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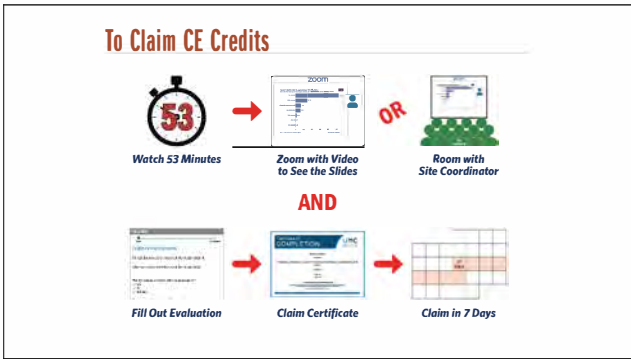
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Poll Everywhere

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Our Presenter

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- 1. She lives in Durham with her husband, two sons, and cat.

Sample Poll Everywhere Question

Anemia is a problem of not having enough healthy red blood cells or hemoglobin to carry oxygen to the body's tissues while Thrombocytopenia is a condition that occurs when the platelet count in your blood is too low.

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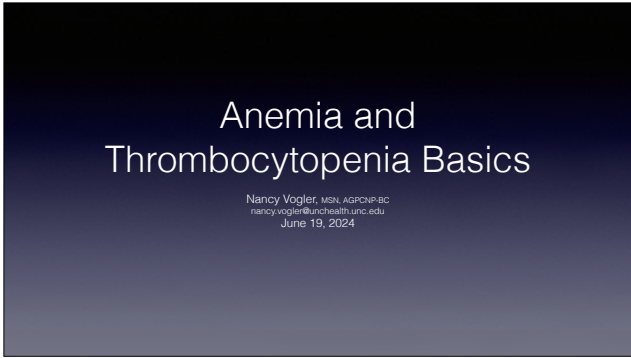
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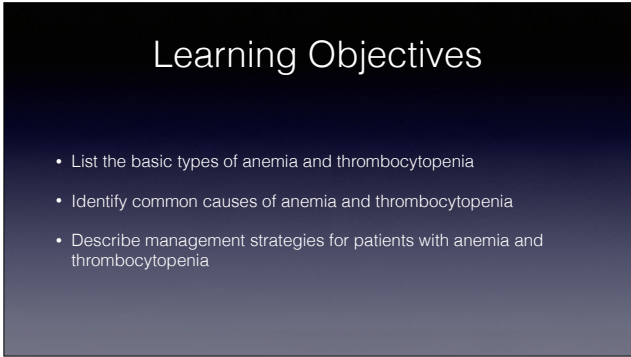
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Anemia is a problem of not having enough healthy red blood cells or hemoglobin to carry oxygen to the body's tissues while Thrombocytopenia is a condition that occurs when the platelet count in your blood is too low.

True	0%
False	0%

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In Men anemia is defined as hemoglobin less than 13.

True 0%

False 0%

Use the pollster app to see the results. For more information, check the pollster app. Get help at [pollsterhelp](#)

In Women anemia is defined as hemoglobin less than 11-12.

True 0%

False 0%

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What is Anemia?

- **Anemia is a decrease in the number of healthy red blood cells**
- Not enough RBCs = Not enough oxygen rich blood to the body
- In adults this is defined by a decrease in hemoglobin or hematocrit

MEN:
Hemoglobin < 13 g/dL

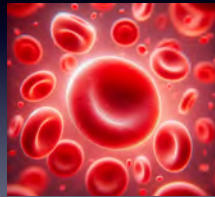


WOMEN:
Hemoglobin < 11-12 g/dL

Criteria for hemoglobin levels to define anemia in individuals and populations. Geneva: World Health Organization; 2011. License: CC BY-NC-SA 3.0 IGO.

