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What's in a Drop? Interpreting CBC Results

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Presented By

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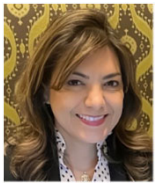


Sylvia Luna, MSN, RN, CCDS, is corporate CDI manager at Steward Health Care based in Dallas, Texas. She has 27 years of nursing and management experience with 12 years in CDI. She has a background in nursing education and is passionate about CDI education and team development. Luna is a current member of the ACDIS Leadership Council, past ACDIS poster presenter, and past member of the Texas ACDIS local chapter.

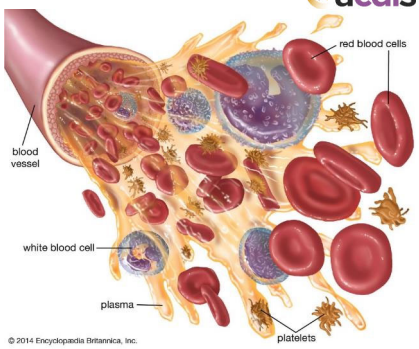
Learning Outcomes

- At the completion of this educational activity, the learner will be able to:
  - List blood tests performed as part of a CBC
  - State normal adult values for CBC test results
  - Identify the purpose of erythrocyte indices
  - Describe classifications of anemias based on the results of erythrocyte indices
  - List five types of white blood cells and state the function of each type of cell
  - State the implications of a "shift to the left" on a white blood cell differential
  - Identify common patterns of white blood cell increase or decrease in disease processes

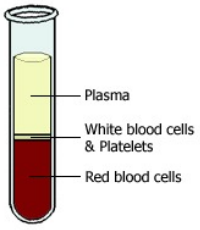
Blood Composition

- On average, an adult circulates 5 liters of blood
  - 3 liters plasma
  - 2 liters blood cells and formed elements
- A test tube of blood will separate into 3 layers if left standing for 30 minutes
  - Denser components sink to bottom
    - Top layer is plasma and forms about 60% of blood
    - Middle layer is composed of white blood cells (WBC) and platelets
    - Bottom red layer is the red blood cells
    - Plasma is mainly water, but it also contains proteins (albumin, clotting factors, antibodies, enzymes, and hormones), sugars (glucose), and fat particles

(Bertschi, 2021)

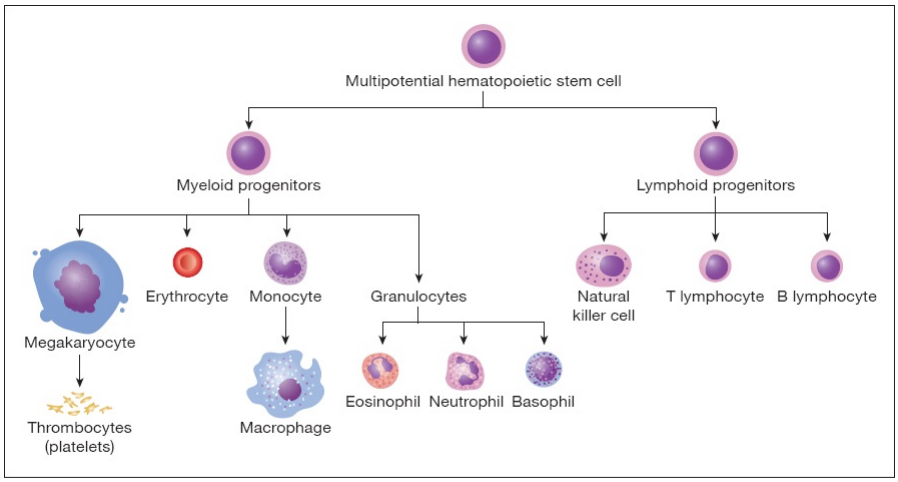


Schwartz, et. al., 2023



(National Center for Biotechnology Information, 2005)

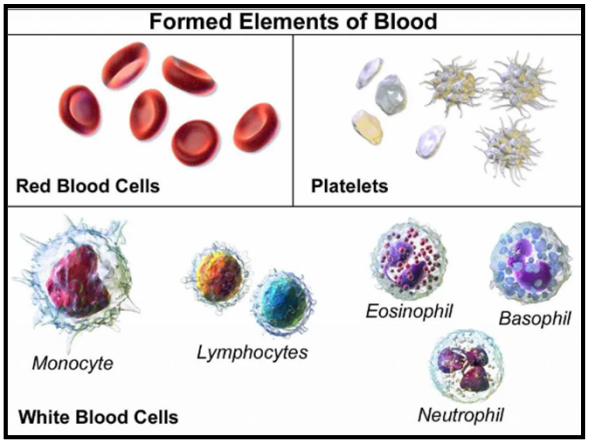
Stem Cells: Differentiate Into Blood Components



Hematopoietic stem cells in the bone marrow differentiate into either myeloid or lymphoid progenitor cells, which in turn create specialized cell types. Illustration by Sara Jarret.

(Bertschi, 2021)

Complete Blood Count (CBC)



(Blausen Medical, 2014)

Normal CBC Component Values for Adults

RBC values and indices.

- RBC count: 4.7–6.1 × 10^6 per mm^3 for men; 4.2–5.4 × 10^6 per mm^3 for women
- Hb: 14–18 g/dL for men; 12–16 g/dL for women
- Hct: 42%–52% for men; 37%–47% for women
- MCV: 80–95 fL/cell
- MCH: 27–31 pg/cell
- MCHC: 32–36 g/dL
- RDW: 11%–14.5%

Platelet count: 150,000–400,000/mm^3

WBC values.

