LUCENT NCLEX REVIEWS

Hematologic Disorders

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Structures and Components of the Hematologic System

- Bone marrow
- Liver
- Spleen
- Blood
- Red blood cells (erythrocytes)
- Platelets (thrombocytes)
- White Blood cells (leukocytes)
- Clotting factors
- Plasma

Physiologic Functions of the Hematologic System

- **Oxygenation**
  - Red blood cells transport oxygen from the lungs to the tissues and carbon dioxide from the tissues back to the lungs for excretion
  - Hemoglobin in red blood cells combines with oxygen and carbon dioxide to accomplish oxygenation
- **Hemostasis**
  - Control of bleeding
    - Blood vessel constricts; reduces bleeding
    - Platelets adhere to the injured blood vessel, forming an unstable platelet plug
    - Coagulation initiated, forming a stable fibrin matrix, (scab)

Age-Related Changes

- Bone marrow becomes less productive
- Hematologic function not affected unless a person is unusually stressed with trauma, a chronic illness, or treatment for cancer
- In conditions necessitating a higher production of blood cells, bone marrow usually responds to the increased demand, given time

Review of Systems

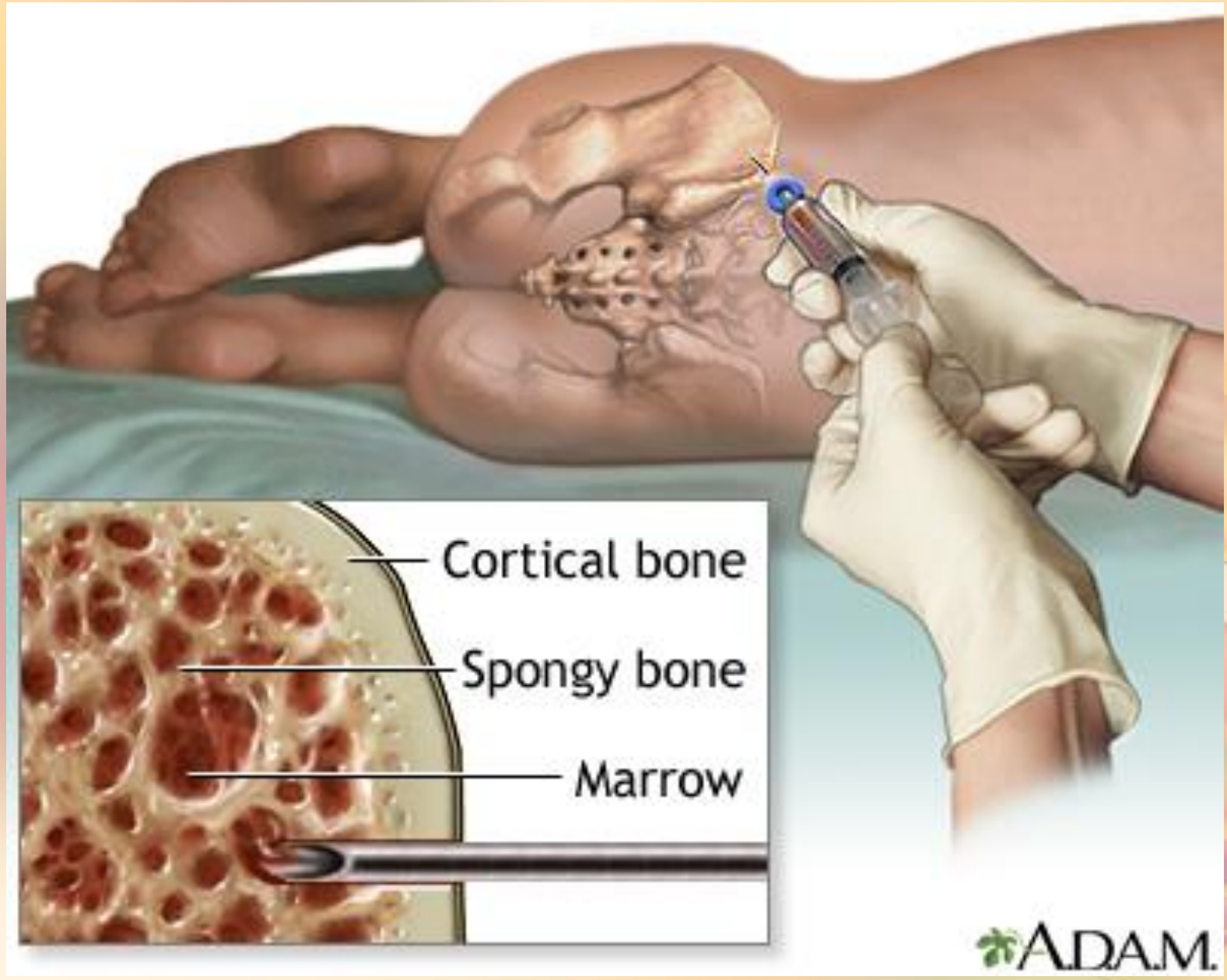
- Changes in skin color, skin dryness, pruritus (itching), and brittle fingernails or toenails
- Dizziness, vertigo, confusion, and pain
- Headaches; Changes in vision
- Epistaxis, hemoptysis, dyspnea, heart palpitations, or chest pain
- Changes in eating habits, including appetite or episodes of nausea or vomiting
- Bleeding or pain in the mouth, gums, or tongue
- Normal bowel function and recent changes
- Blood in the urine
- Unusually heavy menses
- Joint pain
- Fatigue or cold intolerance

Diagnostic Tests and Procedures

- Blood tests
  - Red blood cell count
  - Hemoglobin (Hb or Hgb)
  - Hematocrit (Hct)
  - Platelet counts
- Bone marrow biopsy

Bone Marrow Biopsy

- ***Before the procedure***
  - Make sure that written, informed consent has been obtained.
  - Explain the procedure to the client.
  - Determine the client's ability to lie still during aspiration.
  - Tell the client that he may experience a burning sensation as the bone marrow is aspirated.



