

Advanced Diagnostics: Beyond the Basics of CBC, LFTs, Lipids

Amelie Hollier, DNP, FNP-BC, FAANP

Co-Founder APEA

Lafayette, LA

Objectives

- **Evaluate and interpret selected WBC abnormalities and create a differential diagnosis (45 mins)**
- **Create a differential diagnosis list for selected abnormal values in a chemistry profile (10 mins)**
- **Avoid common interpretation problems with lipid panel and TSH results (5 mins)**

Speaker has no relationship to disclose.

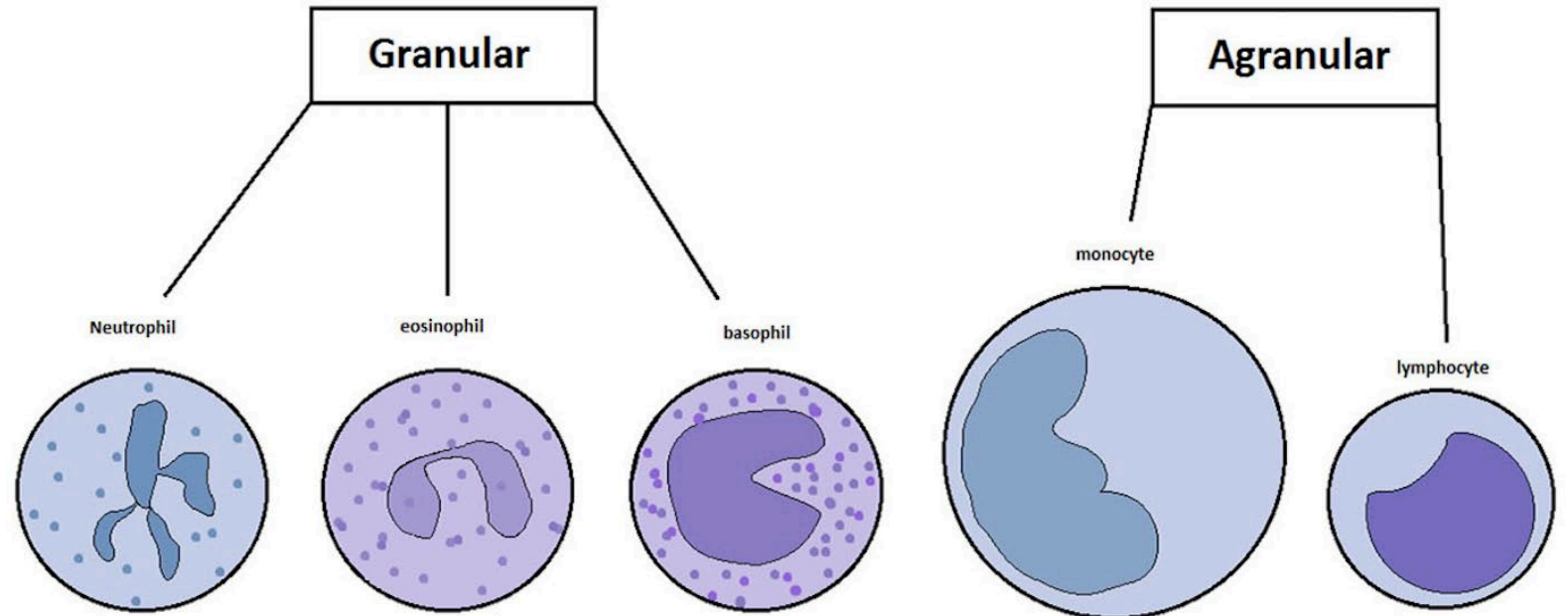
**What is the most ordered
laboratory test?**

WBCs: The Basics

White Blood Cells

Leukocytes

Neutrophils
Eosinophils
Basophils
Monocytes
Lymphocytes



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Leukocytosis = most common lab abnormality

WBC Differential

White Cell Type	Percentage!
Polymorphonuclear neutrophils ("polys", "segs", "neuts", neutrophils, PMNs,)	45-65
Band Neutrophils	0-5
Lymphocytes	15-40
Monocytes	2-8
Eosinophils	0-5
Basophils	0-3

Percentage is a very quick and convenient way to look at the differential.

