Hematologic Disorders
Anemias

Dr. Ahmad Aqel
The University of Jordan
Hematologic System

- Blood: Plasma: 55%, Blood cells: 45% (RBCs, WBCs, Platelets).
- Hematopoiesis: is the process of creating new blood cells.
- All blood cells start off as hematopoietic stem cells, and then specialize (differentiate) into:
  - myeloid cells (erythrocytes, megakaryocytes, monocytes, neutrophils, basophils, eosinophils) or
  - lymphoid cells (T-lymphocytes and B-lymphocytes).

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Dr. Ahmad Aqel
Stem Cells

Multipotential Lymphocytic cells

Multipotential Hematopoietic cells

Common myeloid progenitor

- Erythrocyte
- Mast cell
- Myeloblast

Common lymphoid progenitor

- Natural killer cell (Large granular lymphocyte)
- Small lymphocyte
- T lymphocyte
- B lymphocyte
- Plasma cell

Red cells

Platelets

Neutrophils

Monocytes

Basophils

Eosinophils

Megakaryocyte

Thrombocytes

Macrophage
Blood Cells

**Leukocyte: WBC**

**Erythrocyte: RBC**

**Neutrophil:** First responders at the site of infection & Releases toxins that kill bacteria and fungi (Phagocytosis) & Recruits other immune cells to site of infection

**Eosinophil:** releases toxins that kill bacteria and parasites

**Basophil:** defense against parasites & Releases histamines (allergic reactions

**Monocyte:** differentiate into macrophages in response to inflammation

**Thrombocyte:** platelet

**Lymphocyte:** T and B lymphocyte
Anemias

• Normal hemoglobin: Male 13–18 gm/Dl; Females 12–16 gm/dL

CLASSIFICATION OF ANEMIA

1. **Defect in the production** of RBCs (hypoproliferative anemia)
   - Due to iron, vitamin B12, or folate deficiency, decreased erythropoietin production, cancer, chemotherapy

2. **Destruction of RBCs** (hemolytic anemia)
   - Due to altered erythropoiesis, or other causes such as hypersplenism, drug-induced or autoimmune processes, mechanical heart valves

3. **Loss of RBCs** (bleeding).
Anemia

Morphology Based on

- Mean corpuscular volume (MCV): the average volume of red cells in a specimen.
- MCH: amount of hemoglobin in an average red blood cell.

- Low MCV indicates Microcytic (small average RBC size),
- Normal MCV indicates Normocytic (normal average RBC size)
- High MCV indicates Macrocytic (large average RBC size).

• Size: Macrocytic, microcytic, & normocytic, Identified by terms that end in “-cytic”

• Hemoglobin content: Normochromic & hypochromic, Identified by terms that end in “-chromic”
Etiologic classification of anemia

Iron Def. anemia
- (most common) measured by serum ferritin & Hb.
- Microcytic, normochromic
- Iron supplement therapy (gastric distress, constipation)

Anemia in renal disease and other chronic disease
- low erythropoietin & hemodialysis
- Normochromic, normocytic.
- Hemodialysis causes folic acid def.
- RX: Epeotin Alfa.
Etiologic classification of anemia

Defective DNA synthesis:
- Megaloblastic Anemia
- Vitamin B (Cobalamin) & Folic acid deficiency
- Macrocycitic, Normochromic

Decreased number of erythrocytes
- Aplastic anemia (BM stem damage), leukemia.
- Reduced Hematopoiesis + neutropenia+ thrombocytopenia
- Normocytic, Normochromic
Etiologic classification of anemia

Blood loss:

- **acute:** trauma, blood vessels rupture
- **chronic:** gastritis, menstrual flow, hemorrhoids
  
  * **Normocytic, Normochromic**

Increased RBC’s destruction

- **Intrinsic:** sickle cell, G6PD deficiency
- **Extrinsic:** physical trauma (artificial heart valves, dialysis, CABG), infections, medications, toxins.
  