Bone Marrow Biopsy

- ***During the procedure***
- Patient position may vary depending on the bone that is used. **Patient may be asked to lie on the side or the stomach if the pelvis bone is used**.
- During the procedure, you will need to lie as still as possible.
- ***After the procedure***
  - Have the patient lie on the left side for an hour
  - Maintain a pressure dressing at the aspiration site.
  - Monitor the aspiration site for bleeding and infection.
- Maintain bed rest as ordered

The ABO Blood Group System

- Group A – has only the A antigen on red cells (and B antibody in the plasma)
- Group B – has only the B antigen on red cells (and A antibody in the plasma)
- Group AB – has both A and B antigens on red cells (but neither A nor B antibody in the plasma)
- Group O – has neither A nor B antigens on red cells (but both A and B antibody are in the plasma)

DONOR & RECEPIENT

Blood Type	Antigens on rbcs	*Antibodies* in blood	Safe transfusions	
			To	From
A	A	*B'*	A , AB	A , O
B	B	*A'*	B , AB	B , O
AB	A , B	-	AB	A , B , AB , O
O	-	*A'* , *B'*	A , B , AB , O	O

- The Rh factor is a type of protein on the surface of red blood cells. Most people who have the Rh factor are Rh-positive.

  Those who do not have the Rh factor are Rh-negative.
- When the mother is Rh-negative and the father is Rh-positive, the fetus can inherit the Rh factor from the father. This makes the fetus Rh-positive too.
- Problems can arise when the fetus's blood has the Rh factor and the mother's blood does not.

RHOGAM

- An injection of Rh immunoglobulin (RhIg) (RhoGam), a blood product that can prevent sensitization of an Rh-negative mother
- Administered intramuscularly.
- A pregnant mother will be administered at least one dose of RhoGAM Ultra-Filtered PLUS between 26 and 28 weeks of pregnancy.
- If the baby is found to be Rh-positive at birth, the mother will receive an additional dose within 72 hours after delivery.

Blood Product Transfusion

- Typing for transfusions
  - ❑ Sample sent for typing and crossmatching
- Transfusions of packed red blood cells
  - Consent signed before any blood transfusion
  - Blood sample drawn; sent for type and crossmatch
  - Policies for administering blood products vary; be familiar with and follow your institution's policies
  - Autologous transfusion: using the patient's own blood
    - Patient donates blood several times before procedure
    - Blood is stored by the blood bank and reinfused into the patient if needed intraoperatively or postoperatively

Blood Product Transfusion

- Platelet transfusion
  - When platelet count falls <20,000 cells/mm^3
  - Patient must give signed consent
  - Sample sent to the blood bank for typing
  - Policies for administering blood products vary; be familiar with and follow your institution's policies

Blood Product Transfusion

- Fresh frozen plasma transfusions
  - Plasma separated from whole blood by centrifugation and quickly frozen
  - Contains all the clotting factors as well as the plasma proteins
  - Cryoprecipitate contains only fibrinogen and factor VIII; can be further separated out from plasma and administered alone

Blood Product Transfusion

- Reactions to blood transfusions
  - Four main types
    - Hemolytic
    - Anaphylactic
    - Febrile
    - Circulatory overload
  - Symptoms
    - Back or chest pain, fever, chills, decreased blood pressure, urticaria, wheezing, dyspnea, or coughing during the transfusion