Leukocytosis: what cells

White Cell Type	% age	Leukocytosis
Polymorphonuclear neutrophils	45-65	Neutrophilia (most common)
Band Neutrophils	0-5	
Lymphocytes	15-40	Lymphocytosis
Monocytes	2-8	Monocytosis
Eosinophils	0-5	Eosinophilia
Basophils	0-3	Basophilia

Take Home Point

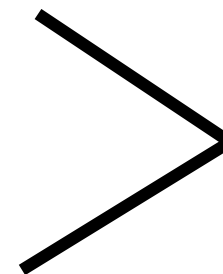
As you start to analyze your differential, always ask *which* WBC(s) is/are elevated

Start your analysis: What do we have?

	Patient	Norms
WBC	18.2 (H)	4-15
RBC	4.01	4.5-5.60
HGB	13.4	12.0-16.0 g/dL
HCT	40.8	37.5-51
MCV	90.7	83.4-96.0
MCH	28.1	27.8-32.5
MCHC	34.0	32.5-35.4
RDW	18	12-17
PLT	316	150-375
MPV	8.1	6.5-12

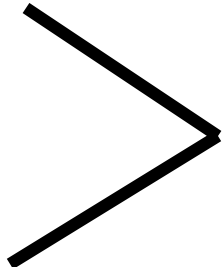
POLY%	75.5 (H)	45-65
LYMPHS%	12.1 (L)	15-40
MONO%	6.8	2-8
EOS%	3.1	0-5
BASO%	2.6	0-3

Does it add up?



Differential

Leukocytosis, neutrophilia

	Patient	Norms	
WBC	18.2 (H)	4-15	
RBC	4.01	4.5-5.60	
HGB	13.4	12.0-16.0 g/dL	
HCT	40.8	37.5-51	
MCV	90.7	83.4-96.0	
MCH	28.1	27.8-32.5	
MCHC	34.0	32.5-35.4	
RDW	18	12-17	
PLT	316	150-375	
MPV	8.1	6.5-12	
POLY%	75.5 (H)	45-65	
LYMPHS%	12.1 (L)	15-40	
MONO%	6.8	2-8	
EOS%	3.1	0-5	
BASO%	2.6	0-3	

Differential

**If you REALLY want to know if
someone has neutrophilia, you
need to know
how many cells are present**

Absolute Neutrophil Count (ANC)

If you really want to know how much you have of something, you need a count, not a percent

White Cell Type	Percent!
Polymorphonuclear neutrophils (“polys”, “segs”, “neuts”, neutrophils, PMNs,)	45-65
Band Neutrophils	0-5
Lymphocytes	15-40
Monocytes	2-8
Eosinophils	0-5
Basophils	0-3

Neutrophilia = $ANC > 7.5 \times 10^9/L$

- **ANC = total WBC count x neutrophil % \div 100**
(norm is 2.5 -6.0)
- **Absolute neutrophil count that exceeds $7.5 \times 10^9/L$ is *REAL neutrophilia***

Example: total white count 8.0, and 50% of WBC are neuts, then ANC is 4.0

Take Home Point

**Neutrophils are
most important WBC in
infection**

Neutrophilia

Most common cause of neutrophilia is acute, sub-acute infection

- **Bacterial**
- **Viral**
- **Fungal**
- **Rickettsial**
- **Spirochetal**
- **Usual range: 10-25 x 10⁹/L**

Basic WBC Review: you need a process!

	Patient	Norms
WBC	18.2 (H)	4-15
RBC	4.01	4.5-5.60
HGB	13.4	12.0-16.0 g/dL
HCT	40.8	37.5-51
MCV	87.7	83.4-96.0
MCH	28.1	27.8-32.5
MCHC	34.0	32.5-35.4
RDW	18	12-17
PLT	316	150-375
MPV	8.1	6.5-12

POLY%	75.5 (H)	45-65
LYMPHS%	12.1 (L)	15-40
MONO%	6.8	2-8
EOS%	3.1	0-5
BASO%	2.6	0-3

1. What's the total WBC count?
2. Does diff add up to 100?
3. What white cells/what percent were found?
4. Need absolute counts?

Neutrophilia

Polys, lymphs: first responders,
“far apart”

Mono: normal

The following CBC is from a 52-year-old male who was diagnosed with community acquired pneumonia.

