* normocytic Anemia MCV 80 -100

*

normocytic Anemia

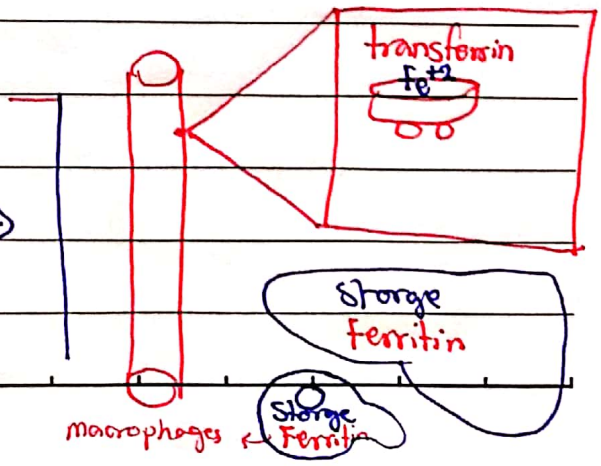
- non-hemolytic
- hemolytic
  - extrensic
    - AIHA
    - MAHA
    - Mechanical.
  - Intrensic
    - PNH
    - G6PD ↓
    - PK ↓
    - SCA
    - Spherocytosis

* % sat = Iron / TIBC

iron
- non-heme → Fe^{+2} (+ Vit. C) → absorption on duodenal epithelial cells.
- heme → meat easily ✓

→ Serum iron — Iron level
→ Total iron binding capacity — transferrin — Hbc
→ Serum ferritin — Storage
% Saturation — amount of transferrin bound to Fe

Ferroprotin → excrete Fe^{+2} out of enterocyte



→ hereditary spherocytosis

Intrinsic

PNH "Paroxysmal Nocturnal hemoglobinuria"

- intravascular hemolysis
- destruction via complement system
- Acquired ↘ mutation
- loss of GPI anchor in stem cell
- DAF ⇐ ↓ Protective protein Conf
  - CD55
  - C5 59
  - bind ⇒ Compl ↑ ⇒ hemolysis
- ± Platelets/WBCs lysis.
- hemolysis at night.
- SOB, fatigue
- iron in urine, Fe deficiency
- abdominal pain
- thrombosis "main cause of ☠"
- Hb, hemosidrin in urine
- erectile dysfunction, dysphagia

Dia ⇒ LDH, ↓ hemoglobin

(-) coombs

→ Flow cytometry GPI ↓

treat ⇒ Eculizumab "anti complement therapy"

Protect against intravascular hem

Pyruvate Kinase Deficiency

→ No mitochondria in RBCs

→ Plt. Required for anaerobic meta

⇒ membrane failure ⇒ phagocytosis in the spleen

- Extravascular hemolysis
- ↓ splenomegaly

↓ AR, new born ✓

G6PD ↓ X-linked

Important to produce NAPDH

↓↓ oxidative damage ↵

of RBCs ✕✕ ⇒ No NAPDH

↑↑ ROX ⇒ ↑↑ H_2O_2 ⇒ ☠

by infections, Drugs, Fava beans. ↑↑

- extravascular in spleen

✕ Drugs → Asprin, Anti-malar Anti-biotics.

✕ Jaundice, dark urine, anemia

✕ back pain

↓ bite cells

↓ Heinz bodies

✕ Dia → Fluorescent spot test → fail to fluoresce

Hereditary spherocytosis

→ AD or AR

→ Spherocyte

spherical - smaller, lacks central pallor

→ spectrin, ankyrine, band 3/4.2

→ ↓↓% O_2 Function

→ extravascular hemolysis

↳ spleenomegaly ↳ bilirubin gallstones

↳ Jaundice

→ ↑ RDW, ↑ MCHC, MCV → normal or low

↳ Rt ⇒ ↑

↳ Sphe → ↓

→ Rigid → ↑ Resistance

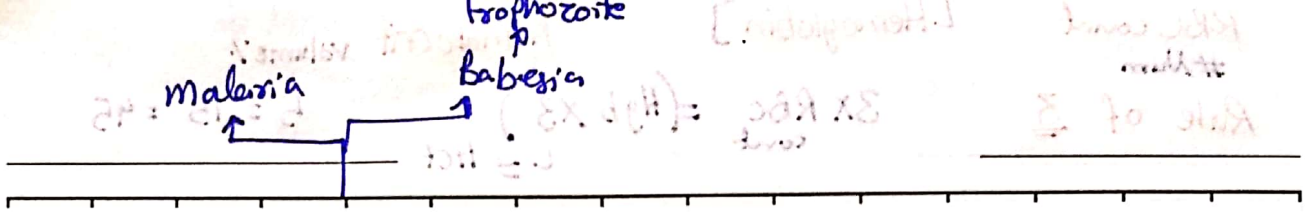
⇒ B M. infection ⇒ Risk of aplastic Crisis

→ Diagnosis ⇒ "Osmotic Fragility" test

⇒ Poor swelling ⇒ Lyse in hypotonic solution!