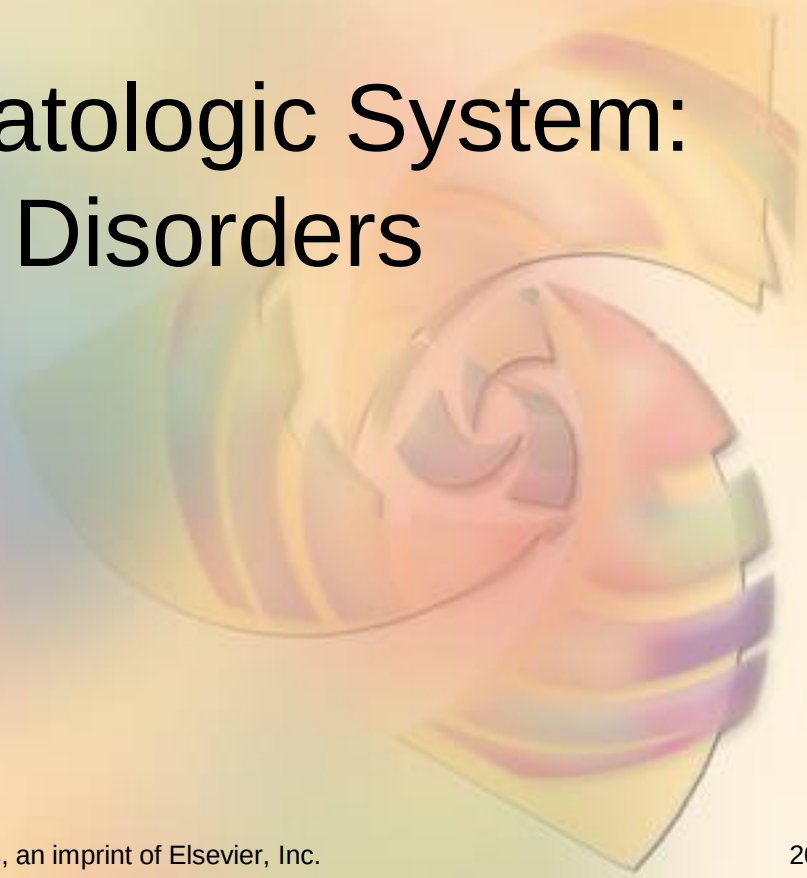
Blood Product Transfusion

- Reactions to blood transfusions
  - Interventions
    - Stop transfusion immediately; keep intravenous line open with normal saline
    - Immediately notify physician, nursing supervisor, blood bank
    - Be prepared to administer oxygen, epinephrine, Solu-Cortef, furosemide (Lasix), antipyretics as prescribed by physician
    - Save the unused portion of the blood bag for the blood bank
    - Be prepared to collect blood and urine samples from the patient for evaluation

Colony-Stimulating Factors

- Naturally occurring hormones that stimulate the bone marrow to produce more blood cells
  - Erythropoietin (Epogen)
    - Stimulates bone marrow to produce more red blood cells
    - Effects on the hematocrit not apparent for several days; not an option for patients immediately needing to elevate their red blood cell count

Disorders of the Hematologic System: Red Blood Cell Disorders



Polycythemia Vera

- Too many red blood cells are produced
- Increased cells make blood more viscous (thicker); doesn't circulate freely throughout body
- Symptoms: headache, dizziness, ringing in the ears, and blurred vision. Patients with this disorder may have a ruddy (reddish) complexion
- Treatment is to have a unit of blood phlebotomized, or taken off, to keep the hematocrit normal

Assessment findings

- Feeling of fullness in the head
- Headache
- Hemorrhage
- Hypertension
- Ruddy cyanosis of the nose
- Thrombosis of smaller vessels
- Visual disturbances (blurring, diplopia, engorged veins of fundus and retina)
- Weight loss
- Clubbing of the digits

Diagnostic Test

- Blood tests show increased RBC mass and normal arterial oxygen saturation in association with splenomegaly or two of the following: thrombocytosis, leukocytosis, elevated leukocyte alkaline phosphatase level, or elevated serum vitamin B12 or unbound B12 binding capacity.

Treatment

- Phlebotomy (typically, 350 to 500 ml of blood is removed every other day until the client's HCT is reduced to the low-normal range)
- Plasmapheresis
- Chemotherapy: busulfan (Myleran), chlor- ambucil (Leukeran), melphalan (Alkeran)
- Myelosuppressive drugs: hydroxyurea (Hydrea), radioactive phosphorus (32P)
- Antigout agent: allopurinol

Interventions

- During phlebotomy, assess for tachycardia, clamminess, or complaints of vertigo. *These signs and symptoms indicate hypovolemia.*
- After phlebotomy, administer 24 oz (720 ml) of juice or water *to replace fluid volume lost during the procedure.*
- Administer I.V. fluids and medications *to improve the client's condition.*
- Avoiding infection
- Keeping the environment free from hazards that could cause falls
- Using a safety razor to prevent bleeding

Aplastic Anemia

- Aplastic anemia, also known as *pancytopenia*, results from suppression, destruction, or aplasia of the bone marrow. This damage to the bone marrow causes an inability to produce adequate amounts of erythrocytes, leukocytes, and platelets.

Assessment findings

- Anorexia
- Dyspnea, tachypnea
- Epistaxis
- Fatigue, weakness
- Gingivitis
- Headache
- Melena
- Multiple infections, fever
- Palpitations, tachycardia
- Purpura, petechiae, ecchymosis, pallor

Diagnostic Test

- Bone marrow biopsy shows fatty marrow with reduction of stem cells.
- Fecal occult blood test is positive.
- Hematology shows decreased granulo- cytes, thrombocytes, and RBCs.
- Peripheral blood smear shows pancyto- penia.
- Urine chemistry reveals hematuria.

Treatment

- High-protein, high-calorie, high-vitamin diet
- Tepid sponge baths, cooling blankets
- Transfusion of platelets and packed RBCs
- Analgesics: ibuprofen (Motrin), acetamino-phen (Tylenol)
- Androgen: oxymetholone (Anadrol-50)
  Antibiotics: according to the sensitivity of the infecting organism
- Antithymocyte globulin
- epoetin alfa (Epogen)
- filgrastim (Neupogen)

Intervention

- Monitor for infection, bleeding, and bruising *caused by reduced levels of WBCs and platelets.*
- Encourage fluids and administer I.V. fluids
- *to replace fluids lost by fever and bleeding.*
- Administer oxygen *because low hemoglobin levels reduce the oxygen-carrying capacity of the blood.*
- Assist with turning, coughing, and deep breathing *to mobilize and remove secretions.*
- Administer transfusion therapy, as prescribed, *to replace low blood components.*