- Total WBC count: 5,000–10,000/mm^3
- Neutrophils: 55%–70%; 2,500–8,000/mm^3
- Lymphocytes: 20%–40%; 1,000–4,000/mm^3
- Monocytes: 2%–8%; 100–700/mm^3
- Eosinophils: 1%–4%; 50–500/mm^3
- Basophils: 0.5%–1%; 25–100/mm^3

(Bertschi, 2021)

RBC Components of the CBC

Red blood cell count (RBC)

- Carries oxygen for the lungs to body tissues and transfers carbon dioxide from body tissues to lungs
- Biconcave disk shape
- Live about 120 days in the bloodstream
- Able to change shape
- A count of the number of red blood cells per cubic millimeter of blood
- Classic red blood cell indices:
  - Mean cell volume (MCV)
  - Mean cell hemoglobin (MCH)
  - Mean cell hemoglobin concentration (MCHC)
  - Red blood cell distribution width (RDW)
  - Red blood cell morphology

Hemoglobin (HGB)

- Each gram of hemoglobin can carry 1.34 ml of oxygen
- The number of RBCs does not indicate blood's oxygen content because some cells may contain more hemoglobin than others
- Serves as an important pH buffer in the extracellular fluid

Hematocrit (HCT)

- Determines the percentage of red blood cells in the plasma
- If the RBC and the hemoglobin are both normal, it is possible to estimate the hematocrit as being approximately three times the hemoglobin
- Any increase or decrease in plasma volume affects the hematocrit

Doig & Zhang, 2017

Erythrocyte Indices

Mean corpuscular volume (MCV) measures the mean or average size of individual red blood cells

- If the MCV is low, the cells are microcytic or smaller than normal
- Microcytic red blood cells are seen in iron deficiency anemia, lead poisoning and the genetic diseases thalassemia major and thalassemia minor
- If the MCV is high, the cells are macrocytic, or larger than normal
- Macrocytic red blood cells are associated with pernicious anemia and folic acid deficiencies
- If the MCV is within the normal range, the cells are referred to as normocytic indicating a possible acute hemorrhage

Mean corpuscular hemoglobin (MCH) measures the amount, or the mass, of hemoglobin present in one RBC

- The result is reported by a very small weight called a picogram (pg)
- Mean corpuscular hemoglobin concentration (MCHC) measures the proportion of each cell taken up by hemoglobin
- The MCH and the MCHC are used to assess whether red blood cells are normochromic, hypochromic, or hyperchromic An MCHC of less than 32% or an MCH under 27% indicates that the red blood cells are deficient in hemoglobin concentration most often seen in iron deficiency anemia

Red cell distribution width (RDW)

- Measures the differences in the volume and size of red blood cells, should be around same size
- High RDW means that there's a major difference between the size of the smallest and largest red blood cells
- Helps determine types of anemia
- Recent research indicates may predict metabolic syndrome

Reticulocyte count

- Measures number of new red blood cells in body

Doig & Zhang, 2017

Determining Type of Anemia

Type of Anemia	Description
Normocytic/normochromic	Normal cell size; normal amount of Hgb
Microcytic/hypochromic	Small cell size; low amount of Hgb
Microcytic/normochromic	Small cell size; normal among of Hgb
Macrocytic/normochromic	Large cell size; normal amount of Hgb

(Bertschi, 2021)

NORMAL VALUEs & FORMULAE FOR CALCULATION OF MCV, MCH, MCHC

- Mean Corpuscular Volume (fl) $MCV = \frac{PCV\ X\ 10}{RBC}$
- 78 – 98 (fl)

- Mean Corpuscular Hemoglobin (pg)
- 27 – 33 pg. $MCH = \frac{Hb\ X\ 10}{RBC}$
- Mean corpuscular Hb concentration
- 30 – 35% $MCHC = \frac{Hb\ X\ 100}{PCV}$

(Doig & Zhang, 2017)

Common Causes of Anemia

- Iron deficiency
  - Inadequate dietary iron intake
  - Chronic blood loss
  - Microcytic and hypochromic RBCs
- Vitamin deficiency
  - Folic acid deficiency
  - B12 deficiency
  - Macrocytic and normochromic RBCs
- Acute blood loss
  - RBC indices normal
  - Expect a drop of ≥ 2 grams and indication of blood loss
  - Bone marrow stimulation causes immature RBCs to be released rapidly increasing reticulocyte count
- Chronic renal failure
  - Uremia may cause myelosuppression
  - Erythropoietin level low
  - Microcytic and normochromic
- Myelosuppression
  - Pancytopenia
  - May be due to infection, toxic exposure, medications

(Bertschi, 2021)

Anemia *Coding Clinics*

Acute on chronic blood loss anemia
ICD-10-CM/PCS Coding Clinic, **Third Quarter ICD-10 2019** Page: 17 Effective with discharges: October 1, 2019

Question:

A patient with melena and hematemesis was diagnosed with acute on chronic blood loss anemia due to a bleeding duodenal ulcer. ICD- 10-CM classifies acute blood loss anemia to code D62, Acute posthemorrhagic anemia, and chronic blood loss anemia to code D50.0, Iron deficiency anemia secondary to blood loss (chronic). An Excludes1 note for "anemia due to chronic blood loss (D50.0)" appears at code D62, and an Excludes1 note for "acute posthemorrhagic anemia (D62)" appears at code D50.0. What is the appropriate code assignment for documented "acute on chronic blood loss anemia," when Excludes1 notes appear at both codes?

Answer:

In this case, assign code D62, Acute posthemorrhagic anemia, for the acute on chronic blood loss anemia. When acute and chronic blood loss anemia are both present, assign only a code for acute blood loss anemia.

