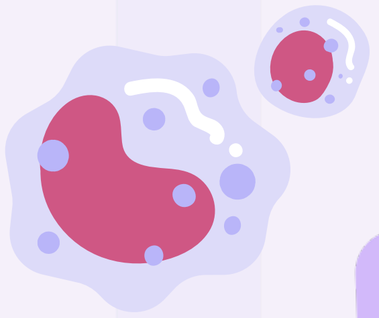

Approach to leukocytosis and leukopenia

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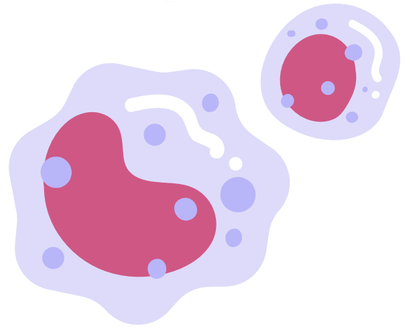
WBCs

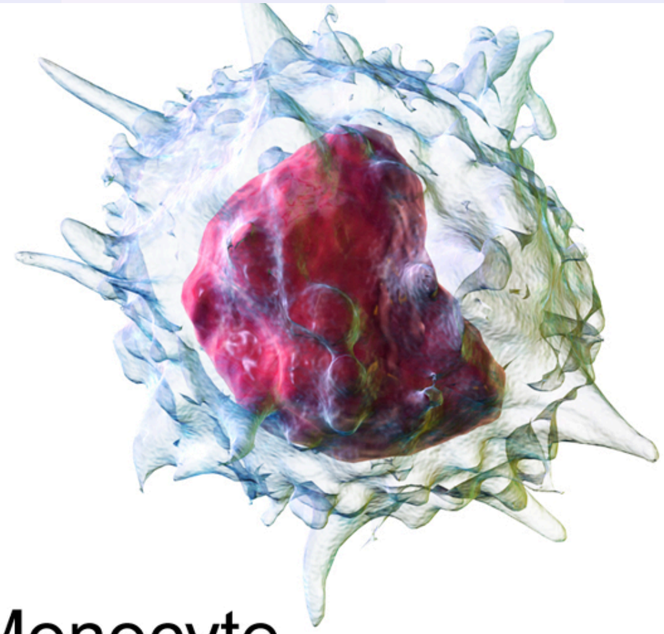
Our body is made up different types of blood cells, including white blood cells (WBC), or leukocytes.

- WBC are important part of our immune system, helping our body to fight off diseases and infections.

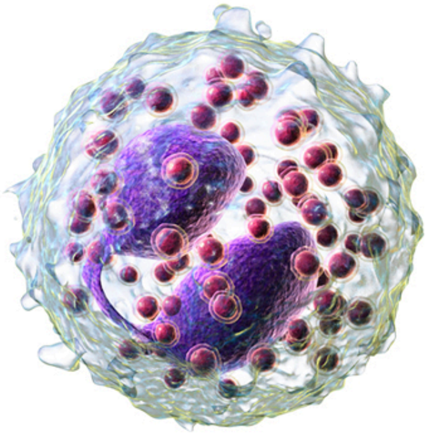
- Normal WBC count is 4.500–11.000/mm3 in adult man.

- Normal WBC count ranges vary based on an individual's age, pregnancy status, sex, and ethnicity, and on the laboratory performing the study.