Intervention

- Provide a high-protein, high-calorie, high- vitamin diet *to promote red blood cell produc- tion and fight infection.*
- Encourage verbalization of concerns and fears *to allay the client's anxiety.*
- Alternate rest periods with activity *to con- serve energy and reduce weakness caused by anemia.*
- Provide cooling blankets and tepid sponge baths for fever *to promote comfort and reduce metabolic demands.*
- Avoid giving the client I.M. injections *to reduce the risk of hemorrhage.*

Autoimmune Hemolytic Anemia

- Bone marrow makes enough blood cells, but they are destroyed once released into circulation
- **Causes**: certain infections, drug reactions, and certain cancers
- Hemolytic anemia of the newborn can occur after delivery if the mother has Rh-negative blood and the baby has Rh-positive blood
- Transfusions can cause a hemolytic anemia if lymphocytes in the transfused blood make antibodies against the recipient

Autoimmune Hemolytic Anemia

- **Signs and symptoms:** pallor, extreme fatigue, tachycardia, shortness of breath, and hypotension
- Patients may appear jaundiced
- High bilirubin levels from all the red blood cells lysed (broken down)
- Patients have a positive Coombs' antiglobulin blood test
- **Medical treatment**: identifying and treating the cause
  - Blood transfusions may be needed to replace red blood cells
  - Corticosteroids may be administered to the patient
  - Patient usually recovers in a few days to weeks

Iron Deficiency Anemia

- From a diet too low in iron or from the body not absorbing enough iron from the gastrointestinal tract
- Iron deficiency anemia is a chronic, slowly progressing disease involving circulating RBCs. Iron deficiency results when an individual either absorbs inadequate amounts of iron or loses excessive amounts (such as through chronic bleeding). This decreased iron affects formation of hemoglobin and RBCs which, in turn, decreases the capacity of the blood to transport oxygen.

Causes

- Acute and chronic bleeding
- Alcohol abuse
- Certain drugs
- Gastrectomy
- Inadequate intake of iron-rich foods
- Malabsorption syndrome
- Menstruation
- Pregnancy
- Vitamin B6 deficiency

Assessment finding

- Dizziness
- Dyspnea
- Koilonychia (spoon-shaped nails)
- Pale, dry mucous membranes
- Pallor
- Palpitations
- Papillae atrophy of the tongue
- Sensitivity to cold
- Stomatitis
- Weakness and fatigue

Diagnostic Test

- Hematology shows decreased Hb, HCT, iron, ferritin, reticulocytes, red cell indices, transferrin, and saturation; absent hemosiderin; and increased iron-binding capacity.
- Peripheral blood smear reveals microcytic and hypochromic RBCs.

Treatment

- Diet: high in iron, roughage, and protein with increased fluids; avoidance of teas and coffee, which reduce absorption of iron
- Transfusion therapy with packed RBCs, if necessary
- Vitamins: pyridoxine (vitamin B6), ascorbic acid (vitamin C)
- Antianemics: ferrous sulfate (Feosol), iron dextran (DexFerrum)

Intervention

- Monitor intake and output *to detect fluid imbalances.*
- Assess cardiovascular and respiratory status *to detect decreased activity intolerance and dyspnea on exertion.*
- Iron is best absorbed when taken on an empty stomach, with water or fruit juice about 1 hour before or 2 hours after meals
- Provide mouth, skin, and foot care *because the tongue or lips may be dry or inflamed and nails may be brittle*

Intervention

- Monitor stool, urine, and emesis for occult blood *to identify the cause of anemia.*
- Administer oxygen, as necessary, *to treat hypoxemia caused by reduced hemoglobin.*
- Provide a diet high in iron *to replace iron stores in the body.*
- Administer iron injection deep into muscle using Z-track
- Encourage fluids *to avoid dehydration.*
- Provide rest periods *to avoid fatigue and reduce oxygen demands.*

Intervention

- Iron stains teeth, thus use with straw
- Milk, calcium and antacids should not be taken at the same time as iron supplements. You should wait at least 2 hours after having these foods before taking your iron supplements.
- Foods that you should not eat at the same time as you take your iron include:
  - High fiber foods, such as whole grains, raw vegetables, and bran
  - Foods or drinks with caffeine
- Monitor side effects of constipation: Give COLACE!

Megaloblastic Anemia
(Vitamin B12 & Folate Deficiency)

- Megaloblastic anemia is characterized by red blood cells that are larger than normal (megaloblast).

- There also aren't enough of them. It's known as vitamin B-12 or folate deficiency anemia, or macrocytic anemia, as well.

Megaloblastic Anemia

- Megaloblastic anemia occurs when your body produces red blood cells that are larger than normal and you have a low red blood cell count.
- Megaloblastic anemia is a type of anemia, a blood disorder in which the number of red blood cells is lower than normal.
- Red blood cells transport oxygen through the body. When your body doesn’t have enough red blood cells, your tissues and organs don’t get enough oxygen.

Causes

The two most common causes of megaloblastic anemia are:

A. deficiencies of vitamin B-12

or

B. folate.

These two nutrients are necessary for producing healthy red blood cells

Symptoms of Megaloblastic Anemia

- Fatigue (most common sign)
- shortness of breath
- muscle weakness
- abnormal paleness of the skin
- glossitis (swollen tongue)
- loss of appetite/weight loss
- diarrhea
- nausea
- fast heartbeat (tachy)
- Smooth (silvery) or tender tongue
- tingling in hands and feet
- numbness in extremities

Folate Deficiency

- Folate is another nutrient that's important for the development of healthy red blood cells.
- Folate is found in foods like beef liver, spinach, and Brussels sprouts. You can also find it in fortified (enriched) cereals (grain)
- Folate is often mixed up with folic acid — technically, folic acid is the artificial form of folate, found in supplements.

