THE UNIVERSITY OF KANSAS HEALTH SYSTEM

The CBC as a Clinical Compass:

Recognizing Common Abnormalities to Guide Diagnosis

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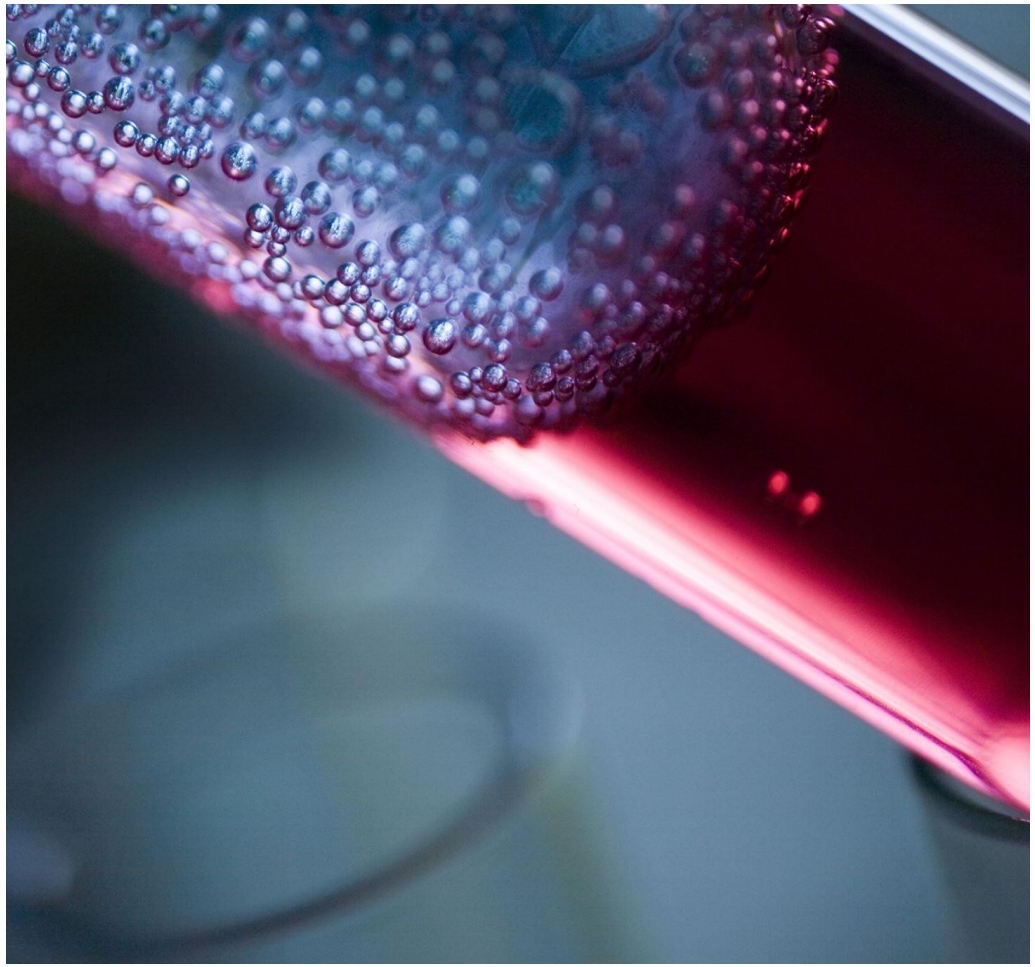
Objectives

- Identify components of a complete blood count (CBC) with differential and their physiological significance.
- Discuss diagnostic utility of the CBC in detecting anemia, infections, inflammatory conditions, and hematologic malignancies.
- Describe key patterns and abnormalities in CBC results and their clinical significance.
- Discuss practical guidance on when to order additional tests or consult a hematologist based on CBC findings to ensure comprehensive patient care.

The CBC

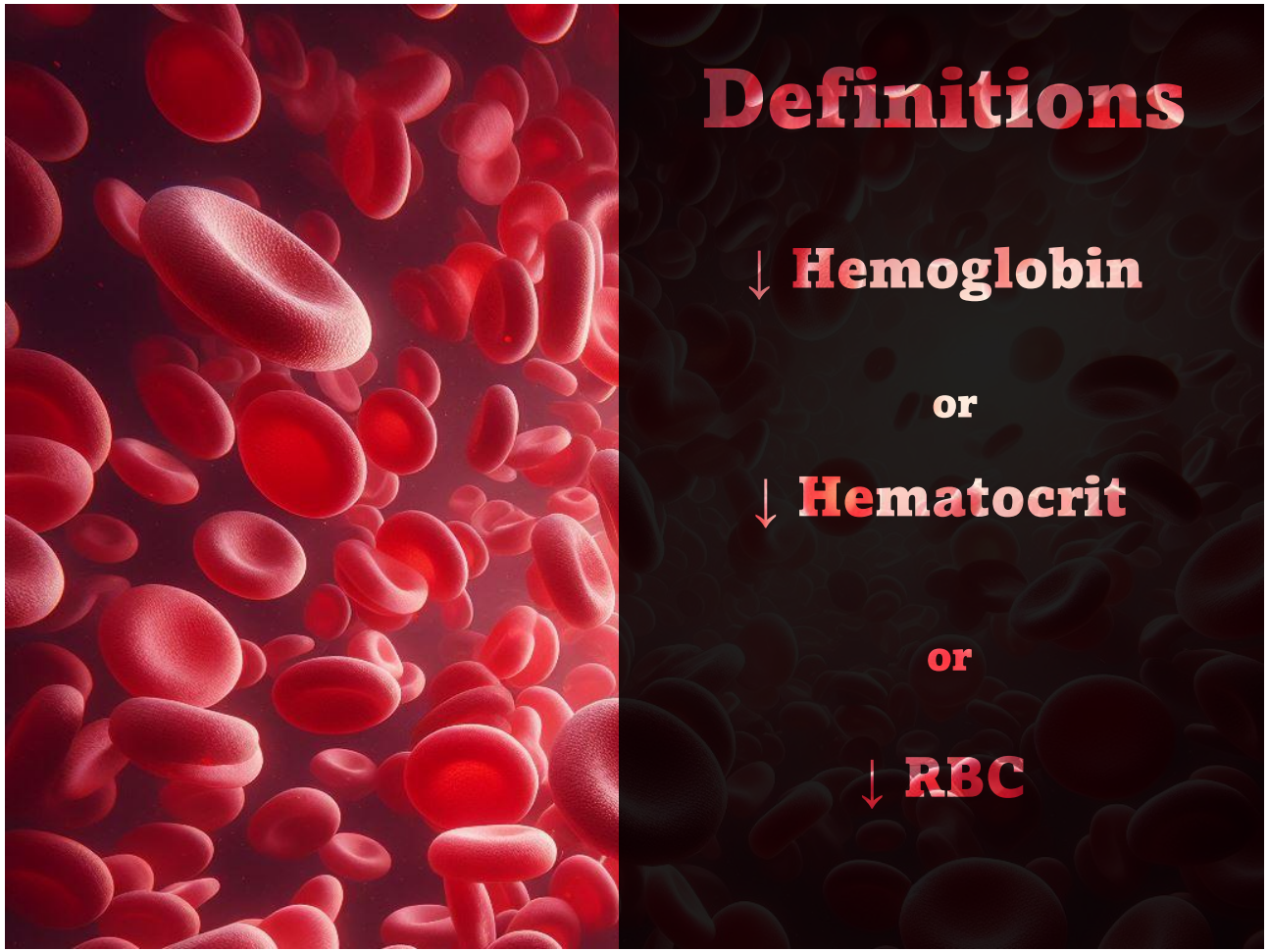
- Most commonly performed lab test worldwide
- An easy to obtain, cheap to process, liquid biopsy
- Used to evaluate the cellular components of blood



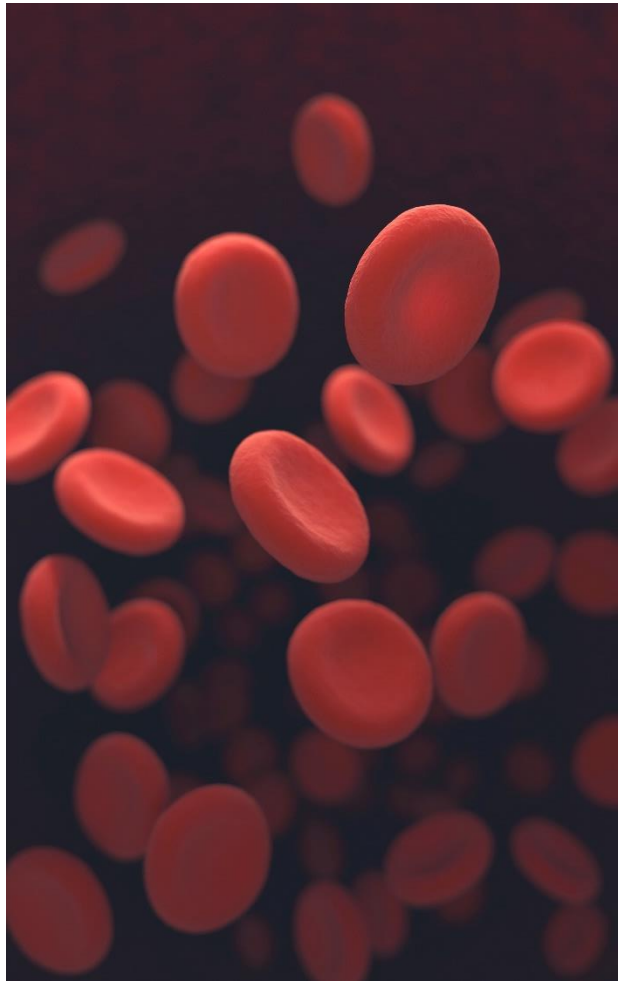
Components of a CBC

BLOOD COUNTS	
Hemoglobin	9.3 ▼
Hematocrit	27.3 ▼
Platelet Count	315
White Blood Cells	3.5 ▼
Neutrophils	66
Absolute Neutrophil Count	2.31
Lymphocytes	19 ▼
Absolute Lymph Count	0.65 ▼
Monocytes	5
Absolute Monocyte Count	0.19
Eosinophils	9 ▲
Absolute Eosinophil Count	0.30
Absolute Basophil Count	0.03
MDW (Monocyte Distribution Width)	
Basophils	1
RBC	2.61 ▼
MCV	104.6 ▲
MCH	35.6 ▲
MCHC	34.0
MPV	6.9 ▼
RDW	17.4 ▲

