Anemia in Childhood

More Common Types

Presented by: Dr. Neil S. Levy, *STAR Kids Medical Director*

UnitedHealthcare Community Plan of Texas

United Healthcare

DISCLOSURE

I have no actual or potential conflict of interest in relation to any product or service mentioned in this program or presentation.

LEARNING OBJECTIVES

1. Define childhood anemia and explain its significance, including the prevalence and potential impact on a child's growth and development
2. Identify the common causes of anemia.
3. Be familiar with the major symptoms associated with anemia such as fatigue, shortness of breath and pale skin
4. Describe potential treatment options for some anemias
5. Know that Iron Deficiency Anemia is the most common cause of childhood anemia.

ANEMIA in CHILDHOOD
Educational Goals

Understand Each Item

1. What is Anemia in Childhood
2. Causes of Anemia
3. Presentation and Symptoms
4. Small Red Blood Cells
5. Big Red Blood Cells
6. Funny Looking Red Blood Cells
7. Treatment

WHAT IS ANEMIA?

WHAT IS ANEMIA

Not enough RED BLOOD CELLS (RBC) or they do not function normally

- 20% of US children may be anemic
- May be a problem by itself
- May be a symptom of other diseases
- Affects overall health and well being

WHAT IS ANEMIA

There are 3 kinds of blood cells

- Red Blood Cells (RBC)
- White Blood Cells (WBC)
- Platelets (PLT)

WHAT IS ANEMIA

Red Blood Cells

- Contain hemoglobin
  - Hemoglobin is the oxygen carrying protein
- Carries oxygen in the blood
- RBCs are disk-shaped
- No nucleus

WHAT IS ANEMIA

White Blood Cells

- Immune cells: fight infection
- Amorphous
- Have a nucleus

WHAT IS ANEMIA

Platelets

- Help to form clots
- Amorphous
- No nucleus

WHAT IS ANEMIA

Acquired

- Iron deficiency anemia
- Megaloblastic anemia
- Hemolytic anemia
- Aplastic anemia

Congenital/Genetic

- Iron-refractory iron deficiency anemia (IRIDA)
- Congenital sideroblastic anemia
- Sickle cell anemia
- Thalassemia (Cooley's anemia)
- Aplastic anemia
  - Fanconi anemia (bone marrow failure)
  - Diamond-Blackfan anemia (RBC aplasia-not being formed)

WHAT IS ANEMIA

Risk Factors

- Premature or low birth weight
- Living in poverty or immigrating from developing country (SDoH)
- Early use of cow's milk
- Dietary deficiencies
- Blood loss (surgery, accidents)
- Chronic illnesses (infection, kidney dx, liver dx)
- Inherited anemia
  - Sickle Cell Anemia
  - Thalassemia

HOW DOES ANEMIA PRESENT

Most Common Symptoms

- Increased heart rate
- Breathlessness
- Lack of energy
- Tiring easily
- Dizziness
- Orthostatic vertigo
- Headache
- Irritability
- Sore or swollen tongue (glossitis)
- Jaundice
- Enlarged spleen or liver
- Slow growth
- Delayed development
- Poor wound healing
- Irregular menstrual cycles

WHAT IS ANEMIA

Anemia has 3 main causes:

- Inability to make enough red blood cells
- Loss of red blood cells
- Destruction/malformation of red blood cells

WHAT IS ANEMIA

Laboratory Tests (Screen for Causes)

Complete Blood Count		
	Normal Values (Hg)	(Hct)
	Hemoglobin g/dl	Hematocrit %
6m - <2y	11-13.5	31-42
2 - 6y	11-13.7	34-44
6 - 12y	11.2-14.5	35-44
12 - 18y	F 11.4-14.7	36-46
	M 12.4-16.4	40-51

WHAT IS ANEMIA

Laboratory Tests (Screen for Causes)

- Hct is % of RBC in 1 ml of blood
- Normal values MCHC

  In RBCs, the ratio of Hg to cell size is a constant (Mean Corpuscular Volume or MCV)

  Hg in an RBC/RBC Size (MCV)
- Mean Corpuscular Hemoglobin Concentration (MCHC) 32–36 g/dL
- Becomes abnormal with some anemias

WHAT IS ANEMIA

Laboratory Tests (Screen for Causes)

