

How to Evaluate Anemia



Dayne Alonso, PA-C
Heme Onc Call

What I will be discussing

- Overview of anemia
 - How to organized the causes of anemia
- Iron deficiency anemia
- RBC Transfusions and transfusion refusal
- Hematologist's organized approach to anemia

Hematology disorders

	Low	High
RBC	Anemia	Polycythemia
WBC	Leukopenia	Leukocytosis Leukemia
Platelets	Thrombocytopenia	Thrombocytosis
Clotting	Bleeding and Coagulopathy	Thrombophilia

What is anemia?

- Decreased number of RBC
and
- Decreased amount of hemoglobin
- Anemia is:
 - a possible chief complaint
 - a “disease” itself
 - a consequence of a larger problem

Low hemoglobin (anemia) conditions

Iron deficiency	Chronic bleeding or malabsorption
Erythropoietin deficiency	Renal dysfunction
MDS	Bone marrow dysfunction
Myeloma	Heme malignancy

High hemoglobin conditions

Polycythemia vera	Low erythropoietin JAK-2 mutation positive
Chronic hypoxia (secondary polycythemia)	High erythropoietin Pulmonary disease Altitude

Why do we care about anemia?

- Why does the patient have anemia?
- Does the patient have cancer?
- Do they feel ill because of anemia?
- Do they need treatment for anemia?
- Do they need blood transfusions?
- Do they need a hematology referral?
- Do they need a bone marrow biopsy?

Symptoms & signs that could prompt evaluation for anemia

- Fatigue
- Dyspnea
- Bleeding/bruising
- Jaundice
- Dark urine
- Syncope
- Angina

“Symptomatic” anemia

- Asymptomatic
- “Symptomatic” anemia (e.g. with hemoglobin<8)
 - Dyspnea or fatigue without exertion
 - Palpitations, bounding pulse, roaring in ears
- Special symptoms
 - Jaundice, dark urine, syncope, angina

Why do we test CBC's?

- “Routine” CBC in healthy people
 - Screening for anemia or chronic bleeding
 - Screening for bone marrow disorders (i.e. heme malignancies)
- “Diagnostic” test for somebody who is ill
 - High WBC may be infection or heme malign
 - Anemia in somebody who is acutely or chronically ill
 - Heme malignancy may be discovered

What is anemia?


HCT<40 or Hgb<13.5 in a man

HCT<36 or Hgb<12 in a woman

- Hospitalized patients are different
- Severe anemia (requires transfusion):
 - Bleeding patients with HCT<20
 - Bleeding CAD/CVD pts with HCT<25
 - (not chronic or subacute anemia unless Sx's)

Hematology consult for anemia

- 30yo AA woman
- 32 wks pregnant
 - Now pre-term labor
- c/o fatigue
- PMH: C section
- FHx “sickle cell”
- Exam: comfortable, no resp distress, HR 90

2012 15 May 04:16 	
Hematocrit	7.0 L
Hemoglobin	21.7 L
WBC	11.6 H
Platelet count	182
	3.14 L
MCV	69 L

Hematology consult for anemia

	2012 15 May 04:16		2009 01 Feb 19:32
6.9 * LC *_		Hemoglobin	7.0 L 11.5 L
21.5 L		Hematocrit	21.7 L 33.0 L
17.8 H		WBC	11.6 H 8.6
194		platelets	182 213
3.15 L		MCV	3.14 L 4.14
68 L			69 L 80

11/5/12
6305

Transfuse 2 units PR
Increase Magnesium Si
TO De

Hematology consult for anemia

Iron	13 L
TIBC	513 H
% Iron sat	3 L
187 L	
222.0	

<input type="checkbox"/> Retic Count Automated (0.3-2.0) %	0.9
<input type="checkbox"/> Hemoglobin A1 % (96.0-100.0) %	61.7 L
<input type="checkbox"/> Hemoglobin A2 % (0.0-4.0) %	2.0
<input type="checkbox"/> Hemoglobin F % (0.0-1.0) %	0.0
<input type="checkbox"/> Hemoglobin S % (0.0-0.0) %	36.3 H
<input type="checkbox"/> Hemoglobin C % (0.0-0.0) %	0.0