  * **Normocytic, Normochromic**
Hemolytic anemia

• Due to hemolysis (destruction of RBCs)

  Classification:
  • Inherited (Sickle Cell Anemia, Thalassemia) or
  • Acquired (Autoimmune Hemolytic Anemia).

  Symptoms: Fatigue and SOB, the breakdown of red cells leads to jaundice
Manifestations of Anemia

- Weakness, fatigue, and general malaise
- Pallor of the skin and mucous membranes
- Cardiac & respiratory symptoms
- Nail changes: brittle & concave. (in IDA)
  - Jaundice in both megaloblastic anemia or hemolytic anemia.
  - The tongue may be smooth and red (in iron deficiency anemia) or Beefy red and sore (in megaloblastic anemia)
  - the corners of the mouth may be ulcerated (angular cheilosis) in both types of anemia
Angular cheilosis

Pica
Assessment of anemia

• Clinical manifestations

• Medication history (some medications can depress bone marrow, induce hemolysis, or interfere with folate metabolism).

• History of alcohol intake (amount and duration)

• Family history (certain anemias are inherited).
Assessment of anemia

Nutritional assessment:

- Ask if deficiencies in nutrients such as iron, vitamin $B_{12}$, folate.
  - vegetarians are at risk for megaloblastic anemias, if they do not supplement their diet with vitamin $B_{12}$.
  - Older adults may have a diminished intake of vitamin $B_{12}$ or folate.
Assessment of anemia

Assess Cardiac status:

- When the hemoglobin level is low, the heart compensate result in symptoms as tachycardia, palpitations, dyspnea, dizziness, orthopnea, and exertional dyspnea.

- Heart failure may develop, as evidenced by an enlarged heart (cardiomegaly) and liver (hepatomegaly) and by peripheral edema.

- Patients with anemia should be assessed for signs and symptoms of heart failure, including ascites and peripheral edema.
Assessment of anemia

Assessment of the GI system

- Nausea, vomiting (coffee grounds), melena (dark stools), diarrhea, anorexia, and glossitis (inflammation of the tongue).
- Stools should be tested for occult blood
- Women menstrual periods (excessive menstrual flow, other vaginal bleeding) and the use of iron supplements during pregnancy.
Assessment of anemia

Neurologic examination

• Pernicious anemia affects the central and peripheral nervous systems. Assessment should include:
  • the presence of peripheral numbness and paresthesias,
  • ataxia, poor coordination, and confusion.
  • Delirium may result from other types of anemia, particularly in older adults.

❖ Monitor relevant laboratory test results and to note any changes over time
DIAGNOSTIC TESTS

1. Hemoglobin, hematocrit, reticulocyte count, and the mean corpuscular volume [MCV] and RBC distribution width [RDW]).

   • Reticulocytes 0.5%–1.5% of red cells Number fraction:
     • Increased with infection, blood loss, polycythemia
     • Decreased with acute leukemia, late stage of severe anemias

   • Mean corpuscular volume متوسط حجم الخلايا الحمراء (Increased in macrocytic anemias; decreased (MCV) in microcytic anemia)

   • RBC distribution width (RDW) التباين في حجم الخلايا الحمراء May increase in iron or B12 and folate deficiency (megaloplastic)
DIAGNOSTIC TESTS

2. Serum iron level, total iron-binding capacity, and ferritin

3. B12 and folate levels; and erythropoietin level.

4. Bone marrow aspiration
Nursing Diagnoses

- **Fatigue** related to decreased hemoglobin and diminished oxygen-carrying capacity of the blood
- **Imbalanced nutrition**, less than body requirements, related to inadequate intake of essential nutrients
- **Ineffective tissue perfusion** related to inadequate hemoglobin and hematocrit
- **Noncompliance** with prescribed therapy
Anemia /Potential Complications

- Heart failure
- Angina
- Paresthesias
- Confusion
- Injury related to falls
- Depressed mood
Nursing Interventions

Managing Fatigue

• The most common symptom and complication of anemia is fatigue.