Peripheral Smear

- Urine Test
- Metabolic profile
- Bilirubin
- Fecal Blood Test
- Genetic Tests

WHAT IS ANEMIA

Today I will discuss some of the more common anemias of childhood

- Iron deficiency anemia
- Megaloblastic anemia
- Sickle cell anemia
- Hemolytic Anemia

IRON DEFICIENCY ANEMIA (Small RBCs)

- Most common cause of anemia
- Not enough iron
  - Iron needed to form Hemoglobin (Hg)
  - Hg carries Oxygen in the blood
- Not enough red blood cells
- RBCs have a smaller size (Microcytosis)
- Red Blood Cells have less Hg per cell (Hypochromia)
- Not enough Oxygen carrying capacity
- MCHC is low (less Hg/MCV)

IRON DEFICIENCY ANEMIA
Additional Symptoms

- Cold hands and feet
- Pica
  - Unusual cravings for non-nutritive substances, such as ice, dirt or starch
- Poor appetite
- Pale skin
- Brittle nails
- Koilonychia
  - Ridges, thin, up-curved edges

IRON DEFICIENCY ANEMIA
Additional Laboratory Tests

- Serum ferritin
- Total Iron
- Iron binding capacity
- Bone marrow biopsy

These all have standardized normal values for comparison

IRON DEFICIENCY ANEMIA

Causes

- Inadequate Iron intake
- Blood loss
- Poor intestinal Iron absorption

  -Milk

- Pregnancy

IRON DEFICIENCY ANEMIA

Complications

Mild anemia may have no symptoms

- Heart problems
  - Heart works harder
  - Causes enlarged heart
- Pregnancy Problems
  - Premature birth
  - Low birth weight

IRON DEFICIENCY ANEMIA

Complications

- Growth problems
  - Small size
  - Delayed development
    - Iron is a coenzyme metabolic processes
  - Increased risk of infection

IRON DEFICIENCY ANEMIA

Prevention

- Choose Iron rich foods
  - -Meat, poultry, fish
  - -Beans, peas, dried fruit
  - -Green leafy vegetables
  - -Iron fortified foods
- Foods with high Vitamin C
  - -Improves Iron absorption

IRON DEFICIENCY ANEMIA
Prevention

- For infants
  - -BREAST FEED ALL INFANTS
  - -Ensure the mother takes iron supplements
- When solids are introduced after 6 mo.
  - -Use iron-fortified foods
- Limit milk after 1 year of age
- Ensure a variegated diet with Iron rich foods

IRON DEFICIENCY ANEMIA

Treatment

- Treat the underlying cause

- Oral iron treatment based upon weight

  -Prevention dose 1-2mg/kg/day

  -Treatment dose 3-6mg/kg/day

IRON DEFICIENCY ANEMIA

Treatment

- Recheck
  - -Hg/Hct monthly initially, then less frequently with increasing Hg/Hct
  - -Failure to respond to oral Iron
    - Consider IV Iron
    - Reevaluate for underlying causes

MEGALOBLASTIC ANEMIA
(Big RBCs)

- Not enough Red Blood Cells produced
- Not enough oxygen carrying capacity of the blood
- Bone marrow makes fewer RBCs
- Cells are larger than normal RBCs
- May be abnormally shaped

MEGALOBLASTIC ANEMIA

Symptoms

- In addition to the prior list
- Pale or yellow skin
- Stomach upsets, nausea, diarrhea, gas, constipation
- Trouble walking
- Numbness or tingling in hands and feet
- Weak muscles

MEGALOBLASTIC ANEMIA

Causes

- Deficiency of Vitamin B12
- Deficiency of Folic Acid
  - -Both are necessary for Red Blood Cell production
  - -Both are necessary for normal nerve and brain function

MEGALOBLASTIC ANEMIA

Causes

- Digestive diseases, e.g. celiac disease or inflammation of the intestine

  -Reduces intrinsic factor

  -Causes failure to absorb B12 and folate

- Congenital folate malabsorption, genetic
- Medications, e.g., seizure medications

  -Restrictive Diets

MEGALOBLASTIC ANEMIA

Laboratory Tests

- These are the same as for diagnosing Iron Deficiency Anemia
  - -MCHC is normal
- B12 and Folate levels
- Evaluation of nerve and muscle functioning
  - -Nerve conduction
  - -EEG
  - -Electromyography

