ANEMIA.

Reduction of total circulating red cell mass below normal limits.

Reduction in hematocrit or Hb conc.

Microcytic hypochromic anemias.

microcytic < 80 MCV.
normocytic 80 – 100 MCV.
macrocytic > 100 MCV.

1/3rd of RBC central pallor in normal chromicity.
> 1/3rd → hypochromic.

Microcytic Hypochromic Anemia.

1. Iron deficiency anemia.
2. Thalassemia.
3. Sideroblastic anemia.
4. anemia of chronic disease.
5. lead poisoning.

Iron deficiency Anemia (ESSAY)

- iron metabolism.

storage pool → ferritin, Hemosiderin.
Heme & non heme iron.
functional iron → hemoglobin (80%) myoglobin, enzymes.
transferrin – transport form.

- Regulation of iron absorption

Hepcidin – liver → inhibit ferroportin (1)

pathogenesis.

dietary lack.
impaired absorption. increased requirement. chronic blood loss.

↓
Iron deficiency
↓ Hb pellor.
inadequate
↓
microcytic hypochromic anemia

Diagnosis.

CBC.

Hb, Hematocrit, MCV, MCH MCHC reduced.

PS

micro hypo RBCs.
poikilocytosis → pencil shaped RBCs.

Serum iron studies.

Serum ferritin ↓.
transferrin saturation ↓.
TIBC → increased.

Bone marrow.

mild increase in erythroid progenitors.
Reduced iron stores (Prussian blue – Neg).

Anemia of chronic disease.

c/c microbial infections (osteomyelitis, bacterial endocarditis)
c/c immune disorders.
Neoplasms

Red's on peripheral of erythroid progenitors.
Impaired iron utilisation.

Pathogenesis.

Inflammatory mediators IL6 → Stimulate pdhg of hepcidin → ferroportin fun ↓ → Impaired transfer of iron from storage pool to erythroid precursors → Anemia

Inflammatory cytokines → Suppression of renal EPO → Red. RBC production → Anemia

Diagnosis
CBC → Hb ↓
PS → micro, hypo.
Pappenheimer bodies
Basophilic stippling
Sideroblasts

Serum iron. — Serum ferritin ↑.
TIBC ↓.
Bone marrow → ↑ iron stores.
Sideroblasts ↓

iron not incorporated into heme.
accumulate in mitochondria
→ Ringed sideroblasts. in bone marrow

myelodysplastic syndrome also has

	Iron def	ACD	Thalassemia	Sideroblastic
Serum Ferritin	↓	↑	N	↑.
TIBC.	↑	↓	N	↓
Bone marrow iron stores	↓	↑.	N	↑.

Diagnosis
CBC → Hb ↓
PS → micro hypo.
Serum iron studies →
Serum ferritin - high.
TIBC reduced.
Bone marrow → increased iron stores → prussian blue +ve.

target cells, tear drop cells
marked poikilocytosis
→ Thalassemia

Sideroblastic anemia.
iron is available but cant incorporate it into Hb

congenital → X linked
ALA synthase mutation

acquired → alcohol, B6 deficiency
Pb poisoning (d-aminolevulinic acid dehydratase, ferrochelatase).

classification of Anemia (Pushon)

manifestation of a disease

~ < 10g → anemia.

① Pathophysiologic
② Morphologic

Pathophysiologic classification

(i) Anemia due to ↑ blood loss
(ii) Impaired red cell pathos
(iii) ↑ red cell destruction.

- ↑ blood loss
→ Acute post-hemorrhagic.
→ chronic blood loss-

- Impaired production
(a) cytoplasmic maturation defect
→ Deficient heme synthesis. (ie. Iron deficiency)
→ deficient globin synthesis (thalassemia syndromes)

- Impaired production.
(b) Nuclear maturation defect
Vit B12 and / folate def
→ megaloblastic anemias.

(c) Defect in stem cell proliferation and differentiation
→ Aplastic anemia
→ Pure red cell aplasia.

(d) chronic d/s.
Renal disease
Liver disease
Endocrine disease
Nutritional disorder
rheumatological
infection & Inflammation.

(e) Bone marrow infiltration
Leukemia
lymphoma
myeloma
myelodysplasia.

(f) Congenital anemia.
eg. Sideroblastic anemia
congenital dyserythropoiesis.

(iii) ↑ destruction (hemolytic anemia)
→ intracorpuscular defect
→ extracorpuscular red cell abnormality.