Facility-specific coding guidelines
ICD-10-CM/PCS Coding Clinic, **First Quarter ICD-10 2014** Pages: 15-16 Effective with discharges: March 31, 2014

Question:

We are considering developing internal coding guidelines and obtaining medical staff approval to code acute blood loss anemia. The guidelines would specify lab values pre and post-surgery, as well as some clinical signs to allow coders to code acute blood loss anemia without the need to have physician documentation. Would this be acceptable?

Answer:

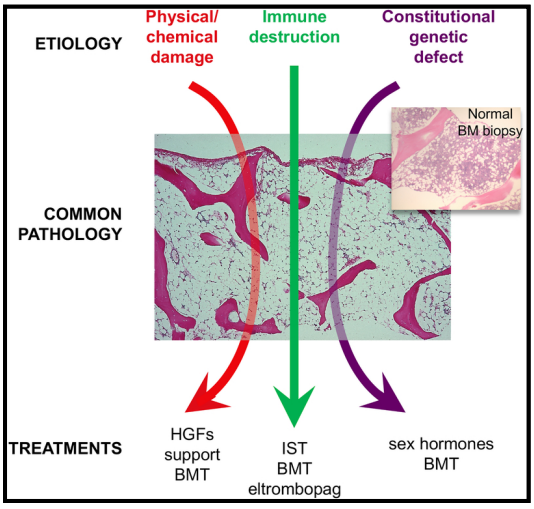
No, it is not acceptable. The Official Coding Guideline Section III.B., states: "Abnormal findings (laboratory, x-ray, pathologic, and other diagnostic results) are not coded and reported unless the physician indicates their clinical significance. If the findings are outside the normal range and the physician has ordered other tests to evaluate the condition or prescribed treatment, it is appropriate to ask the physician whether the diagnosis should be added." Therefore, internal guidelines should not replace physician documentation.

Facilities can work together with their medical staff to develop facility specific coding guidelines, which promote complete documentation needed for consistent code assignment. Additionally, these guidelines can guide the coding professionals as to when they should query physicians for clarification of their documentation. Any guidelines developed must be applied consistently to all records coded. An internal facility guideline should not interpret abnormal findings to replace physician documentation or physician query. The guideline may provide assistance in determining when a physician query is appropriate, but it may not interpret abnormal test results.

These facility guidelines must not conflict with the *"Official ICD-10-CM Guidelines for Coding and Reporting"* developed by the Cooperating Parties and, additionally, they should not be developed to replace the physician documentation needed to support code assignment.

Aplastic Anemia

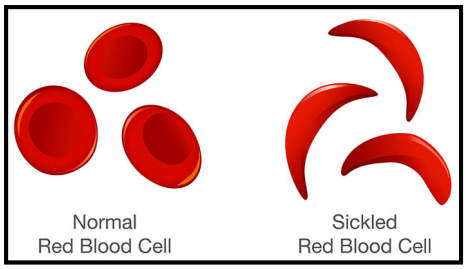
- Non-malignant bone marrow failure
- Presents with pancytopenia and hypocellular bone marrow
  - Immune mediated
  - Toxin/medication exposure
  - May occur in pregnancy
- 2-3 cases per million per year, 3X higher in Asian population
- Typically occurs before age 30 with second peak around age 60
- Treatment
  - Immunosuppression
  - Stem cell transplant
- 5-year survival in 1989 was 57%
- 5-year survival now 90%



(Young, 2018)

(Young, 2018)

Sickle Cell Anemia



(Centers for Disease Control, 2023)

- Inherited disorder that causes hemolysis and vaso-occlusive crisis (VOC)
- Red blood cell converts into rigid, elongated crescent shape
- ALL patients will experience VOC during their lives
  - Earliest presentation around 6 months of age
- Chronic complications
  - Iron overload
  - Avascular necrosis (AVN) of joints
  - Leg ulcers
  - Pulmonary artery hypertension (PAH)
  - Renal complications
  - Retinopathy

(Mangla et al., 2022)

Acute Complications in Sickle Cell Anemia

- Acute Chest Syndrome
  - Sudden onset of cough and shortness of breath
  - May have fever (look for infection)
  - Chest x-ray shows new pulmonary infiltrate
- Splenic Sequestration Crisis
  - Major cause of acute anemia
  - Rapid enlargement of spleen with LUQ pain
  - Children present with acute anemia and hypovolemic shock
  - Adults more insidious onset
- Hepatic Sequestration Crisis
  - Rapid enlargement of liver with stretching of capsule
- Stroke
- Aplastic Crisis
  - Usually precipitated by parvo virus
  - Present with severe fatigue, rapid drop in Hb of 3-6 gm/dL, near absent reticulocytes, and syncope
- Acute Intrahepatic Cholestasis (AIC)
  - Sudden onset of RUQ pain
  - Jaundice
  - Enlarged, tender liver
  - High bilirubin, elevated alkaline phosphatase, coagulopathy
- Infections
- Priapism
  - Affects 35% of all men/boys
- Acute Ocular Complications
  - Hyphema
    - Accumulation of blood in the anterior chamber of the eye due to blunt trauma
  - Central Retinal Artery Occlusion
    - Due to thrombus formation in the retinal artery
  - Orbital infarction
    - Infarction of orbital bone
  - Orbital Compression Syndrome
    - Vision loss due to nerve damage

(Mangla et al., 2022)

Sickle Cell Disease *Coding Clinics*

Sickle cell crisis triggered by COVID-19 infection

ICD-10-CM/PCS Coding Clinic, **Second Quarter ICD-10 2022** Pages: 28-29 Effective with discharges: June 3, 2022

Question:

What is the correct coding and sequencing for an immunocompromised patient with sickle cell disease (SCD) who presents in sickle cell crisis (SCC) triggered by a COVID-19 infection? The sickle cell disease is not a manifestation of COVID-19 infection, but the acute sickle cell pain crisis is directly linked to a COVID-19 infection.