MEGALOBLASTIC ANEMIA
Complications

- Problems with growth and development
- Fatigue
- Poor exercise tolerance
- If the B12/folate deficiency is severe
  - -Enlarged heart or heart failure
  - -Seizures
  - -Mental deterioration

MEGALOBLASTIC ANEMIA
Treatment

- Treat the underlying problem, e.g. digestive problems
- B12 or folic acid supplements
  - -Vitamin B-12 supplements are best absorbed when given by injection
  - -Oral treatment to follow
- Foods naturally high in B12 and Folate are mostly the same as those high in Iron
- B12 and Folate fortified foods

SICKLE CELL ANEMIA
(Funny-looking RBCs)

Sickle Cell Anemia is a genetic disorder

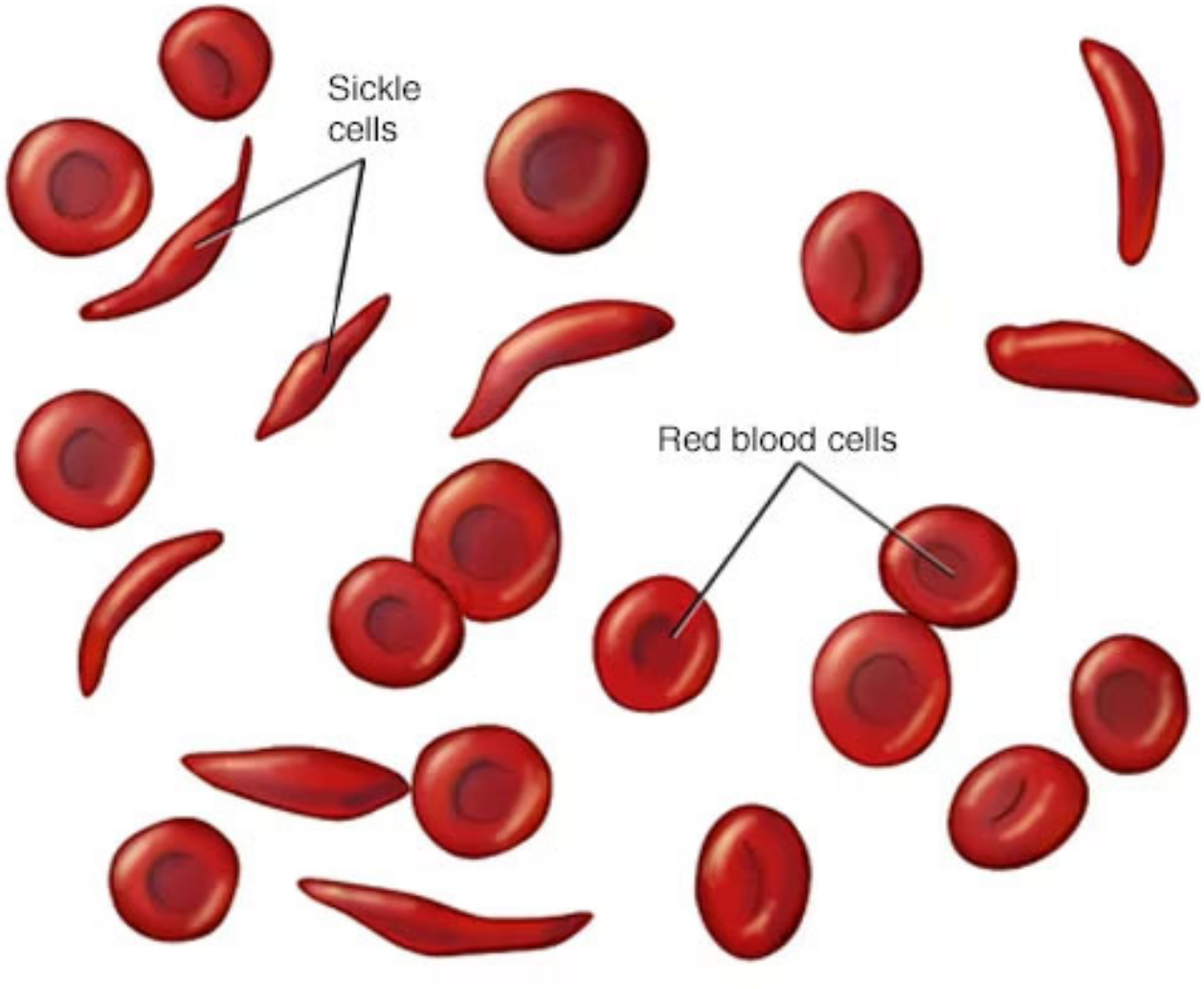
- When the RBC gives the Oxygen to the tissue, the cell changes shape