Anemia



Definitions



Females

- Hemoglobin <11.9 g/dL or hematocrit <35 percent or RBC <4.0 M/UL

Males

- Hemoglobin <13.6 g/dL or hematocrit <40 percent or RBC <4.4 M/UL

Gender dysmorphia

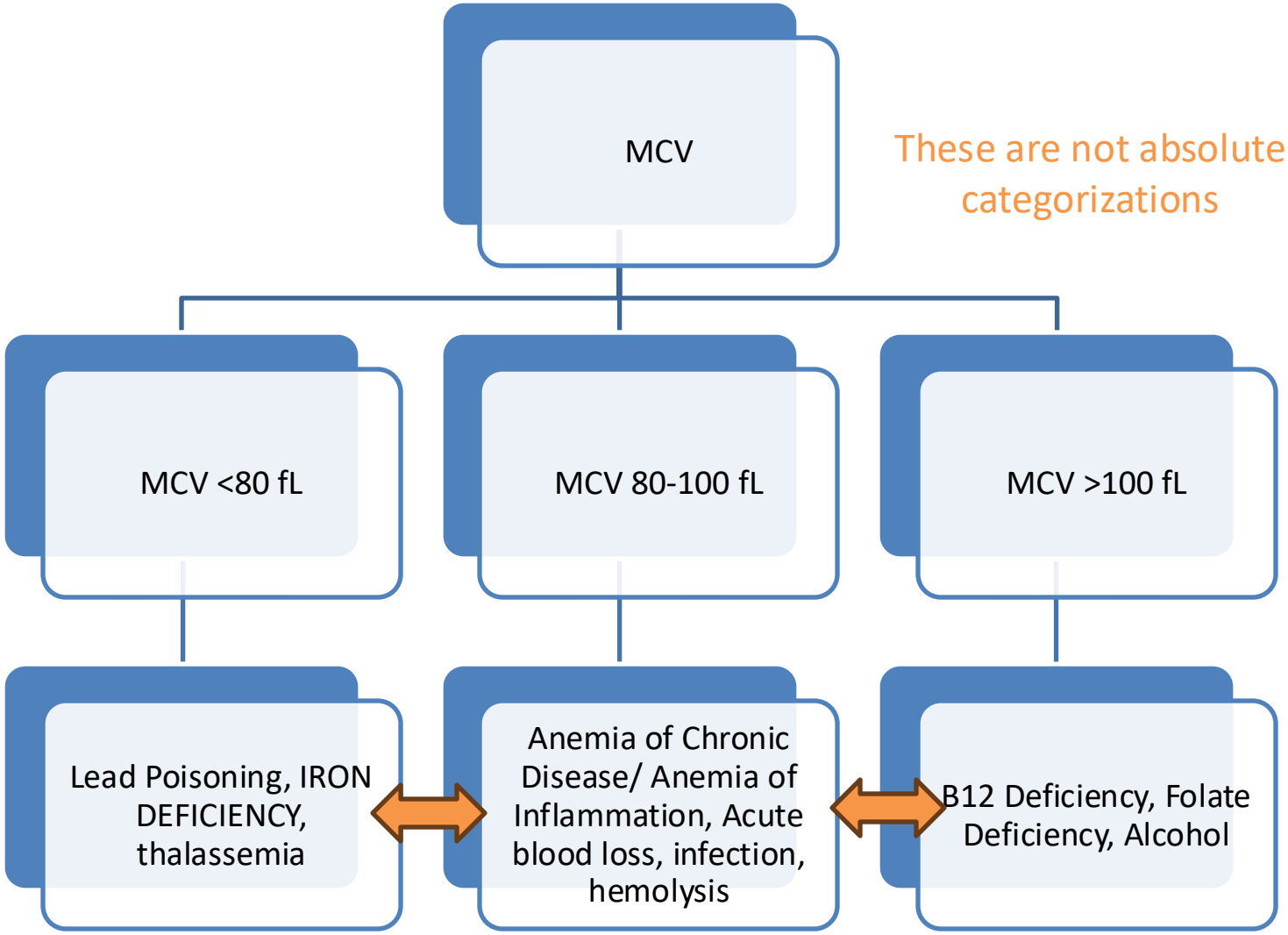
HPI

- Detailed history
- Acute or chronic?
- Any other persistent CBC abnormalities?
- Supporting labs: MCV, RBC, reticulocyte count
- Symptomatic?

Based on HPI…

- Nutritional evaluation: Vitamin B12, copper, folate
- Endocrine: TSH with T4 reflex, early AM testosterone
- Hemolysis markers: Haptoglobin, LDH, DAT
- Blood loss: PT, PTT, fibrinogen
- Peripheral smear
- Autoimmune markers: ANA and RF
- Hemoglobin electrophoresis
- Refer to Hematology
  - For any concerns, which could include:
  - Hemoglobin < 10 without obvious cause
  - Anemia + any other persistent CBC abnormality
  - Highly symptomatic anemia, including constitutional symptoms
  - Anemia unresponsive to prescribed therapy
  - Concern for inherited disorders, bleeding disorders, clonal disorders, or hemolysis

Why does the MCV matter?

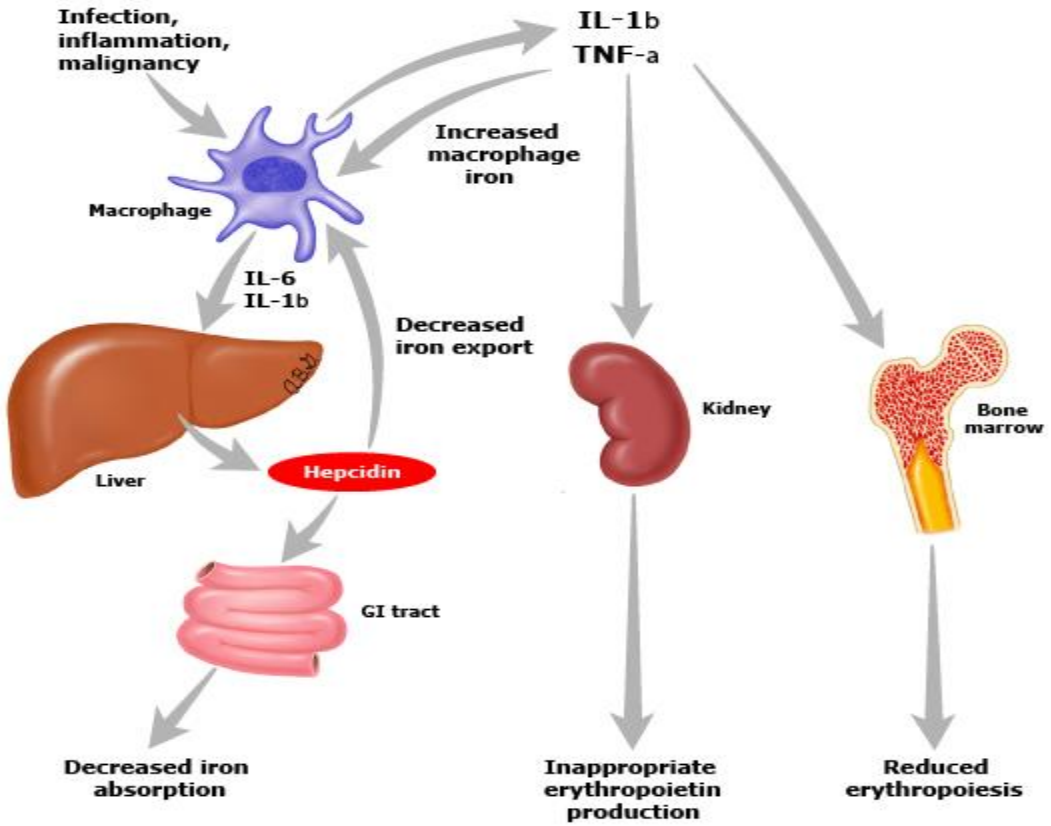


These are not absolute categorizations

Lichtman et al., 2022

Normocytic Anemias

Anemia of Inflammation/Anemia of Chronic Disease



·Systemic Infection ·DM ·Obesity ·Heart Failure ·CKD

Treat underlying cause

Camaschella & Weiss, 2024

Normocytic Anemias

Hemolysis

- Autoimmune
- Abnormal RBCs
- Hemoglobinopathies
- Chemical/ Physical Agent
- Infection

Lichtman et al., 2022

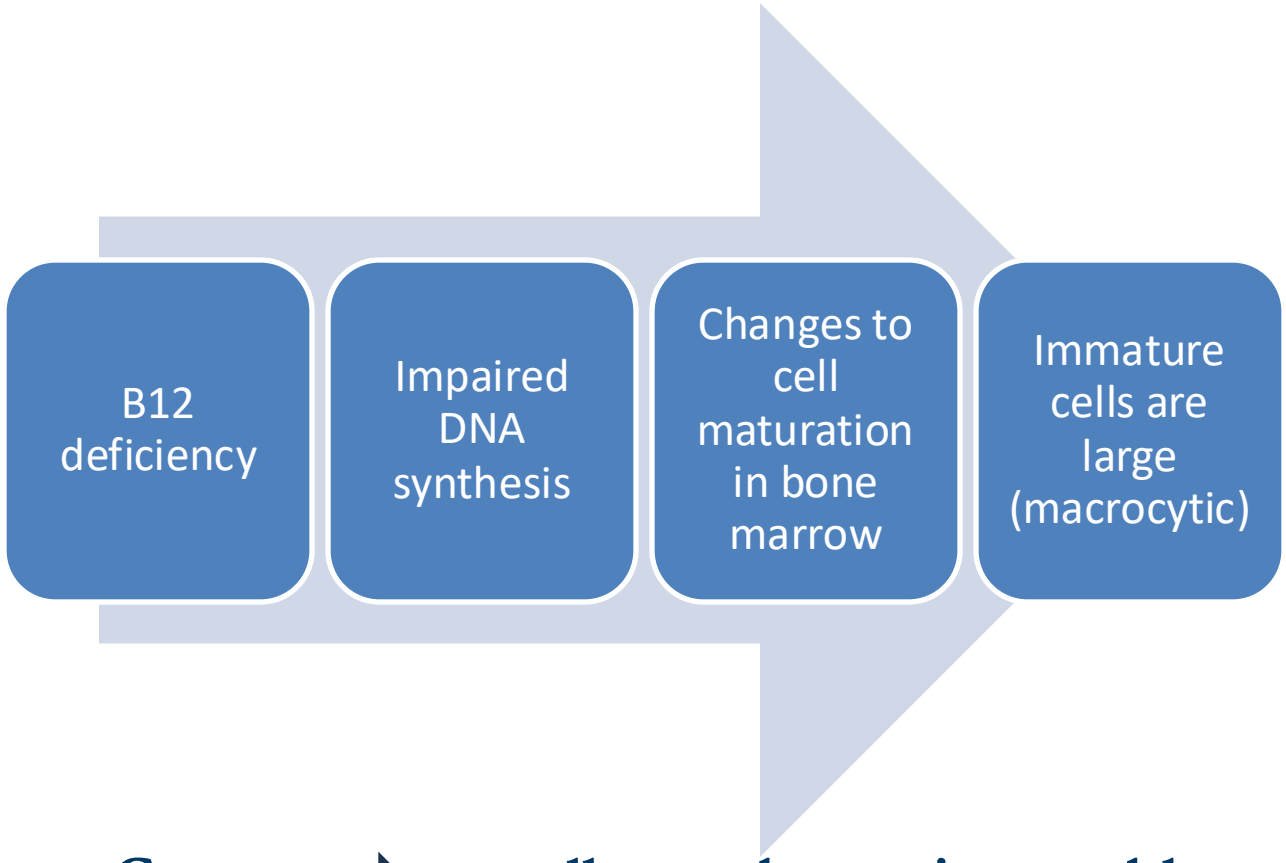
An 80 year-old male with PMH of hypertension, DM2, hyperlipidemia, hearing loss, and Stage IV CKD. No history of blood loss. What is his history and laboratory findings most consistent with?