⇒ treatm → spleenectomy

⇒ howell-Jolly bodies



Extrinsic hemolysis

infections

AIHA
autoimmune hemolytic anemia
= auto ABs target RBCs
- extravascular hemolysis

Warm
m.c. Type
37c°, IgG
Anemia Pale, tach, fatig SOB
- splenomegaly
- Jaundice
- spherocytes
- smaller

Cold
less common
< 30 c°
limbs
painful fingers
↑ cold exposure
IgM
(+) DAt - anti c3

PAT
⊕ coomb test ⇒ agglution ⇒ ABs bond to RBCs.
direct
⊕ indirect coomb test. ⇒ Abs in serum
- idiopathic / m.c.c
lupus / Non-hodgkin / chronic lymphocytic leukemia CLL
⇒ methyldopa to HTN in pregnancy
⇒ Penicillien
Tre :- Splenectomy, Immunospressants. Glucocorticoids,

MAHA
microangeopathic hemolytic Anemia
⇒ thromb in SV ⇒ obstruction
⇒ Shearing
⇒ Schistocytes

Malignant HTN
+ TTP, HUS, DK
⇒ intravascular
extravascular
(intra rarely with complement activation
- with mycoplasma Pneumonia
- EBV
- CLL
Tre: - avoid cold + im. Sup

Mechanical hemolysis
⇒ in large BV
* AS
* Mechan Valves
* LV assist devs
⇒ Schistocytes

RBC count #Num [Hemoglobin] hemadocrit volume %

Rule of 3 — 3x RBC cont = (Hgb x3) = Hct — 5 : 15 : 45

MCV = 80-100

MCH = amount of Hgb inside RBC

MCHC = [Hgb] in RBCs

Microcytic Anemia

MCV < 80

↓ Hgb / ↓ MCH

↓ MCHC

↳ hypochromic

↳ Could be normocyt initially →*

↓ loss of Iron

↓ intake / loss of Iron

* babies ~6 months ↓ Iron storage

* ↓ GIT absorption or ↓ acid

↳ PPI, gastrectomy ↳ Fe^{+3}

* bleeding

Period: peptic ulcer, colon cancer

↑ demand on Pregnancy

* to diagnose Tr. def

⇒ ↑ transferrin → ↓ serum Iron

⇒ ↓ ferritin → ↓ %

* Plummer-Vinson syndrome

⇒ beefy red tongue

⇒ esophageal webs

⇒ Iron-defe. anemia

↓ loss of globins

↓ α

↓ α Thalassemia

↓ loss of heme

↓ β

↓ β-thalassemia

RDW → ↑ B12 / folate def

↑ Protoporphyrin

↓ MCV ↓ Hgb
↓ MCHC ↓
↓ MCH

Microcytic Anemia <80

Iron ↓
↓ Ferritin
↓ Serum Iron
↑ transferrin
↓ Sat%
RDW↑ → B12 & folate ↓
Protoprophyrin ↓
treat → Iron supplement

Anemia Chronic disease
Com with RA, lymphoma
Mild Hgb > 10 g/dl
asymptomatic
* ↓ RBC survival
* ↑ Ferritin → hepcidin
Serum Iron ↓
Normocytic-normochromic
25% micro
Serum Iron ↓
transferrin ↓
* % normal

↳ symptoms:-
GI ↳ abdo. pain, headache, constipation
lead-lines ↳ nephropathy "Fanconi"
AA, Glucose, phosphate wasting
↳ neuropathy ⇒ Drop wrist, Foot.
⇒ Children → behavioral changes
treatment → Chelation therapy
DMSA
EDTA

lead Poisoning
(-) 2 enzymes
δ-ALA
Ferrochelatase
↓ heme syn.
Iron Study
normal or low
Hgb ↓
MCV ↓
* ↑ δ-ALA
* ↑ Protoporphyrin
↑ plasma lead

basophilic Stippling.

Sidero blastic anemia
-Sidero blasts in peripheral blood!!
→ Alcohol
→ B6 ↓
→ lead
→ X-linked
↑ serum Iron
↑ Ferritin
↓ TIBC trans
↓ Protoporphyrin.

Sickle cell anemia

AR / B6 Glu → Val B globin

→ Clinical features:-

- Chronic hemolytic Anemia → splenomegaly early then fibrosis
  - Howell Jolly-bodies
  - Jaundice
  - Gallstones pigmented.
  - B19 infection
- Functional asplenia due to infarctions
- Vaso-occlusion → Renal dysfunction
- chest syndrome ⇒ SOB, R acidosis, ↑ sickling ⇒ PE
  - often with infections pneumonia
- osteoporosis.

Swollen cheeks.

treatment :- Immunisation, hydroxyurea, transfusions, bone marrow transplant