• Prioritize activities and establish a balance between activity and rest

• Maintain some physical activity and exercise

• Assess for conditions that exacerbate fatigue, such as pain, depression, and sleep disturbance.
Nursing Interventions

Maintaining Adequate Nutrition

• Encourage a healthy diet.

• No or decrease alcohol intake (interferes with the utilization of essential nutrients)

• Dietary education sessions should be individualized, involve family members, and include cultural aspects related to food preferences and food preparation.

• Dietary supplements (e.g., vitamins, iron, folate, protein) may be prescribed.
Nursing Interventions

• Teach patient & family that excessive intake of nutritional supplements will not improve the anemia.
  • chronic blood transfusion are at risk for iron overload from their transfusions
  • So, the addition of an iron supplement only exacerbates the situation.
Nursing Interventions

Maintaining Adequate Perfusion

• Blood transfusions or intravenous (IV) fluids
• Supplemental oxygen may be necessary,
• Monitors vital signs and pulse oximeter
• Other medications, such as antihypertensive agents, may need to be adjusted or withheld.
Nursing Interventions

Promoting Compliance With Prescribed Therapy

• Teach patients about the purpose of medication, dose & frequency, and how to manage side effects.

• To enhance compliance,
  • assists the patient to develop ways to incorporate the therapeutic plan into everyday activities rather than merely giving the patient a list of instructions.
  • iron supplements may cause GI effects and pts stop taking the iron.
Nursing Interventions

• Abruptly stopping some medications can have serious consequences, as in the case of high-dose corticosteroids to manage hemolytic anemias.
Nursing Interventions

Monitoring and Managing Potential Complications

• Assess for s&s of heart failure

• A neurologic assessment for megaloblastic anemia.
  • Patients may complain of paresthesia in lower extremities (numbness and tingling on the bottom of the foot, and they gradually progress.
Iron Deficiency Anemia

<table>
<thead>
<tr>
<th>Causes:</th>
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<tbody>
<tr>
<td>▪ Inadequate intake of dietary iron</td>
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<tr>
<td>▪ Blood loss (e.g., from intestinal hookworm).</td>
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<tr>
<td>▪ Bleeding from ulcers, gastritis, IBD</td>
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<td>▪ Premenopausal women: Menorrhagia (excessive menstrual bleeding) and pregnancy</td>
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<tr>
<td>▪ Chronic alcoholism</td>
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<tr>
<td>▪ Iron malabsorption</td>
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</table>

<table>
<thead>
<tr>
<th>Clinical Manifestations</th>
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<tbody>
<tr>
<td>▪ Smooth, sore tongue;</td>
<td></td>
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<tr>
<td>▪ brittle nails; and angular cheilosis.</td>
<td></td>
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<tr>
<td>▪ ?history of multiple pregnancies, GI bleeding, and pica.</td>
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</tbody>
</table>
# Iron Deficiency Anemia

## Assessment and Diagnostic Findings
- Bone marrow aspiration to detect iron level (law or absent).
- Low serum ferritin & serum iron levels
- Low hemoglobin & Hematocrit and RBC level
- Low MCV level (the size of the erythrocytes),
- Elevated TIBC (which measures the transport protein supplying the marrow with iron)

## Medical Management
- Identify the cause of iron deficiency
- Stool tested for occult blood.
- Colonoscopy, endoscopy, or x-ray examination of the GI tract to detect ulcerations, gastritis, polyps, or cancer
## Parenteral Iron Formulations

<table>
<thead>
<tr>
<th>Ferric gluconate</th>
<th>125 mg is diluted in 100 mL N/S OVER 1 hour</th>
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<tbody>
<tr>
<td>Iron sucrose (Venofer):</td>
<td>100–200 mg a slow IV push injection over 2–5 minutes. Repeated every 3 days over 2 weeks</td>
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</table>

- **Oral iron preparations:**
  - ferrous sulfate, ferrous gluconate, and ferrous fumarate
  - To re-store iron: continue taking the iron for 6 to 12 months.
IDA / Nursing Management

**Food rich in iron**
- beef, liver, beans; leafy green vegetables, raisins, molasses.
- لحوم البقر أو الكبد والفاصوليا والخضراوات الورقية والزبيب والدبس.