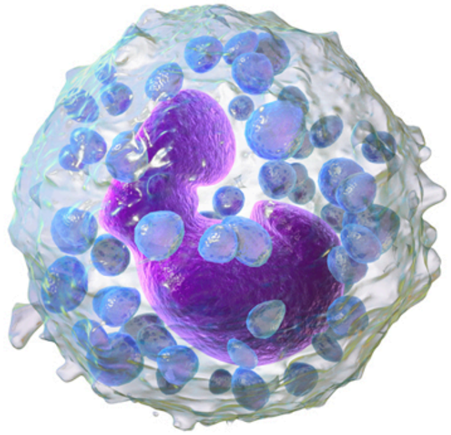




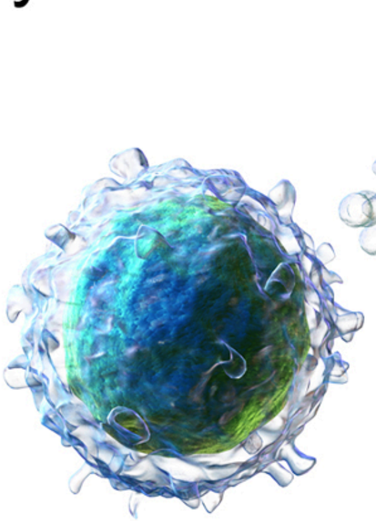
Monocyte

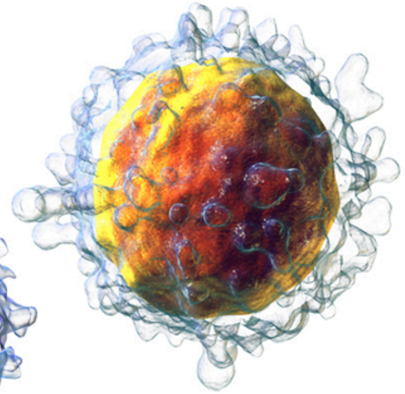


Eosinophil

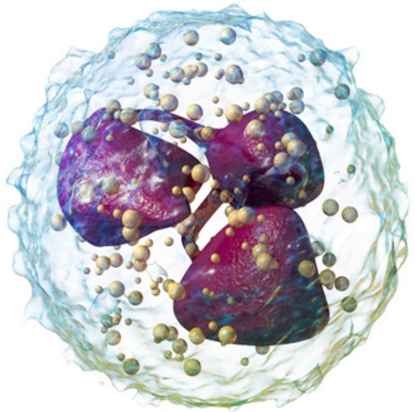


Basophil

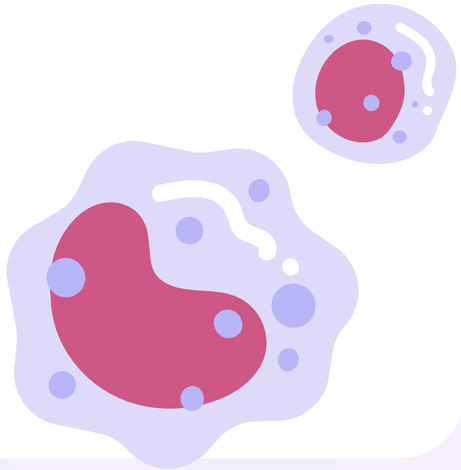




Lymphocytes



Neutrophil

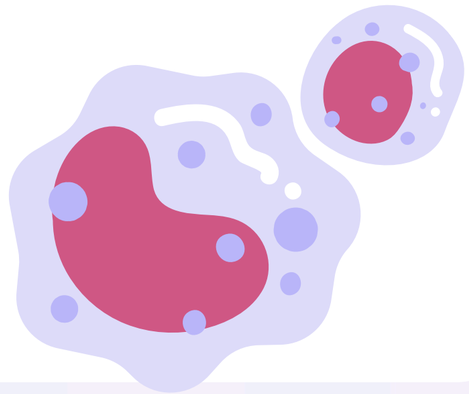


Leukocytosis

Leukocytosis is an increase in the white blood cell (WBC) count (>11,000/mm3).

- Which can be further characterized by the predominating cell type, e.g., neutrophilia,lymphocytosis, eosinophilia .
- This condition can occur for various reasons and is often an indication that the body is responding to an infection, inflammation, or other underlying medical conditions.
- Leukocytosis can be categorized into several types, depending on which specific type of white blood cell is elevated :

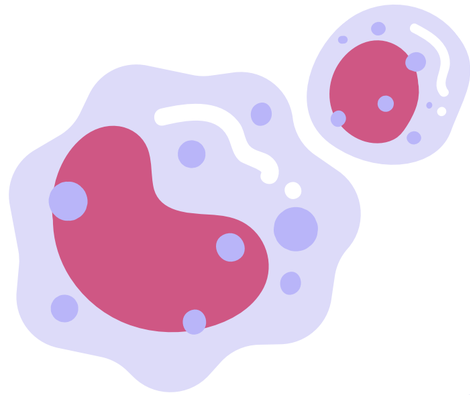
1) Neutrophilic leukocytosis 2) Monocytic leukocytosis
3) Lymphocytic leukocytosis 4) Eosinophilic leukocytosis
5) Basophilic leukocytosis