Answer:

Assign the appropriate code from category D57, Sickle-cell disorders, for the sickle cell crisis and code U07.1 for the COVID-19 infection. Sequencing would depend on the circumstances of the admission. While the COVID-19 infection triggered an acute sickle cell crisis, SCD is not a manifestation of COVID-19.

Sickle-cell disorders

ICD-10-CM/PCS Coding Clinic, **Fourth Quarter ICD-10 2020** Page: 6-7 Effective with discharges: October 1, 2020

Related Information

Codes were created in category D57, Sickle-cel disorders, to identify sickle-cell disease (Hb-SS disease, sickle-cell/Hb-C disease, sicklecell thalassemia, and other sickle-cell disorders) with cerebral vascular involvement **(D57.03, D57.213, D57.413, D57.813)** and with crisis with other specified complication **(D57.09, D57.218, D57.418, D57.818)**.

Cerebral infarct and cerebral ischemia are major complications in patients with sickle-cell disease. Children are at risk for symptomatic stroke that can cause learning problems and lifelong disabilities. Treatment for stroke prevention includes regular blood transfusions and in selected cases, hematopoietic stem cell transplantation. Other specified complications of sickle-cell disease may include acute gallbladder involvement, priapism and fever.

In addition, codes were created in subcategory D57.4, Sickle-cell thalassemia, for sickle-cell thalassemia beta zero (HbS-ß0) and sickle-cell thalassemia beta plus (HbS-ß+), and common crises associated with these conditions. Specifically, unique codes were created for HbS-ß0 and HbS-ß+ respectively as follows:

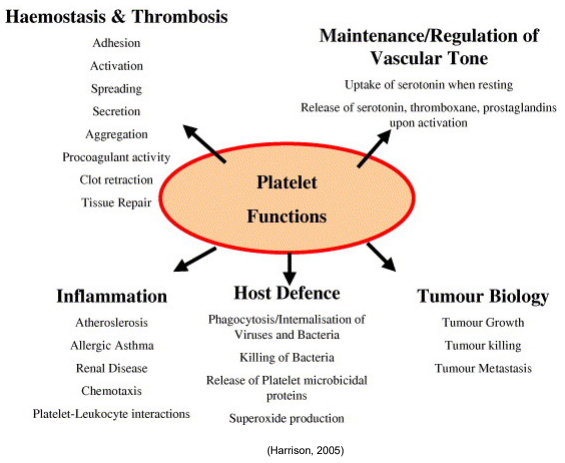
- Without crisis **(D57.42, D57.44)**,
- With acute chest syndrome **(D57.431, D57.451)**,
- With splenic sequestration **(D57.432, D57.452)**,
- With cerebral vascular involvement **(D57.433, D57.453)**,
- With crisis with other specified complication **(D57.438, D57.458)**, and
- With crisis, unspecified **(D57.439, D57.459)**.

In addition to the abnormal sickle shape of the red blood cells associated with sickle-cell disease, individuals with sickle-cell beta thalassemia have an abnormal beta globin chain (ßS) with a defective beta globin gene that affects the production of hemoglobin. The beta globin gene is either decreased in synthesis (sickle-cell thalassemia beta plus (HbS-ß+) or absent of synthesis (sickle-cell thalassemia beta zero (HbS-ß0). The amount of hemoglobin is either reduced or no normal hemoglobin is produced by the red blood cells. The amount of normal hemoglobin in the body affects the severity of symptoms. Symptoms of HbS-ß0 are similar to sickle-cell disease. Patients may experience acute and chronic complications such as anemia, stroke, vaso-occlusive pain, acute chest syndrome and splenic sequestration. The manifestations of HbS-ß+ are significantly less severe and there is little or no anemia.

Platelets

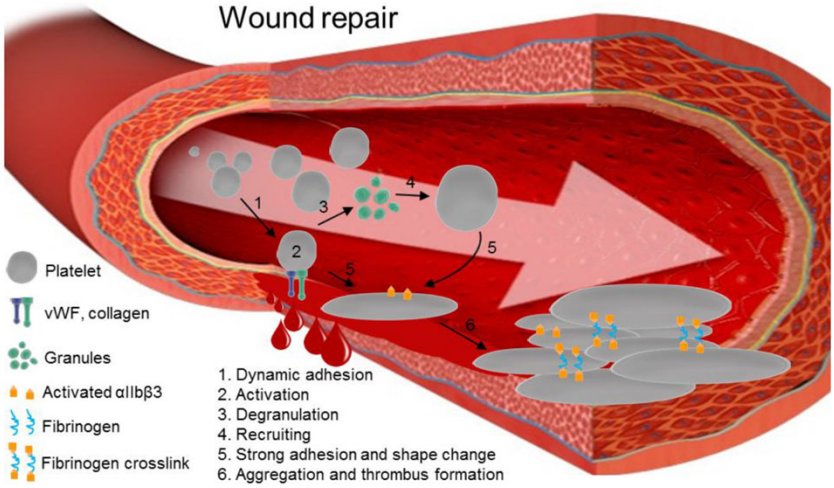
- Small anucleate cell fragments that circulate in blood playing crucial role in managing vascular integrity and regulating hemostasis
- Primarily involved in minimizing blood loss
- Involved in the fundamental biological process of chronic inflammation associated with disease pathology
- Platelets activation and dysfunction have been implicated in diabetes, renal diseases, tumorigenesis, Alzheimer's, and CVD
- Circulate about 7-10 days in the blood stream