A. Folate deficiency
B. B12 deficiency anemia
C. Anemia of chronic disease
D. Iron deficiency anemia

BLOOD COUNTS	
Hemoglobin	7.9 ↓
Hemoglobin POC	
Hematocrit	23.4 ↓
Hematocrit POC	
Platelet Count	356
White Blood Cells	9.9
Neutrophils	
Absolute Neutrophil Count	
Lymphocytes	
Absolute Lymph Count	
Monocytes	
Absolute Monocyte Count	
Eosinophils	
Absolute Eosinophil Count	
Absolute Basophil Count	
MDW (Monocyte Distribution Width)	
Basophils	
RBC	2.71 ↓
MCV	86.2
MCH	29.0
MCHC	33.6
MPV	7.8
RDW	18.2 ↑

Macrocytic Anemias

B12 Deficiency



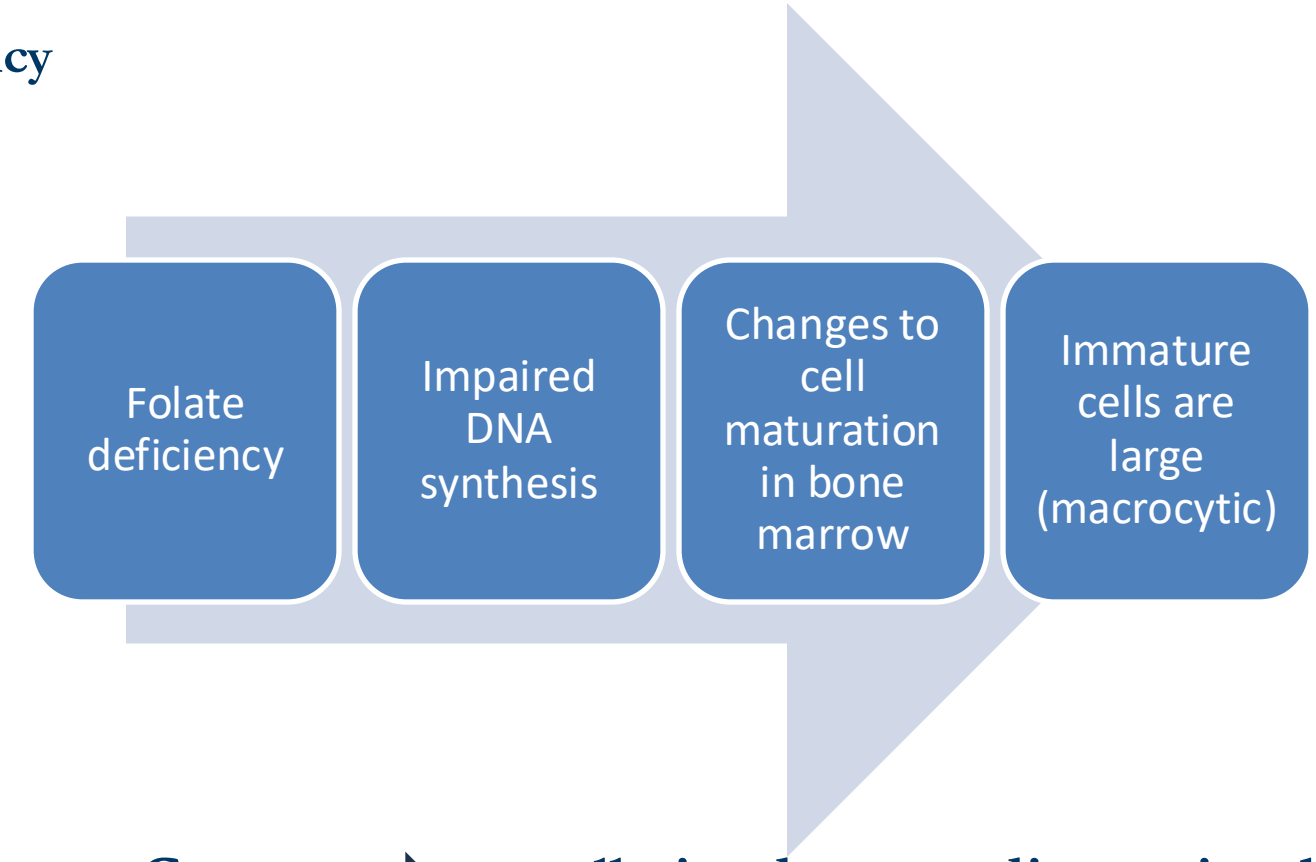
Cause ⇨ usually an absorption problem:

-Deficiency in gastric intrinsic factor (pernicious anemia)
-Anti-parietal cell antibodies
-Gastric and ileum resection
-Dietary deficiency

Lichtman et al., 2022

Macrocytic Anemias

Folate Deficiency



Cause ⇨ usually inadequate dietary intake

-Poor nutrition
-Old age, poverty
-Alcoholism
-Increased requirements (pregnancy, chronic hemolytic anemia)

Lichtman et al., 2022

Microcytic Anemias: Iron deficiency

Why do we need it?

- Helps maintain bodily functions including red cell production, which oxygenates organs and tissues

Where do we get it?

- GI tract absorbs iron from food and supplements. Only a small percentage is absorbed.
- Iron is released into bloodstream where it's stored by multiple avenues, until needed by the bone marrow to produce red blood cells.

Common causes of IDA

Reduced absorption	Iron loss	Increased iron needs	Inflammatory conditions
• Dietary restrictions • Malabsorption conditions: bariatric surgery, autoimmune gastritis, celiac disease, h.pylori, GI parasites, medications including PPIs?	• Bleeding: epistaxis, abnormal menses, occult and overt GI loss (ulcers, IBD, hemorrhoids, malignancy), recent trauma • Frequent blood donation • Hemolysis	• Pregnancy, breastfeeding	• CKD, HFrEF

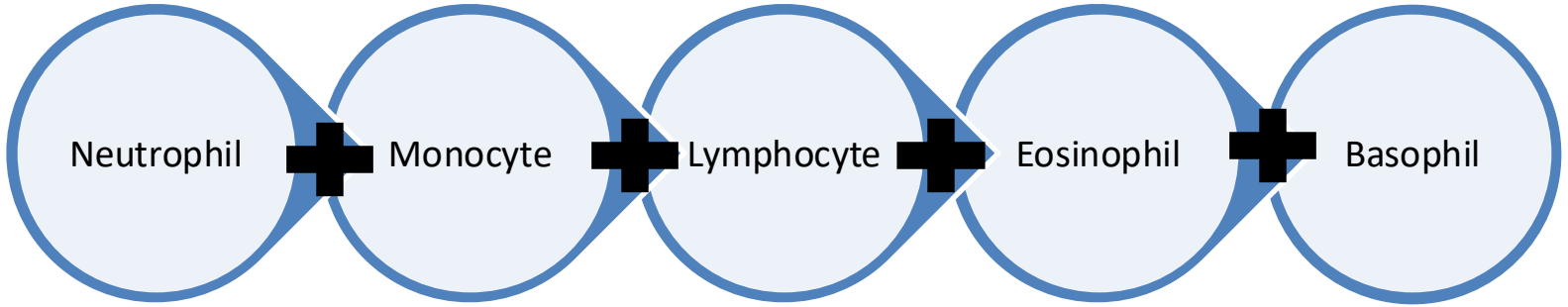
A 76-year-old male with chronic kidney disease stage 3b who presents for evaluation with the CBC below. He reports tinnitus and exertional SOA. What type of anemia is most likely?

BLOOD COUNTS			
Hemoglobin	10/03/23	Range: 13.5 - 16.5 GM/...	6.5 ↓
Hematocrit	10/03/23	Range: 40 - 50 %	22.7 ↓
Platelet Count	10/03/23	Range: 150 - 400 K/UL	426 ↑
White Blood Cells	10/03/23	Range: 4.5 - 11.0 K/UL	4.8
Neutrophils	10/03/23	Range: 41 - 77 %	
Absolute Neutrophil Count	10/03/23	Range: 1.8 - 7.0 K/UL	
Lymphocytes	10/03/23	Range: 24 - 44 %	
Absolute Lymph Count	10/03/23	Range: 1.0 - 4.8 K/UL	
Monocytes	10/03/23	Range: 4 - 12 %	
Absolute Monocyte Count	10/03/23	Range: 0 - 0.80 K/UL	
Eosinophils	10/03/23	Range: 0 - 5 %	
Absolute Eosinophil Count	10/03/23	Range: 0 - 0.45 K/UL	
Absolute Basophil Count	10/03/23	Range: 0 - 0.20 K/UL	
Segmented Neutrophils	05/08/23	Range: 41 - 77 %	58
Absolute Neutrophil Count Manual	05/08/23	Range: 1.8 - 7.0 K/UL	2.78
Lymphocytes	05/08/23	Range: 24 - 44 %	32
Monocytes	05/08/23	Range: 4 - 12 %	4
Eosinophil	05/08/23	Range: 0 - 5 %	5
Basophils	10/03/23	Range: 0 - 2 %	1
RBC	10/03/23	Range: 4.4 - 5.5 M/UL	3.73 ↓
MCV	10/03/23	Range: 80 - 100 FL	61.0 ↓
MCH	10/03/23	Range: 26 - 34 PG	17.3 ↓
MCHC	10/03/23	Range: 32.0 - 36.0 G/DL	28.5 ↓
MPV	10/03/23	Range: 7 - 11 FL	8.4
RDW	10/03/23	Range: 11 - 15 %	21.8 ↑
Retic, Uncorrected	03/27/23	Range: 0.5 - 2.0 %	1.4
Retic, Corrected	03/27/23	Unit: %	0.7
Retic, Absolute	03/27/23	Range: 30 - 94 K/UL	52.2
Platelet Estimate	05/08/23	No range found	SLT INC
ANISO	05/08/23	No range found	PRESENT
HYPO	04/03/23	No range found	PRESENT
POIK	04/03/23	No range found	

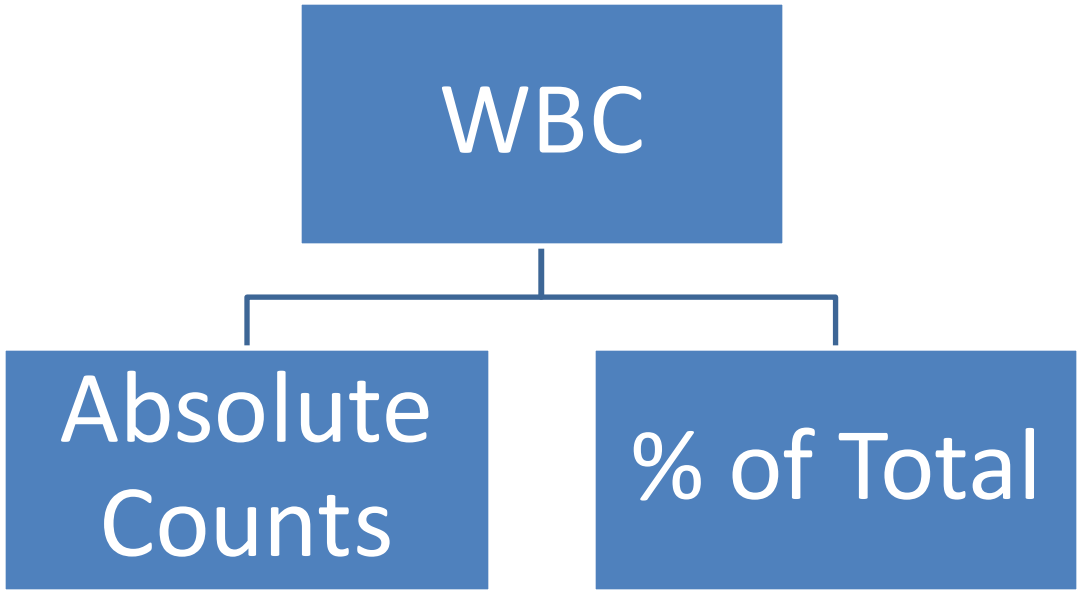
A. Iron deficiency anemia
B. Anemia of CKD
C. Lead poisoning
D. Folate deficiency anemia

IRON STUDIES			
Iron	10/03/23	Range: 50 - 185 MCG/DL	19 ↓
% Saturation	10/03/23	Range: 28 - 42 %	4 ↓
Iron Binding-TIBC	10/03/23	Range: 270 - 380 MCG/...	520 ↑
Ferritin	10/03/23	Range: 30 - 300 NG/ML	4 ↓
Haptoglobin	03/27/23	Range: 16 - 200 MG/DL	180

White Blood Cell Count with Differential



White Blood Cell Count with Differential



1.54+1.72+0.38+0.18+0.03= 3.85

40%+44%+10%+5%=1%=100%

BLOOD COUNTS	
White Blood Cells	3.8 ↓
Hemoglobin	14.1
Hematocrit	45.0
Platelet Count	158
Neutrophils	40 ↓
Absolute Neutrophil Count	1.54 ↓
Lymphocytes	44
Absolute Lymph Count	1.72
Monocytes	10
Absolute Monocyte Count	0.38
Eosinophils	5
Absolute Eosinophil Count	0.18
Absolute Basophil Count	0.03
Basophils	1
Peripheral Smear	NO SIGNIFICA...
Pathologist Signature	INTERPRETE...
RBC	6.54 ↑
MCV	68.9 ↓
MCH	21.6 ↓
MCHC	31.4 ↓
MPV	9.1
RDW	15.5 ↑

White Blood Cell Count with Differential

You can ignore the percentages!