Start your analysis

	Patient	Norms
WBC	28.2 (H)	4-15
RBC	4.01	4.5-5.60
HGB	14.4	12.0-16.0 g/dL
HCT	43.2	37.5-51
MCV	89.7	83.4-96.0
MCH	28.1	27.8-32.5
MCHC	34.0	32.5-35.4
RDW	18	12-17
PLT	316	150-375
MPV	8.1	6.5-12
POLY%	80.5 (H)	45-65
LYMPHS%	8.1 (L)	15-40
MONO%	4.4	2-8
EOS%	0.1	0-5
Bands%	6.9	0-5

WBC count ELEVATED!
(usual $10-25 \times 10^9/L$)

Pneumococcal infection
can be associated with
WBC counts $>25 \times 10^9/L$

Reason for the leukocytosis?

	Patient	Norms
WBC	28.2 (H)	4-15
RBC	4.01	4.5-5.60
HGB	14.4	12.0-16.0 g/dL
HCT	42.2	37.5-51
MCV	89.7	83.4-96.0
MCH	28.1	27.8-32.5
MCHC	34.0	32.5-35.4
RDW	18	12-17
PLT	316	150-375
MPV	8.1	6.5-12

POLY%	80.5 (H)	45-65
LYMPHS%	8.1 (L)	15-40
MONO%	4.4	2-8
EOS%	0.1	0-5
Bands%	6.9	0-5

Neutrophilia
(neuts = polys + bands)

"Left Shift"?

Reactive Neutrophilia

- **Reactive neutrophilia is a response by a healthy bone marrow to infection (or a response to something other than infection)**
- **WBC < 25-30 x 10⁹/L**
- **Absence of basophils**
- **On peripheral blood smear (“smear”): RBCs, platelets have normal morphology**
- **Spleen of normal size**

Marked Neutrophilia (*Need a smear!*)

Leukemoid Reaction vs Neoplastic Neutrophilia

When WBC > 25-30 x 10⁹/L :

- ***Leukemoid Reaction*** = WBC > 25-30 x 10⁹/L , but returns to normal range with treatment (AB)
- ***Neoplastic Neutrophilia*** = WBC > 25-30 x 10⁹/L (usually > 50 x 10⁹/L) , progressive increase in white count
- CML is most common cause of neoplastic neutrophilia: usually presents with increased platelets/abnormal morphology and blasts

Closer look

	Patient	Norms
WBC	28.2 (H)	4-15
RBC	4.01	4.5-5.60
HGB	14.4	12.0-16.0 g/dL
HCT	42.2	37.5-51
MCV	89.7	83.4-96.0
MCH	28.1	27.8-32.5
MCHC	34.0	32.5-35.4
RDW	18	12-17
PLT	316	150-375
MPV	8.1	6.5-12
POLY%	80.5 (H)	45-65
LYMPHS%	8.1 (L)	15-40
MONO%	4.4	2-8
EOS%	0.1	0-5
Bands%	6.9	0-5

Lab Request!
Peripheral Blood
Smear

Patient has Neutrophilia

If.....

- ↑ Polys (mature neuts)
- ↑ Bands (immature neuts)
- ↓ Eosinophils
- Basophils may be rare

**Results of Peripheral Blood Smear
Indicate:
*Normal cell morphology***

Why I'm not worried yet...

- Patient has CAP, *Streptococcus pneumoniae* is a common cause
- Pneumococcal infections can be associated with WBC counts $> 25 \times 10^9/L$
- Differential reflects classic bacterial presentation (bacterial pneumonia)
- Peripheral smear shows normal cell morphology

Expectations During/After Antibiotic Treatment

- Decreased total white count
- Decreased neutrophil count
- Increased lymphocytes
- Decreased band neutrophils
- Monocytes and eosinophils likely to increase
- Reappearance of basophils

WBC

28.2 (H)

4-15

POLY%

80.5 (H)

45-65

LYMPHS%

8.1 (L)

15-40

MONO%

4.4

2-8

EOS%

0.1

0-5

Bands%

6.9

0-5

Suppose...

the 52-year-old male had WBC count of $20 \times 10^9/L$ but *didn't have pneumonia and wasn't infected.*

What else can cause neutrophilia?