Folate Deficiency

- Your diet is an important factor in making sure you have enough folate.
- Folate deficiency can also be caused by chronic alcohol abuse, since alcohol interferes with the body's ability to absorb folic acid.
- Pregnant women are more likely to have folate deficiency, because of the high amounts of folate needed by the developing fetus.

Diagnostic Test

- CBC
- Rombergs
- Schilling Test

  The Schilling test is a blood test that evaluates your ability to absorb vitamin B-12. After you take a small supplement of radioactive vitamin B-12, you'll collect a urine sample for your doctor to analyze. **You will then take the same radioactive supplement in combination with the "intrinsic factor" protein that your body needs to be able to absorb vitamin B-12**. Then you'll provide another urine sample so it can be compared to the first one.

  It's a sign that you don't produce intrinsic factor of your own if the urine samples show that you only absorbed the B-12 after consuming it along with the intrinsic factor. This means that you're unable to absorb vitamin B-12 naturally.

Folate Deficiency - Treatment

- Megaloblastic anemia caused by a lack of folate may be treated with oral or intravenous folic acid supplements.
- Dietary changes also help boost folate levels. Foods to include in your diet include:
  - oranges
  - leafy green vegetables
  - peanuts
  - lentils
  - enriched grains

Vitamin B12 Deficiency

- Vitamin B-12 is a nutrient found in some foods like meat, fish, eggs, and milk. Some people can't absorb enough vitamin B-12 from their food, leading to megaloblastic anemia. *Megaloblastic anemia caused by vitamin B-12 deficiency is referred to as pernicious anemia.*
- Vitamin B-12 deficiency is most often caused by the lack of a protein in the stomach called "intrinsic factor." Without intrinsic factor, vitamin B-12 can't be absorbed, regardless of how much you eat. It's also possible to develop pernicious anemia because there isn't enough vitamin B-12 in your diet.

Causes

- Autoimmune disease
- Bacterial or parasitic infections
- Deficiency of intrinsic factor
- Gastric mucosal atrophy
- Lack of administration of vitamin B12 after small-bowel resection or total gastrectomy
- Malabsorption
- Prolonged iron deficiency

Assessment finding

- Constipation or diarrhea
- Dyspnea
- Glossitis, sore mouth
- Mild jaundice of sclera
- Pallor
- Paralysis, gait disturbances
- Tachycardia, palpitations
- Tingling and paresthesia of hands and feet
- Weakness, fatigue
- Weight loss, anorexia, dyspepsia

Diagnostic Test

- Blood chemistry tests reveal increased bilirubin and lactate dehydrogenase levels.
- Bone marrow aspiration shows increased megaloblasts, few maturing erythrocytes, and defective leukocyte maturation.
- Gastric analysis shows hypochlorhydria.
- Hematology shows decreased HCT and Hb.
- Peripheral blood smear reveals oval, macrocytic, hyperchromic erythrocytes.
- Romberg test is positive.
- Schilling test is positive.
- Upper GI series shows atrophy of gastric mucosa.

Treatment

- Foods that have vitamin B-12 in them include:
- eggs
- chicken
- fortified cereals (especially bran)
- red meats (especially beef)
- milk
- shellfish

Treatment

- Transfusion therapy with packed RBCs
- **Vitamins**: pyridoxine (vitamin B6), ascorbic acid (vitamin C), cyanocobalamin (vitamin B12), folic acid (vitamin A)
- **Antianemics**: ferrous sulfate (Feosol), iron dextran (DexFerrum)

Interventions

- Administer medications as prescribed. *Vitamin B_{12} injections are given monthly and are lifelong.*
- Encourage activity, as tolerated, *to avoid fatigue.*
- Advise the client to use soft toothbrushes
- *to avoid injuring mucous membranes.*
- Maintain a warm environment *to keep the client comfortable.*
- Provide foot and skin care *because sensation to feet may be reduced.*
- Monitor and record amount, consistency, and color of stools *to allow for early detection and treatment of diarrhea and constipation.*

Sickle Cell Anemia

- Genetic disease: almost exclusively in African Americans
- Carried on a recessive gene; a person must inherit the gene from both the mother and the father to actually have the disease
- Sickle cell crisis: the sickled cells become stuck in larger blood vessels of the body; obstruct blood flow and cause severe pain

Sickle Cell Anemia

- Disk-shaped red blood cells become sickle shaped
- Misshapen cells more fragile than normal red blood cells; as a result, the sickled cells easily rupture as they pass through small capillaries, resulting in a chronic anemia
- Cells become stuck in the small capillaries, obstructing blood flow

Sickle Cell Anemia

- Various stressors can trigger a sickle cell crisis
  - Dehydration, infection, overexertion, cold weather changes, excessive alcohol consumption, smoking
- Symptoms vary: depend on where circulation is blocked by the sickled red blood cells
  - Circulation to the chest, abdomen, bones, joints, bone marrow, brain, or penis may be compromised
  - Tissue hypoxia occurs, causing severe pain