Classification of Anemias

- **Microcytic Anemia = MCV < 80**
 - *Iron deficiency, thalassemias, ACD/ACI*
- **Normocytic Anemia = MCV 80-100**
 - *Iron, B-12 and/or folate deficiencies, drug induced, liver disease, hemolysis, hypothyroidism, ACD/ACI*
- **Macrocytic Anemia = MCV >100**
 - *B-12 or folate deficiencies, drug induced, liver disease, hypothyroidism, myelodysplastic syndrome*



Werner, D., Brinkley, H. (2012). Diagnostic Approach to Anemia in Adults. [pdf]. Retrieved June 14, 2024 from https://www.pearsoncmg.com/api/v1/print/med-ed/9780323084860_chapter07?lang=en&country=usa

Anemia Case Study

- 47 yo African American female with PMHx of HTN, DMT2, obesity and vitamin D deficiency
 - Presents for annual physical, last seen in 2019
 - C/o fatigue, hot flashes, cold intolerance, exercise intolerance and RLS. Denies CP, SOB at rest. Weight has increased 3 lbs since 2019. Vitals stable.
 - Surgical Hx: ACL repair in 1994
 - Social Hx: from Wash DC. Moved to NC in 2019 w/ husband and 2 kids. Works in billing at a local company. EtOH socially, denies tobacco, drug use
- Labs from 2019:
 - WBC 11, Hgb 11.6, MCV 80, RDW 17.1, platelets 356
 - CMP unremarkable
 - TSH normal
 - Vitamin D 38
 - A1C 6.0



Iron Deficiency Anemia (IDA)



- Most common cause of anemia worldwide
- WHO estimates that worldwide in 2019, 40% of children under 5, 37% of pregnant women, and 30% of women aged 15-49 were anemic
- Symptoms: fatigue, weakness, SOB, exercise intolerance, dizziness, racing heart, palpitations, chest pain, hair loss, brittle nails, RLS, pica

©2021 Anemia Collaborative (2021). *Prevalence, persistence with disability, and burden in anemia burden by severity and cause*. 1901-2021. *Findings from the Global Burden of Disease Study 2019*. *The Lancet Hematology*. 19(6), 472-473A. [https://doi.org/10.1016/S2663-6612\(21\)00044-4](https://doi.org/10.1016/S2663-6612(21)00044-4)

IDA Diagnosis and Causes

- Lab values: **Iron saturation <15-20%**, **Ferritin <30**
- Decreased dietary iron intake
- Decreased iron absorption
 - Gastric bypass, Crohn's/UC, Celiac disease
- Blood loss
 - Menstruation, chronic GI bleeding, blood donation



Choudhury, Chakraborty. "Iron Deficiency." *Blood*, vol. 153, no. 1, Jan. 2019, pp. 30-38. DOI.org (Crossref). <https://doi.org/10.1182/blood-2018-02-810368>.

B-12 Deficiency Causes and Tx



- Due to decreased dietary B-12 intake
 - Livers, meats, fish, dairy products, eggs, fortified cereals
- Due to decreased B-12 absorption
 - Bariatric surgery, gastric/ileum surgeries, Crohn's disease, celiac disease, gastric atrophy a/w aging
 - Medications: Metformin, H2 Blockers, PPIs
- Many routes to replete B-12:
 - Daily oral or sublingual supplements OTC (1000-2000 mcg)
 - IM Injection, 1000 mcg weekly then monthly, in home or in clinic
 - Intranasal and skin patches: Variable, expensive, not preferred

Wassil, R., Pathak, K. (2018). Clinical manifestations and diagnosis of vitamin B12 and folic acid deficiency. UpToDate. Retrieved June 19, 2024 from <https://www.uptodate.com/consultations?search=clinical%20manifestations%20and%20diagnosis%20of%20vitamin%20B12%20and%20folic%20acid%20deficiency>

Other vitamin deficiency anemias


- **Folate Deficiency:** Important in RBC production. Deficiency can cause macrocytic anemia
 - Pregnancy, chronic or acute hemolytic anemia, gastric bypass, excessive alcohol use, methotrexate
 - Replete with 1-2g PO daily
- **Copper Deficiency:** Important in formation of hemoglobin
 - Malnutrition, malabsorption, zinc supplement
 - Replete with 2-8 mg daily PO, may need IV
- **Vitamin C:** while being deficient in Vitamin C doesn't cause anemia, vitamin C can help iron absorption, so many PO iron supplements also include Vitamin C



Wassil, R., Bradley, P. (2018). Diagnostic Approach to Anemia in Adults. UpToDate. Retrieved July 16, 2024 from <https://www.uptodate.com/consultations?search=diagnostic%20approach%20to%20anemia%20in%20adults>

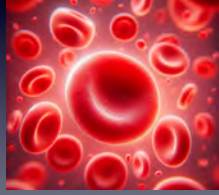


When to be concerned It's Cancer?