(Jinna & Khandhar, 2022)



(Harrison, 2005)

Platelets in Action



(Sonego et al., 2017)

Platelet Disorders

Essential thrombocythemia- myeloproliferative neoplasm causing overproduction of platelets

- Relatively benign but may evolve to Polycythemia Vera, myelofibrosis, and/or acute leukemia
- Marked thrombocytosis may cause hemorrhage or thrombosis
- Treated with antiplatelet therapy
- Fatigue and thrombosis most common symptoms

Reactive thrombocytosis- platelet overproduction caused by another disorder

- Iron deficiency
- Infection
- Chronic inflammatory disorders (RA, TB, Sarcoid)
- Certain cancers

Platelet dysfunction- defect that alters the function of normal platelets

- Hereditary
  - von Willebrand disease
- Acquired
  - Cirrhosis
  - Cancer
  - Renal failure
  - Lupus
  - Aspirin, NSAIDS
  - Cardiopulmonary bypass

(Accurso et al., 2020)

Thrombocytopenia

Primary immune thrombocytopenia (ITP)- autoimmune condition where antibodies are produced against platelets causing their destruction

Drug-induced immune thrombocytopenia

- Heparin-induced thrombocytopenia (HIT)- anti-platelet antibodies activate platelets resulting in thrombosis
- Quinine, sulfa, ampicillin, vancomycin, Zosyn, Tylenol, NSAIDS, cimetidine, glycoprotein IIb/IIIa inhibitors, herbs

Drug-induced non-immune thrombocytopenia

- Valproic acid, daptomycin, Zyvox
- Dose-dependent

Infections

- Viral: HIV, hepatitis C, Epstein-Barr, parvovirus, mumps, varicella, Zika, rubella
- Sepsis: Causes bone marrow suppression
- H-pylori
- Tick-borne infections
- Malaria, babesiosis intracellular parasite infections

Alcohol abuse

Hypersplenism due to chronic liver disease

(Jinna & Khandhar, 2022)

Other Causes of Thrombocytopenia

Myelodysplasia

Malignancy

- Can be due to chronic DIC or marrow suppression

Thrombotic microangiopathy (TMA)

- Thrombotic thrombocytopenia purpura (TTP)
  - Fever, renal failure, thrombocytopenia, microangiopathic hemolytic anemia
- A hemolytic uremic syndrome (HUS) caused by Shiga toxin-producing organism (E. coli and Shigella) seen in children
- Drug-induced TMA
  - Quinine, specific chemo agents

Antiphospholipid antibody syndrome

Aplastic anemia

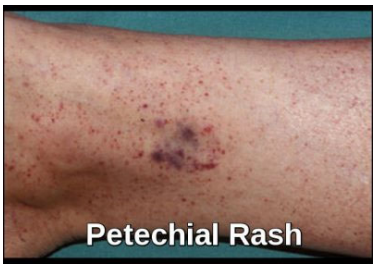
Inherited thrombocytopenia

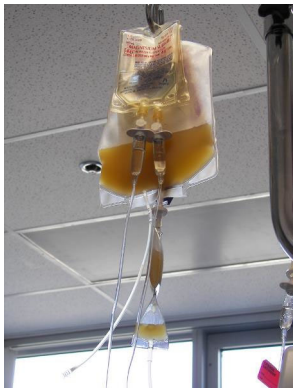
- Von Willebrand disease type 2
- Alport syndrome
- Fanconi syndrome
- Bernard–Soulier syndrome
- May-Hegglin anomaly

(Jinna & Khandhar, 2022)

Thrombocytopenia Treatment

- Mild thrombocytopenia without symptoms
  - Routine monitoring
- Severe thrombocytopenia and bleeding
  - Platelet transfusion
- Primary immune thrombocytopenia (ITP)
  - Steroids, IVIG (first line)
  - Immunosuppressive drugs (second line)
  - Splenectomy (second line)
  - Thrombopoietin receptor agonists to stimulate platelet production (third line)
- Secondary immune thrombocytopenia (ITP)
  - Manage underlying condition
- Drug-induced thrombocytopenia
  - Withhold causative drug
  - HIT- withdraw all heparin products
  - Initiate anti-thrombin and anti-Xa activity anticoagulant agents (Argatroban, Arixtra)
- TTP
  - Plasma exchange

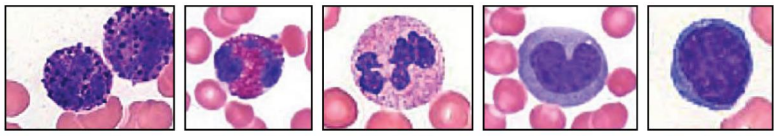




(Jinna & Khandhar, 2022)

White Blood Cells (Leukocytes)

- Part of the immune system that mount inflammatory and cellular responses to injury or pathogens
- Classified as granulocytes or agranulocytes
- Granulocytes
  - Neutrophils
  - Basophils
  - Eosinophils
- Agranulocytes
  - Lymphocytes
  - Monocytes
- White blood cell (WBC) count
  - Measures the number of WBCs in blood
- WBC differential
  - Measures the percentage of each type of WBC in blood



(Bertschi, 2021)