Sickle Cell Anemia

- Medical diagnosis of sickle cell disease
  - Physicians use clinical judgment
  - Radiographs and scans of the painful area to evaluate for bleeding
- Medical treatment of sickle cell crisis
  - There is no cure; treatment is symptomatic
  - Intravenous fluids and pain medication
  - Red blood cell transfusions correct the anemia and help the body oxygenate tissues
  - Oxygen therapy
  - Hydroxyurea

Sickle Cell Anemia

- Assessment
  - Complete description of the pain
  - Document location, intensity, duration, and precipitating events; vital signs every 4 hours
  - Assess for fever
  - Any symptoms of an infection, such as sore throat, cough, abnormal breath sounds, dysuria, or diarrhea
  - Monitor for signs and symptoms of dehydration

Intervention

- Monitor vital signs *to identify complications.*
- Assess pain level and administer analgesics *to promote comfort.*
- Provide emotional support *to allay anxiety*.
- Refer for genetic counseling *to decrease anxiety and help understand the chances of passing the disease to offspring*.
- Give antibiotics as ordered *to treat infections and avoid precipitating a crisis.*
- Administer prescribed I.V. fluids *to ensure fluid balance and renal perfusion.*
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Intervention

- Apply warm compresses to painful areas. *Cold compresses and temperature can aggravate the condition.*
- Administer an analgesic-antipyretic, such as aspirin or acetaminophen, *for pain relief.*
- Maintain bed rest *to reduce workload on the heart and reduce pain.*
- Administer blood components (packed RBCs) as ordered *for aplastic crisis caused by bone marrow suppression.*
- Administer oxygen *to enhance oxygenation and reduce sickling.*

Thalasemia

- Defective production of globin portion of hemoglobin molecule.
- Globin chains structurally normal but have imbalance in production of two different types of chains.
- May be either homozygous defect or heterozygous defect.
- Two major types of thalassemia:
  - Alpha (a) - Caused by defect in rate of synthesis of alpha chains.
  - Beta (B) - Caused by defect in rate of synthesis in beta chains.
- Genetic counseling needed for more children

Thalassemia Signs & Symptoms

- Pallor, Loss of weight
- Hepatosplenomegaly
- Severe anemia, headache, gout
- Folic acid deficiency
- Osteoporosis and associated fractures, bone pain
- Heart murmurs
- Darkening of skin
- Epistaxis
- Hemosiderosis (excess iron in body tissues)
- Hemochromatosis (excess iron storage resulting in cell damage)

Thalassemia Treatment

- Monitoring ordered blood transfusion
- Monitoring for excess hemosiderosis and hepatitis
- Observing for signs and symptoms of infection
- Administering ordered folic acid
- Reinforce teaching to prevent fractures: no contact sports, slippery rugs, and so on
- Implementing iron chelation treatment with deferoxamine (Desferal)
- Supporting the patient and family during bone marrow transplantation

Audience Response Question

- A child with β-thalassemia is undergoing a blood transfusion. To prevent organ damage from the excessive amount of iron, chelation therapy is prescribed. Which of the following medications will be added to this therapy?

A. Dextromethorphan.
B. Desirudin.
C. Deferasirox.
D. Desipramine.

Disorders of the Hematologic System: Coagulation Disorders

Thrombocytopenia

- Too few platelets circulating in the blood
- Not enough platelets being made in bone marrow or too many platelets are being destroyed in circulation
- Major cause: treatment with chemotherapy or radiation therapy

Thrombocytopenia

- Both immune thrombocytopenia (ITP) and thrombotic thrombocytopenic purpura (TTP) are disorders that affect platelets.
- Acute ITP usually follows a viral infection, such as rubella or chicken pox. Chronic ITP is commonly liked to immunologic disorders and drug reactions.
- What is TTP?
- **CAUSES OF ITP**
- Autoimmune disorder

Assessment finding

- Echymoses
- Hemorrhage (rare)
- Mucosal bleeding from mouth, nose, or GI tract
- Petechiae
- Purpuric lesions on vital organs

Diagnostic Test

- Bleeding time is prolonged.
- Bone marrow study shows an increase in megakaryocytes and decreased circulating platelet survival time.
- Platelet antibodies may be found in vitro, but this doesn’t usually help make a diagnosis of ITP.
- Platelet count is less than 20,000 µl.

Treatment

- Blood transfusion of blood and blood components
- May resolve spontaneously
- Splenectomy (if unresponsive to high-dose steroids)
- Anti-RhD therapy (in clients with specific blood types)
- Glucocorticoids: prednisone, methylprednisone (Solu-Cortef)
- Immunoglobulin I.V.
- Vitamin K for coagulation defects (aquamephyton)

Intervention

- Monitor the client for petechiae, ecchymosis and other signs of bleeding to determine if he is bleeding
- Monitor platelet function and other coagulation values *to monitor progression or remission of disease.*
- Help the client avoid unnecessary trauma *to decrease the risk of bleeding.*
- Test stool for bleeding *because internal bleeding may not be visible. (melena)*

Intervention

- Avoid administering aspirin, ibuprofen, and warfarin (Coumadin) *because these drugs interfere with platelet function and blood clotting.*
- Avoiding trauma that could cause bleeding
- Using soft toothbrush, electric razor
- Avoiding aspirin and other medications before checking with physician
- Recognizing signs and symptoms of bleeding

Leukemia

- Leukemia is characterized by an uncontrolled proliferation of WBC precursors that fail to mature. Leukemia occurs when normal hemopoietic cells are replaced by leukemic cells in bone marrow. Immature forms of WBCs circulate in the blood, infiltrating the liver, spleen, and lymph nodes. Types of leukemia include:
  - acute lymphocytic
  - acute myelogenous
  - chronic lymphocytic
  - chronic myelocytic.
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Assessment findings

- Enlarged lymph nodes, spleen, and liver
- Epistaxis
- Fever
- Frequent infections
- Hematemesis
- Hypotension
- Melena
- Night sweats
- Petechiae and ecchymoses
- Weakness and fatigue

Diagnostic Test

- Bone marrow biopsy reveals a large number of immature leukocytes (neutrophils)
- Hematology shows decreased HCT, Hb, RBCs, and platelets and increased ESR, immature WBCs, and prolonged bleeding time.