Diagnosis: severe iron deficiency
AND sickle trait/alpha thalassemia

Interpreting anemia diagnostic tests

Category	Test
Blood counts	Hemoglobin, Hematocrit
Microcytic/macrocytic	MCV, Iron/TIBC, Retic, LDH, Vitamin 12, folate
RBC production	Retic
RBC destruction	LDH, Coombs (DAT), Haptoglobin
Bone marrow dysfunction	WBC differential, platelets Hemoglobin electrophoresis

MCV guides anemia evaluation

	Testing by Primary Care
LOW MCV	Iron, TIBC, ferritin, retic Hgb electrophoresis (look for beta thal) GI, GU, or GYN referral
NORMAL MCV	Iron, TIBC, ferritin, retic B12, folic acid, TSH, Creat
HIGH MCV	Iron, TIBC, ferritin, retic B12, MMA, folic acid, TSH, Liver enzymes LDH, Direct Coombs

Anemia: History and Physical Exam

- History: bleeding, fatigue, dyspnea, dark urine
- Physical: pallor, jaundice, hematoma, bruising, tachycardia, heart murmur



Anemia patterns

- Always request a retic count and LDH
- If retic is not high: Fe, TIBC, Ferr
- If retic is high: hemolysis evaluation (LDH, DAT)
- If pt is a bleeder: iron studies
- If pt is a clotter: vitamin B12
- If pt is malnourished: folate
- If FHx or SHx: hemoglobin electrophoresis
- If all else normal and 2 lines down: BMBx

What I will be discussing

- Overview of anemia
- Iron deficiency anemia
- RBC Transfusions and transfusion refusal
- Hematologist's organized approach to anemia

Organized anemia evaluation

1. Is the patient bleeding? (RBC & iron loss)
"acutely" bleeding vs. "chronically" bleeding
2. Low MCV vs. high MCV
3. RBC production vs. RBC consumption/destruction