Normal Adult White Blood Cell Count Differential

Type of WBC	Absolute Value	Percentage
Neutrophils	2.0-7.0 x10^9/L	40-75%
Lymphocytes	1.0-3.0 x10^9/L	20-45%
Monocytes	0.2-1.0 x10^9/L	2-10%
Eosinophils	0.02-0.5 x10^9/L	1-6%
Basophils	0.02-0.1 x10^9/L	0-2%

(Bertschi, 2021)

Neutrophils

- Most abundant leukocyte
- First responders to bacteria or viruses
- "Soldiers" of immune system
- Live for around 8 hours
- Body produces around 100 billion cells a day

Eosinophils

- Play a role fighting off bacteria
- Trigger allergy symptoms

Basophils

- Release histamine when stimulated
- Play role in asthma

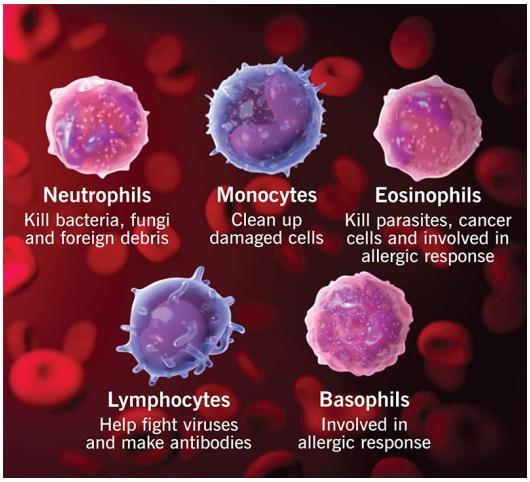
Lymphocytes

- Two types
  - B Lymphocytes
    - Humoral immunity (antibodies)
  - T cells
    - Recognize pathogens and kill them

Monocytes

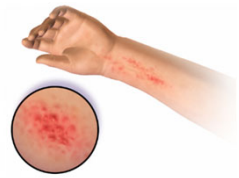
- Clean up dead cells in the body

(Riley & Rupert, 2015)



(Cleveland Clinic, 2023)

Etiology of White Blood Cell Abnormalities



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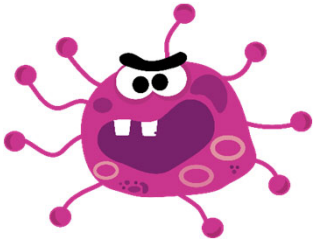
Eosinophilia

- *Allergic events*
- Parasitic infections
- Dermatologic conditions
- Infections: Scarlet fever, chorea, leprosy, genitourinary infections
- Immunologic disorders: Rheumatoid arthritis, periarteritis, lupus erythematosus, eosinophilia-myalgia syndrome
- Pleural and pulmonary conditions: Löffler's syndrome, pulmonary infiltrates and eosinophilia
- Malignancies: Non-Hodgkin's lymphoma, Hodgkin's disease
- Myeloproliferative disorders: Chronic myelogenous leukemia, polycythemia vera, myelofibrosis
- Adrenal insufficiency: Addison's disease
- Sarcoidosis



Basophilia

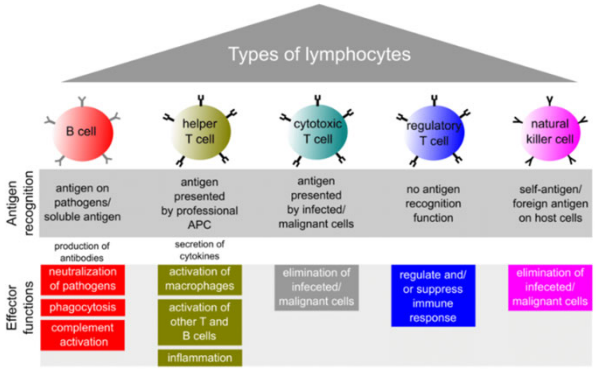
- Uncommon cause of leukocytosis
- Infections: Viral infections (varicella), chronic sinusitis
- Inflammatory conditions: Inflammatory bowel disease, chronic airway inflammation, chronic dermatitis
- Myeloproliferative disorders: Chronic myelogenous leukemia, polycythemia vera, myelofibrosis
- Alteration of marrow and reticuloendothelial compartments: Chronic hemolytic anemia, Hodgkin's disease, splenectomy
- Endocrinologic causes include hypothyroidism, ovulation, estrogens

(Riley & Rupert, 2015)

Etiology of White Blood Cell Abnormalities

Absolute lymphocytosis (elevated WBC count)

- Acute infections: Cytomegalovirus infection, Epstein-Barr virus infection, pertussis, hepatitis, toxoplasmosis
- Chronic infections: Tuberculosis, brucellosis
- Lymphoid malignancies: Chronic lymphocytic leukemia



(Tavasolian et al., 2020)

Relative lymphocytosis (normal WBC count)

- Normal in children less than 2 years of age
- Acute phase of several viral illnesses
- Connective tissue diseases
- Thyrotoxicosis
- Addison's disease
- Splenomegaly with splenic sequestration

- B cells recognize soluble antigen and pathogens and develop into antibody producing cells
- Helper T cells recognize specific antigen on the surface of APCs; they get activated and start to induce further immune response processes
- Cytotoxic T cells as well as NK cells recognize infected or malignant cells and eliminate them directly with the difference that NK cells only exhibit a very limited receptor diversity
- Regulatory T cells prevent an excessive immune response including actions against healthy tissue.