  -It becomes crescent shaped

- The abnormal RBCs get stuck in the smaller blood vessels or break up

- Sickle RBCs live 1/5 as long as normal RBCs

SICKLE CELL ANEMIA



SICKLE CELL ANEMIA

Symptoms

- Anemia
- Episodes of pain
  - -Sickled RBCs block blood flow in tiny vessels
- Duration can be hours to days
- Intensity moderate to severe
- Damages bones and joints
- Causes ulcers and organ damage

SICKLE CELL ANEMIA

Symptoms

Sickle Cell Disease (SCD)

- Swelling of hands and feet
- Frequent infections
  - More susceptible to bacterial infection
- Delayed growth or puberty
  - Blocked vessels impair delivery of Oxygen and nutrients
- Vision problems from damage to retinal vessels

SICKLE CELL ANEMIA
Laboratory Tests

- Hemoglobin is 5-9 g/dL
- Hematocrit is 17-29%
- Both well below normal
- MCHC may be high

SICKLE CELL ANEMIA
Genetics

- Simple Mendelian inheritance
- May have full SCD
- May have partial SCD (SCTrait)
- Some children of sickle cell parents have no SCD or SCT

SICKLE CELL ANEMIA
Complications

Blocked vessels can cause

- Strokes
- Thinking problems
- Paralysis or weakness
- Numbness
- Headache

SICKLE CELL ANEMIA
Complications

- Acute chest syndrome
  - -Critical blockage of lung vessels
  - -Emergency
- Pulmonary hypertension
- Blindness

SICKLE CELL ANEMIA
Complications

- Avascular necrosis
  - -Loss of blood supply parts of bone
  - -Those parts die
- Organ damage
- Splenic sequestration
  - -Sickle RBCs trapped in spleen
  - -Enlarges, Pain
  - -Life-threatening

SICKLE CELL ANEMIA
Complications

- Leg ulcers
- Gallstones
  - -Excess Bilirubin
- Priapism/Impotence
- Deep vein thrombosis
- Pregnancy complications
  - -Hypertension, blood Clots
  - -Miscarriage, premature birth

SICKLE CELL ANEMIA

Treatments

- Bone marrow or stem cell transplantation
  - Can cure SCD
  - Transplants are risky
  - Severe SCD

SICKLE CELL ANEMIA

Treatments

- Gene therapies
  - -12 years and older
  - -Repeated sickle cell crises
  - -Bone marrow cells
    - Adding new DNA
    - Changing existing DNA
    - Make normal RBCs

SICKLE CELL ANEMIA
Treatments

Treatments that relieve symptoms

- Antibiotics to prevent infections
- Pain relievers for pain
  - Hydroxyurea (prevents sickling)
    - Reduce or prevent complications
    - Reduces production of sickle RBCs
    - Increases fetal hemoglobin RBCs

SICKLE CELL ANEMIA

- Treatments
  - -Blood transfusions for severe anemia
- Other treatments
  - -Blood pressure medication
  - -Vitamins/nutritional supplements

SICKLE CELL DISEASE
NATIONAL LIBRARY OF MEDICINE

HEMOLYTIC ANEMIA
(Funny-looking RBCs)

- RBCs are destroyed faster than they can be made
- Destruction is called hemolysis
- 2 Forms

  -Congenital (Genetic)

  -Acquired

HEMOLYTIC ANEMIA

- Acquired
  - -RBCs are normal
  - -RBCs are destroyed
- Causes
  - -Some infections
  - -Cancer
  - -Hypersplenism
  - -Mechanical Heart Valves
  - -Autoimmune reactions