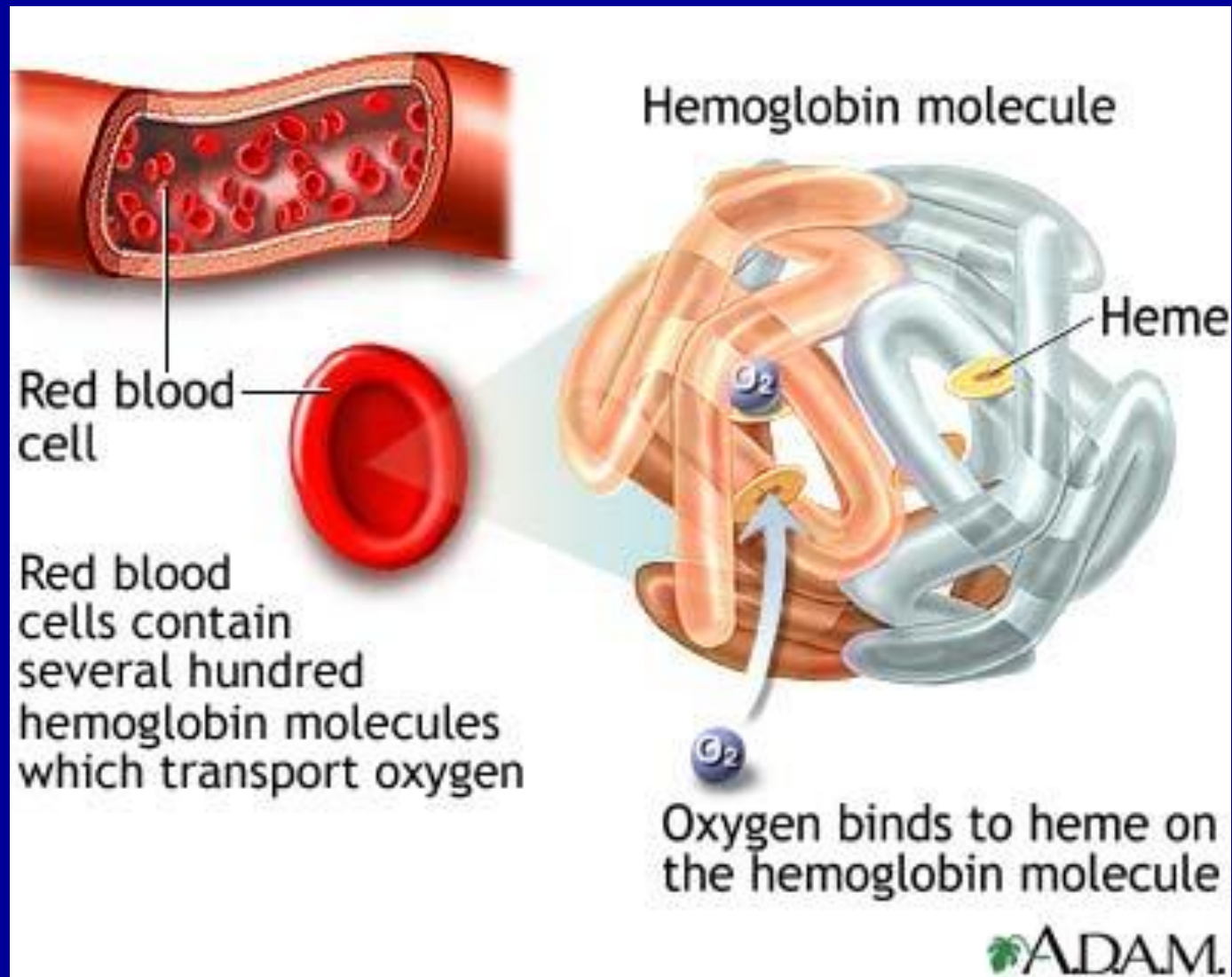
Question 1

Is the patient (acutely or chronically) bleeding?

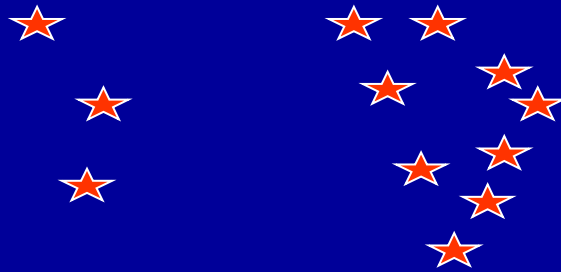
- How acute is the anemia?
- Where is bleeding occurring?
- Is it GI tract bleeding related to IBD?
- Is it a heavy or irregular menstrual bleeding?
- Does the patient have "bleeding tendency"?
- Is bleeding tendency due to medications?
- Has iron deficiency been established?



Iron is the oxygen carrier



Erythropoietin and iron are both important



Causes of Iron Deficiency

Decreased iron intake

Excess RBC/iron loss

Causes of Iron Deficiency

Decreased iron intake

Excess RBC/iron loss

- Chronic bleeding

Causes of Iron Deficiency

Decreased iron intake

Excess RBC/iron loss

- Chronic bleeding
- Chronic wounds
- Excessive phlebotomy
- Chronic hemolysis
- Parasite
- Pregnancy

Causes of Iron Deficiency

Decreased iron intake

- Malabsorption
- Malnutrition
- Acid suppression
- Gastric bypass surgery

Excess RBC/iron loss

- Chronic bleeding
- Chronic wounds
- Excessive phlebotomy
- Chronic hemolysis
- Parasite
- Pregnancy



RUNNING OUT OF STEAM?

Symptoms of iron deficiency

- Feeling tired and “weak”
- Palpitations
- Headache
- SOB with minimal exertion
- Brittle hair and nails
- Increased vulnerability to infection
- Craving ice
- Disturbed sleep, concentration, memory
- Abdominal pain



Iron deficiency affects the whole body

Central Nervous System

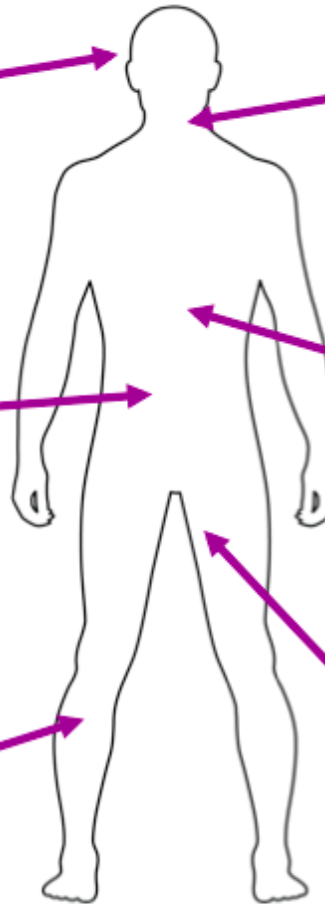
- ◆ Debilitating fatigue
- ◆ Depression
- ◆ Impaired cognitive function