- **Colon cancer:**
 - Anemia in a post-menopausal woman or a man is evidence of colon cancer until proven otherwise
 - All adults older than 45 should have colon cancer screening
- **Myelodysplastic Syndrome (MDS) or Multiple Myeloma (MM):**
 - Adults older than 50
 - Normocytic or Macrocytic anemia
 - Elevated RDW, LOW reticulocyte count, no known bleeding
 - MDS: Other cytopenias, including thrombocytopenia, neutropenia
 - MM: Bone pain, increased serum protein, creatinine and/or calcium

Questions about Anemia?




A platelet count of 110 is considered:

Mild thrombocytopenia	0%
Moderate thrombocytopenia	0%
Severe thrombocytopenia	0%

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What is Thrombocytopenia?



- Thrombocytopenia is defined as any platelet count <150,000
- Mild thrombocytopenia = 100,000-149,000
- Moderate thrombocytopenia = 50,000 to 99,000
- Severe thrombocytopenia = <50,000
 - Considered to be < 20-30,000 in some diseases (ITP)
 - Less than 10,000-20,000 is at risk for spontaneous bleeding

Casper, Nichols, and Mikolajewicz. "Thrombocytopenia." New England Journal of Medicine, edited by C. G. Silliman, vol. 361, no. 10, Sept. 2019, pp. 945-55. DOI.org/10.1056/NEJMp1916275


Causes of Thrombocytopenia

- Normal Variant: 2.5% of people have a "normal" platelet count <150
- Immune Thrombocytopenia (ITP)
- Thrombotic Microangiopathies (TMAs) such as TTP
- Vitamin Deficiencies:
 - **B-12 Deficiency:** Replete with 1-2g daily (PO, IM, SL)
 - **Folate Deficiency:** Replete with 1-2g daily PO
 - **Copper Deficiency:** Replete with 2-8mg daily PO, may need IV
- Liver Disease/Cirrhosis
- Viral illness (HIV, EBV, HCV); bacterial illness (H.pylori, tick-borne infections); parasites (malaria, babesiosis)
- Cancers (hematologic and non-hematologic)
- Acute illness/sepsis

Thrombocytopenia Case Study

- 24 yo Caucasian female with to significant PMHx
- Presents to her PCP c/o 2 weeks of fatigue, LE bruising, prolonged bleeding when she cuts herself shaving, gum bleeds when brushing and flossing her teeth, and blood when she blows her nose in the morning
- Surgical Hx: s/p wisdom teeth extraction at age 18
- Social Hx: Graduate student at UNC. Drinks 2-3 alcoholic beverages/night on the weekends only. Denies tobacco, drug use
- Family Hx: Mom with HTN, hypothyroidism. Dad with HTN and HLD. No siblings

Thrombocytopenia Causes: Immune Thrombocytopenia (ITP)



- Isolated thrombocytopenia (<100k) that results from accelerated clearance and destruction of antibody coated platelets
- Symptoms: fatigue, headaches, bruising, mucosal bleeding (nose, gum, vaginal), wet purpura, petechial rashes
- Primary ITP = no known cause
- Secondary ITP causes include infection (HCV, HIV, H.pylori), autoimmune diseases (SLE)

Casper, Nichols, and Rabkin Obenaus. "Immune Thrombocytopenia." New England Journal of Medicine, edited by Carol D. Solomon, vol. 381, no. 10, Sept. 2019, pp. 945-55. DOI.org/10.1056/NEJMra1918478