HEMOLYTIC ANEMIA

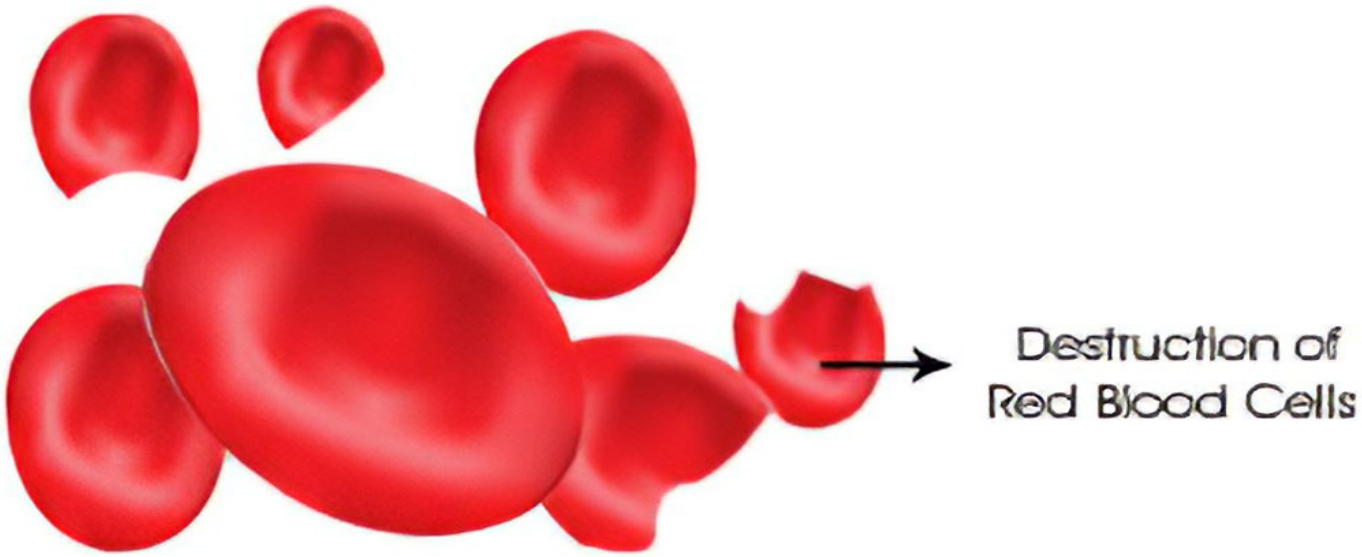
Symptoms

- Pale or Jaundiced skin
- Jaundiced eyes
- Dark urine
- Lack of energy
- Enlarged liver or spleen
- Murmur
- May present like other anemias

HEMOLYTIC ANEMIA
Laboratory Tests

- CBC
- Peripheral smear
- Urinalysis
  - -Hg in urine
- Bone marrow aspiration

HEMOLYTIC ANEMIA
Laboratory Tests



HEMOLYTIC ANEMIA
Treatment

Genetic

- Transfusions
- Avoid illness exposures
- Frequent hand washing
- Avoid undercooked foods
- Good dental hygiene
- Same other treatments as acquired

HEMOLYTIC ANEMIA
Treatment

Acquired

- Blood transfusions
- Corticosteroids
- Immune suppressants
- IV immunoglobulin
- Splenectomy

ANEMIA IN CHILDHOOD
Takeaways

- Anemia is a condition of decreased ability of the blood to supply the body with oxygen

- There are many different causes:
  - Not enough RBCs
  - Not enough oxygen carrying capacity
  - Defects in the RBGs
  - Defects in the hemoglobin

ANEMIA IN CHILDHOOD
Takeaways

- Iron Deficiency Anemia is the most common anemia of childhood
- 20% of US children may be affected
- The lack of adequate iron to make RBCs is the final common pathway causing the problem

ANEMIA IN CHILDHOOD
Takeaways

- Anemias are associated with changes in the shape and size of the RBCs
- Identifying these variations contributes to recognizing the kind of anemia
- Treatment is specific to the type of anemia
- Treating the underlying cause of anemia is necessary to achieve a positive outcome

ANEMIA IN CHILDHOOD

Why is this important?

Having this knowledge enables you to better guide the caregivers of children

ANEMIA IN CHILDHOOD

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ANEMIA IN CHILDHOOD

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ANEMIA IN CHILDHOOD

Questions