Gastrointestinal System

- ◆ Anorexia
- ◆ Nausea

Vascular System

- ◆ Low skin temperature
- ◆ Pallor of skin, mucous membranes and conjunctiva



Immune System

- ◆ Impaired T cell and macrophage function

Cardio-respiratory System

- ◆ Exertional dyspnea
- ◆ Tachycardia, palpitations
- ◆ Cardiac enlargement, hypertrophy
- ◆ Increased pulse pressure, systolic ejection murmur
- ◆ Risk of cardiac failure

Genital Tract

- ◆ Menstrual problems
- ◆ Loss of libido

Chewing Ice is Not Just a Habit



Pica, pagophagia

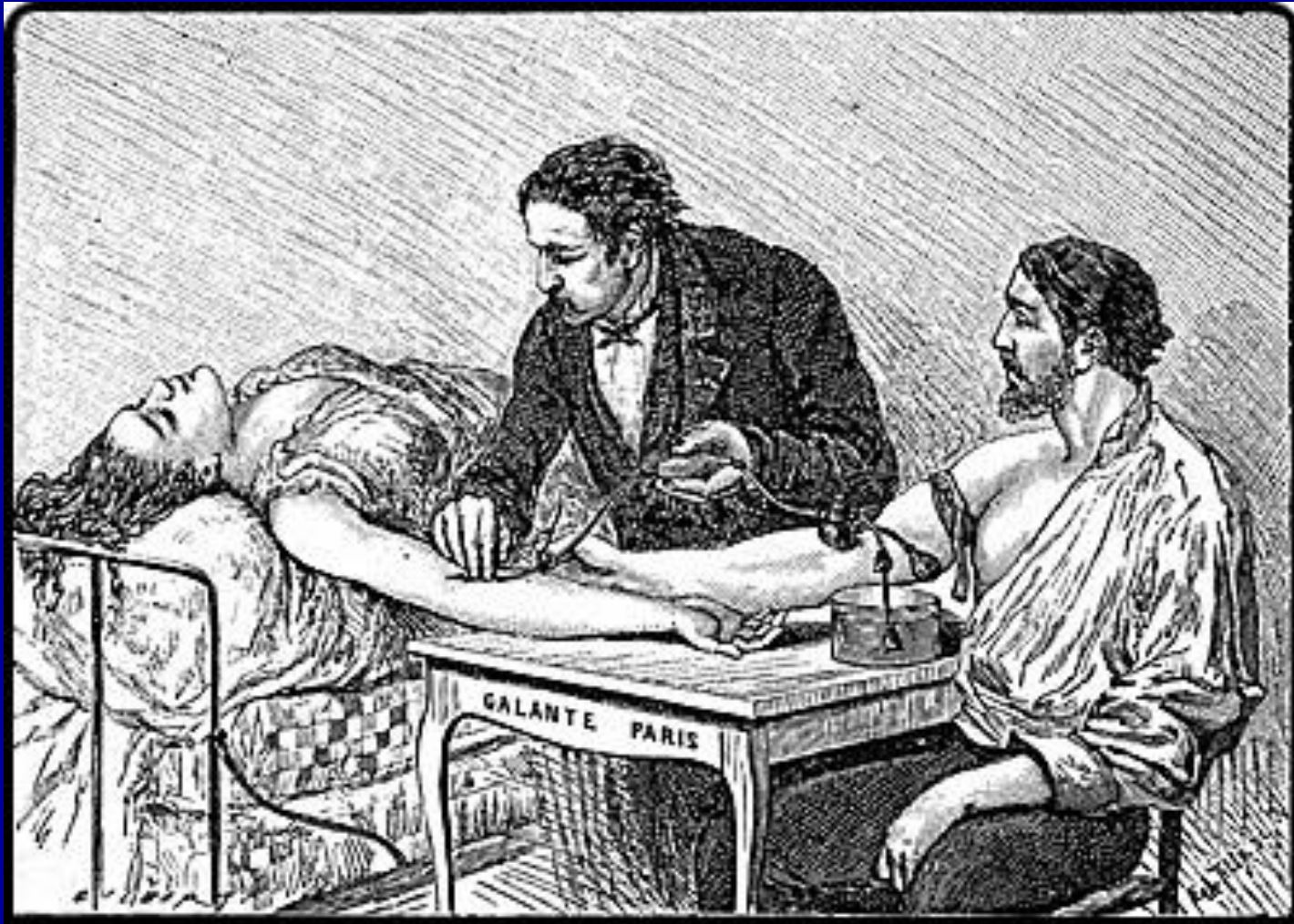
How to treat iron deficiency

Intervention	Hemoglobin	Iron
Address chronic or acute bleeding	Stop decreasing	
Oral iron supplement	Weeks-months	Slow
IV iron supplement	Days-weeks	Fast
RBC transfusion	Hours	Fast

What I will be discussing

- Overview of anemia
- Iron deficiency anemia
- **RBC Transfusions and transfusion refusal**
- Hematologist's organized approach to anemia

19th Century blood transfusion