Fad diets or strict vegetarian diets contain inadequate amounts of absorbable iron.

**Oral Iron side effects:** (constipation, cramping, nausea, vomiting).

Take iron on an empty stomach with orange juice to enhance absorption.

- Stools will become dark in color.
- To prevent staining the teeth with a liquid preparation, use a straw.
- Antacids or dairy products should not be taken with iron (diminish absorption).
**Thalassemia**

A group of hereditary anemias characterized by:
- **Hypochromia** (decrease in the hemoglobin content of erythrocytes)
- Extreme **microcytosis** (small erythrocytes)
- Destruction of blood elements (hemolysis)
- Anemia

- Defective synthesis of hemoglobin; reduced production of globulin chain
- Imbalance in the configuration of the hemoglobin causes it to precipitate in the erythrocytes
- Increases the rigidity of the erythrocytes and thus the premature destruction of these cells.
Hemoglobin Structure

- Four subunits
  - two $\alpha$
  - two $\beta$
- Iron
- Heme
- Binds 4 $O_2$
Thalassemia

- Thalassemias are classified into two major groups according to which hemoglobin chain is diminished: alpha or beta.

<table>
<thead>
<tr>
<th>The alpha-thalassemia</th>
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<tbody>
<tr>
<td>Milder than the beta forms</td>
</tr>
<tr>
<td>Often occur without symptoms;</td>
</tr>
<tr>
<td>Erythrocytes are extremely microcytic</td>
</tr>
<tr>
<td>Mild anemia if present</td>
</tr>
</tbody>
</table>
Thalassemia

• The severity of Beta-thalassemia varies depending on:
  • The extent to which the hemoglobin chains are affected.
  • Severe beta-thalassemia (i.e., thalassemia major or Cooley’s anemia) can be fatal within the first few years of life.
  • The disease is usually treated with transfusion of PRBCs.
  • Patient education during the reproductive years should include preconception counseling about the risk of thalassemia major in offspring.
Thalassemia

- Thalassemia major is characterized by
  - severe anemia, marked hemolysis, ineffective erythropoiesis.
  - Organ dysfunction due to iron overload results from the excessive amounts of iron in multiple PRBC transfusions.
    - Regular chelation therapy can reduce the complications of iron overload
  - This disease is potentially curable by Hematopoietic stem cell transplantation (HSCT) if the procedure can be performed before significant liver damage occurs (i.e., during childhood)
  - Death is often due to heart failure.
Anemias in Renal Disease

• In ESRD do not become significantly anemic until the serum creatinine level exceeds 3 mg/100 mL.

• Caused by both a mild shortening of erythrocyte lifespan and a deficiency of erythropoietin (necessary for erythropoiesis).

• Hemodialysis may become iron deficient.
  • Folic acid deficiency develops because this vitamin passes into the dialysate.

