ALTERATIONS OF LEUKOCYTE FUNCTION

(CHAPTER 16)

QUESTION 1

Describe the two ways in which leukocyte function can be altered.

Leukocyte abnormalities fall into one of two general categories: **quantitative** or **qualitative**.

In **quantitative** alterations, the **quantity** of WBCs is either excessive or deficient.

In **qualitative** alterations, the quantity may be appropriate, but the **individual cells** are unable to perform their function effectively.

Consider how this mirrors **hypochromic** and **normochromic** anemias from unit 13.

Here, we again have two types of disorder: either a problem with the **individual cells**, or a **deficiency** in the number of cells.

QUESTION 2

Define leukocytosis and leukopenia.

Leukocytosis and **leukopenia** (sometimes called **leukocytopenia**) are the two major **quantitative** leukocyte alterations.

In **leukocytosis**, the WBC count is **elevated**, usually due to infection.

In **leukopenia**, the WBC count is **low**, which can occur for many reasons.

There are also terms for an excess of an **individual type** of WBC:

More granulocytes than normal → **granulocytosis**

(More specific: **neutrophilia**, **basophilia**, **eosinophilia**)

More monocytes than normal → **monocytosis**

More lymphocytes than normal → **lymphocytosis**

(The suffix **-penia** can be used to indicate a deficiency of any type.)

Total WBC quantity is one of the tests included in a **complete blood count** or CBC, along with RBCs, platelets, and "H/H" (hemoglobin & hematocrit.)

To test for the levels of individual WBC types, a test called a **differential** is sometimes added.

(a.k.a. "CBC w/ diff.")

QUESTION 3

Describe some clinical manifestations of leukopenia.

One of the most serious consequences of leukopenia is the emergence of **opportunistic infection**, including the potential for sepsis if untreated.

Other common symptoms include **malaise** and **oral ulcers**.

QUESTION 4

What are the two major types of acute leukemia?

In total, there are **four** major types of leukemia:

ALL

acute lymphoblastic leukemia

AML / ANL

acute myeloid leukemia

(or "non-lymphoblastic")

CLL

chronic lymphocytic leukemia

CML / CGL

chronic myeloid leukemia

(or "granulocytic")

ALL and **AML**, the acute forms of leukemia, are characterized by **sudden onset** and **rapid progression**.

Untreated, acute leukemia can become **fatal** in **weeks to months**.

Acute leukemias, particularly **ALL**, occur far more commonly in **children** than do chronic leukemias.

ALL represents about 3/4 of childhood leukemia cases. Most of the remainder are AML, although AML is actually far more common in adults.

QUESTION 5

Describe some physical manifestations of leukemia.

Increased bleeding – epistaxis, ecchymosis, petechiae, etc.

(Due to thrombocytopenia)

Fatigue, **dyspnea**, **pallor**

(Due to anemia)

Opportunistic infection – pneumonia, UTIs, etc.

(Due to leukopenia)

QUESTION 6

What is the Philadelphia chromosome, and with which type of leukemia is it associated?

The **Philadelphia chromosome** is a particular genetic abnormality (an "oncogene"—we'll talk about what this means in the cancer unit) which allows for the **hyperproliferation** of myeloid bone marrow cells.

This mutation is the primary diagnostic criterion of **CML**—all cases of CML are associated with the presence of the Philadelphia chromosome.

QUESTION 7

Describe the two types of chronic leukemia.

CLL and **CML**, the chronic forms of leukemia, are characterized by **insidious onset** and **slow progression**.

Many people with chronic leukemia are diagnosed through abnormal CBC results before they display any symptoms.

Chronic leukemias occur almost exclusively in adults. **CML** is the most common type of leukemia in adulthood.

QUESTION 8

Describe multiple myeloma.

Myeloma is a type of cancer affecting the **B plasma cells**, a type of WBC responsible for the creation of antibodies.

These cancerous WBCs can accumulate in the bone marrow, forming solid tumors of cancer cells throughout the body.

(This is where the condition gets its name: **myelo** means "marrow," therefore "multiple marrow tumors")

Multiple myeloma is more common in men than women, and peaks at around the age of 60. It is fairly rare in younger adults.

It tends to be initially **asymptomatic**, but as the proportion of bone marrow affected increases, can cause similar symptoms to leukemia.

QUESTION 9

Contrast Hodgkin and non-Hodgkin lymphomas.

Lymphoma, like myeloma, is another type of white blood cell cancer. It specifically affects the **lymphocytes**, and thus tends to propagate through the **lymphatic system**.

Symptoms include **painless enlargement** of the lymph nodes, **fever**, and **fatigue**.

Lymphoma can be split into two categories: **Hodgkin** lymphoma, and **non-Hodgkin** lymphoma.

Non-Hodgkin lymphoma is **far more common**, making up about 85–90% of all cases. It also has a generally worse prognosis than the Hodgkin variety.

Hodgkin lymphoma can be differentiated from non-Hodgkin lymphoma by the presence of what are called **Reed–Sternberg cells**.

These cells are **abnormally large** B lymphocytes which have undergone extensive mutation, and **must** be observed for a diagnosis of Hodgkin lymphoma.

Hodgkin lymphoma is highly associated with infection by the **Epstein–Barr virus**, which causes roughly 50% of cases.

(Mnemonic tip: Reed–Sternberg, Epstein–Barr, and Hodgkin... all the names go together!)

QUESTION 10

Describe Burkitt lymphoma.

Burkitt lymphoma is a **relatively rare** form of lymphoma which is seen most commonly in **children** living in regions with a high rate of **malaria**.

Like Hodgkin lymphoma, it is also strongly associated with **EBV**.

With proper treatment, it can often be cured, but access to modern healthcare is frequently limited.

The characteristic symptom is **jaw swelling**, caused by tumor development in the jaw that is likely promoted by the rapid growth of a child's permanent teeth.

This can result in **severe disability** if the growth progresses untreated, and can even compromise the upper respiratory tract.

QUESTION 11

How do platelet alterations affect hemostasis?

Changes in platelet quantity or function can either **promote** or **impair** clotting, depending on the condition.

Hypocoagulation (e.g. due to **thrombocytopenia**) results in increased bleeding.

Hypercoagulation (e.g. due to **thrombocytosis**) can promote intravascular clotting and thromboembolism.

(It may be worthwhile to go back and review the unit on hemostasis.)

QUESTION 12

Describe disseminated intravascular coagulation (DIC.)

Disseminated intravascular coagulation (DIC) is an acute disorder that occurs when something triggers spontaneous formation of tiny blood clots throughout the body.

Although DIC is a disorder of **hypercoagulation**, it actually results in a **hypocoagulative** state as the supply of platelets and clotting factors is quickly exhausted.

Symptoms due to the clotting can include **chest pain**, **dyspnea**, and **pain** in the extremities.

DIC also results in **increased bleeding** once the body begins to run out of clotting factors.

Precipitating causes of DIC include **sepsis**, **cancer**, and certain kinds of **trauma**.