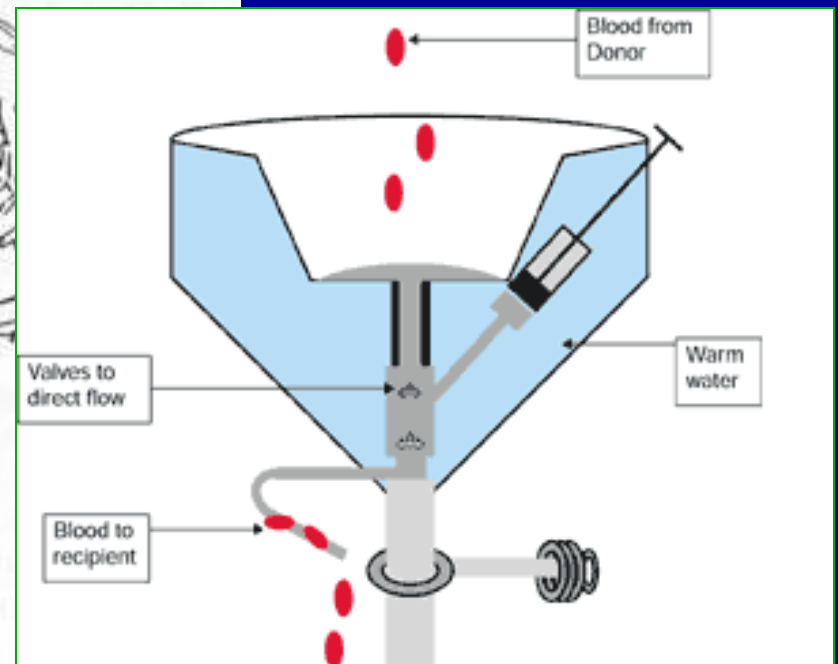


1800's: direct transfusions used for several medical conditions

History of transfusion



FIGURE 2.—Clinical transfusion with Blundell gravitator for transmitting “blood in a regulated stream from one individual to another” (3).



1800's: spouse blood transfused for postpartum hemorrhage

20th Century blood transfusion



FIGURE 80.—Fifth U.S. Army corpsmen administering blood plasma in open field to wounded comrade. In background is a war-ravaged town. Date is unknown, but the picture was taken before the introduction of large plasma bottles.

Benefits of transfusion

RBC	<i>Iron repletion for iron deficiency</i> Replace lost blood in bleeding pt Supply oxygen-carrying capacity Treat “symptomatic” anemia in patients with RBC production prob <i>(or sometimes hemolytic anemia)</i>
Platelets	Stop or prevent bleeding
Plasma	Stop or prevent bleeding Special circumstances: TTP

Who needs RBC transfusion?