• Erythropoietin (epoetin alfa), limiting their use to raise the hemoglobin to a level not greater than 12 g/Dl.
Aplastic Anemia

• Caused by a decrease in or damage to marrow stem cells.
• Anemia, neutropenia and thrombocytopenia occur.
• Can be congenital or acquired, but most cases are idiopathic (i.e., without apparent cause)
• Infections and pregnancy can trigger it, or it may be caused by certain medications, chemicals, or radiation damage.
• Agents that may produce marrow aplasia include benzene and benzene derivatives (e.g., paint remover, dry-cleaning solutions).
Aplastic Anemia

Clinical Manifestations

- Typical complications are infection and the symptoms of anemia (e.g., fatigue, pallor, dyspnea).
- Purpura (bruising) may develop later.
- If the patient has had repeated throat infections, cervical lymphadenopathy may be seen.
- Other lymphadenopathies and splenomegaly sometimes occur.
- Retinal hemorrhages are common.
Aplastic Anemia

Assessment and Diagnostic Findings

• Aplastic anemia occurs when a medication or chemical is ingested in toxic amounts.

• A bone marrow aspirate shows an extremely hypoplastic or even aplastic (very few to no cells) marrow replaced with fat.
Aplastic Anemia

Nursing Management

• Assess for signs of infection and bleeding.

• Monitor for hypersensitivity reaction while administering antithymocyte globulin.

• For long-term cyclosporine therapy, monitor for renal or liver dysfunction, hypertension, pruritus, visual impairment, tremor, and skin cancer.

• Do not abruptly stop immunosuppressive therapy.
Megaloblastic Anemias

- Caused by deficiencies of vitamin B$_{12}$ or folic acid
- The erythrocytes are abnormally large and called *megaloblastic red cells*. Leukocytes, platelets are also abnormal.
- **Pancytopenia** (a decrease in all myeloid stem cell) can develop.
  - The hemoglobin value may be as low as 4 to 5 g/dL,
  - The leukocyte count 2,000 to 3,000/mm$^3$
  - The platelet count less than 50,000/mm$^3$
- The erythrocytes are abnormally shaped, and the shapes may vary widely (**poikilocytosis**).
Megaloblastic Anemias

Clinical Manifestations

• Smooth, sore, red tongue and mild diarrhea.

• Pale, confusion; paresthesias in the extremities (particularly numbness and tingling in the feet and lower legs).

• Difficulty maintaining their balance because of damage to the spinal cord, and lose position sense (proprioception).

• Without treatment, patients can die after several years, usually from heart failure secondary to anemia.
Megaloblastic Anemias

Assessment and Diagnostic Findings

• Schilling test
  • the patient receives a small oral dose of radioactive vitamin B\(_{12}\), followed in a few hours by a large, nonradioactive parenteral dose of vitamin B\(_{12}\) (this aids in renal excretion of the radioactive dose).
  • If the oral vitamin is absorbed, more than 8% is excreted in the urine within 24 hours;
  • if no radioactivity is present in the urine (i.e., the radioactive vitamin B\(_{12}\) stays within the GI tract), the cause is GI malabsorption of the vitamin B\(_{12}\).
Megaloblastic Anemias

Nursing Management

- Inspection of the skin, mucous membranes, and tongue.
- Mild jaundice (best seen in the sclera)
- Vitiligo (patchy loss of skin pigmentation) and premature graying of the hair (seen pernicious anemia).
- Neurologic assessment: tests of position, vibration sense, and cognitive function.
Megaloblastic Anemias

- Assess the patient’s gait and stability, (need for assistive devices e.g., canes, walkers)

- Physical and occupational therapy referrals may be needed.

- If sensation is altered, the patient needs to be instructed to avoid excessive heat and cold.

- Eat small amounts of bland, soft foods frequently.
Megaloblastic Anemias

Medical Management

• Folate deficiency is treated by increasing the amount of folic acid in the diet and administering 1 mg of folic acid daily.

• Pernicious anemia (Vitamin $B_{12}$ deficiency) is treated by vitamin $B_{12}$ replacement.