Etiology of Neutrophilia (Left Shift)

- Infection including bacterial, viral, fungal, and parasitic
- Acute and chronic inflammation, e.g., granulomatous diseases, vasculitis, inflammatory bowel disease
- Leukemoid reaction
- Hematological and non-hematological malignancies
- Medications
- Asplenia or hyposplenia
- Physical and emotional stimuli (stress, active smoker, vigorous exercise, pregnancy, obesity)
- Tissue damage, e.g., surgery, trauma, burns
- Laboratory artifacts

Bands – immature form of neutrophils
- Causes of bandemia
  - Leukemia
  - Steroid use
  - Autoimmune diseases
  - Cancer
  - Chemotherapy

(Riley & Rupert, 2015)

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Leukocytosis With Primary Bone Marrow Disorders

- Clinical Factors Increasing Suspicion of an Underlying Bone Marrow Disorder
- Leukocytosis: White blood cell count greater than 30,000 per mm3 (30 × 109 per L)
- Concurrent anemia or thrombocytopenia
- Organ enlargement: Liver, spleen or lymph nodes
- Life-threatening infection or immunosuppression
- Bleeding, bruising or petechiae
- Lethargy or significant weight loss
- Marrow abnormalities may occur with stem cells (acute leukemia) or more differentiated cells (chronic leukemia)
- Acute leukemia often present with signs and symptoms of bone marrow failure, such as fatigue and pallor, fever, infection and/or bleeding with purpura and petechiae
  - Marrow is typically overpopulated with blast cells which indistinguishable from stem cells; normal marrow cellular elements absent or decreased
  - Peripheral WBC count may be high or low; anemia, thrombocytopenia common
  - Medical emergency; WBC > 100,000 per mm^3 at risk for brain infarction or hemorrhage
- Chronic leukemia typically present with less severe disease; diagnosed incidentally
  - Results from the proliferation and persistence of relatively mature-appearing lymphocytes
  - The spleen and lymph nodes are enlarged because of the excessive accumulation of lymphocytes
  - Impairs immunity

(Davis et al., 2014)

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Differential Characteristics of Acute and Chronic Leukemias

Subtype	*Description*	*Typical group(s) affected*	*Common presenting features*	*Five-year relative survival rate**
Acute lymphoblastic leukemia	Blast cells on peripheral blood smear or bone marrow aspirate	Children and young adults (53% of new cases occur in persons < 20 years)	Symptoms: fever, lethargy, bleeding, musculoskeletal pain or dysfunction Signs: hepatosplenomegaly and lymphadenopathy	< 50 years: 75% ≥ 50 years: 25%
Acute myelogenous leukemia	Blast cells on peripheral blood smear or bone marrow aspirate; Auer rods on peripheral smear	Adults (accounts for 80% of acute leukemia in adults)	Symptoms: fever, fatigue, weight loss, bleeding or bruising Signs: hepatosplenomegaly and lymphadenopathy (rare)	< 50 years: 55% ≥ 50 years: 14%
Chronic lymphocytic leukemia	Clonal expansion of at least 5,000 B lymphocytes per μL (5.0×10^9 per L) in the peripheral blood	Older adults (85% of new cases occur in persons > 65 years)	Symptoms: 50% of patients are asymptomatic Signs: hepatosplenomegaly and lymphadenopathy	< 50 years: 94% ≥ 50 years: 83%
Chronic myelogenous leukemia	Philadelphia chromosome (*BCR-ABL1* fusion gene)	Adults	Symptoms: 20% of patients are asymptomatic Signs: splenomegaly	< 50 years: 84% ≥ 50 years: 48%

(Davis et al., 2014)

What Does *Coding Clinic* Say?

Pancytopenia due to acute myelogenous leukemia
ICD-10-CM/PCS Coding Clinic, **First Quarter ICD-10 2019** Pages: 16-17 Effective with discharges: March 20, 2019

Question:

A patient presented to the hospital with severe fatigue. Complete blood count (CBC) showed low platelets, red and white blood cells. Further workup included bone marrow biopsy that revealed acute myelogenous leukemia. The provider's final diagnostic statement listed "Pancytopenia due to acute myelogenous leukemia (AML)". Is the pancytopenia coded in addition to the AML, or is it considered inherent to the AML and therefore not coded separately?

Answer:

The ICD-10-CM classification does not prohibit assigning code D61.818, Other pancytopenia, along with a code from category C92, Myeloid leukemia.

Pancytopenia is not inherent in AML, and therefore both conditions are coded when they meet reporting requirements. In AML, white blood cell counts may be elevated or reduced, and not all patients will have low red blood cell or platelet counts.

AML is a malignant disease of the bone marrow in which the production of normal blood cells decreases, resulting in various degrees of anemia, thrombocytopenia, and neutropenia. Pancytopenia is very common in certain types of AML, and it can be of prognostic importance.

Admission for consolidation chemotherapy with bone marrow biopsy
ICD-10-CM/PCS Coding Clinic, **First Quarter ICD-10 2022** Pages: 16-17 Effective with discharges: March 18, 2022

Question:

A patient with central nervous system 1a, B-cell acute lymphoblastic leukemia (B-ALL) is admitted for intrathecal consolidation chemotherapy. Immediately following chemotherapy, per protocol, an end of induction bone marrow biopsy is performed to evaluate the effectiveness of prior therapy and to determine whether the leukemia is in remission. The Official Guidelines for Coding and Reporting (I.C.2.a.) states, "When treatment is directed at a malignancy, the malignancy is sequenced as the principal diagnosis, except when the admission is solely for chemotherapy." In this case, the provider clearly documents the reason for admission is the administration of chemotherapy and the bone marrow biopsy was part of the treatment protocol. When a patient is admitted for chemotherapy but also has a diagnostic test such as a biopsy, is the neoplasm assigned as the principal diagnosis instead of code Z51.11, Encounter for antineoplastic chemotherapy? What is the principal diagnosis in this case?