Bleeding after trauma or surgery

Post-partum bleeding



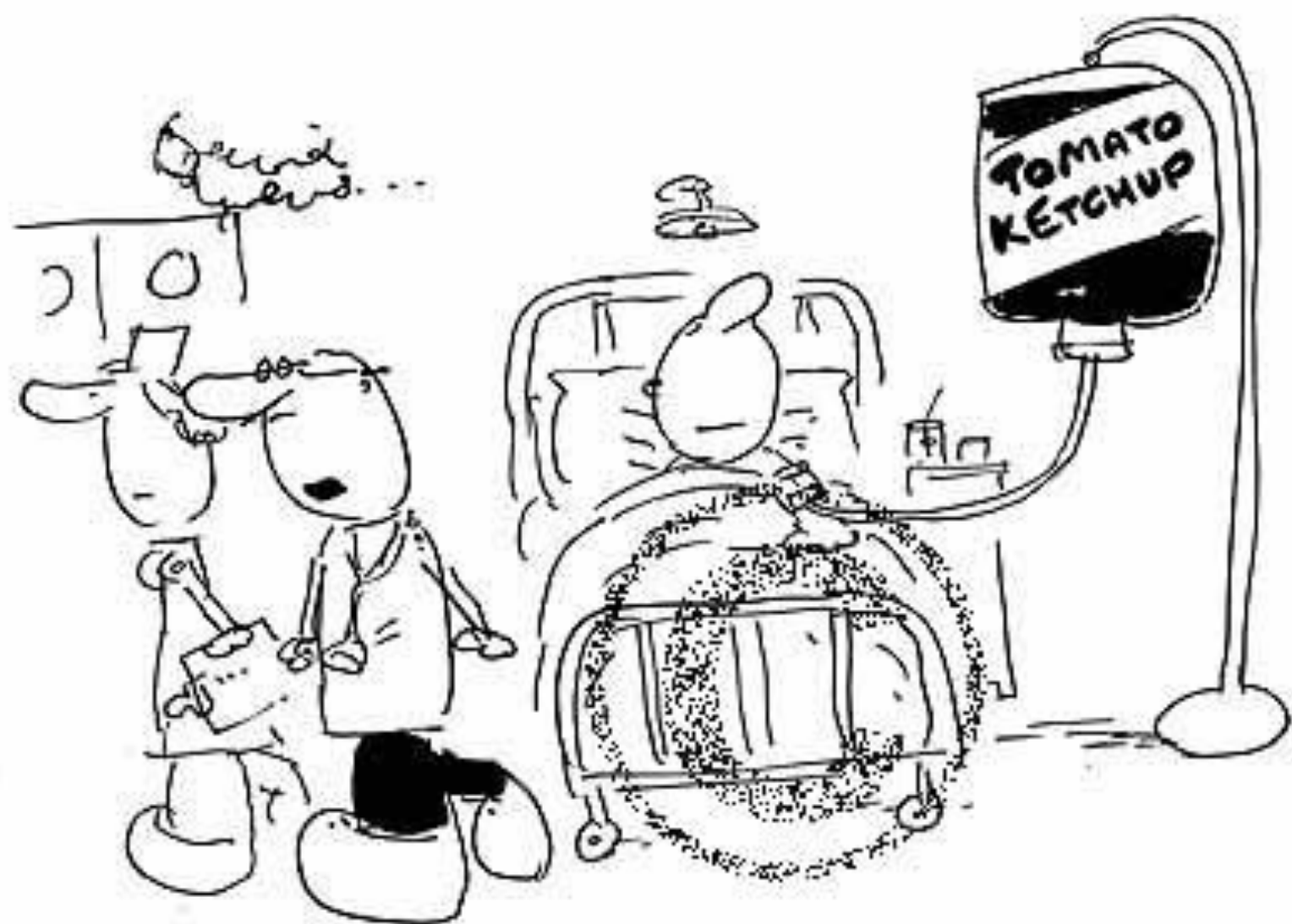
Who needs RBC transfusion?

Cancer patients receiving cytotoxic chemotherapy

MDS patients receiving palliative treatment

Thalassemia patients





"He has a pretty rare bloodgroup."