BLOOD COUNTS	
White Blood Cells	1.8 ↓
Hemoglobin	12.2 ↓
Hematocrit	36.0 ↓
Platelet Count	378
Neutrophils	41
Absolute Neutrophil Count	0.70 ↓
Lymphocytes	44
Absolute Lymph Count	0.80 ↓
Monocytes	11
Absolute Monocyte Count	0.20
Eosinophils	2
Absolute Eosinophil Count	0.00
Absolute Basophil Count	0.00
Segmented Neutrophils	
Absolute Neutrophil Count Manual	
Bands	
Lymphocytes	
Monocytes	
Eosinophil	
Basophils	2

White Blood Cell Count with Differential

Hot Tip

You can ignore the percentages!

Pro Tip

You need to figure out how to tell your patient that.

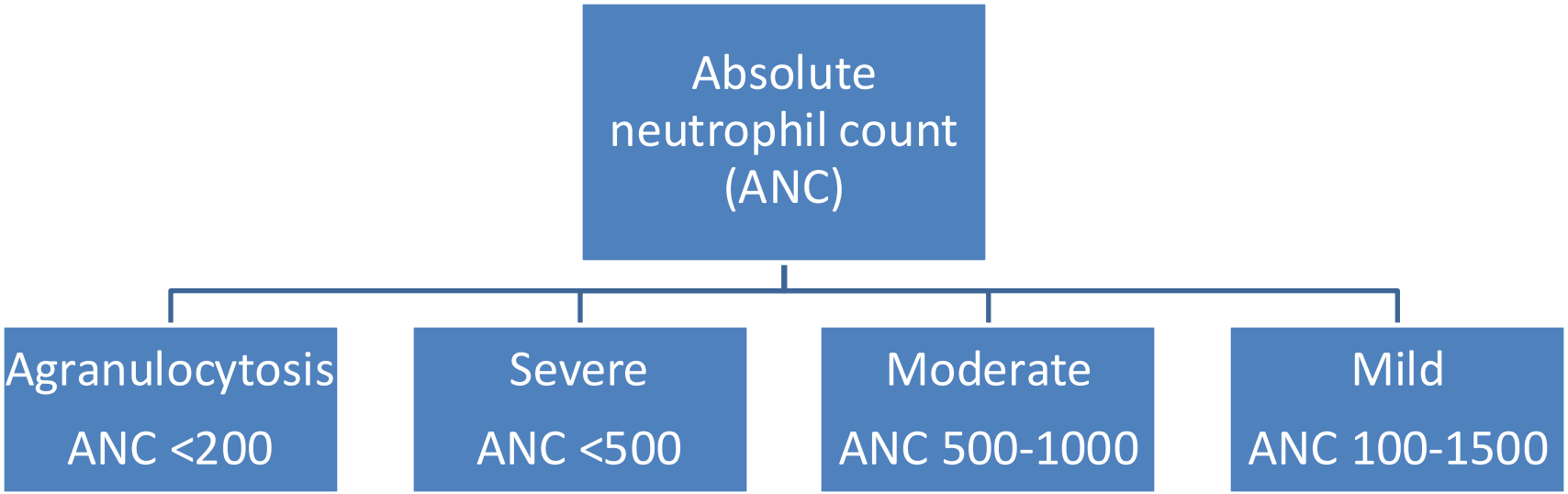
BLOOD COUNTS	
White Blood Cells	22.5 ▲
Hemoglobin	11.6 ▼
Hematocrit	34.9 ▼
Platelet Count	359
nRBCs (Manual Diff)	
Neutrophils	15 ▼
Absolute Neutrophil Count	3.30
Lymphocytes	82 ▲
Absolute Lymph Count	18.80 ▲
Monocytes	1 ▼
Absolute Monocyte Count	0.10
Eosinophils	1
Absolute Eosinophil Count	0.10
Absolute Basophil Count	0.10

White Blood Cell Count with Differential

Is this a problem?

BLOOD COUNTS	
White Blood Cells	06/23/25 3.90 ▼
Hemoglobin	06/23/25 12.7
Hematocrit	06/23/25 38.1
Platelet Count	06/23/25 200
Neutrophils	06/23/25 62.7
Absolute Neutrophil Count	06/23/25 2.40
Lymphocytes	06/23/25 25.9
Absolute Lymph Count	06/23/25 1.00
Monocytes	06/23/25 9.5
Absolute Monocyte Count	06/23/25 0.40
Eosinophils	06/23/25 1.3
Absolute Eosinophil Count	06/23/25 0.10
Absolute Basophil Count	06/23/25 0.00
Basophils	06/23/25 0.6
Peripheral Smear	03/26/25 No qualit...
RBC	06/23/25 4.07
MCV	06/23/25 93.6
MCH	06/23/25 31.2
MCHC	06/23/25 33.3
MPV	06/23/25 10.7
RDW	06/23/25 12.9

Neutropenia



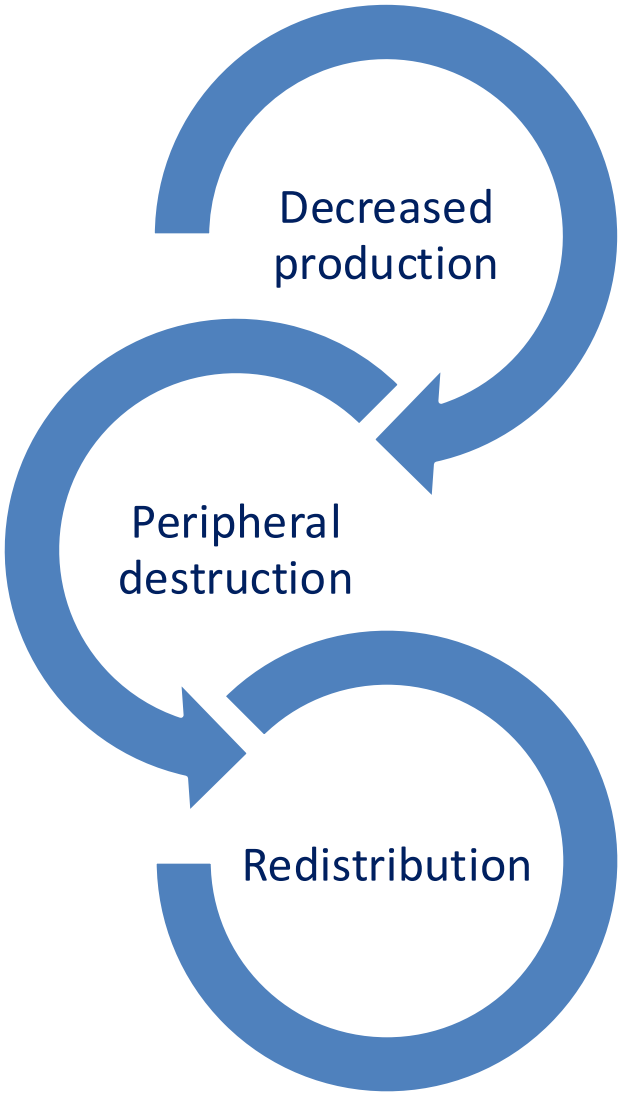
Neutropenia

Does the patient have symptoms potentially related to neutropenia?

- Severe or recurrent infections
- Aphthous ulcers
- Constitutional symptoms: weight loss, fever, fatigue

Neutropenia

Three Mechanisms:



Neutropenia

- Congenital
- Medication
- Infection
- Rheumatologic Disorders
- Nutritional Deficiency
- Hematologic Malignancy
- Duffy Null

Duffy Null Neutropenia

What is the Duffy Antigen?

- A **protein on red blood cells**, encoded by the ACKR1 gene
- Duffy null phenotype is **caused by a genetic variant**
- High prevalence in people of **African and Arab** ancestry:

66% of African Americans
80-100% in West Africans
>50% of Middle Eastern/North Africans
Rare in people of Asian or European ancestry

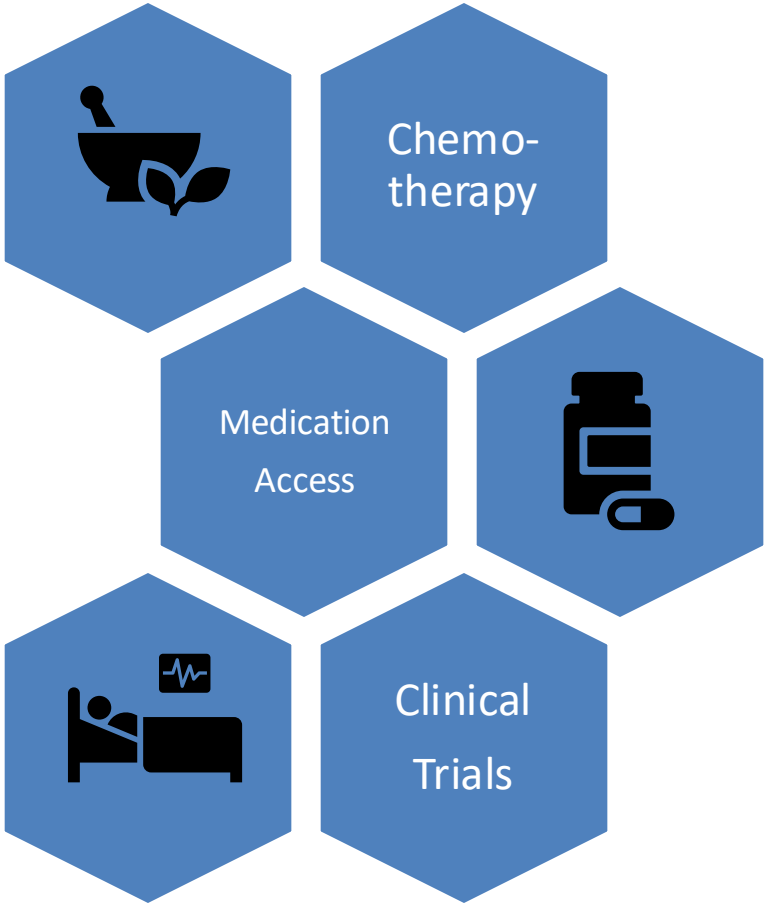
Impact on Clinical Care

- ~20% of Duffy null are **healthy but labeled neutropenic**

Afenyi-Annan et al., 2009, Merz et al., 2023

Duffy Null Neutropenia

Why does is matter?



Smith et al., 2006

Neutropenia

A 43-year-old female with a past medical history of GERD, endometriosis, PCOS, rheumatoid arthritis, Sjogren's disease and allergic rhinoconjunctivitis is referred for leukopenia. She has no history of recurrent infection or repeat need for antibiotics. Her medications include allegra, azathioprine, famotidine, fluticasone, guafenesin, and spironolactone. Review of labs shows acute onset of neutropenia that coincided with her diagnosis of rheumatoid arthritis. What do you suspect is the etiology of her neutropenia?