Other Causes of Neutrophilia

- **Malignancy: solid tumors, lymphoma**
- **Medications: Steroids, lithium, others**
- **Trauma (crush injuries, electric shock)**
- **Hematologic disorders: leukemia, megaloblastic anemia, CML, Sickle cell crisis, others)**
- **Inflammatory diseases (RA, IBD, UC, Hepatitis)**
- **Others: cigarette smoking, cocaine use, childbirth**

Red Flags

- **Neutrophilia** *plus a red cell*
abnormality
- **Neutrophilia** *plus a platelet*
abnormality

Neutrophilia + a second CBC Abnormality

Abnormality	Diagnostic Considerations
Anemia	Malignancy, hemolytic anemia, chronic inflammation or infection
Elevated Hgb/Hct	Myeloproliferative disorder polycythemia vera
Thrombocytosis	Inflammation, infection, malignancy
Thrombocytopenia	TTP, malignancy, infection, inflammation, sepsis, DIC

Leukopenia

Remember we said....

**Neutrophils are
most important WBC in
infection**

Leukopenia

- **WBC count < 4,000 μL**
- **Usually due to decreased neutrophils
(could be lymphopenia)**

Leukopenia: Take Home Point

As you start to analyze your differential, always ask *which* WBC(s) is/are decreased

Neutropenia

If you **REALLY** want to know if
someone has neutropenia, you
need to know
how many cells are present

Absolute Neutrophil Count (ANC)

If you really want to know how much you have of something, you need a count, not a percent

White Cell Type	Percent!
Polymorphonuclear neutrophils (“polys”, “segs”, “neuts”, neutrophils, PMNs,)	45-65
Band Neutrophils	0-5
Lymphocytes	15-40
Monocytes	2-8
Eosinophils	0-5
Basophils	0-3

Neutropenia = ANC < 1500 μ L

- **ANC = total WBC count x neutrophil % \div 100
(norm is 2.5 -6.0)**
- **Neutrophil count = segs + bands**
- **Do not include neutrophil precursors in count
(metamyelocytes, myelocytes, blasts)**

The following CBC is from a 64-year-old African-American male who is in clinic for surgical clearance for dental implants. He feels well and has no complaints.

Start Analysis

	Patient	Norms
WBC	3.2 (L)	4-15
RBC	4.01	4.5-5.60
HGB	12.4	12.0-16.0 g/dL
HCT	38.2	37.5-51
MCV	89.7	83.4-96.0
MCH	28.1	27.8-32.5
MCHC	34.0	32.5-35.4
RDW	18	12-17
PLT	316	150-375
MPV	8.1	6.5-12

POLY%	35.5 (L)	45-65
LYMPHS%	50.1 (H)	15-40
MONO%	8.0	2-8
EOS%	2.1	0-5
BASO%	4.3	0-5

Patient has Neutropenia

ANC 1.1

On Further Review

- ANC is 1.1
- What's his risk of infection?

Assessment of Neutropenia

Degree of Neutropenia	Absolute Neut Count
Mild Minimal to no risk of infection	1.0-1.5 x 10⁹ cells/L
Moderate Some risk of infection	0.5 - 1.0 x 10⁹ cells/L
Severe Hospitalization	< 0.5 x 10⁹ cells/L

Questions to Ask

- **Are there previous CBCs that we can compare to this one?**
- **Peripheral smear if previous CBCs not available**

On Further Review

- **The last 7 years of CBCs reflect a persistent neutropenia**
- **Any worries?**

FYI: *Ethnicity* can affect Neutrophil Count

- **25% of healthy African-Americans can have ANC 1000-1500 μ L**
- **Yemenite Jews, Arab Jordanian, South African, West Indian can have lower counts**
- **Important to determine ethnicity and family history in workup of neutropenia**

Benign Ethnic Neutropenia

- **3 consistent samples reflect this**
- **Diagnosis of exclusion**
- **They are not more likely to get infections**

The following CBC is from a 54-year-old female who is in clinic for a well woman exam. She feels well and has no complaints.