Morphologic classification

I Based on size.

① Normocytic normochromic
MCH, MCV, MCHC normal.
Blood loss, bone marrow failure, chronic d/s affecting RBC

② Microcytic hypochromic anemia
MCH, MCV, MCH reduced
iron def. anemia.
thalassemia
sideroblastic anemia.

③ Macrocytic normochromic
MCV ↑
megaloblastic anemia.

MEGALOBLASTIC ANEMIA

causes:

Vit B_{12}, B_9 & intrinsic factor deficiency.

B_{12} → RDA → 2-4 Mg.
Folate RDA → 100 - 200

Absorption of B_{12} → ileum
" of folate → duodenum & jejunum.

Mechanism of Absorption.

Folate → Methyl THF (malabsorption)

Etiological classification.

- Vit B_{12} deficiency

causes:

① dietary → vegetarians, breast fed infants, gastrectomy

- Malabsorption
  → pernicious anemia. gastrectomy, malabsorption syndrome.
  → Tropical sprue, Crohns disease, tapeworm infestation

Folic acid.

Malabsorption syndrome.

causes of increased demand

→ pregnancy, lactation & infancy.

→ pathological — malignancy
↳ increase hematopoiesis. tuberculosis, rheumatoid arthritis.

unknown etiology → refractory megaloblastic anemia, congenital erythropoietic syndrome.

Clinical features

1. Macrocytic anemia (insidious onset)
2. Glossitis (smooth leafy red tongue.
3. Demyelination (of peripheral nerves, SC, cerebellar) causing numbness, paresthesia, weakness, ataxia etc.

Mild jaundice.
Angular stomatitis
Purpura.
melanin pigmentation etc.

Lab findings

blood picture — (in peripheral smear)
RBC - macrocytes, oval in shape.
Aniso poikilocytosis.
Basophilic stippling
Presence of erythroblast or

nucleated RBC.

Reticulocytes
↑ → iron def. anemia.

MCV → >120.
MCH → ~50 pg.
MCHC → Normal or low.

WBC
- Total count → reduced.
- hypersegmented neutrophils (normally 2–5 lobes)
- occasional myelocytes (shift to left).
- platelets decreased, bizarre forms are seen with hypogranulation.

Bone marrow
→ show hypercellularity myeloid : erythroid ratio is decreased.

Type of erythropoiesis
→ Abnormal large nucleated erythroid precursors showing nuclear cytoplasmic asynchrony.

Nucleus
Nucleus is large and the chromatin is fine – sieve like chromatin which stains lightly – immature compared to cytoplasm. Abnormal mitosis seen.

→ Giant metamyelocytes (WBC)
→ Increased number of band forms (U shaped chromatin)

Iron stores – normal
Chromosomal abnormalities ass. with megaloblastic anemia is seen

Biochemical findings
Vit B12 & folic acid assays are done.

Schilling's test. → 24 hr. Fig 20 excretion test

- Serum B12 → microbiological assays
  eg: Lactobacillus lebi used.
- Radio immuno assay
- Serum enzyme levels
  methyl malonic acid
  homocystein
  (both ↑ in B12 def
  Homocystein ↑ in B9 def.)
- Serum folate levels.
- Urinary figlu after histidine overload.
- RBC folate level

Folate assays
Lactobacillus used
Inhibited by antibiotics
Radio immuno assay

B_{12}

- 100 Mg of hydroxycobalamines 3 weeks ∂ as Injection

B_9

- 5 mg tab - methylcobalamine 4 months.

Usually given as a combination.

Diff. b/w erythroblast & megaloblast.

Pernicious anemia (short note)

Seen in old age.
Pn 10 years (childhood/juvenile pernicious anemia)

Associated with autoimmune disorders.
Familial.
Steroids, immunosuppressed → symptom ↓.

A ∂ globulinemia

Ab seen against IF & parietal cell of gastric mucosa.

- Type 1 or blocking Ab: seen in 55%
① prevents combination of cobalamin and IF
- Type 2 or binding Ab - 36%. prevents IF in blood mucosa

Ab against parietal cells.
proton pump, α1, K⁺ & ATPase
Antibodies.
Morphology: Gastric mucosa ↓ atrophied.

And
gastric ep → displastic change
↓
CA.

Diabetes, Anorexia, dyspepsia.

Treatment
Inj B_{12} supplementation
Blood transfusion.
Physiotherapy.