Blood & Lymphoreticular/Immune Systems

United States Medical Licensing Examination (USMLE) Step 1

9 to 13% of Step 1 · 8 sections · content outline and specifications

This system covers the immune system and the blood: immunodeficiencies, HIV, hypersensitivity, transplant immunology and immune drugs, then infections of blood and lymph nodes, anemias, white cell cancers, bleeding and clotting, transfusion and the spleen. It is one of the larger systems on Step 1. Most questions give a patient with a pattern of infections or a set of blood tests. You first name the disorder. Then you answer a question about its mechanism, the defective protein, a typical finding or how a drug works. Learn each disorder as a short chain: who gets it, what is broken, what you see, and what follows.

You should be able to: After this guide, you should be able to name an immune or blood disorder from a patient's infections or laboratory pattern and explain its mechanism, its typical finding and how the drugs that treat it work.

Every section: the key point and the trap

1 Antibody (B-cell) immunodeficiencies

Antibody defects cause repeated infections with encapsulated bacteria in the sinuses, ears and lungs, and Giardia in the gut.

Trap: Do not confuse low B cell number with low antibody. XLA has almost no B cells; CVID and hyper-IgM have normal B cell numbers that do not work. Look at the B cell count and at IgM before you choose.

2 T-cell, combined, complement and phagocyte defects

T-cell defects cause viral, fungal and Pneumocystis infections and failure to thrive. Live vaccines are dangerous for these patients.

Trap: Match the organism to the defect. Neisseria points to the terminal complement components. Catalase-positive organisms with granulomas point to NADPH oxidase. Swelling without hives points to C1 esterase inhibitor, not to an allergy.

3 HIV and AIDS

HIV gp120 binds CD4 and then a coreceptor, CCR5 or CXCR4; gp41 then fuses the viral and cell membranes.

Trap: Kaposi sarcoma and bacillary angiomatosis both cause purple skin lesions. Kaposi shows spindle cells and slit-like vessels (HHV-8). Bacillary angiomatosis shows neutrophils and bacteria (Bartonella).

4 Hypersensitivity, transplant rejection and immune drugs

Type I: IgE on mast cells is cross-linked by allergen; minutes; anaphylaxis, raised tryptase.

Trap: Timing decides the type. Minutes means type I or hyperacute rejection. One to three days means type IV. One to two weeks with low complement means type III. Do not call a Jarisch-Herxheimer reaction a penicillin allergy.

5 Infections of blood and lymphoid tissue, and the spleen

Malaria: Plasmodium falciparum causes severe disease by sticking infected cells to small vessels; P. vivax and P. ovale leave hypnozoites in the liver that cause relapse.

Trap: Ring forms do not always mean malaria. Without travel, with tick exposure and with tetrads, think Babesia. Relapse (hypnozoites) is not the same as resistance (early failure).

6 Anemias: production, hemolysis and hemoglobin disorders

Start with the MCV and the reticulocyte count: small cells suggest iron deficiency, thalassemia, anemia of chronic disease or sideroblastic anemia; a high reticulocyte count suggests hemolysis or blood loss.

Trap: Low serum iron does not always mean iron deficiency. Look at ferritin and TIBC. In iron deficiency, ferritin is low and TIBC is high; in anemia of chronic disease, ferritin is high and TIBC is low.

7 Leukemias, lymphomas, plasma cell disorders and other marrow disorders

Acute leukemias have many blasts and low normal cells. ALL: children, TdT-positive lymphoblasts. AML: older adults, myeloperoxidase-positive blasts with Auer rods; acute promyelocytic leukemia has t(15;17), causes DIC and responds to all-trans retinoic acid.

Trap: Learn the translocation with its disease and its gene, not just the numbers. t(14;18) is follicular lymphoma with BCL2 (cells do not die); t(8;14) is Burkitt with MYC (cells divide fast).

8 Bleeding, clotting, transfusion and the drugs that act on them

Platelet problems cause skin and mucosal bleeding (petechiae, nosebleeds, heavy periods). Factor problems cause deep bleeding into joints and muscles.

Trap: A long PTT does not always mean bleeding. Lupus anticoagulant prolongs the PTT in the test tube but causes clots in the body. And low platelets with new clots after heparin means HIT: stop all heparin.

Key terms

Opsonization: Coating a microbe with antibody or complement so phagocytes can eat it.

Class switching: The change by which a B cell moves from making IgM to making IgG, IgA or IgE.

Hapten: A small molecule that becomes an antigen only when it binds a larger protein.

Reticulocyte: A young red blood cell; a high count shows that the marrow is making more red cells.

Schistocyte: A fragment of a red cell broken in small vessels.

Hepcidin: A liver hormone that blocks iron release into the blood.

Monoclonal protein: One identical antibody, or part of one, made in excess by a single clone of plasma cells.

D-dimer: A breakdown product of cross-linked fibrin that rises when clots form and are broken down.

Myeloproliferative neoplasm: A marrow cancer that makes too many mature blood cells.

Immune reconstitution: The return of immune function, as when HIV treatment raises the CD4 count.

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