Start Analysis

	Patient	Norms
WBC	3.0 (L)	4-15
RBC	4.01	4.5-5.60
HGB	12.4	12.0-16.0 g/dL
HCT	38.2	37.5-51
MCV	89.7	83.4-96.0
MCH	28.1	27.8-32.5
MCHC	34.0	32.5-35.4
RDW	18	12-17
PLT	316	150-375
MPV	8.1	6.5-12
POLY%	40.5 (L)	45-65
LYMPHS%	45.1 (H)	15-40
MONO%	8.0	2-8
EOS%	2.1	0-5
BASO%	4.3	0-5

Patient has Neutropenia

ANC 1.1 (Inf risk: low)

Glu, LFT Results

	Patient	Normal Values
Glucose	82	70-110 mg/dL
Total Protein	7.5	6.0-8.5 g/dL
Total Bilirubin	0.4	0.1-1.2 mg/dL
Albumin Level	4.5	3.5-5.5 g/dL
Alkaline Phosphatase	82	30-120 U/L
AST (SGOT)	118 H	0-41 U/L
ALT (SGPT)	124 H	0-45 U/L

Additional Labs

- **Peripheral blood smear**
- **Viral Serology (Hep A, B, C, EBV, CMV, HIV)**

Long term Neutropenia

- **HIV**
- **EBV**
- **Hepatitis B**

Hepatitis Panel Results

Hep A IgM (-) IgG (-)

Hep B surface AB (+)

HCV Antibody (+)

HCV RNA (+)

Results

HIV, EBV, CMV (-)

**Peripheral Smear: normal cell
morphology**

She has Hepatitis C!

- **Viral infections are common cause of neutropenia**
- **Viral infections can be a consequence of neutropenia (always assess for fever)**

Expectations During/After Hepatitis C Treatment

- WBC normalize
- Increased neutrophil count
- Decreased lymphocytes

WBC	3.0 (L)	4-15
POLY%	35.5 (L)	45-65
LYMPHS%	50.1 (H)	15-40

Recheck CBC within 3 months of completion of treatment for Hepatitis C

Pseudoneutropenia

- EDTA (ethylenediamine tetra acetic acid) = anticoagulant
- Pink top tube
- Sometimes in the presence of EDTA, RBCs binds to neutrophils and can cause *spurious neutropenia*
- Can use a different anticoagulant like citrate or heparin

**How can you rule out
suspected
Pseudoneutropenia?**

Peripheral Smear Enlightenment!!!

Smear Findings	Disease/Condition
Normal morphology	Non-Bone marrow
RBC/neutrophil complexes	EDTA
Myeloblasts: Auer rods	AML
Lymphoblasts	ALL
Abnormal platelet morphology, abnormal RBCs, abnormal WBCs	Myelodysplastic Syndrome

Many Causes of Neutropenia

Drug Induced Neutropenia

- *Chemotherapeutic agents*
- **Antibiotics: PCN, cephalosporins, sulfonamides, chloramphenicol**
- **NSAIDs: Naproxen, ibuprofen, others**
- **Antithyroid: PTU, MMI**
- **Allopurinol**
- **Spirolactone, chlorothiazide**
- **Anti-rheumatic meds: Gold, sulfasalazine**
- **Others**

Non-Drug Causes of Neutropenia

- **B12 and folate deficiency**
- **Lupus, RA, connective tissue diseases**
- **Hypersplenism**
- **Hematologic: AML, ALL, myelodysplastic syndrome**

Lymphocytes and Lymphocytosis

Lymphocytes

- **Serum lymphocytes include B cells, T cells, natural killer cells**
- **T cell: B cell ratio (4:1)**
- **Natural killer cells = 10%**

WBC Differential

White Cell Type	Percentage!
Polymorphonuclear neutrophils ("polys", "segs", "neuts", neutrophils, PMNs,)	45-65
Band Neutrophils	0-5
Lymphocytes	15-40
Monocytes	2-8
Eosinophils	0-5
Basophils	0-3

Lymphocytosis

- **Absolute lymphocyte Count (ALC) =**
total WBC count x lymphocyte % \div 100
- **Absolute lymphocytosis = ALC $>$ $4 \times 10^9/L$**
- **Relative lymphocytosis = lymphocyte % $>$ 50%**

Take Home Point

Viral infection is the most common cause of lymphocytosis.