A. Congenital
B. Nutritional
C. Medication induced
D. Blood cancer

BLOOD COUNTS				
White Blood Cells		3.10 ↓		3.40 ↓
Hemoglobin		12.9		12.9
Hematocrit		38.7		37.3
Platelet Count		169		184
Neutrophils		43		36 ↓
Absolute Neutrophil Count		1.40 ↓		1.20 ↓
Lymphocytes		43		49 ↑
Absolute Lymph Count		1.30		1.70
Monocytes		13 ↑		12
Absolute Monocyte Count		0.40		0.40
Eosinophils		1		2
Absolute Eosinophil Count		0.00		0.10
Absolute Basophil Count		0.00		0.00
MDW (Monocyte Distribution Width)				
Basophils		1		1
Peripheral Smear				
Pathologist Signature				
RBC		4.14		4.06
MCV		93.5		91.9
MCH		31.2		31.7
MCHC		33.4		34.5
MPV		8.1		8.5
RDW		13.9		13.7

Neutropenia

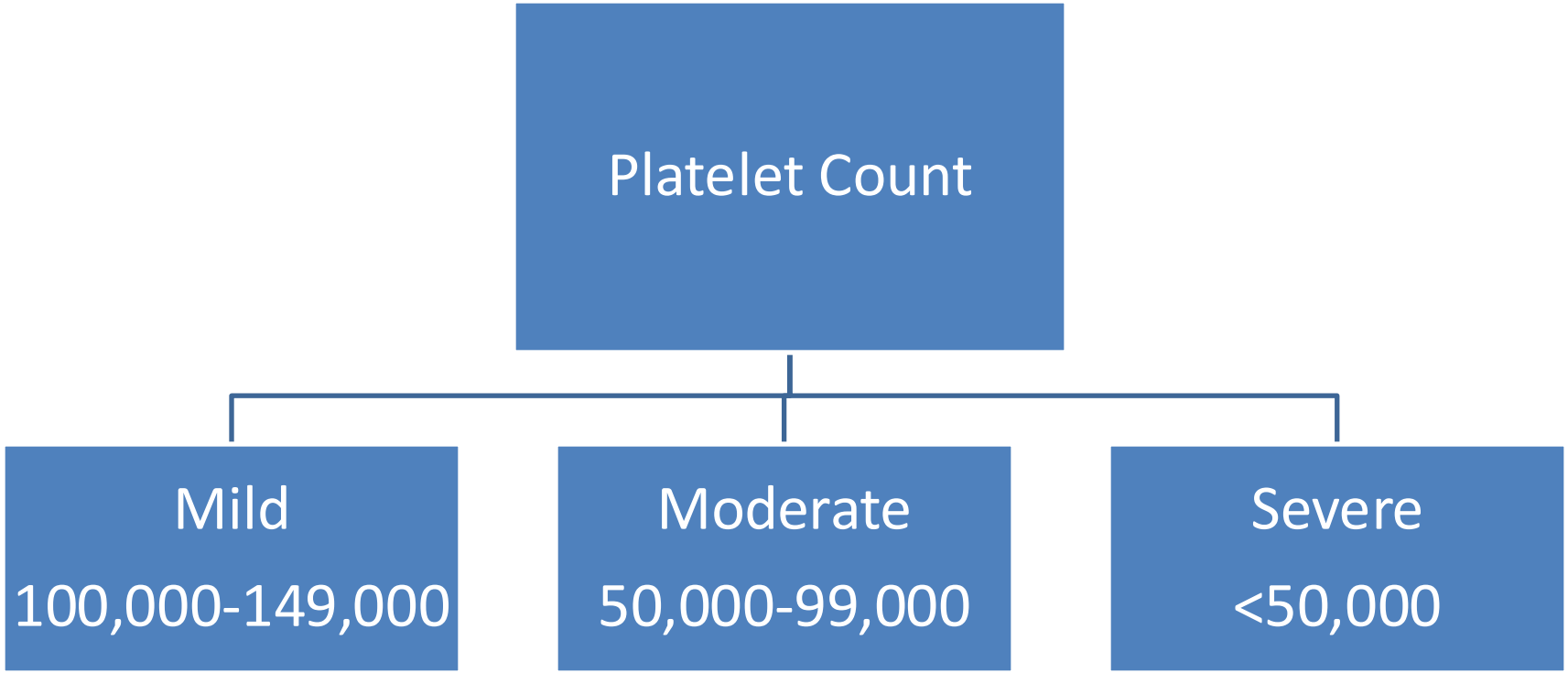
A. Repeat CBC
B. Bone marrow biopsy
C. ABO/ Rh(D)
D. Blood cultures

A 57-year-old male with a past medical history of hypertension, hyperlipidemia, GERD, and Vit D deficiency is referred for leukopenia. He has no history of recurrent infection or repeat need for antibiotics. His CBC shows a lifelong neutropenia. His medications include losartan, atorvastatin, ergocalciferol. He is married with 2 children, drives a bus for a living, parents immigrated from Jamaica. Which lab test would be most helpful in establishing the etiology of his neutropenia?

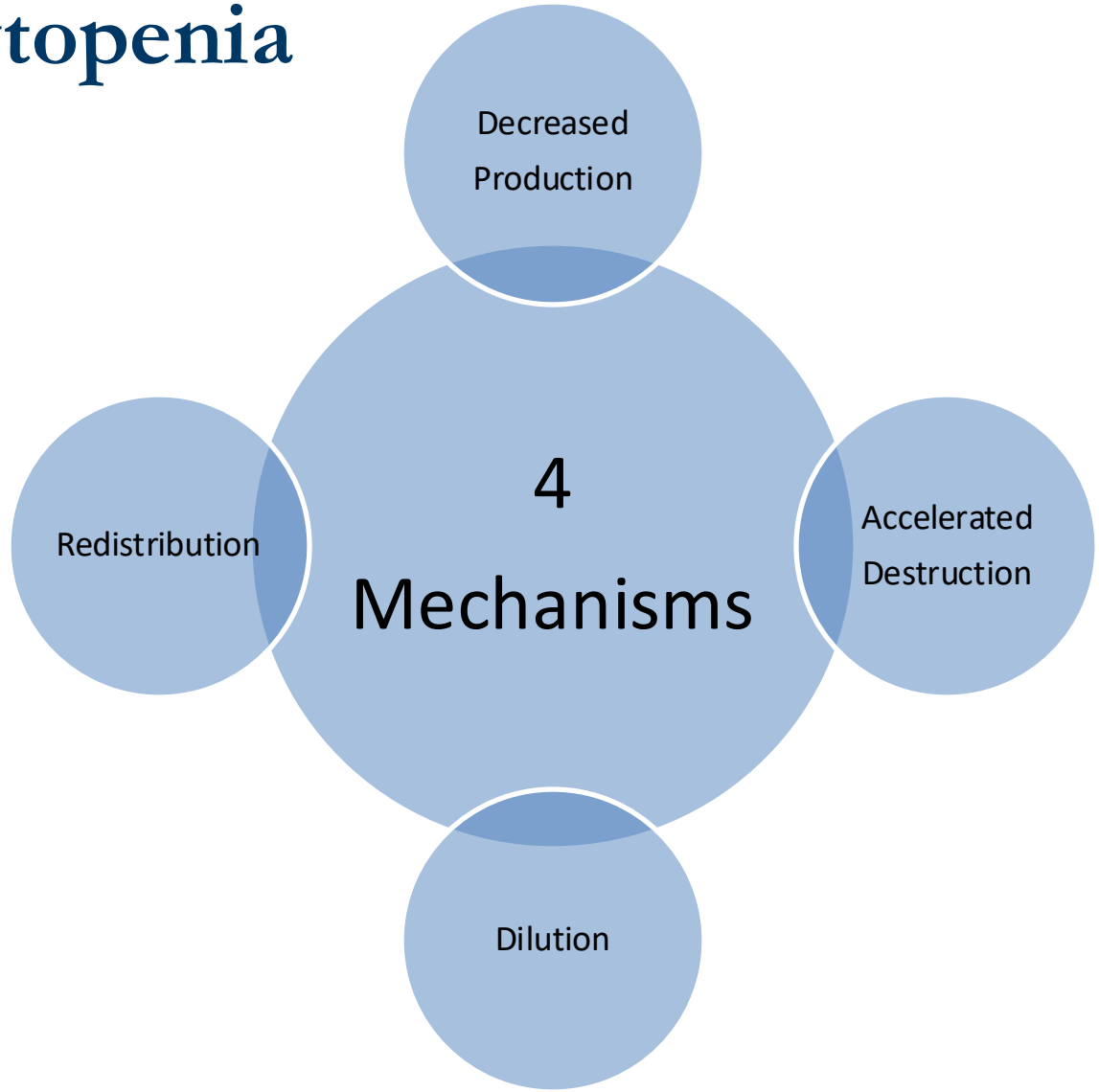
Component Ref Range & Units (hover)	3/26/25 1359
ABO/RH(D)	O POS
Antigen Information	Fy(a) antigen NEG, Fy(b) antigen NEG,
Resulting Agency	KU MAIN LAB BB

BLOOD COUNTS						
White Blood Cells			2.50 ↓	3.30 ↓		3.00 ↓
Hemoglobin			12.8	13.1		13.5
Hematocrit			38.8	40.1		41.0
Platelet Count			270	228		246
Neutrophils			35 ↓	33 ↓		54
Absolute Neutrophil Count			0.90 ↓	1.10 ↓		1.60 ↓
Lymphocytes			45 ↑	40		29
Absolute Lymph Count			1.10	1.30		0.90 ↓
Monocytes			12	18 ↑		11
Absolute Monocyte Count			0.30	0.60		0.30
Eosinophils			7 ↑	9 ↑		5
Absolute Eosinophil Count			0.20	0.30		0.20
Absolute Basophil Count			0.00	0.00		0.00
Basophils			1	0		1
Peripheral Smear				Leukope...		
RBC			4.20	4.34		4.44
MCV			92.5	92.3		92.4
MCH			30.6	30.2		30.5
MCHC			33.1	32.7		33.1
MPV			10.0	10.0		10.4
RDW			12.3	12.3		12.9

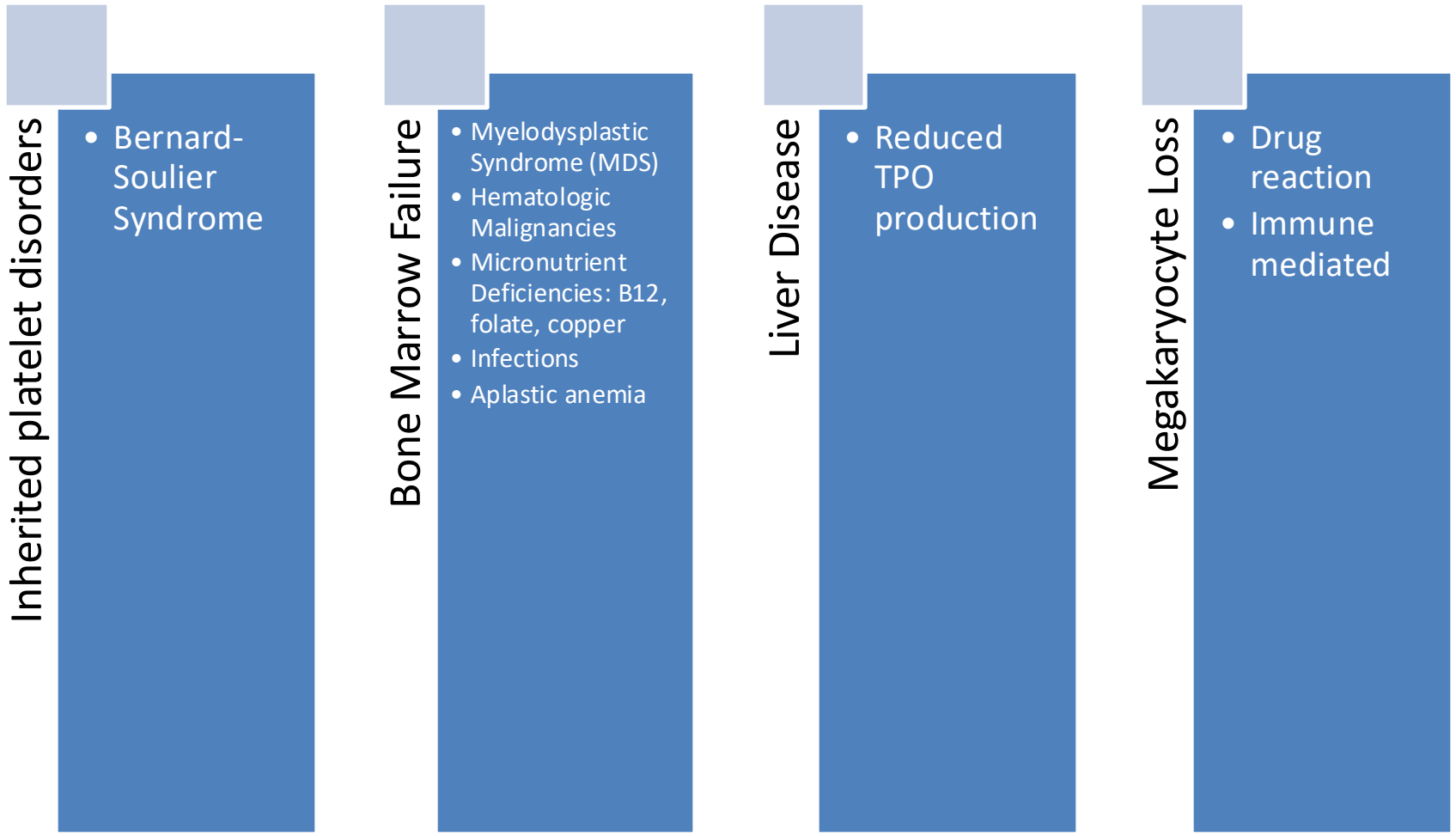
Thrombocytopenia



Thrombocytopenia



Thrombocytopenia: Decreased Production



Thrombocytopenia: Accelerated Destruction

Immune thrombocytopenia purpura

- Immune ITP
- Drug-induced ITP

Consumptive

- Disseminated intravascular coagulation (DIC)
- Thrombotic microangiopathies (TMAs): thrombotic thrombocytopenic purpura (TTP) and complement-mediates TMAs (CM-TMAs)
- Thrombosis