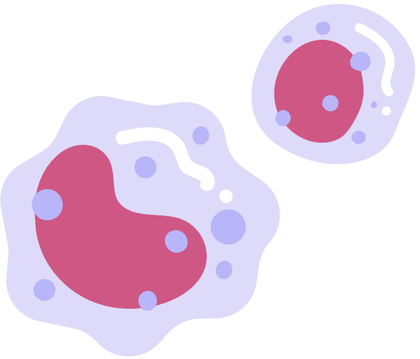


1- Neutrophilic leukocytosis:

Is an increase number of neutrophil in differential leukocytic count which normally (60-70%).

Common causes of neutrophilia:



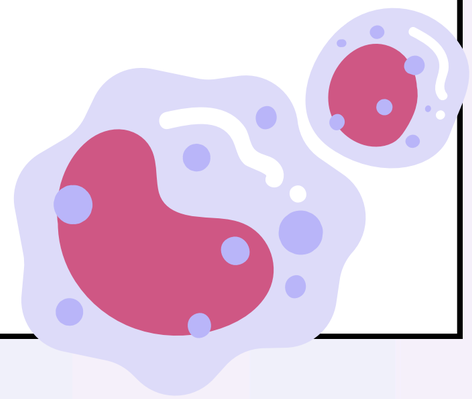
condition	Infection	Stress response
clinical features	• Feve • Features specific to infection site, e.g : Cough, shortness of breath, dysuria , New heart murmur	• Recent physical stress (e.g., surgery, seizure,vigorous exercise) • Recent emotional stress (e.g., panic attack)
dignostic finding	• Neutrophil left shift • Body fluid cultures with bacteria or fungus • Imaging (e.g., CXR) consistent with infection	Reactive neutrophilia 

condition	Acute myeloid leukemia	Chronic myeloid leukemia	Myeloproliferative neoplasm
clinical features	• Sudden onset and rapid progression of symptoms . • Fatigue, pallor, weakness . • Epistaxis, bleeding gums,petechiae, purpura	• Weight loss, fever, night sweats, fatigue • Splenomegaly, LUQ discomfort, infections.	• Constitutional symptoms, especially fatigue • Abdominal pain • Features of hyperuricemia, e.g., gout
dignostic finding	CBC and blood smear: • Anemia • Thrombocytopenia • > 20% myeloblasts • Bone marrow aspiration and biopsy	CBC and blood smear: • Sever leukocytosis • Thrombocytosis • Anemia later stages • Bone marrow aspiration and biopsy	CBC and blood smear: • changes in myeloid cell lines • Elevated LDH, uric acid, and/or leukocyte alkaline phosphatase • Abdominal imaging (e.g.,CT or ultrasound) with hepatosplenomegaly

2-Lymphocytic leukocytosis

Is an increase in number of lymphocyte in differential leukocytic count which normally more than (20-30%).

Common causes of lymphocytosis:



condition	Viral infectin	Pertussis	Hyperthyroidism
clinical features	• Fever • Disease -Specific features • Malaise and/or fatigue,myalgias • Symptoms ofURTI (e.g., cough) • Lymphadenopathy • Nausea, vomiting, diarrhea	• Watery nasal discharg • Paroxysmal coughing with high-pitched whooping • Posttussive vomiting • Low-grade fever (rare)	• Clinical features of thyrotoxicosis • Fatigue • Pretibial myxedema • Graves ophthalmopathy • Hypertension.
dignostic finding	• Often a clinical diagnosis • Antibody detection and/ or viral PCR • Imaging (e.g., CXR)consistent with infection.	• **First 4 weeks of symptoms: PCR and/or bacterial culture of nasopharyngeal swab or aspirate sample** • **> 4 weeks of symptoms: pertussis serology.** • **CBC: A lymphocyte count of > 20,000 cells/μL is a characteristic Diagnostic finding in infants.**	• **Thyroid function tests:** **↓ TSH, ↑ free T4** • **Imaging of the thyroid gland**