Treatment

- High-protein, high-vitamin, high-mineral diet, involving soft, bland foods in small, fre- quent feedings
- Stem cell transplant
- Transfusion of platelets, packed RBCs, and whole blood
- Alkylating agents: busulfan (Myleran), chlorambucil (Leukeran)
- Antibiotic: doxorubicin
- Antimetabolites: 5 FU fluorouracil, methotrexate (Trexall)
- Antineoplastics: cisplastine, vinblastine, vincristine
- Hematopoietic growth factor: epoetin alfa (Epogen)

Intervention

- Monitor laboratory studies *to help establish blood replacement needs, assess fluid status, and detect possible infection.*
- Monitor for bleeding*. Regular assessment may help anticipate or alleviate problems.*
- Place the client with epistaxis in an upright position leaning slightly forward *to reduce vascular pressure and prevent aspiration.*
- Monitor for infection. *Damage to bone marrow may suppress WBC formation.* Promptly report temperature over 101° F (38.3° C) and decreased WBC counts so that antibiotic therapy may be initiated.

Disseminated Intravascular Coagulation

- DIC, also called *consumption coagulopathy* and *defibrination syndrome,* occurs as a complication of diseases and conditions that accelerate clotting. This accelerated clotting process causes small blood vessel occlusion, organ necrosis, depletion of circulating clotting factors and platelets, and activation of the fibrinolytic system—which, in turn, can provoke severe hemorrhage

Disseminated Intravascular Coagulation

- Clotting in the microcirculation usually affects the kidneys and extremities but may occur in the brain, lungs, pituitary and adrenal glands, and GI mucosa. Other conditions, such as vitamin K deficiency, hepatic disease, and anticoagulant therapy, may cause a similar hemorrhage

Disseminated Intravascular Coagulation

- Always secondary to another pathologic process: overwhelming sepsis, shock, major trauma, crush injuries, burns, cancer, acute tumor lysis syndrome, or obstetric complications (abruptio placentae, fetal demise)
- Coagulation occurs at so many sites that eventually all available platelets and clotting factors are depleted and uncontrolled hemorrhage results

Disseminated Intravascular Coagulation

- Blood tests that help diagnose DIC include prothrombin time, partial thromboplastin time, fibrinogen, thrombin time, fibrin split products level, and D-dimers
- Blood component replacement therapy
- Heparin to interrupt the DIC cycle and allow the body to replenish platelets and clotting factors

Assessment finding

- Abnormal bleeding without an accompanying history of a serious hemorrhagic disorder (petechiae, hematomas, ecchymosis, cutaneous oozing)
- Coma
- Dyspnea
- Nausea
- Oliguria
- Seizures
- Severe muscle, back, and abdominal pain
- Shock
- Vomiting

Interventions

- Administer blood products as ordered. Monitor for transfusion reactions and signs of fluid overload *to prepare for possible complications*.
- Monitor the results of serial blood studies (particularly HCT, Hb, and coagulation studies) *to guide the treatment plan*.
- Enforce complete bed rest during bleeding episodes. If the client is agitated, pad the side rails *to protect him from injury.*
- Check all I.V. and venipuncture sites fre- quently for bleeding. Apply pressure to injec- tion sites for at least 10 minutes. Alert other personnel to the client's tendency to hemor- rhage. *These measures prevent hemorrhage.*

Hemophilia

- Genetic disease: affected person lacks some blood clotting factors normally found in plasma
- Signs and symptoms
  - Uncontrollable bleeding is the hallmark of hemophilia
    - **Occurs after trauma; however, also spontaneously for no clear reason**
    - **Commonly, bleeding occurs into the joints, causing swelling and severe pain**
    - **Also can occur into the skin; from the mouth, gums, and lips; and from the gastrointestinal tract**

Hemophilia

- **Medical diagnosis**
  - Measuring factors VIII and IX in the blood
  - Partial thromboplastin time
- **Medical treatment**
  - No cure; treatment is symptomatic
  - Physician prescribes transfusions of fresh frozen plasma or cryoprecipitate, or both
  - Red blood cell transfusions
  - Intravenous morphine
  - Physicians try quickly to transition from IV opioids to oral opioids to nonopioid pain relievers as crisis resolves

Hemophilia

- **Assessment**
  - For bleeding and pain; note what measures have stopped the bleeding and relieved pain in the past
  - Monitor vital signs and urine output
- **Interventions**
  - Risk for Injury
  - Acute Pain
  - Ineffective Therapeutic Regimen Management

Other Disorders

Multiple Myeloma

- Multiple myeloma is the abnormal proliferation of plasma cells. These plasma cells are immature and malignant and invade the bone marrow, lymph nodes, liver, spleen, and kidneys, triggering osteoblastic activity and leading to bone destruction throughout the body.
  - **CAUSES**
    - **Environmental**
    - **Genetic**
    - **Unknown**