Types of Transfusion Reactions

Acute Reactions (Minutes to Hours)

- Anaphylaxis
- Other allergic reactions
- ABO incompatibility
- Bacterial contamination
- Febrile non-hemolytic transfusion reaction
- Transfusion-Related Acute Lung Injury (TRALI)

Delayed Reactions (Days to Weeks)

- Extravascular hemolysis
- Post-transfusion purpura
- Graft vs. host reaction
- Transmission of infectious agents
- Unrecognized risks



An initiative of the ABIM Foundation



Five Things Physicians and Patients Should Question

1

Don't transfuse more units of blood than absolutely necessary.

Each unit of blood carries risks. A restrictive threshold (7.0-8.0g/dL) should be used for the vast majority of hospitalized, stable patients without evidence of inadequate tissue oxygenation (evidence supports a threshold of 8.0g/dL in patients with pre-existing cardiovascular disease). Transfusion decisions should be influenced by symptoms and hemoglobin concentration. Single unit red cell transfusions should be the standard for non-bleeding, hospitalized patients. Additional units should only be prescribed after re-assessment of the patient and their hemoglobin value.

2

Don't transfuse red blood cells for iron deficiency without hemodynamic instability.

Blood transfusion has become a routine medical response despite cheaper and safer alternatives in some settings. Pre-operative patients with iron deficiency and patients with chronic iron deficiency without hemodynamic instability (even with low hemoglobin levels) should be given oral and/or intravenous iron.

3

Don't routinely use blood products to reverse warfarin.

Patients requiring reversal of warfarin can often be reversed with vitamin K alone. Prothrombin complex concentrates or plasma should only be used for patients with serious bleeding or requiring emergency surgery.

4

Don't perform serial blood counts on clinically stable patients.

Transfusion of red blood cells or platelets should be based on the first laboratory value of the day unless the patient is bleeding or otherwise unstable. Multiple blood draws to recheck whether a patient's parameter has fallen below the transfusion threshold (or unnecessary blood draws for other laboratory tests) can lead to excessive phlebotomy and unnecessary transfusions.



An initiative of the ABIM Foundation



Five Things Physicians and Patients Should Question

1

Don't transfuse more units of blood than absolutely necessary.

Each unit of blood carries risks. A restrictive threshold (7.0-8.0g/dL) should be used for the vast majority of hospitalized, stable patients without evidence of inadequate tissue oxygenation (evidence supports a threshold of 8.0g/dL in patients with pre-existing cardiovascular disease). Transfusion decisions should be influenced by symptoms and hemoglobin concentration. Single unit red cell transfusions should be the standard for non-bleeding, hospitalized patients. Additional units should only be prescribed after re-assessment of the patient and their hemoglobin value.

2

Don't transfuse red blood cells for iron deficiency without hemodynamic instability.

Blood transfusion has become a routine medical response despite cheaper and safer alternatives in some settings. Pre-operative patients with iron deficiency and patients with chronic iron deficiency without hemodynamic instability (even with low hemoglobin levels) should be given oral and/or intravenous iron.

3

Don't routinely use blood products to reverse warfarin.

Patients requiring reversal of warfarin can often be reversed with vitamin K alone. Prothrombin complex concentrates or plasma should only be used for patients with serious bleeding or requiring emergency surgery.

4

Don't perform serial blood counts on clinically stable patients.

Transfusion of red blood cells or platelets should be based on the first laboratory value of the day unless the patient is bleeding or otherwise unstable. Multiple blood draws to recheck whether a patient's parameter has fallen below the transfusion threshold (or unnecessary blood draws for other laboratory tests) can lead to excessive phlebotomy and unnecessary transfusions.

Blood Transfusion Refusal

NO BLOOD TRANSFUSION !

As a God-fearing Christian and a believer of Jehovah's word, the Bible, I hereby demand that blood, in any way, shape or form, is **NOT** to be fed into my body; however, blood substitutes may be used in case of extreme loss of blood.