Post Operative

- Wound healing
- Dilution

Thrombocytopenia: Redistribution

Hypersplenism

- Portal hypertension
- Lymphoproliferative disease

Thrombocytopenia: Dilutional

Dilutional

- Fluid resuscitation
- Massive transfusion
- Gestational thrombocytopenia

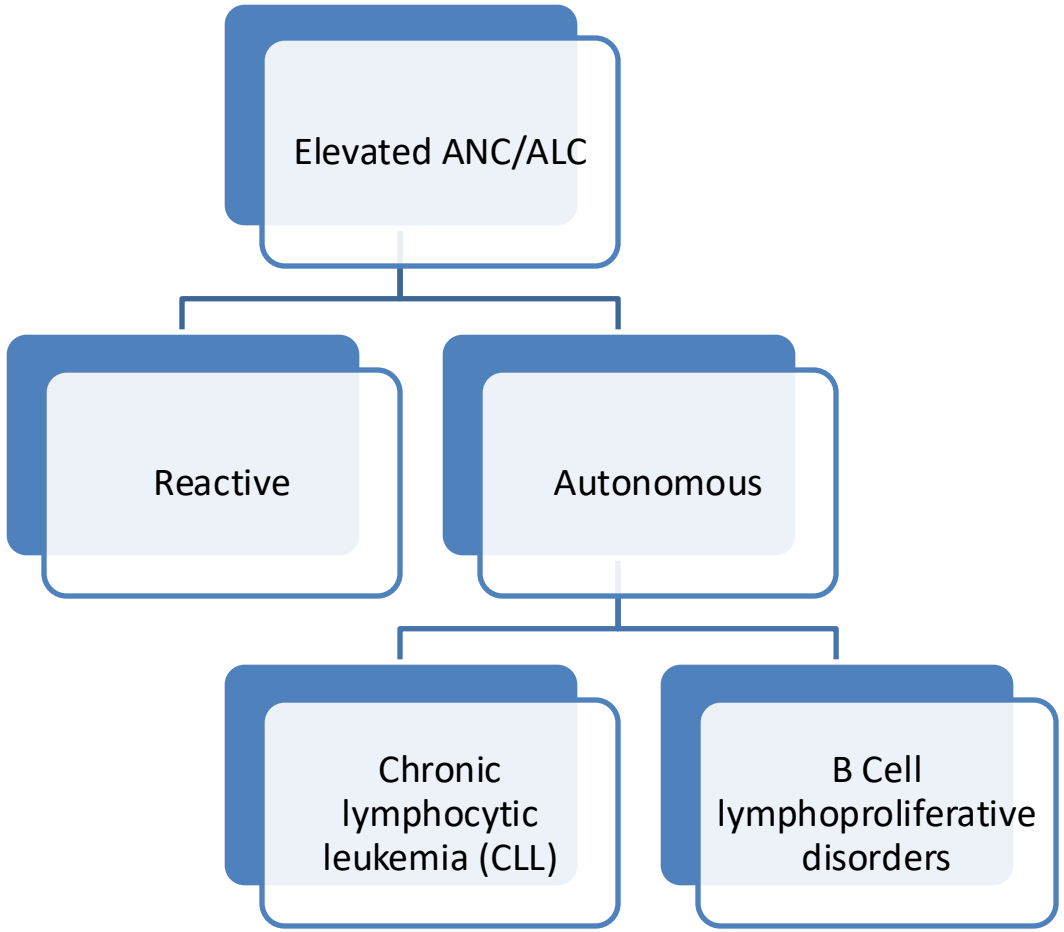
Thrombocytopenia

A 76-year-old female with a past medical history of squamous cell carcinoma of skin, Vitamin D deficiency, and colon polyps is referred for persistent thrombocytopenia. She has not recently started any new medications. Her B12/iron/copper/folate are normal. Abd US shows normal liver and spleen. CMP is normal. Infectious studies are normal. Patient is not having any bleeding problems. What diagnosis does this likely represent?

A. Dilutional neutropenia
B. Nutritional deficit
C. Splenic sequestration
D. ITP

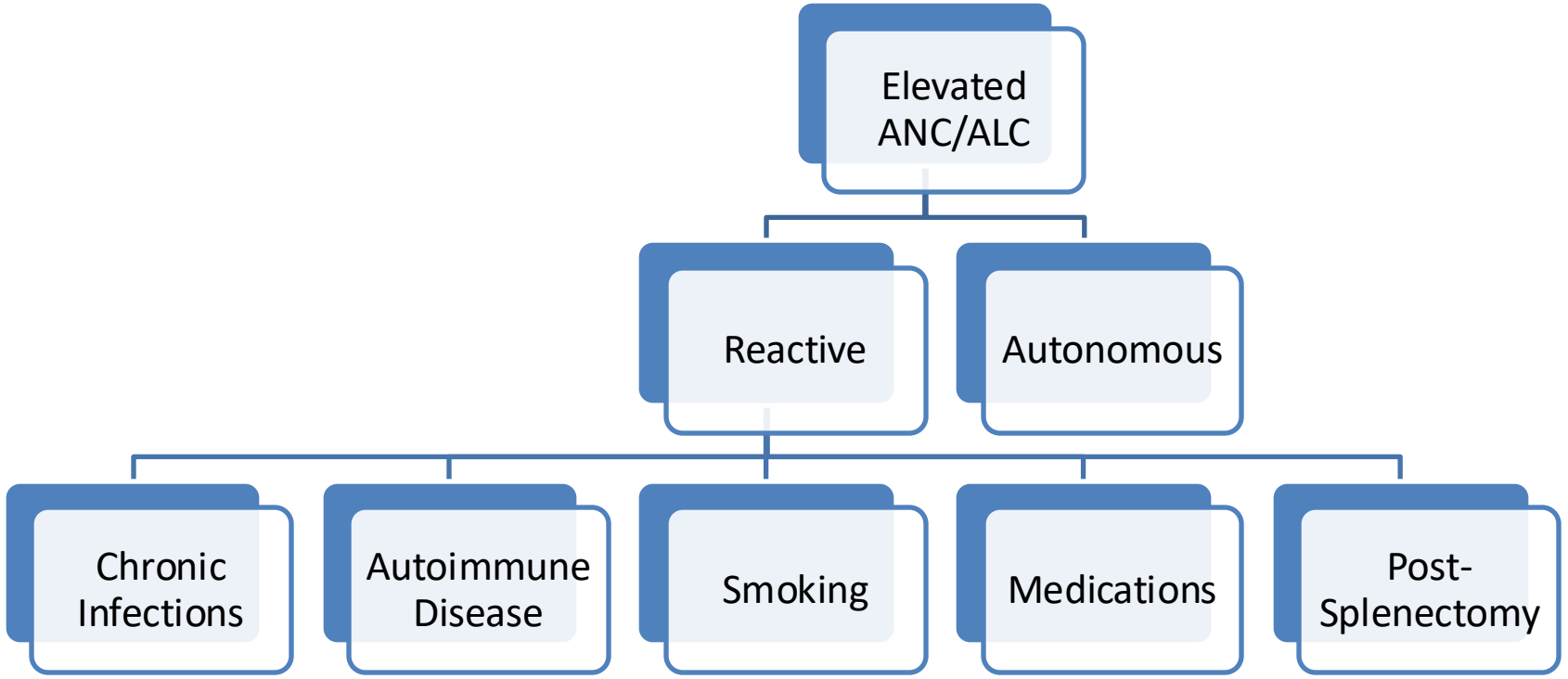
	2022 7/14/22 08:45	7/15/22 12:13	11/8/22 09:53	2023 4/16/23 00:00	11/13/23 14:36	11/28/23 11:59	12/20/23 11:51	2024 3/8/24 15:12
BLOOD COUNTS								
White Blood Cells	4.6	3.2 ↓	2.9 ↓	5.40	5.2	4.8	4.5	5.53
Hemoglobin	12.9	13.1	13.4	14.4	13.6	13.5	13.1	13.5
Hematocrit	37.3	37.8	39.0	41	39.3	39.7	38.1	39.6
Platelet Count	33 ↓	58 ↓	49 ↓	32 ↓	41 ↓	40 ↓	142 ↓	57 ↓
Neutrophils	73	60	51		74	61	64	
Absolute Neutrophil Count	3.40	2.00	1.49 ↓		3.85	2.94	2.90	
Lymphocytes	13 ↓	23 ↓	35		19 ↓	27	23 ↓	
Absolute Lymph Count	0.60 ↓	0.70 ↓	0.99 ↓		1.01	1.28	1.01	
Monocytes	12	14 ↑	11		6	11	11	
Absolute Monocyte Count	0.50	0.50	0.32		0.32	0.51	0.48	
Eosinophils	2	2	2		1	1	1	
Absolute Eosinophil Count	0.10	0.00	0.05		0.04	0.07	0.03	
Absolute Basophil Count	0.00	0.00	0.01		0.01	0.02	0.04	
Segmented Neutrophils								
Absolute Neutrophil Count Manual								
Lymphocytes								
Monocytes								
Eosinophil								
Basophils	0	1	1		0	0	1	
Peripheral Smear								
Pathologist Signature								
RBC	3.82 ↓	3.85 ↓	3.90 ↓	4.29	4.20	4.23	4.07	4.09
MCV	97.6	98.3	100.1 ↑	96	93.6	93.9	93.6	96.8
MCH	33.8	34.0	34.4 ↑	34	32.2	31.8	32.2	33.0
MCHC	34.6	34.6	34.4	35	34.4	33.9	34.4	34.1
MPV	12.2 ↑	11.1 ↑	12.1 ↑	13.9 ↑	13.6 ↑	13.6 ↑	10.7	14.9 ↑
RDW	12.7	12.7	12.6	12.1	13.3	13.1	13.1	12.7

Leukocytosis



Lichtman et al., 2022

Leukocytosis



Lichtman et al., 2022

Case 2

A 34 y.o. female non-smoker with a past medical history of hyperlipidemia, hypertension, obesity, seasonal allergies, Raynaud's syndrome, anxiety, and depression. She was recently evaluated by rheumatology for joint pain and Raynaud's phenomenon. Laboratory evaluation demonstrated thrombocytosis and leukocytosis. She was referred to hematology for further evaluation. She reports profound fatigue, but no other constitutional symptoms. CBC abnormalities have been present for several years without progression. Medications include alprazolam, ergocalciferol, labetalol, and tizanidine. What factor in her history could explain these CBC changes?