condition	Acute lymphoblastic leukemia	Chronic lymphocytic leukemia
clinical features	• Sudden onset of symptoms and rapid progression (days to weeks) • Fever, night sweats, unexplained weight loss • Bone pain • Painless lymphadenopathy	• B symptom • repeated infections • hepatomegaly/ splenomegaly • dermatologic symptoms • Painless lymphadenopath
dignostic finding	CBC and blood smear: • Anemia • Thrombocytopenia • > 20% lymphoblasts • Bone marrow aspiration and biopsy.	CBC and blood smear: • Persistent(>3 months) lymphocytosis • Smudge cell • Anemia • Thrombocytopenia • granulocytopenia • flow cytometry • bone marrow aspiration & biopsy

3-Monocytic leukocytosis:

Is an increase number of monocyte in differential leukocytic count which normally (3-8%).

Monocytosis is most commonly caused by bacterial infections.

#Causes of monocytosis:

1- Infection

- Bacterial(e.g ,TB)
- Fungal
- Viral (e.g , EBV)
- Protozoal infections (e.g ,malaria)

2-Autoimmune or inflammatory

- IBD
- Sarcoidosis
- SLE

3-Malignancy

- Lymphoma
- Multiple myloma
- Acute or chronic myelomonocytic leukemia

4-Hematologic

- Recovery from bone marrow suppression
- Neutropenia

5- Other: splenectomy

Eosinophilic leukocytosis

Is an increase number of eosinophils in differential leukocytic count which normally (1-5%).

- Usually cause by **Infection , Autoimmune or hypersensitivity** :

Bacterial (e.g., scarlet fever, leprosy, genitourinary infections, chlamydial infections) and Parasitic infections.
Asthma, Allergic rhinitis, Eosinophilic esophagitis , Rheumatoid arthritis, SLE and Sarcoidosis .

- Medications: drug hypersensitivity reactions .

- Other Causes by Malignancy , Hematologic , or Dermatological diseases :

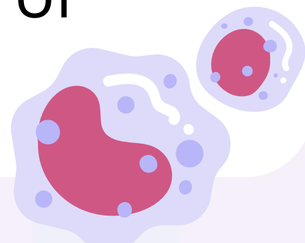
Hodgkin and NH. lymphoma lymphoma , CML , T cel malignancy, Polycythemia vera, Myelofibrosis
Dermatitis herpetiformis and Erythema multiforme

Basophil leukocytosis

Basophilia Is an increase number of eosinophils in differential leukocytic count which normally (1-.5%)

Contain heparin and histamine granules , it is become mast cell in tissue

- The usual cause is a **myeloproliferative or haematological** disorder such as chronic myeloid leukemia, Hodgkin lymphoma , polycythaemia vera and Chronic hemolytic anemia
- Reactive basophil increases are sometimes seen during smallpox or chickenpox infection and in ulcerative colitis
- Other Causes such as Allergy , Chronic inflammation of air way or dermatitis , Hypothyroidism , Ovulation and splenectomy .



Leukopenia

Is a decrease in the white blood cell **(WBC) count (< 4.500/mm3)**.

related to a number of that affect WBCs. Or BM :

- Aplastic anemia
- Autoimmune disorders eg. lupus or rheumatoid arthritis.
- Cancer or diseases of the bone marrow eg. MM
- Certain medications eg. antibiotics .
- Cancer treatments : chemotherapy, radiation and bone marrow transplant
- Congenital conditions – Conditions present at birth that affect the bone marrow.

Kostmann syndrome : is a rare, severe, congenital neutropenia disorder characterized by a lack of mature neutrophils , it is caused by disabling mutations in the HAX1 gene, which encodes HAX1, a mitochondrial protein that inhibits apoptosis .