'YOU MUST NOT EAT THE BLOOD OF ANY SORT OF FLESH'
LEVITICUS 17:14 NW

Signature _____

Witness _____

(Over)

Question 2: Low MCV vs. High MCV

MCV < 80	MCV > 100
<p>Hgb synthesis problems</p> <ul style="list-style-type: none">--Iron-deficiency<ul style="list-style-type: none">absolute iron deficfunctional iron defic“anemia of chronic dz”--Thalassemia<ul style="list-style-type: none">alpha thalassemiabeta thalassemia“thalassemia major”	<p>DNA synthesis problems</p> <ul style="list-style-type: none">Drugs (cancer/HIV drugs)Vitamin B12 deficiencyFolate deficiency<ul style="list-style-type: none">malnutrition, malabsorpseizure medsalcohol dependenceHypothyroidismLiver disease, hypersplenismHigh retic counts

Question 3: RBC production or destruction?

Production	Destruction
Bone marrow failure	Hemolytic anemia
Thalassemia Nutrient defic (iron, B12, folate) Drugs, chemotherapy Epo defic (CRI or ESRD) Anemia of chronic disease MDS, Aplastic anemia “Sideroblastic” anemia = MDS	Intravascular RBC membrane Sickle cell disease Microangiopathic: DIC, TTP, HUS Extravascular AIHA, Drug-induced

What I will be discussing

- Overview of anemia
- Iron deficiency anemia
- RBC Transfusions and transfusion refusal
- Hematologist's organized approach to anemia

Hematologist's view of anemia

- Iron deficiency
- Non-iron deficiency

Hematologist's view of anemia

- Iron deficiency
 - Chronic bleeding
 - Iron malabsorption
- Non-iron deficiency

Hematologist's view of anemia

- Iron deficiency

- Chronic bleeding

- GYN
 - GI tract
 - GU tract

(r/o malignancy)

- Iron malabsorption

- GI tract surgery
 - Autoimmune disease

- Non-iron deficiency

Hematologist's view of anemia

- **Iron deficiency**

- Chronic bleeding

- GYN
 - GI tract
 - GU tract

(r/o malignancy)

- Iron malabsorption

- GI tract surgery
 - Autoimmune disease

- **Non-iron deficiency**

Hematologist's view of anemia

- **Iron deficiency**

- Chronic bleeding

- GYN
- GI tract
- GU tract

(r/o malignancy)

- Iron malabsorption

- GI tract surgery
- Autoimmune disease

- **Non-iron deficiency**

- What is the MCV?

- Production problem or destruction problem?

- Benign or malignant?

Hematologist's view of anemia

- **Iron deficiency**

- Chronic bleeding

- GYN
- GI tract
- GU tract

(r/o malignancy)

- Iron malabsorption

- GI tract surgery
- Autoimmune disease

- **Non-iron deficiency**

- What is the MCV?

- Low MCV alpha thal

- High MCV

- B12/folate
- Liver dysfunction
- Hypothyroidism
- Meds-antibiotics

Hematologist's view of anemia

- **Iron deficiency**

- Chronic bleeding

- GYN
 - GI tract
 - GU tract

(r/o malignancy)

- Iron malabsorption

- GI tract surgery
 - Autoimmune disease

- **Non-iron deficiency**

- Low MCV alpha thal
 - High MCV
 - B12/folate
 - Liver dysfunction
 - Hypothyroidism
 - Meds-antibiotics

- Production problem

- Anemia of chronic dz
 - Epo deficiency CKD

- Destruction problem

- Autoimmune (AIHA)
 - Non-autoimmune

Hematologist's view of anemia

- Iron deficiency

- Chronic bleeding

- GYN
 - GI tract
 - GU tract

(r/o malignancy)

- Iron malabsorption

- GI tract surgery
 - Autoimmune disease

- Non-iron deficiency

- Low MCV alpha thal
 - High MCV
 - B12/folate
 - Liver dysfunction
 - Hypothyroidism
 - Meds-antibiotics
 - Production problem
 - Anemia of chronic dz
 - Epo deficiency CKD
 - Destruction problem
 - Autoimmune (AIHA)
 - Non-autoimmune

- Heme malignancy

- Myeloma, lymphoma, MDS, MPD, leukemia

What I've discussed

- Overview of anemia
 - Bleeding?
 - Low MCV or high MCV?
 - Production or destruction?
- Iron deficiency anemia
- RBC Transfusions and transfusion refusal
- Hematologist's organized approach to anemia
 - Iron deficiency vs. non-iron deficient



Reddy the Blood Drop Says...

**GIVE BLOOD,
GIVE LIFE !**

[Click to Enter](#)