BLOOD COUNTS		
White Blood Cells		14.1 ▲
Hemoglobin		12.7
Hematocrit		38.1
Platelet Count		444 ▲
Neutrophils		64
Absolute Neutrophil Count		9.07 ▲
Lymphocytes		27
Absolute Lymph Count		3.88
Monocytes		6
Absolute Monocyte Count		0.90 ▲
Eosinophils		2
Absolute Eosinophil Count		0.22
Absolute Basophil Count		0.08
Segmented Neutrophils		
Absolute Neutrophil Count Manual		
Lymphocytes		
Monocytes		
Eosinophil		
Basophils		1
Peripheral Smear		MILD THROM...
Pathologist Signature		INTERPRETE...
RBC		4.47
MCV		85.3
MCH		28.4
MCHC		33.3
MPV		8.5
RDW		13.6

Case 2

BCR-ABL Fish- within normal limits
Flow cytometry- normal
CT chest/abdomen/pelvis- no adenopathy, masses, or other abnormalities
Sed rate- 28 (0-20)
CRP- 2.77 (<1.0)
HIV-neg, Hep B- neg, Hep C-neg

What do you suspect is the cause of her leukocytosis and thrombocytosis?

A. Folate deficiency
B. Autoimmune process
C. Blood cancer
D. Medication side effect

BLOOD COUNTS		
White Blood Cells		14.1 ▲
Hemoglobin		12.7
Hematocrit		38.1
Platelet Count		444 ▲
Neutrophils		64
Absolute Neutrophil Count		9.07 ▲
Lymphocytes		27
Absolute Lymph Count		3.88
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Segmented Neutrophils		
Absolute Neutrophil Count Manual		
Lymphocytes		
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Eosinophil		
Basophils		1
Peripheral Smear		MILD THROM...
Pathologist Signature		INTERPRETE...
RBC		4.47
MCV		85.3
MCH		28.4
MCHC		33.3
MPV		8.5
RDW		13.6

Case 2

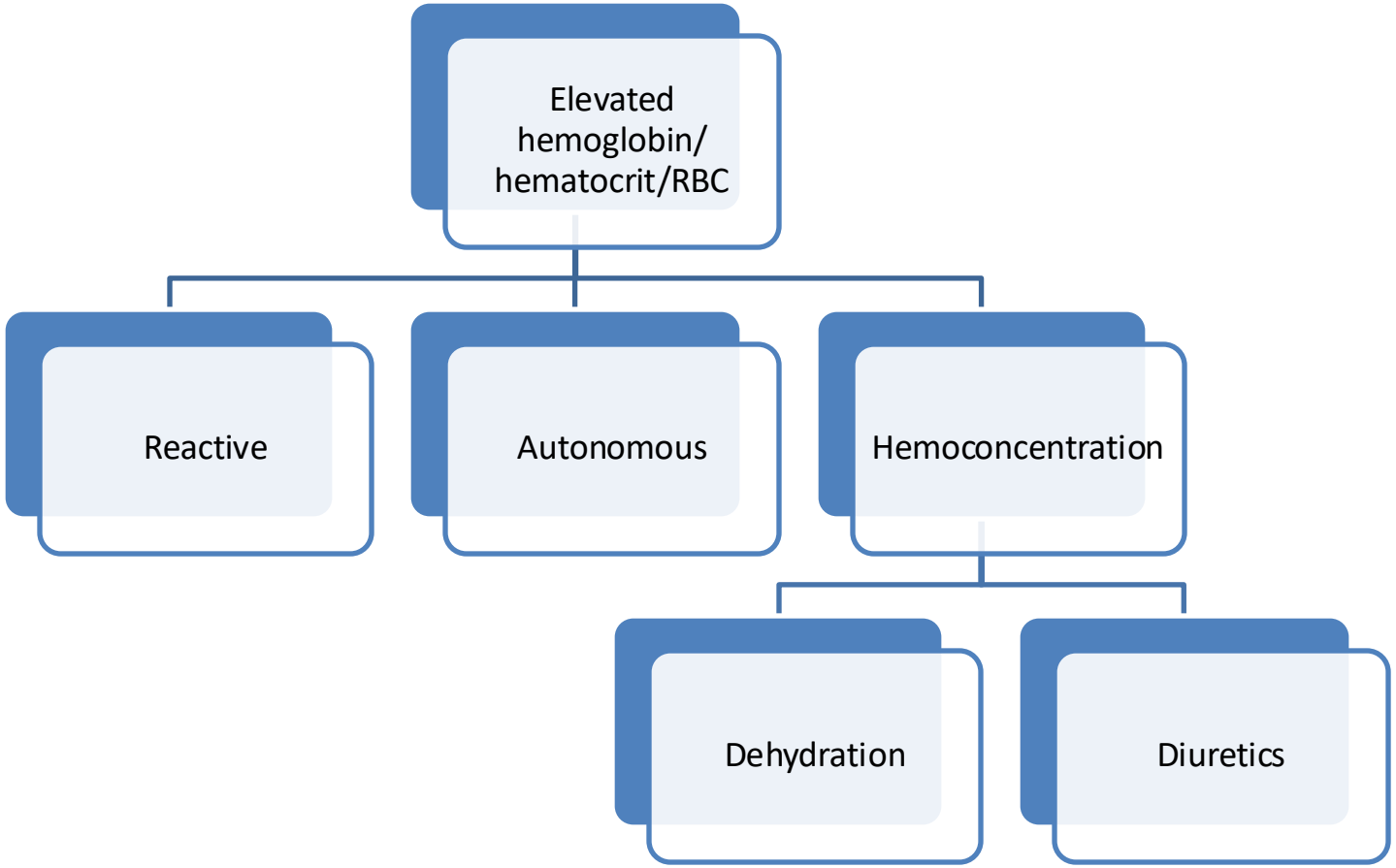
A 67 y.o. male with a past medical history of hyperlipidemia, hypertension, coronary artery disease, current tobacco use, and hypothyroidism. Medications include aspirin, HCTZ, levothyroxine, lisinopril, and rosuvastatin.

What do you suspect is the cause of his leukocytosis?

A. Tobacco use
B. HCTZ
C. Lymphoma
D. Aspirin

BLOOD COUNTS	
White Blood Cells	10.8
Hemoglobin	13.0
Hematocrit	39.9
Platelet Count	335
Neutrophils	68
Absolute Neutrophil Count	7.34 ▲
Lymphocytes	26
Absolute Lymph Count	2.85
Monocytes	4
Absolute Monocyte Count	0.43
Eosinophils	2
Absolute Eosinophil Count	0.19
Absolute Basophil Count	0.04
Basophils	0
Absolute Immature Granulocytes	
Immature Granulocytes %	
Nucleated Red Cells %	
Nucleated RBCs	
Absolute Nucleated RBC	
Peripheral Smear	
Pathologist Signature	
RBC	4.87
MCV	82.1
MCH	26.7
MCHC	32.6
MPV	8.8
RDW	14.1

Erythrocytosis/Polycythemia



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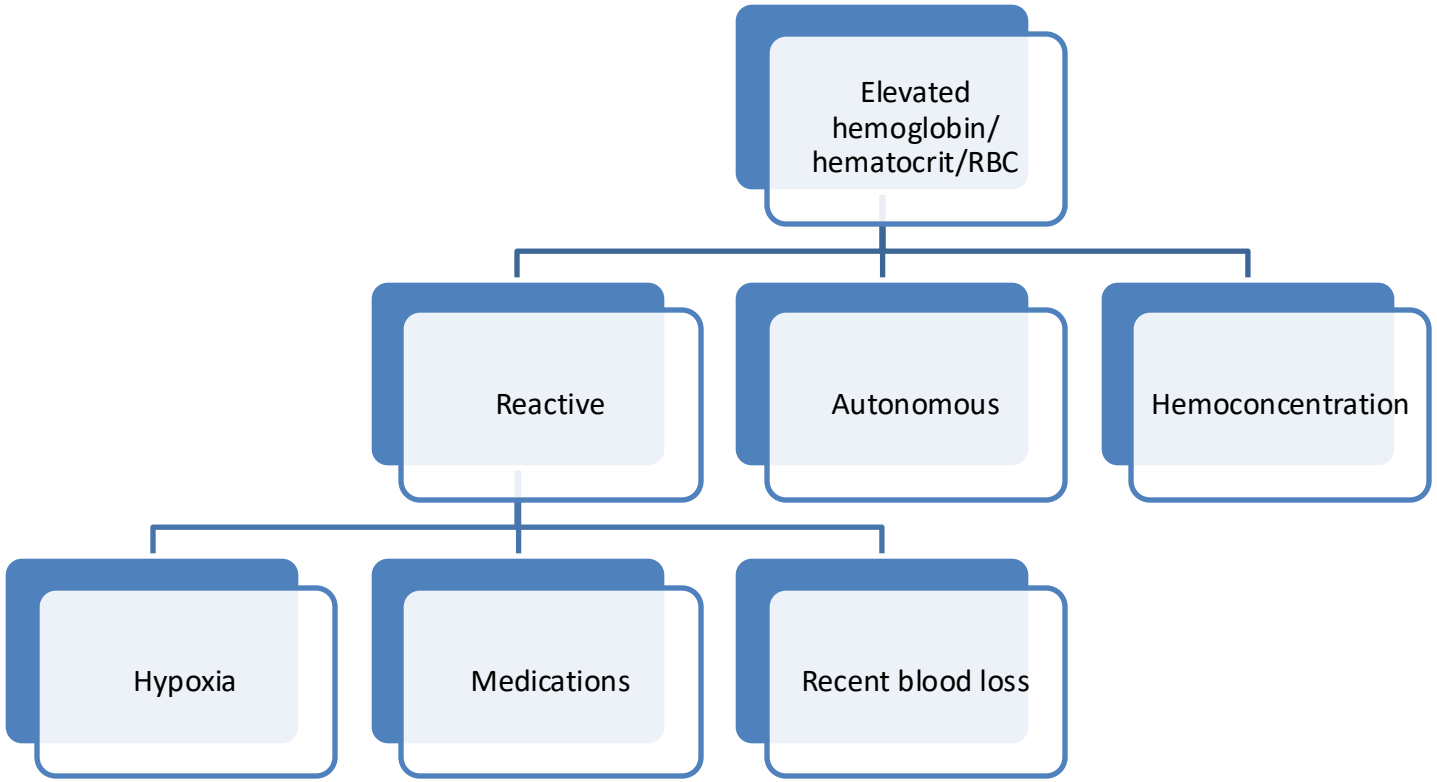
Erythrocytosis/Polycythemia