• When the deficiency is due to absence of intrinsic factor, replacement is by monthly intramuscular injections of vitamin $B_{12}$. 
Hemolytic anemia

- Sickle cell anemia
- Thalassemia
- Glucose-6-phosphate dehydrogenase deficiency
- Immune hemolytic anemia
- Hereditary hemochromatosis
# Hemolytic (Resulting From RBC Destruction)

<table>
<thead>
<tr>
<th>Condition</th>
<th>Effect on MCV</th>
<th>Other Observations</th>
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<tbody>
<tr>
<td>Altered erythropoiesis (sickle cell anemia, thalassemia, other hemoglobinopathies)</td>
<td>↓ MCV</td>
<td>↑ Reticulocytes Fragmented RBCs (various shapes)</td>
</tr>
<tr>
<td>Hypersplenism (hemolysis)</td>
<td>↑ MCV</td>
<td></td>
</tr>
<tr>
<td>Drug-induced anemia</td>
<td>↑</td>
<td>Presence of spherocytes</td>
</tr>
<tr>
<td>Autoimmune anemia</td>
<td>↑</td>
<td>Presence of spherocytes</td>
</tr>
<tr>
<td>Mechanical heart valve–related anemia</td>
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<td>Fragmented red cells</td>
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**Sickle Cell Anemia**

- Sickle cell anemia is a severe hemolytic anemia
- results from inheritance of the sickle hemoglobin (HbS) gene.
- the erythrocyte containing HbS loses its round, pliable, biconcave disk shape and becomes dehydrated, rigid, and sickle shaped
Sickle Cell Anemia

Clinical Manifestations

• Usually, hemoglobin values range between 7 and 10 g/dL.

• Jaundice in the sclerae.

• Enlargement of the bones of the face and skull in childhood because of bone marrow expansion.

• Tachycardia, cardiac murmurs, and often an enlarged heart (cardiomegaly).

• Dysrhythmias and heart failure may occur in adults.
Sickle Cell Anemia

• All tissues and organs are susceptible to hypoxic damage or ischemic necrosis.

complications of sickle cell disease and sickle cell crises
  • Risk of thrombosis and consequent lack of tissue perfusion
  • Susceptible to infection and osteomyelitis,
  • Dehydration, Stroke,
  • Renal failure,
  • Impotence,
  • Heart failure, and pulmonary hypertension
  • Poor compliance
Sickle Cell Anemia

- Adequate hydration
- Supplemental oxygen.
- Relieve acute pain.
  - Aspirin (decrease platelet adhesion).
  - NSAIDs for moderate pain or in combination with opioid analgesics.
  - Morphine is the medication of choice for acute pain.
- Keeping warm and providing adequate hydration can be effective in diminishing the occurrence and severity of attacks.
Sickle Cell Anemia

Chronic Pain and Substance Abuse.

• Some patients develop problems with substance abuse.
  • This results from inadequate management of acute pain during episodes of crisis, which then promotes mistrust of the health care system and the need to seek care from other sources.

• Encourage the patient to Receive care from a single provider over time

• When crises occur, the staff in the emergency department should be in contact with the patient’s primary provider so that optimal management can be achieved.
Sickle Cell Crisis

• Very painful *acute vaso-occlusive crisis*
  • Results from entrapment of erythrocytes and leukocytes in the microcirculation, causing tissue hypoxia, inflammation, and necrosis

• *Aplastic crisis* results from infection with the human parvovirus.
  • The hemoglobin level falls rapidly and the marrow cannot compensate, as evidenced by an absence of reticulocytes.
Sickle Cell Crisis

Sequestration crisis

• Results when other organs pool the sickled cells.

• Although the spleen is the most common organ responsible for sequestration in children, most children with sickle cell anemia have had a splenic infarction by 10 years of age, and the spleen is then no longer functional (autosplenectomy).

