancer called chronic myelogenous leukemia. Chronic myelogenous leukemia (CML) is a cancer that affects bone marrow, causing the bone marrow to create too many WBCs/granulocytes. CML is most common in older men, especially those who have undergone radiation treatment for cancer. Granulocytosis often occurs in other forms of cancer that impact the bone marrow, which include polycythemia vera, primary myelofibrosis, and essential thrombocythemia.Granulocytosis can also occur anytime there is wide-spread infection or inflammation in the body. Severe bacterial infections, kidney failure, severe burns, and heart attacks are examples of conditions that can result in an abnormally high number of granulocytes in the blood. It should be noted that although these conditions will cause the number of WBCs to increase as part of the normal immune response, they only occasionally develop into granulocytosis.

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ANS 4:

Anemia

Iron deficiency anemia is a common type of anemia — a condition in which blood lacks adequate healthy red blood cells. Red blood cells carry oxygen to the body's tissues.

As the name implies, iron deficiency anemia is due to insufficient iron. Without enough iron, your body can't produce enough of a substance in red blood cells that enables them to carry oxygen (hemoglobin). As a result, iron deficiency anemia may leave you tired and short of breath.

You can usually correct iron deficiency anemia with iron supplementation. Sometimes additional tests or treatments for iron deficiency anemia are necessary, especially if your doctor suspects that you're bleeding internally.

Symptoms

Initially, iron deficiency anemia can be so mild that it goes unnoticed. But as the body becomes more deficient in iron and anemia worsens, the signs and symptoms intensify.

Iron deficiency anemia signs and symptoms may include:

h) Extreme fatigue

i) Weakness

j) Pale skin

k) Chest pain, fast heartbeat or shortness of breath

l) Headache, dizziness or lightheadedness

m) Cold hands and feet

n) Inflammation or soreness of your tongue

o) Brittle nails

p) Unusual cravings for non-nutritive substances, such as ice, dirt or starch

q) Poor appetite, especially in infants and children with iron deficiency anemia

Iron deficiency anemia occurs when your body doesn't have enough iron to produce hemoglobin. Hemoglobin is the part of red blood cells that gives blood its red color and enables the red blood cells to carry oxygenated blood throughout your body.

Causes

If you aren't consuming enough iron, or if you're losing too much iron, your body can't produce enough hemoglobin, and iron deficiency anemia will eventually develop.

Causes of iron deficiency anemia include:

Blood loss. Blood contains iron within red blood cells. So if you lose blood, you lose some iron. Women with heavy periods are at risk of iron deficiency anemia because they lose blood during menstruation.

A lack of iron in your diet. Your body regularly gets iron from the foods you eat. If you consume too little iron, over time your body can become iron deficient. Examples of iron-rich foods include meat, eggs, leafy green vegetables and iron-fortified foods.

An inability to absorb iron. Iron from food is absorbed into your bloodstream in your small intestine. An intestinal disorder, such as celiac disease, which affects your intestine's ability to absorb nutrients from digested food, can lead to iron deficiency anemia.

Pregnancy. Without iron supplementation, iron deficiency anemia occurs in many pregnant women because their iron stores need to serve their own increased blood volume as well as be a source of hemoglobin for the growing fetus.

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ANS 5:

Definition Of Anemia

Anemia is defined as a decrease in the concentration of the hemoglobin depending upon the age and the sex of the patient.Anemia in a broad sense is the inability of the blood to supply adequate O2 to the tissue for proper metabolism.These are the most common hematological disorders.The diagnosis is very important for the physician to treat the cause of anemia..Anemia may be classified roughly into:

Severe anemia when the Hb is <7 g/dL.

Moderate when 7 to 10 g/dL. This group will not produce evident S/S. in most of the cases.

To understand the anemias, it is better to know the hemoglobin types and structure

Type of hemoglobin	Structure of hemoglobin	Frequency of the
At birth		
Hb F	α2 / γ2	60 to 90%
Hb A	α2 / β2	10 to 40%
At adult age		
Hb A1	α2 / β2	>95%
Hb A2	α2 / δ2	<3.5%
Hb F	α2 / γ2	<1 to 2%

Anemia classification:

On the basis of RBC morphology:

1- Normochromic and normocytic anemias are due to:

Anemia of acute hemorrhage.

Hemolytic anemia.

2-Anemia due to chronic diseases.

3-Hypochromic and microcytic anemias are due to:

Iron deficiency anemia.

Thalassemia.

4-Normochromic and macrocytic anemias are due to:

Vit. B12 deficiency.

Folate deficiency.

The morphological classification is based on the size or volume of the red blood cell and may also be classified by the hemoglobin content of the red blood cell. A red blood cell of a normal size or volume is said to be normocytic.

With our earlier terminology lesson this term becomes easy to recall. With this understanding it is easy to see that if the cell volume is decreased, then we will have an abnormally small cell, or it is said to be microcytic, and if the volume is increased, we will have an abnormally large cell, and we can use the term macrocytic.

A morphological classification of anemia can also be normochromic, which we know from our terminology lesson means red blood cells with normal hemoglobin content. Or they could be hypochromic, meaning low hemoglobin content, or hyperchromic, meaning high hemoglobin content.

At this point you might be wondering why we would go to so much trouble to try and classify anemias. The reason is because categorizing an anemia is useful in determining what is going on in the body and, therefore, defining the underlying condition. For example, if tests reveal small red blood cells (microcytic) and low hemoglobin content (hypochromic), then the physician would have a good indication that this patient might be dealing with iron-deficiency anemia and could prescribe an appropriate treatment plan. It might help you to recall this fact by remembering that iron helps make blood cells, so if iron is deficient, then the cell volume and hemoglobin will be deficient, giving us microcytic, hypochromic cells.

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