Assessment findings

- Anemia, thrombocytopenia, hemorrhage
- Constant, severe bone pain
- Headaches
- Hepatomegaly
- Multiple infections
- Pathologic fractures, skeletal deformities of sternum and ribs, loss of height
- Renal calculi
- Splenomegaly
- Vascular insufficiency

Diagnostic Test

- Bence Jones protein assay is positive.
- Blood chemistry tests show increased calcium, uric acid, BUN, and creatinine.
- Bone marrow biopsy shows increased number of immature plasma cells.
- X-rays show diffuse, round, punched-out bone lesions; osteoporosis; osteolytic lesions of the skull; and widespread demineralization
- Hematology shows decreased HCT, WBCs, and platelets and increased ESR.

Treatment

- Allogenic bone marrow transplantation
- High-protein, high-carbohydrate, high-vitamin, and high-mineral diet in small, frequent feedings
- Orthopedic devices: braces, splints, casts
- Peritoneal dialysis and hemodialysis
- Radiation therapy
- Transfusion therapy: packed RBCs
- Alkylating agents: melphalan (Alkeran), cyclophosphamide (Cytoxan)

Treatment

- Analgesic: morphine
- Androgen: fluoxymesterone
- Antacids: magnesium hydroxide and aluminum hydroxide (Maalox), aluminum hydroxide
- Antibiotic: doxorubicin
- Antiemetic: prochlorperazine (Compazine)
- Antigout agent: allopurinol
- Antineoplastics: vinblastine, vincristine
- Diuretic: furosemide (Lasix)
- Glucocorticoid: prednisone

Intervention

- Assess cardiovascular and respiratory status *to detect signs of compromise.*
- Assess pain level *to determine client's response to analgesics.*
- Monitor for infection and bruising *to detect complications.*
- Provide an adequate diet *to ensure nutri- tional requirements are met.*
- Encourage oral fluids and administer I.V. fluids *to prevent dehydration and dilute calcium.*

Intervention

- Assess renal status *to detect renal stones and renal failure secondary to hypercalcemia.*
- Monitor and record vital signs *to allow for early detection of complications.*
- Monitor intake and output, urine specific gravity, and daily weight *to identify fluid volume excess or deficit.*
- Provide rest periods between activities *to prevent fatigue.*
- Institute fall prevention measures *because the client is vulnerable to fractures.*
- Apply and maintain braces, splints, and casts *to prevent injury and reduce pain.*

Acquired Immunodeficiency Syndrome

- AIDS is a defect in T-cell–mediated immunity caused by HIV. AIDS places a client at significant risk for the development of potentially fatal opportunistic infections.
- A diagnosis of AIDS is based on laboratory evidence of HIV infection coexisting with one or more indicator diseases, such as herpes simplex virus, cytomegalovirus, mycobacteria, candidal infection, *Pneumocystis* pneumonia, Kaposi's sarcoma, wasting syndrome, or dementia.

Causes

- Exposure to blood containing HIV: trans-fusions, contaminated needles, handling of blood, in utero
- Exposure to semen and vaginal secretions containing HIV: sexual intercourse, handling of semen and vaginal secretions
- Ingestion of breast milk from an infected mother.

Assessment finding

- Anorexia, weight loss, recurrent diarrhea
- Cough
- Disorientation, confusion, dementia
- Fatigue and weakness
- Fever
- Lymphadenopathy
- Malnutrition
- Night sweats
- Opportunistic infections
- Pain
- Shortness of breath
- Skin lesions

Diagnostic Test

- Blood chemistry shows increased trans-aminase, alkaline phosphatase, and gamma globulin levels and a decreased albumin level.
- CD4+ T-cell count is less than 200 cells/µl.
- ELISA shows positive HIV antibody titer.
- Hematology shows decreased WBCs, RBCs, and platelets.
- Western blot is positive.

Treatment

- Activity: as tolerated, active and passive range-of-motion exercises
- High-calorie, high-protein diet in small, frequent feedings
- Nutritional support: total parenteral nutrition (TPN), enteral feedings if necessary
- Plasmapheresis
- Respiratory treatments: chest physiotherapy, postural drainage, and incentive spirometry
- Specialized bed: air therapy bed
- Standard precautions

Treatment

- Transfusion therapy: fresh frozen plasma, platelets, and packed RBCs
- Antibiotic: co-trimoxazole (Bactrim)
- Antiemetic: prochlorperazine
- Antifungals: fluconazole (Diflucan), amphotericin B (Fungizone)
- Antivirals: dapsone, didanosine (Videx), ganciclovir, zidovudine (Retrovir, AZT), acyclovir (Zovirax), pentamidine (Pentam 300), aerosolized pentamidine (NebuPent)
- Interferon alfa-2a, recombinant

Treatment

- Fusion inhibitor: enfuvirtide (Fuzeon)
- *Combination therapy*
- Nonnucleoside reverse transcriptase inhib- itors: delavirdine (Rescriptor), nevirapine (Viramune)
- Nucleoside reverse transcriptase inhibi- tors: abacavir (Epzicon), lamivudine (Epivir), zidovudine (Retrovir, AZT)
- Protease inhibitors: indinavir (Crixivan), nelfinavir (Viracept), ritonavir (Norvir), saquinavir (Invirase)

End