Approach to a pale child

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objectives

- Definition of anemia
- Classification and causes
- Important points in history and physical examination
- Investigations.
Definition of anemia
- decrease in number of red blood cells (RBCs) or less than the normal quantity of hemoglobin in the blood

- Greek word, meaning *lack of blood*
• Classification

based on *either etiologic mechanism* to

- hemorrhage
- hemolysis
- deficient red blood cell production
or morphology to

- macrocytic
- normocytic
- microcytic

- MCV is age-dependent. In young children, low-normal is approximately 70 fl plus the age in years, up to 98 fl
- Pallor
- Anemia can be acute or chronic

- Clues to acute anemia (emergency)
  - History of blood loss (injury, bleeding disorder, massive upper or lower gastrointestinal (GI) hemorrhage)
  - History of food or drug ingestion
    - 
    - G6PD deficiency
- History of sickle cell anemia (splenic sequestration, aplastic crisis)

- haemodynamic stability
• Children with chronic anemia can tolerate low levels of haemoglobin
• Anemia is not a diagnosis; it is a manifestation of an underlying disorder

• So even mild, asymptomatic anemia should be investigated to detect the primary problem
Anemia can be due to

1 - Inadequate production

2 - Hemolysis

3 - Blood loss
• How to approach a child with anemia?

  History

  Physical examination

  Investigations
Important points in history
- Age (preterm, age related conditions)
- Melena, epistaxis, hematochezia, menorrhagia
- Jaundice and dark urine, in the absence of liver disease
- Bleeding disorder
- History of pica
- Features of malignancy
- Through dietary history
- Chronic nonhematologic problem (e.g., chronic renal failure, inflammatory bowel disease, rheumatological diseases)
- Family history of anaemia
• Physical examination
  pallor, irritability, Koilonychia, tachycardia, hypotension, signs of heart failure

Look for signs of underlying cause:
- Nutritional status
- Jaundice
- Splenomegaly (hemolysis, hemoglobinopathy, connective tissue disease, infection, or cancer)
- Peripheral neuropathy suggests vitamin B₁₂ deficiency
- Petechiae (thrombocytopenia)
• **Investigations :-**

1 - **CBC**

measures Hb, RBC count, and MCV (a measure of RBC size). Hct (a measure of the percentage of blood made up of RBCs), MCH (a measure of the Hb content in individual RBCs), and MCHC (a measure of the Hb level in individual RBCs) are calculated values, WBC & platlets
2 - Reticulocyte count (1%)

3 - Peripheral smear
If anemia associated with other hematologic abnormalities in the CBC (e.g. leukopenia, thrombocytopenia) consider:

- Aplastic anemia
- Leukemia
- Other bone marrow infiltration disorders
• Look at reticulocyte count

• *If there is reticulocytosis*  \( RPI > 3 \)
  indicates bleeding or ongoing hemolysis
e.g. hemoglobinopathy, enzymopathy,
membranopathy or autoimmune
hemolytic anemia
Other investigation

- Bilirubin level, lactate dehydrogenase (LDH) level (hemolytic anemia), and serum haptoglobin level (decreased or none in chronic hemolytic anemia)
- Direct Coombs test (autoimmune hemolytic anemia)
- Hemoglobin electrophoresis (hemoglobinopathies)

- Red cell enzyme studies (e.g., G-6-PD, pyruvate kinase), osmotic fragility (spherocytosis)
• If there is inadequate reticulocyte response  \( RPI < 2 \)

Look at \( MCV \):

If microcytic the DDx is

1. Iron deficiency anemia
   look for :- poor diet
   chronic blod loss
   heavy menses
2- Thalassemia
   \( \beta \text{major , minor} \)
   \( \alpha \text{ minor} \)
3- Sideroblastic anemia
4- Lead poisoning
5- Cooper deficiency
Other investigations to be considered:-

- serum Iron, total iron-binding capacity, and ferritin levels

- Stool for occult blood
If normocytic DDX

1- Chronic inflammatory disease
   - collagen –vascular disease
   - inflammatory bowel disease
   - infection e.g HIV

2- Chronic renal failure

3- Marrow infiltration / malignancy

4- Recent blood loss
Investigate according to symptoms and signs.

consider:

- Blood urea nitrogen (BUN)/creatinine levels
- Bone marrow examination if marrow infiltration / malignancy is suspected
If macrocytic  DDx

1- Vitamin B12 deficiency

  - pernicious anemia
  - ileal resection
  - strict vegetarian
2- Folate deficiency
- malnutrition
- malabsorption
- chronic hemolysis
- drugs e.g. phenytoin, antimetabolite, trimethoprim/sulfa (bactrim)
3- Marrow failure
   - aplastic anemia
   - diamond-blackfan syndrome
   - fanconi anemia
4- Hypothyroidism
5- Chronic liver disease
6- Drugs e.g. zidovudine, alcohol
• Other investigations to be considered:-
  -Folate and vitamin B-12 levels
  -Thyroid function test
  - Bone marrow examination if marrow failure is suspected
Thank you