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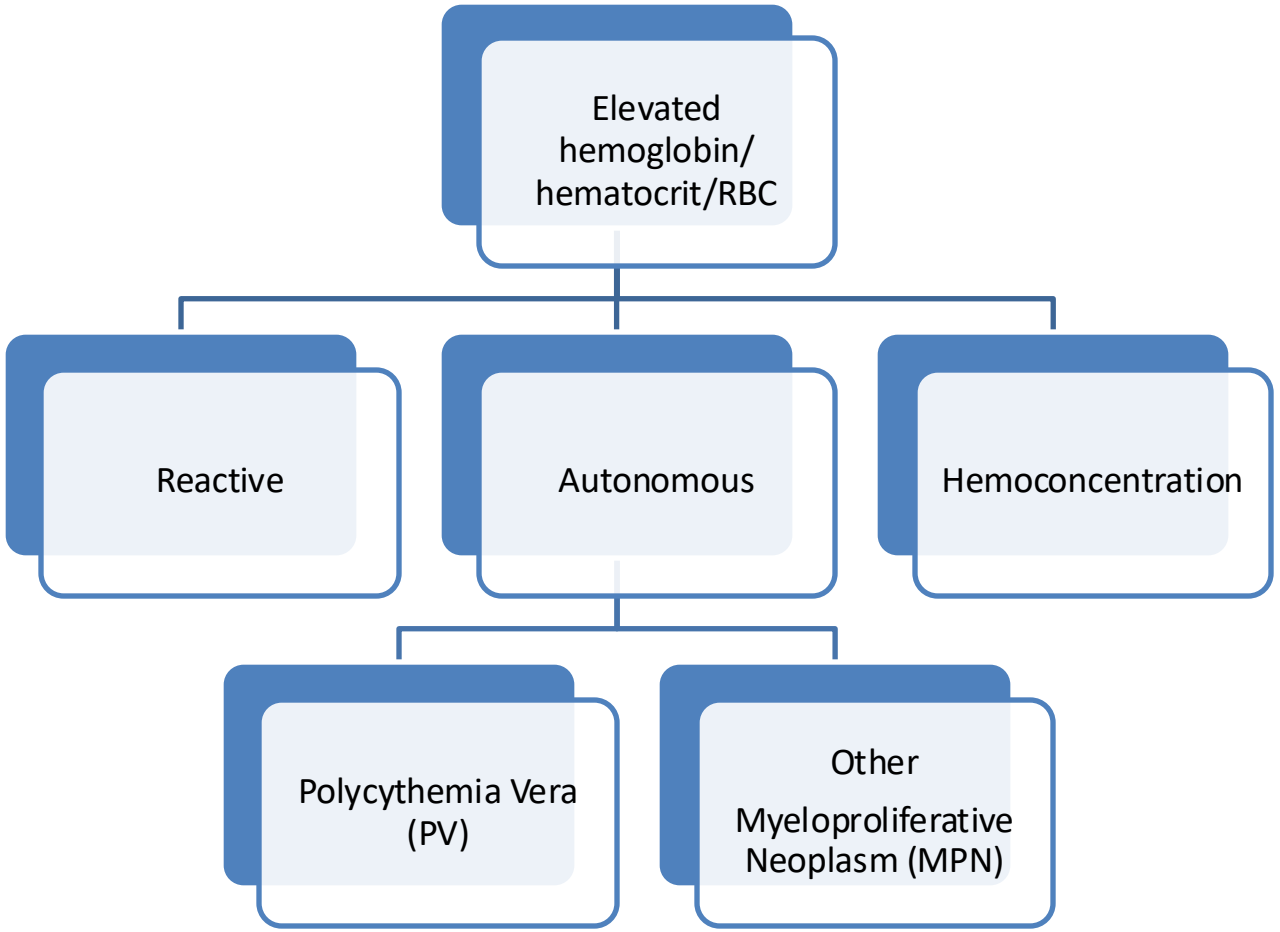
Erythrocytosis/Polycythemia



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Erythrocytosis/Polycythemia

A 52 y.o. male with a past medical history of hypertension, hyperlipidemia, end-stage hypertrophic cardiomyopathy s/p orthotopic heart transplant, type 2 diabetes mellitus, immunosuppression, and TIA is referred for polycythemia. Review of his medication list shows that he takes daily corticosteroids, chlorthalidone, dapagliflozin, furosemide, and IM testosterone. Which of these medications are likely to be contributing to his polycythemia?

A. Corticosteroids
B. Chlorthalidone
C. Dapagliflozin
D. Furosemide
E. Testosterone
F. All of the above
G. B,C,D,E

BLOOD COUNTS							
White Blood Cells	6.5	7.3	5.6	6.4	7.00	5.80	6.20
Hemoglobin	15.4	16.8 ▲	16.6 ▲	17.3 ▲	16.8 ▲	17.1 ▲	17.8 ▲
Hemoglobin POC							
Hematocrit	49.0	52.9 ▲	51.2 ▲	53.5 ▲	52.7 ▲	53.0 ▲	56.1 ▲
Hematocrit POC							
Platelet Count	222	246	263	249	192	200	216
Neutrophils	58	56	52	55	59	50	56
Absolute Neutrophil Count	3.83	4.05	2.99	3.50	4.10	2.90	3.40
Lymphocytes	29	31	34	32	28	36	31
Absolute Lymph Count	1.87	2.25	1.87	2.10	2.00	2.10	1.90
Monocytes	11	10	11	11	12	12	12
Absolute Monocyte Count	0.71	0.72	0.61	0.70	0.80	0.70	0.70
Eosinophils	1	1	2	1	1	1	1
Absolute Eosinophil Count	0.08	0.10	0.08	0.10	0.10	0.10	0.10
Absolute Basophil Count	0.04	0.17	0.04	0.00	0.00	0.00	0.00
Segmented Neutrophils							
Absolute Neutrophil Count Manual							
Lymphocytes							
Monocytes							
MDW (Monocyte Distribution Width)							
Eosinophil							
Basophils	1	2	1	1	1	1	1
Metamyelocyte							
Myelocyte							
Nucleated RBCs							
Peripheral Smear				NO QUALIT...			
Pathologist Signature				INTERPRE...			
RBC	6.48 ▲	7.06 ▲	6.90 ▲	7.29 ▲	7.02 ▲	6.93 ▲	7.19 ▲
MCV	75.6 ▼	74.9 ▼	74.2 ▼	73.5 ▼	75.1 ▼	76.4 ▼	77.9 ▼
MCH	23.7 ▼	23.7 ▼	24.0 ▼	23.8 ▼	23.9 ▼	24.7 ▼	24.7 ▼
MCHC	31.4 ▼	31.7 ▼	32.3	32.4	31.8 ▼	32.3	31.7 ▼
MPV	7.8	7.7	7.7	7.3	8.1	7.7	7.8
RDW	18.2 ▲	18.8 ▲	18.2 ▲	18.3 ▲	19.5 ▲	21.6 ▲	21.5 ▲

Erythrocytosis/Polycythemia

A 52 y.o. male with a past medical history of hypertension, hyperlipidemia, end-stage hypertrophic cardiomyopathy s/p orthotopic heart transplant, type 2 diabetes mellitus, immunosuppression, TIA, and obstructive sleep apnea on CPAP therapy is referred for polycythemia. Review of his medication list shows that he takes daily corticosteroids, chlorthalidone, dapagliflozin, furosemide, and IM testosterone. Which of these medications are likely to be contributing to his polycythemia?

What do you think about his RBC indices?

Component Ref Range & Units (hover)	11/6/24 1341
Iron	45 ↓
Iron Binding-TIBC	553 ↑
% Saturation	8 ↓
Ferritin	7 ↓

BLOOD COUNTS							
White Blood Cells	6.5	7.3	5.6	6.4	7.00	5.80	6.20
Hemoglobin	15.4	16.8 ↑	16.6 ↑	17.3 ↑	16.8 ↑	17.1 ↑	17.8 ↑
Hemoglobin POC							
Hematocrit	49.0	52.9 ↑	51.2 ↑	53.5 ↑	52.7 ↑	53.0 ↑	56.1 ↑
Hematocrit POC							
Platelet Count	222	246	263	249	192	200	216
Neutrophils	58	56	52	55	59	50	56
Absolute Neutrophil Count	3.83	4.05	2.99	3.50	4.10	2.90	3.40
Lymphocytes	29	31	34	32	28	36	31
Absolute Lymph Count	1.87	2.25	1.87	2.10	2.00	2.10	1.90
Monocytes	11	10	11	11	12	12	12
Absolute Monocyte Count	0.71	0.72	0.61	0.70	0.80	0.70	0.70
Eosinophils	1	1	2	1	1	1	1
Absolute Eosinophil Count	0.08	0.10	0.08	0.10	0.10	0.10	0.10
Absolute Basophil Count	0.04	0.17	0.04	0.00	0.00	0.00	0.00
Segmented Neutrophils							
Absolute Neutrophil Count Manual							
Lymphocytes							
Monocytes							
MDW (Monocyte Distribution Width)							
Eosinophil							
Basophils	1	2	1	1	1	1	1
Metamyelocyte							
Myelocyte							
Nucleated RBCs							
Peripheral Smear				NO QUALIT...			
Pathologist Signature				INTERPRE...			
RBC	6.48 ↑	7.06 ↑	6.90 ↑	7.29 ↑	7.02 ↑	6.93 ↑	7.19 ↑
MCV	75.6 ↓	74.9 ↓	74.2 ↓	73.5 ↓	75.1 ↓	76.4 ↓	77.9 ↓
MCH	23.7 ↓	23.7 ↓	24.0 ↓	23.8 ↓	23.9 ↓	24.7 ↓	24.7 ↓
MCHC	31.4 ↓	31.7 ↓	32.3	32.4	31.8 ↓	32.3	31.7 ↓
MPV	7.8	7.7	7.7	7.3	8.1	7.7	7.8
RDW	18.2 ↑	18.8 ↑	18.2 ↑	18.3 ↑	19.5 ↑	21.6 ↑	21.5 ↑

Erythrocytosis/Polycythemia

A 69 y.o. female with a past medical history significant only for GERD is referred for polycythemia. Her only medication is famotidine. She is active, biking 20 miles each week. CBC trend shows gradual onset polycythemia over the past several years. She underwent sleep study through her PCPs office that was normal. She has no tobacco history and denies respiratory symptoms. What is your next step in this patient's evaluation?

A. Repeat a CBC
B. Stop famotidine and see if polycythemia resolves
C. Send patient for PFTs
D. Check JAK2 with reflex

BLOOD COUNTS					
White Blood Cells	7.3	7.5	6.90	6.0	7.80
Hemoglobin	15.2 ▲	17.2 ▲	16.7 ▲	17.6	15.9 ▲
Hematocrit	45.8 ▲	51.5 ▲	48.0 ▲	53.9	47.8 ▲
Platelet Count	285	244	262	205	212
Neutrophils	59	54	53	65	61.2
Absolute Neutrophil Count	4.36	4.12	3.60	3.9	4.80
Lymphocytes	31	37	39	27	30.2
Absolute Lymph Count	2.24	2.75	2.70	1.7	2.40
Monocytes	8	7	7	6	6.6
Absolute Monocyte Count	0.56	0.50	0.50	0.4	0.50
Eosinophils	2	1	1		1.6
Absolute Eosinophil Count	0.11	0.07	0.10	0.1	0.10
Absolute Basophil Count	0.02	0.04	0.00	0.0	0.00
Eosinophil				1	
Basophils	0	1	0	0	0.4
Peripheral Smear	NO QUALIT...				
Pathologist Signature	INTERPRE...				
RBC	5.41 ▲	6.09 ▲	5.58 ▲	6.12	5.38 ▲
MCV	84.7	84.6	86.1	88.1	88.9
MCH	28.1	28.3	29.9	28.8	29.5
MCHC	33.2	33.5	34.8	32.7	33.2
MPV	7.7	8.1	7.6	10.4	7.9
RDW	14.6	13.8	14.3	12.9	12.9

Erythrocytosis/Polycythemia

VARIANT DETAILS

Variant of strong clinical significance (1)

JAK2 V617F

Gene: JAK2
Exon: 14
Nucleotide:
NM_004972.4:
g.5073770G>T
c.1849G>T
Amino Acid: p.V617F
Allelic Fraction: 42.0% (of 360 reads)
Classification: Tier 1A
Assessment: Pathogenic

Biomarker summary: *JAK2*-V617F (NM_004972) is an activating mutation.

Clinical relevance: *JAK2* encodes the Janus kinase 2 (Jak2) protein, a tyrosine kinase that regulates signals triggered by cytokines and growth factors [30]. Activation of the Jak/Stat pathway may predict sensitivity to Jak inhibitors, including ruxolitinib, momelotinib, fedratinib, and pacritinib, which have been approved for treatment of primary myelofibrosis, post-polycythemia vera myelofibrosis, and post-essential thrombocythemia myelofibrosis independently of mutations. Additionally, ruxolitinib has been approved for the treatment of polycythemia vera. Hsp90 inhibitors are also being investigated in preclinical studies to target components of the Jak/Stat pathway [37, 52, 105, 48, 15, 106, 65].

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