Most common viral infections that produce lymphocytosis

- **Epstein-Barr virus (infectious mononucleosis)**
- **Cytomegalovirus**
- **Adenovirus**
- **Hepatitis A, B, C**
- **HIV acute seroconversion**
- **Roseola, rubella, chickenpox, mumps, HHV 6**

Other Causes of Lymphocytosis

- **BACTERIAL INFECTIONS!** (Pertussis, TB, typhoid fever)
- **Drug reaction**
- **Malignancy** (early ALL, early CLL, non-Hodgkin's lymphoma, others)
- **Others:** Serum sickness, cigarette smoking, stress, vigorous exercise

Basic Analysis of Lymphs

	Patient	Norms
WBC	3.2 (L)	4-15
RBC	4.01	4.5-5.60
HGB	12.4	12.0-16.0 g/dL
HCT	36.2	37.5-51
MCV	103.7	83.4-96.0
MCH	28.1	27.8-32.5
MCHC	34.0	32.5-35.4
RDW	18	12-17
PLT	316	150-375
MPV	8.1	6.5-12
POLY%	40.5 (L)	45-65
LYMPHS%	50.1 (H)	15-40
MONO%	9.8	2-8
EOS%	0.1	0-5

Lymphocytosis

Polys, lymphs: “close” together

Mono: elevated

Atypical Lymphocytes (“smear”)

- **AKA: Reactive lymphocytes, “variants”, Downy cells**
- **Lymphocytes are small, medium, and large**
- **In response to infection or non-infectious stimuli, stress, the lymphs undergo a morphologic change**
- **Most common: mononucleosis, CMV, infectious hepatitis, pertussis, drug reaction**

The following CBC is from a 14-year-old male who started phenytoin 6 days ago for a seizure disorder. He complains of fatigue and low-grade fever.

Start Analysis

	Patient	Norms
WBC	3.8 (L)	4-15
RBC	4.01	4.5-5.60
HGB	13.4	12.0-16.0 g/dL
HCT	40.3	37.5-51
MCV	103.7	83.4-96.0
MCH	28.1	27.8-32.5
MCHC	34.0	32.5-35.4
RDW	18	12-17
PLT	316	150-375
MPV	8.1	6.5-12

POLY%	37.5 (L)	45-65
LYMPHS%	50.1 (H)	15-40
MONO%	3.2	2-8
EOS%	9.1 (H)	0-5
BASO	0.1	0-3

Lymphocytosis
Eosinophilia

Causes of Eosinophilia

- **Asthma**
- **Atopic disorders: allergic rhinitis, chronic urticaria, atopic dermatitis**
- **Parasitic infection: helminths**
- **TB**
- **Solid cancers**
- **Hematologic: ALL, CML, lymphoma**

**What's *the* most common
cause of eosinophilia?**

Drug Induced Eosinophilia

- **Penicillin, cephalosporins, sulfonamides, nitrofurantoin**
- **Gold**
- **Phenytoin, chlorpromazine**
- **Warfarin**

Closer Look

	Patient	Norms
WBC	3.8 (L)	4-15
RBC	4.01	4.5-5.60
HGB	13.4	12.0-16.0 g/dL
HCT	40.3	37.5-51
MCV	103.7	83.4-96.0
MCH	28.1	27.8-32.5
MCHC	34.0	32.5-35.4
RDW	18	12-17
PLT	316	150-375
MPV	8.1	6.5-12

POLY%	37.5 (L)	45-65
LYMPHS%	50.1 (H)	15-40
MONO%	3.2	2-8
EOS%	9.1 (H)	0-5
BASO	0.1	0-3

Peripheral Smear: atypical lymphs

VCA: IgM neg

VCA: IgG neg

Why I'm not worried yet...