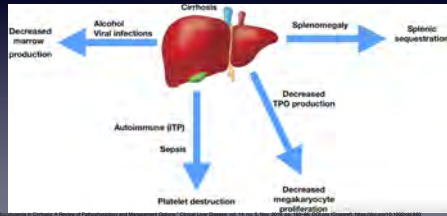
Treatment of ITP

- Treat ITP if actively bleeding or at a significant risk of bleeding, platelet count is less than 20-30k, pregnancy
- Treatment Options
 - Daily PO prednisone, High dose PO dexamethasone (pulsed) +/- IVIG
 - Anti-CD20 (Rituximab)
 - TPO-RA (Romiplostim, Eltrombopag, Avatrombopag)
 - Splenectomy
- Ensure patients with ITP have dexamethasone Rx for travel

Casper, Nichols, and Rabkin Obenaus. "Immune Thrombocytopenia." New England Journal of Medicine, edited by Carol D. Solomon, vol. 381, no. 10, Sept. 2019, pp. 945-55. DOI.org/10.1056/NEJMra1918478

Thrombocytopenia Causes: Liver Disease

- Thrombocytopenia has been reported in 70% of patients with cirrhosis, and 76% of patients with chronic liver disease



Management of Thrombocytopenia in Liver Disease

- Greatest bleeding risk is platelet count <60k
- Complete Abdominal Ultrasound to evaluate liver and spleen
- LFTs, Hepatitis testing
- Referral to hepatology for further work up and management



Thrombocytopenia Causes: Thrombotic Microangiopathy (TMA)

- TMA is a pathological state where vessels are occluded by platelet rich thrombi leading to thrombocytopenia, microangiopathic hemolytic anemia (MAHA)
- This can be systemic or intrarenal, both leading to end organ damage
- TMA types include TTP, atypical hemolytic uremic syndrome (aHUS), Shiga toxin-producing bacteria leading to HUS (most common TMA, largely occurring in children under 5)

Thompson, G. L., & Kavanagh, D. (2023). Diagnosis and treatment of thrombotic microangiopathy. International journal of laboratory hematology, 45(Suppl 1), 101-113. https://doi.org/10.1111/ijlh.15664

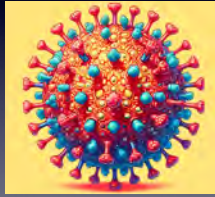
Thrombotic Thrombocytopenia Purpura (TTP)

- Systemic TMA that leads to end organ damage due to a severe deficiency in **ADAMTS13**, an enzyme that cleaves von Willebrand factor (VWF)
- Large VWF leads to platelet adhesion, aggregation and **formation of microvascular thrombi**
- Symptoms: headache, confusion, stroke, seizures, cardiac ischemia, mesenteric ischemia, AKI (less common)
- Medical emergency - mortality rate of 90% without treatment
- Treatment includes: plasma exchange to remove autoantibodies and replace ADAMTS13, steroids, Rituximab, and +/- Caplacizumab

Thompson, G. L., & Kavanagh, D. (2023). Diagnosis and treatment of thrombotic microangiopathy. International journal of laboratory hematology, 45(Suppl 1), 101-113. https://doi.org/10.1111/ijlh.15664

Thrombocytopenia Causes: Infections

- Viral illnesses: Hepatitis B/C, HIV, COVID, EBV, Influenza
 - Enteroviruses, rotaviruses in children
 - CMV and VZV in immunocompromised
- Bacterial illnesses
 - Tick-borne diseases, H.pylori
- Mild thrombocytopenia often accompanies lymphopenia.
- Bleeding is rare
- Treatment of the underlying infection is key



Radtke, M., Du Toit, J., Langenhove, T., van Bussel, B., van Gorp, E., & Graetjens, M. (2021). Thrombocytopenia in Viral Infections. *Journal of clinical medicine*, 10(6), 877. <https://doi.org/10.3390/jcm10060877>

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Radtke, M., Du Toit, J., Langenhove, T., van Bussel, B., van Gorp, E., & Graetjens, M. (2021). Thrombocytopenia in Viral Infections. *Journal of clinical medicine*, 10(6), 877. <https://doi.org/10.3390/jcm10060877>

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UpToDate. Mechanisms of Drug-Associated Anemia Chart. <https://pro.uptodate.com/look/131773>

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The song *Back Rhoades* written and performed by Don Poe

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Colorectal Cancer: Epidemiology, Risk Factors, and Screening Strategies Lisa M. Gangarosa, MD	
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