Answer:

Assign code Z51.11, Encounter for antineoplastic chemotherapy, as the principal diagnosis. Assign code C91.00, Acute lymphoblastic leukemia not having achieved remission, as a secondary diagnosis.

In this case, an end of induction bone marrow biopsy was performed to evaluate the effectiveness of prior chemotherapy, measuring for minimal residual disease. Although a bone marrow biopsy was performed, the administration of intrathecal consolidation chemotherapy was the reason for the admission. Consolidation chemotherapy follows the induction (initial) phase of chemotherapy. The purpose is to destroy any remaining leukemia cells to "consolidate" the gains obtained and to prevent the cancer from returning.

Characteristic Features of Myeloproliferative Diseases

Disease	*Red blood cells*	*White blood cells*	*Platelets*	*Marrow*
Polycythemia vera	Increased	Normal or increased	Normal or increased	Hypercellular
Chronic myelogenous leukemia	Normal or increased	Increased	Normal or increased	Hypercellular
Myelofibrosis	Normal or decreased	Variable	Variable	Fibrosis
Essential thrombocythemia	Normal or decreased	Slightly increased or normal	Increased	Hypercellular

(Liesveld, 2022)

Neutropenia

- Reduction in neutrophils
- Neutrophils are body's main defense against bacterial and fungal infections
- Severity relates to the relative risk of infection
  - At < 500/mcL, endogenous microbial flora (e.g., in the mouth or gut) can cause infections
  - At < 200/mcL, the inflammatory response may be muted and the usual inflammatory findings of leukocytosis or white blood cells in the urine or at the site of infection may not occur
- Most frequently occurring infections with neutropenia:
  - Cellulitis
  - Furunculosis
  - Pneumonia
  - Septicemia

Mild: 1000 to 1500/mcL (1 to 1.5 × 10^9/L)
Moderate: 500 to 1000/mcL (0.5 to 1 × 10^9/L)
Severe: < 500/mcL (< 0.5 × 10^9/L)

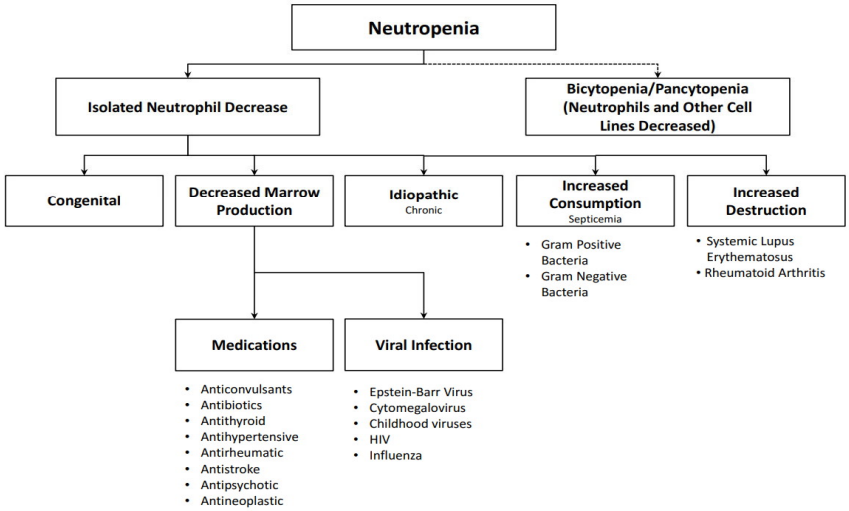
$$\text{ANC} = \frac{(\%\ mature\ neutrophils + \%\ immature\ neutrophils) \times WBC}{1000}$$

https://www.merckmanuals.com/professional/multimedia/clinical-calculator/absolute-neutrophil-count

(Tomita, 2022)

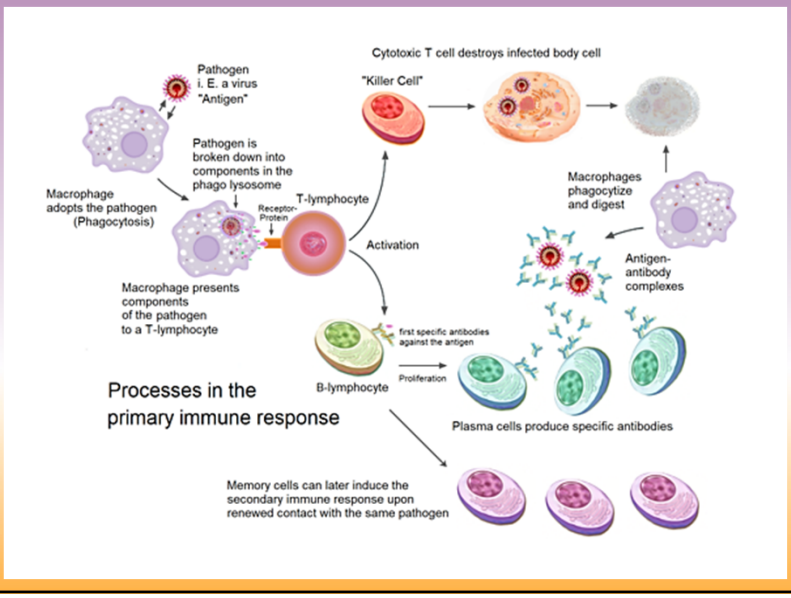
Neutropenia

Decreased Neutrophils Only



(Territo, 2022)

Immune System in Action



(Warrington et al.,2011)

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Thank you. Questions?

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In order to receive your continuing education certificate(s) for this program, you must complete the online evaluation. The link can be found in the continuing education section of the program guide.

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