- Patient has mildly reduced total white count
- He has eosinophilia
- Patient has recently started phenytoin, a common cause of drug induced eosinophilia
- Peripheral smear indicates atypical lymphs which are not uncommon in drug reaction
- Contact prescriber of phenytoin to discuss plan
- Recheck CBC with smear in 3 months after d/c phenytoin

Start Analysis

	Patient	Norms
WBC	4.0	4-15
RBC	4.01	4.5-5.60
HGB	14.4	12.0-16.0 g/dL
HCT	43.2	37.5-51
MCV	103.7	83.4-96.0
MCH	28.1	27.8-32.5
MCHC	34.0	32.5-35.4
RDW	18	12-17
PLT	316	150-375
MPV	8.1	6.5-12
POLY%	37.5 (L)	45-65
LYMPHS%	50.1 (H)	15-40
MONO%	3.2	2-8
EOS%	4.1	0-5
BASO	0.1	0-3

Differential Diagnosis for Increasing or Persistent Lymphocytosis

Lymphoproliferative disorders

- ALL, CLL, Hairy cell leukemia, non-Hodgkin's lymphoma, monoclonal B cell lymphocytosis, others
- Peripheral smear and referral

Platelet Disorders

Thrombocytopenia

**If Actual
Thrombocytopenia.....**

The following CBC is from a 41-year-old who had a wellness exam that included a CBC, CMP. He is in his usual state of health and has no complaints.

Start Analysis

	Patient	Norms
WBC	4.8	4-15
RBC	4.01	4.5-5.60
HGB	14.4	12.0-16.0 g/dL
HCT	43.2	37.5-51
MCV	83.7	83.4-96.0
MCH	28.1	27.8-32.5
MCHC	34.0	32.5-35.4
RDW	18	12-17
PLT	116 (L)	150-375
MPV	8.1	6.5-12
POLY%	37.5	45-65
LYMPHS%	50.1	15-40
MONO%	3.2	2-8
EOS%	9.1	0-5
BASO	0.1	0-3

If Actual Thrombocytopenia

- Impaired production?
- Increased destruction?
- Pooling in the spleen?

Confirm Thrombocytopenia

**In the setting of an
asymptomatic patient...order a
peripheral smear**

Remember EDTA?

- **Most common cause of spurious or pseudothrombocytopenia**
- **Platelets can adhere to neutrophils (clumping)**
- **Can use a different anticoagulant like citrate or heparin to confirm normal PLT count on subsequent venipuncture**

Another Cause

- **Careless venipuncture**
- **Inadequate anticoagulant in tube
(should invert tube 8-10 times)**

Determining Etiology

**Peripheral Smear
is Great Tool!**

Using Smear to Guide Diagnosis

Smear Findings	Consider
Atypical lymphocytes	Viral etiology
Bands, metamyelocytes	Bacterial infection, sepsis
Hypersegmented neuts	Vitamin B12, Folate deficiency
Spherocytes	Autoimmune hemolytic anemia
Fragmented Red cells Schistocytes (helmet cells)	Hemolytic anemia (DIC, TTP, HUS)
Blasts	Leukemia
RBC, WBC, morphology	Myelodysplastic syndrome

When Smear is Normal

3 Considerations

Drug Induced Thrombocytopenia

- Heparin, PLT inhibitors
- Ranitidine, cimetidine
- NSAIDs: ibuprofen, naproxen, others
- Acetaminophen
- HCTZ, furosemide

Drug Induced Thrombocytopenia

- **Cephalosporins, rifampin, cephalosporins, TMPS, Amphotericin B, fluconazole, linezolid**
- **Gold, D-penicillamine**
- **Phenytoin, carbamazepine**

Hypersplenism

Common cause of hypersplenism is alcohol!

- **Palpate spleen**
- **Consider imaging if not certain of enlargement**

Hypersplenism

- **Hypersplenism due to platelet pooling**
- **Platelet count > 30,000/uL**

Immune-mediated Causes

- *Primary immune thrombocytopenia:*
Idiopathic thrombocytopenia purpura (ITP)
- *Secondary Causes*

If not secondary, then ITP is likely!