• In adults, the common organs involved in sequestration are the liver and, more seriously, the lungs.
Polycythemia

• Increased volume of RBCs

• Secondary polycythemia
  • Excessive production of erythropoietin from reduced amounts of oxygen, cyanotic heart disease, nonpathologic conditions or neoplasms

• Medical management
  • Treatment not needed if condition is mild
  • Treat underlying cause
  • Therapeutic phlebotomy
Neutropenia

• Decreased production or increased destruction of neutrophils (<2,000/mm³)
• Increased risk for infection: monitor closely
• Absolute neutrophil count (ANC)
• Medical management: treatment depends on the cause
• Nursing management: patient education
Thrombocytopenia

• Thrombocytopenia (low platelet level) can result from various factors:
  • Decreased platelet production
  • Increased platelet destruction
  • Increased consumption of platelets (use of platelet in clot formation).
Hemophilia

Two inherited bleeding disorders:

- **Hemophilia A** is caused by a genetic defect that results in deficient or defective factor VIII.

- **Hemophilia B** (also called *Christmas disease*) stems from a genetic defect that causes deficient or defective factor IX.

• Both types of hemophilia are inherited as X-linked traits,

• All affected people are males; females can be carriers but are almost always asymptomatic.
Hemophilia

Clinical Manifestations

1. Hemorrhage into various parts of the body even after minimal trauma.
   - The frequency and severity of the bleeding depend on
     • the degree of factor deficiency & the intensity of trauma.
   - 75% of all bleeding occurs into joints.
   - The most commonly affected joints are the knees, elbows, ankles, shoulders, wrists, and hips.
   - Recurrent joint hemorrhages can result in damage so severe chronic pain, ankylosis (fixation), or arthropathy of the joint occurs
Hemophilia

2. Pain in a joint
3. Swelling
4. Limitation of motion.
5. **hematoma** with severe factor VIII deficiency
   - When the hematomas occur within muscle, particularly in the extremities, peripheral nerves can be compressed.
   - Over time, this compression results in **decreased sensation, weakness, and atrophy of the area involved.**
Medical Management

- **Factor VIII** and X concentrates
- Fresh-frozen plasma.

- Prophylactic use of these factors before traumatic procedures (e.g., lumbar puncture, dental extraction, surgery).
Nursing management

➢ Assist in coping with the condition because it is places restrictions on their lives, and is an inherited disorder that can be passed to future generations.

➢ Patients helped to cope with the disease
  • Encouraged to prevent unnecessary trauma
  • Education about activity restrictions and self-care measures
  • Emphasize safety at home and in the workplace.
Nursing management

➢ Instructed how to administer the factor at home

➢ Avoid agents that interfere with platelet aggregation, such as aspirin, NSAIDs, and alcohol.

➢ Dental hygiene (dental extractions are hazardous).

➢ Applying pressure to a minor wound adequate to control bleeding if the factor deficiency is not severe.
Nursing management

➢ Nasal packing should be avoided, because bleeding frequently resumes when the packing is removed.

➢ Splints and other orthopedic devices may be useful in patients with joint or muscle hemorrhages.

➢ All injections should be avoided;

➢ Invasive procedures (e.g., endoscopy, lumbar puncture) should be minimized or performed after administration of appropriate factor replacement.
Nursing management

➢ Patients with hemophilia should carry or wear medical identification (e.g., Medic-Alert bracelets).

➢ If recent surgery, assesses the surgical site for bleeding.

➢ Frequent monitoring of V/S until there is no excessive postoperative bleeding.
Nursing management

➢ Administer Analgesic to alleviate the pain

➢ Warm baths promote relaxation, improve mobility, and lessen pain.
   ▪ During bleeding episodes, heat is avoided because it can accentuate bleeding; applications of cold are used instead.

➢ Genetic testing and counseling to make decisions regarding having children and managing pregnancy
Important notes

➢ **Vitamin K** is an antidote for ORAL anticoagulant toxicity (warfarin)

➢ **Protamine sulphate**: Heparin is an antidote for heparin toxicity.

➢ **Prothrombin time (PT)**: used to measure the effect of warfarin.

➢ **Partial thromboplastin time (PTT)** used to measure effect of heparin.

➢ **Sepsis** is a common & the highest risk for developing DIC.