INVESTIGATIONS FOR IRON-DEFICIENCY ANEMIA IN PREGNANCY

M. NAGA JYOTHI
8th SEMESTER
1. Hemoglobin and hematocrit:

- Hemoglobin - <10g% (NORMAL: 11-14g%)

WHO Grading:

MILD 8-10g%
MODERATE 7-8g%
SEVERE 4-7g%
VERY SEVERE <4g%

- PCV - <32% (NORMAL: 32%-36%)

- RBC Count - <3.2million (NORMAL: 4-4.5million/cubic millimetre)
Plasma

Formed elements

Leukocytes & thrombocytes

Erythrocytes
2. Peripheral Smear:

- **Thin smear** -

  RBC Morphology - Microcytic hypochromic RBC’s, anisocytosis, poikilocytosis and target cells.

- **Thick smear** -

  Useful in identifying parasites - malaria, leishmaniasis
Iron Deficiency Anemia

anemia

normal blood
3. Red cell indices:

- Mean corpuscular volume \((\text{MCV} = \text{Hct}/\text{RBC} \times 10)\) - decreased \(<80\text{fl}\) (NORMAL : 80-100 fl)

- Mean corpuscular haemoglobin \((\text{MCH} = \text{Hb}/\text{RBC} \times 10)\) - decreased \(<25\text{pg}\) (NORMAL : 27-31 pg)

- Mean cell hemoglobin concentration \((\text{MCHC} = \text{Hb}/\text{Hct} \times 100)\) - reduced \(<30\%\) is sensitive indicator) (NORMAL : 32-36 g/dl)

- Red cell distribution width \((\text{RDW})\) - increased \(>14\%\) [helps to differentiate from thalassemia.] (NORMAL : 11.5-14.5%)
4. **Special tests:**

**A. Ferrokinetic studies**

- Serum iron and Total iron binding capacity: <30mg/dl and >400mg/dl (NORMAL: 65-165mg/dl and 300-400mg/dl) respectively
- Transferin % saturation: <16% (NORMAL: 20-50%)
- Serum ferritin: <12ng/ml (NORMAL: 15-300ng/ml)
- Serum transferrin receptor (TfR): increased (>2.8mg/L) (NORMAL: 1-2mg/dl)
- Zinc protoporphyrin: increased (NORMAL: 0-35microgram/dl)

**B. Bone marrow (prussian blue stain) studies:**

<10% hemosideroblasts

- not done routinely.
5. Investigations to determine the aetiology:

- Urine for hematuria and pyuria (culture & sensitivity)
- Stool examination for occult blood, ova and cysts.
- Renal function tests for chronic renal disease.
- Tests for tuberculosis (x-ray chest)
- Fractional test meal analysis of gastric juice.
- Serum protein.
- Osmotic fragility.
Patient with anemia, mean corpuscular volume < 95 μm³ (95 fL)

- Ferritin ≤ 30 ng per mL (67.41 pmol per L)
  - Increased total iron-binding capacity, low serum iron level, low transferrin saturation
    - Increased
      - Erythrocyte protoporphyrin level increased?
        - Yes
          - Susicion persists; consider bone marrow biopsy
        - No
          - Low bone marrow iron level?
            - Yes
              - Iron deficiency anemia
            - No
              - Workup for other causes of anemia
  - Normal
    - No iron deficiency anemia

- Ferritin 31 to 99 ng per mL (69.66 to 222.45 pmol per L)
  - In patients with any other result, order soluble transferrin receptor test

- Ferritin ≥ 100 ng per mL (224.70 pmol per L)
  - Decreased total iron-binding capacity, high serum iron level, high transferrin saturation
    - Decreased
      - No iron deficiency anemia
PHASES OF IRON-DEFICIENCY ANEMIA

1. Decreased iron stores (tissue iron only): decreased ferritin levels

2. Decrease in iron for erythropoiesis: (no clinical anemia)- serum transferrin receptors increases, decreased ferritin & %saturation of iron, increased FEP, decreased hemoglobin & hematocrit

3. Decrease in peripheral blood haemoglobin: decreased ferritin, %saturation of iron, haemoglobin, hematocrit, increased FEP and microcytic hypo chromic anemia.

4. Decrease in tissue oxygen delivery: clinical signs and symptoms.
DIFFERENTIAL DIAGNOSIS

- Anemia due to chronic disease or an inflammatory process
- Thalassemia trait
- Sideroblastic anemia
- Anemia due to lead poisoning
- Infection
- Nephritis & pre-eclampsia
- Hemoglobinopathies
<table>
<thead>
<tr>
<th>Anemia of Chronic Disease</th>
<th>Serum Ferritin (mcg/ml)</th>
<th>Serum Iron</th>
<th>Transferrin Saturation (%)</th>
<th>Hemoglobin</th>
</tr>
</thead>
<tbody>
<tr>
<td>normal or increased</td>
<td>decreased</td>
<td>normal or decreased</td>
<td>decreased</td>
<td></td>
</tr>
<tr>
<td>Iron Deficiency Anemia</td>
<td>decreased</td>
<td>decreased</td>
<td>decreased</td>
<td>decreased</td>
</tr>
</tbody>
</table>
COMPLICATIONS

1. Maternal:

- Spontaneous abortion
- Susceptibility to infections
- Preterm labour
- Pre-eclampsia
- Inability to withstand postpartum hemorrhage
- Puerperal sepsis
- Congestive cardiac failure
- Sideropenic dysphagia (Paterson-Kelly syndrome, Plummer-Vinson syndrome [rare])
2. Fetal:

- Intrauterine growth restriction
- Prematurity
- Intrauterine fetal death (severe cases)
- Non-immune hydrops
- Increased morbidity and mortality
- Neonatal anemia
- Behavioural abnormalities in children
3. Puerperium:

- Subinvolution
- Poor lactation
- Puerperal venous thrombosis
- Pulmonary embolism
Anaemia is a serious problem especially during pregnancy.

- An estimated 136,000 maternal deaths per year in India.
- Low Hemoglobin leads to:
  - Low Birth Weight Baby
  - If It's a Girl?
    - Even if baby survives, prone to diseases, poor mental development, poor physical development, disability.
  - Does not survive, High Infant Mortality Rate of around 60/1000 live births in India.
PROGNOSIS

MATERNAL -

• If detected early and proper treatment is instituted, anemia improves promptly.

• At times, recurrence in subsequent pregnancy is seen.

• Anemia directly or indirectly contributes to about 20% of the maternal deaths.
• **FETAL:**

  - In severe cases fetal prognosis is adversely affected by prematurity with its hazards.
  - Baby born at term, to severely anaemic mother will not be anaemic at birth, but as there is little or no reserve iron, anaemia develops in neonatal periods.
  - Mean cord blood levels of serum iron, ferritin, B12 and folate are higher than that of mother.
  - However, total iron binding capacity and serum levels of vitamin E are lower than that of mother.
Thank You!