Approach to Anemia
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Important to Remember:
Anemia is a symptom and not a disease
Look for the Primary Cause!
First Question:

- **Acute vs chronic**
- **Clues:**
  - Hemodynamic stability
  - Previous CBC
  - Overt blood loss
Acute vs Chronic Anemia:

- Symptoms from anemia depend on:
  - Decrease O2 carrying capacity
  - Change in blood volume
  - Rate of development
  - Associated manifestations of underlying disease
  - Cardiovascular/respiratory capacity
Acute vs chronic anemia:

- Either due to acute blood loss or acute hemolysis
- Symptoms often due to loss of circulating volume
- Symptoms in chronic anemia due to lack of O2 carrying capacity
- Tolerated better due to compensatory mechanisms
Second question in chronic anemia:

- **What is the mean corpuscular volume (MCV)?**
- **Classify chronic anemia as:**
  - Microcytic (decreased MCV)
  - Normocytic (normal MCV)
  - Macrocytic (increased MCV)
Microcytic anemia

- Microcytic anemias usually as result of defective hemoglobin synthesis
- Differential:
  - Iron deficiency
  - Thalassemia trait
  - Anemia of chronic disease
  - Sideroblastic anemia
  - Lead poisoning
Case Presentation 1

- 24 year old female, asymptomatic
- Routine bloodwork for health insurance
- CBC:
  - Hb - 110 gm/dl
  - WBC - normal
  - Plats - normal
  - MCV - 65
  - RDW - 13
Iron deficiency vs Thalassemia

- Ethnic background
- Family history
- Hb vs MCV
- RDW
- Peripheral smear
<table>
<thead>
<tr>
<th></th>
<th>Hb</th>
<th>MCV</th>
<th>RDW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thalassemia</td>
<td>Normal/Slightly decreased</td>
<td>65</td>
<td>Normal</td>
</tr>
<tr>
<td>Fe deficiency</td>
<td>&lt; 80</td>
<td>65</td>
<td>Increased</td>
</tr>
</tbody>
</table>
Normocytic anemia

- Wide differential:
  - Acute blood loss
  - Hemolysis (acute/chronic)
  - Anemia of chronic disease:
    - chronic inflammation: RA, SLE
    - chronic infection: TB, SBE, abscess
    - malignancy
Normocytic anemia

- Anemia of renal failure
- Liver failure
- Endocrinopathies
  - Addison’s
  - hypothyroidism
  - hypogonadotropic states
- Early iron deficiency
- Pregnancy
- Bone marrow disorders
Case presentation 2

- **40 yr female**
  - 6 mt arthritis small joints of hand
  - 1 mt facial rash
  - 1 wk increasing fatigue and SOB
  - 2 days “yellow” colour of eyes and skin

- **On examination:**
  - BP: 100/70
  - Pulse: 110/min
  - Jaundiced
  - Splenomegaly
  - Swollen MCP jts
Case presentation 2

- Laboratory investigations:
  - Hb: 60 gm/dl
  - MCV: 94
  - WBC: 18 x 10/L
  - Plts: 490 x 10/L
  - RDW: 19
Case presentation 2

- Reticulocyte count: 450
- Total bilirubin: 86
- Direct bilirubin: 2
- LDH: 690
- What is the differential and next investigations?
Case presentation 2

- Direct Anti-globulin Test (DAT): Positive
- Diagnosis:
  - Autoimmune hemolytic anemia
  - Secondary to SLE
Hemolytic Anemia: Two components for diagnosis:

- **Increased production**
  - Elevated reticulocyte count
  - Bone marrow erythroid hyperplasia

- **Red cell destruction:**
  - Increased indirect bilirubin
  - LDH
  - Decreased haptoglobin
  - Heme-hemopexin complexes
  - Hemoglobinuria
Differential Diagnosis

- **Congenital:**
  - Membrane disorders
    - Hereditary spherocytosis
  - Hemoglobinopathies
    - Thalassemias/Sickle cell disease
  - Enzymes
    - G6PD deficiency

- **Acquired:**
  - Immune
    - drugs, autoimmune alloimmune
  - Non-immune
    - microangiopathic
    - infections
    - toxins: copper
    - burns
    - drugs: oxidative hemolysis
    - liver/renal disease
Investigations for Hemolytic anemia

• Peripheral smear is the most important initial investigation
• Coombs test with anti-IgG and anti-complement
Direct Anti-globulin Test (DAT)

Patient’s RBCs coated with antibody

Anti-IgG and anti-C3
Coombs reagent

Agglutination
Indirect Anti-globulin Test (IAT)

Patient’s serum

RBCs

Incubated

Anti-IgG
Anti-C3

Agglutination
Case Presentation 3

- 72 yrs male
  - 4 month hx 30 lbs weight loss
  - anorexia, nausea, fatigue

- On examination:
  - cachetic
  - abdominal mass
Laboratory investigations:

- **CBC:**
  - WBC: 1.2
  - Hb: 75 gms/dl
  - plt: 85

- What is the next investigation?
Macrocytic Anemia

- Differential diagnosis:
  - Megaloblastic anemia
    - Vitamin B12, Folate deficiency
    - Chemotherapeutic drugs
  - Myelodysplastic syndromes
  - Liver disease
  - Hypothyroidism
  - Increased reticulocyte count
Case presentation 4

- **72 yr male**
  - angina x 3 wks
  - SOB x 1 wk
  - Fatigue x 6 wks

- **On examination:**
  - BP: 140/70
  - pulse: 100
  - “lemon-yellow” skin
  - scleral icterus
  - decreased vibration sense feet
Case presentation 4

- Laboratory investigations:
  - Hb: 40 gms/dl
  - MCV: 134
  - WBC: 1.6
  - Plts: 45
  - Retics: 25
  - LDH: 1600
  - TBili: 75 (direct: 4)
Case presentation 4

• **Diagnosis**: Megaloblastic anemia
• Likely B12 deficiency: Why?
• What should we find on peripheral smear?