Myelokathexis (WHIM syndrome) : is a congenital disorder that causes severe,chronic leukopenia and neutropenia , The disorder is believed to be inherited as autosomal dominant manner

Differential type of leukocytopenia

Condition	Range	cause
Neutropenia	Mild: 1,000–1,500 c/mm3 Moderate: 500–1,000 c/mm3 Severe: < 500 c/mm3 (severe infections)	• Genetic conditions As Benign ethnic neutropenia (BEN) • Infections:Commoly HIV, hepatitis, TB , sepsis, and Lyme disease • BM damage/suppression or Drugs e.g.carbimazole, clozapine
Lymphopenia	**< 25%** Mild: 800–1,000/mm³ Moderate: 500–800/mm Severe: <500/mm³	• Immunodeficiencies e.g., DiGeorge syndrome, SCID, Wiskott-Aldrich syndrome . • immunosuppressants: chemotherapy, glucocorticoids, radiation or Drugs (e.g., carbamazepine). • Infections e.g., sepsis, measles, miliary tuberculosis, HIV. • Neoplasia Hodgkin some NH. lymphomas).
Monocytopenia	**< 3%** <200/mm³ <0.2 × 10⁹/L	• Infections (e.g., HIV, EBV). • Aplastic anemia or Drugs (e.g., glucocorticoids, chemotherapy). • Malignancy (e.g., hairy cell leukemia, AML)
Eosinopenia	**< 1%** <50/mm³ <0.05 × 10⁹/L	• Infections (typhoid fever, paratyphoid fever, sepsis). • Cushing syndrome. • Glucocorticoids • Stress

Clinical Assessment

History

- Symptoms of infection (Recent or Recurrent).
- Symp. Of Malignancies: Night sweats, weight loss, lymphadenopathy suggest leukemia or lymphoma.
- Stress/Physiologic changes: Pregnancy, stress, and exercise can transiently increase WBCs .
- ask about Medications and Autoimmune diseases.

Physical Examination

- Fever, signs of infection
- Pallor, bruising, fatigue: Possible bone marrow failure
- Sign Lymphadenopathy or hepatosplenomegaly

Laboratory Investigations

- **Complete Blood Count (CBC)**
- **Peripheral Blood Smear**
- **Bone Marrow Aspiration & Biopsy**
- **Imaging (e.g., CXR in suspected pneumonia).**
- **Additional Tests Based on Clinical Suspicion**

Table 8.1 White cells: normal blood counts.

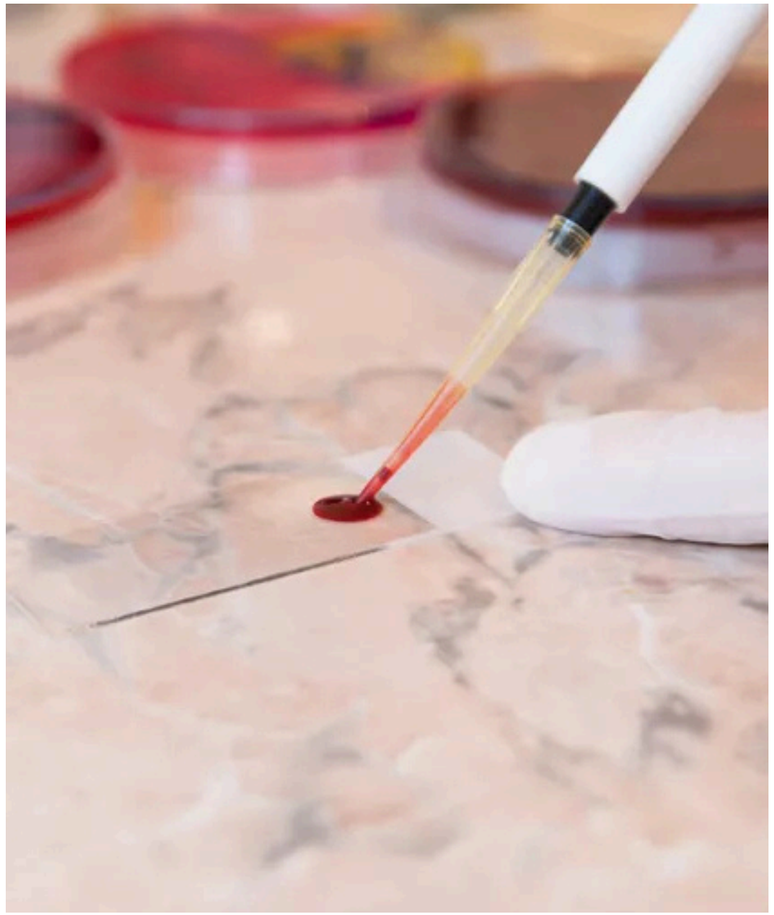
Adults	Blood count
Total leucocytes	$4.0–11.0 \times 10^9$/L*
Neutrophils	$1.8–7.5 \times 10^9$/L*
Eosinophils	$0.04–0.4 \times 10^9$/L
Monocytes	$0.2–0.8 \times 10^9$/L
Basophils	$0.01–0.1 \times 10^9$/L
Lymphocytes	$1.5–3.5 \times 10^9$/L