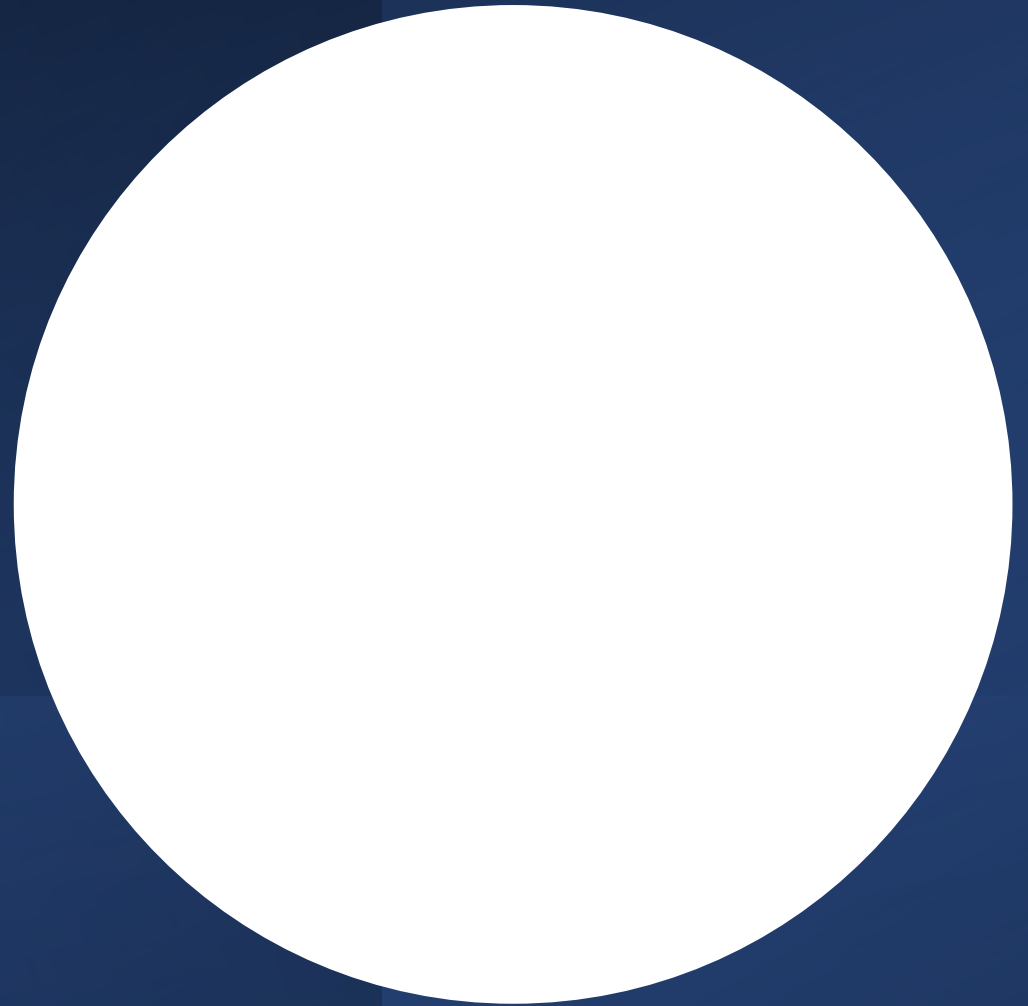
Finding Secondary Cause

- **ANA**: if positive, consider connective tissue disease
- **Lymphadenopathy or splenomegaly**: CT scan of thorax, abdomen, pelvis to look for lymphoma, CLL
- **HIV testing**
- **Lupus anticoagulant/anticardiolipin antibodies** (presence of antiphospholipid antibodies)

And then I'm stumped!

Last section

Order TSH *only*
for evaluation of
non-neoplastic
thyroid disease.



IF TSH Abnormal, then

- **Confirm with free thyroxine (T4)**
- **May follow up with additional evaluation or treatment depending on the findings**

Rationale

- **TSH (has high sensitivity) can detect subclinical thyroid disease in asymptomatic patients**
- **Normal TSH excludes majority of cases of primary overt thyroid disease**

**Do not use serum Cr alone for
evaluation.**

**Need to Evaluate
Patients for CKD?**

**Do not use
serum Cr
alone for
evaluation.**

Need to Evaluate Patients for CKD?

**To assess
albuminuria: “Spot”
urine for albumin-
creatinine ratio (ACR)**

**Serum Cr to estimate
GFR using CKD EPI
equation**

Take Home Point

Follow evidence-based
guidelines when
ordering lab tests!

Summary and Take Home

Take Home Point

Don't forget the
peripheral smear!!!

Take Home Point

**Medications can wreck
normal cell counts!**

Take Home Point

Be on the look out for malignancies.

Thank you!

Amelie Hollier, DNP, FNP-BC, FAANP
Advanced Practice Education Associates
amelie@apea.com