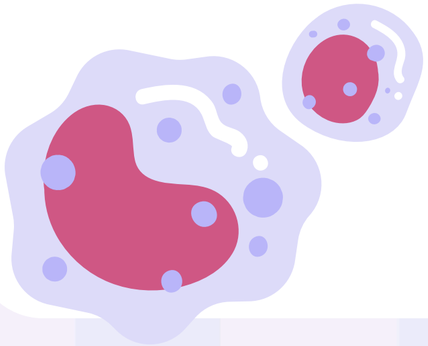
Peripheral Blood Smear Finding :

- **Morphology**

Monomorphic WBCs are concerning for malignancy.
Pleomorphic WBCs suggest reactive leukocytosis

- **Band cells** are common during the acute phase of bacterial infections and/or inflammation.
- **Platelet clumping** may be misinterpreted as WBCs.
- **Toxic granulations** suggest inflammation..





Treatment

Supportive Management :

- **Hydration.**

IV fluids to reduce blood viscosity, especially in extreme leukocytosis

- **Manage Complications.**

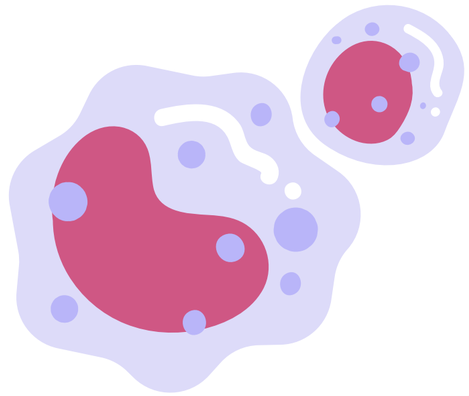
then..

Treat the Underlying Cause.

- Antibiotic or Antiinflammatory .

Leukemias & Myeloproliferative Disorders.

- Hematology consultation.
- Chemotherapy or targeted therapy



HIV

- Is lipid Enveloped virus of retroviruses subfamily .

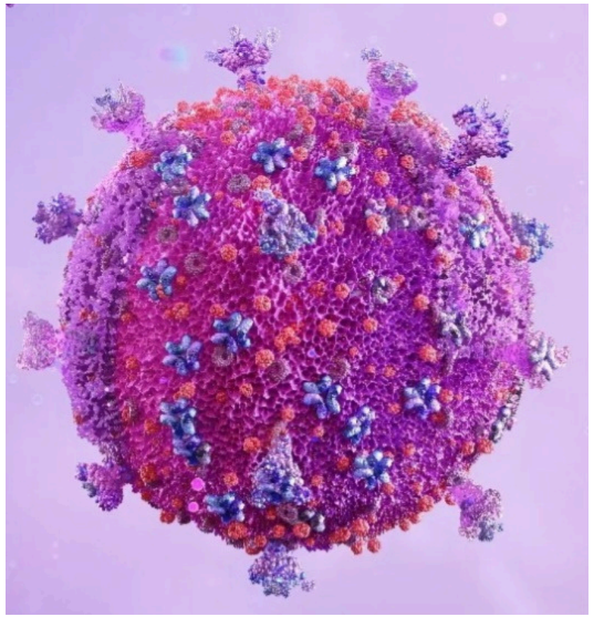
• Two viral strands of RNA found in core.

.The virus infects and distrust macrophages and other CD4+ cells .

- Transmission

• Direct contact with infected blood
• Sexual contact
• HIV-infected mothers to infants

- Treatment by Anti-Retroviral therapy



Thank you...

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