

Anemia 1: Fourth year Medical Students/ October/21/ 2015/

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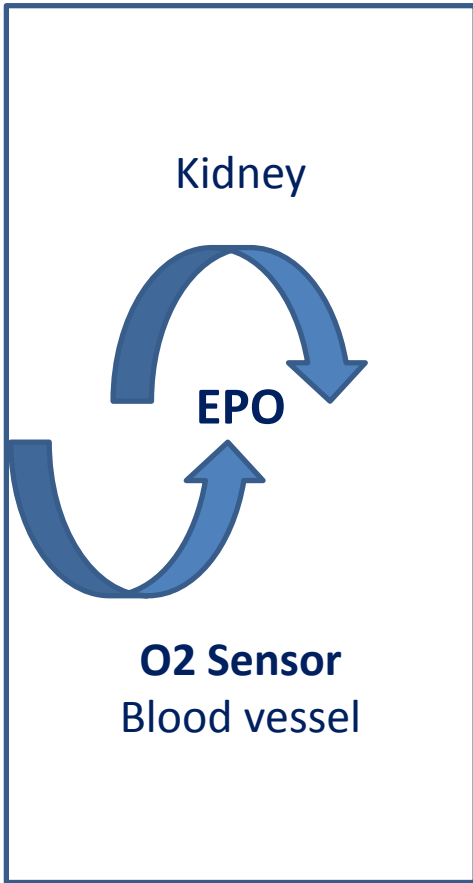
Main Hematological diseases

A- Benign Hematology

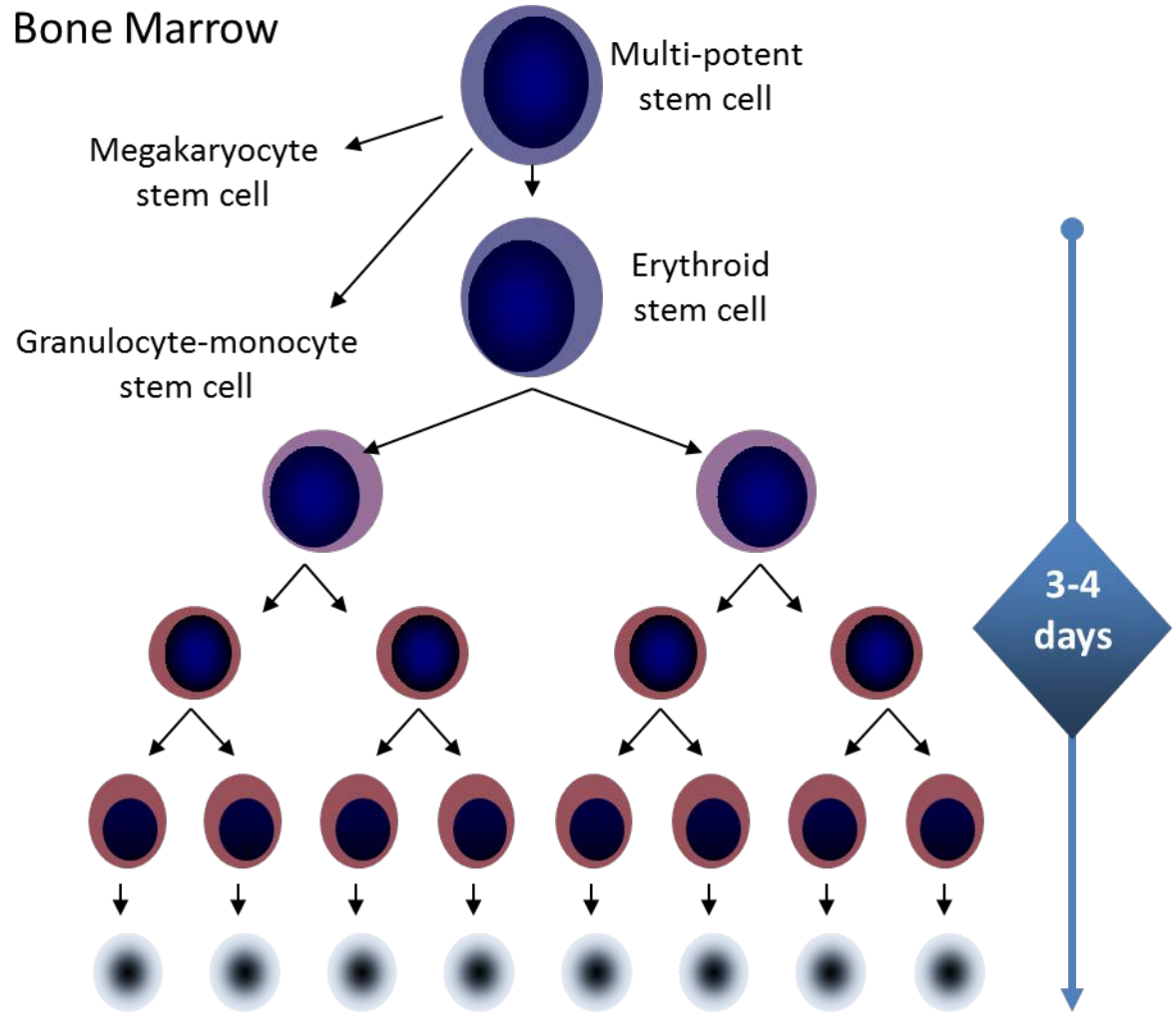
- 1- Anemias
- 2- Bleeding disorders
- 4- Thrombotic disorders
- 3- Benign WBC disorders

B- Hematological Neoplasms/ clonal disorders

- 1- Acute & Chronic leukemias
- 2- Plasma cell disorders
- 3- HD and NHL
- 4- Chronic Myeloproliferative disorders & MPN/MDS



Bone Marrow



Definition:

Anemia is operationally defined as a reduction in one or more of the major RBC measurements:

**Hemoglobin concentration,
Hematocrit,
RBC count**

These are all concentration measures

The cut-off value defining anemia has been determined by convention as the value at -2 SD from the mean or the 2.5th percentile of the normal distribution of a healthy iron-replete population.

WHO's Hemoglobin thresholds used to define anemia (g/dl)

Children (0.5–5.0 yrs) 11.0

Children (5–12 yrs) 11.5

Teens (12–15 yrs) 12.0

Women, non-pregnant (>15yrs) 12.

Women, pregnant 11.

Men (>15yrs) 13.

Anemia

- Understanding anemia
 - Disease - to be treated on its own merits
 - Condition - a secondary manifestation of another disease
- Causes
 - Decreased production
 - Blood loss
 - Hemolysis

Factors that influence symptomatology and severity of symptoms

- Acute or chronic
- Cardiovascular status
- Additional symptoms related to cause
- Additional symptoms related to type of anemia
- Any intravascular hemolysis

Clinical Evaluation of Anemia: History

- **Proper History; including history of bleeding and systemic illness**
- **Dietary History**
- **Past History**
- **Family History**
- **Drug history**
- **Travel History**

Symptoms and Signs of Anemia

1- Symptoms vary according to

A- severity of the anemia

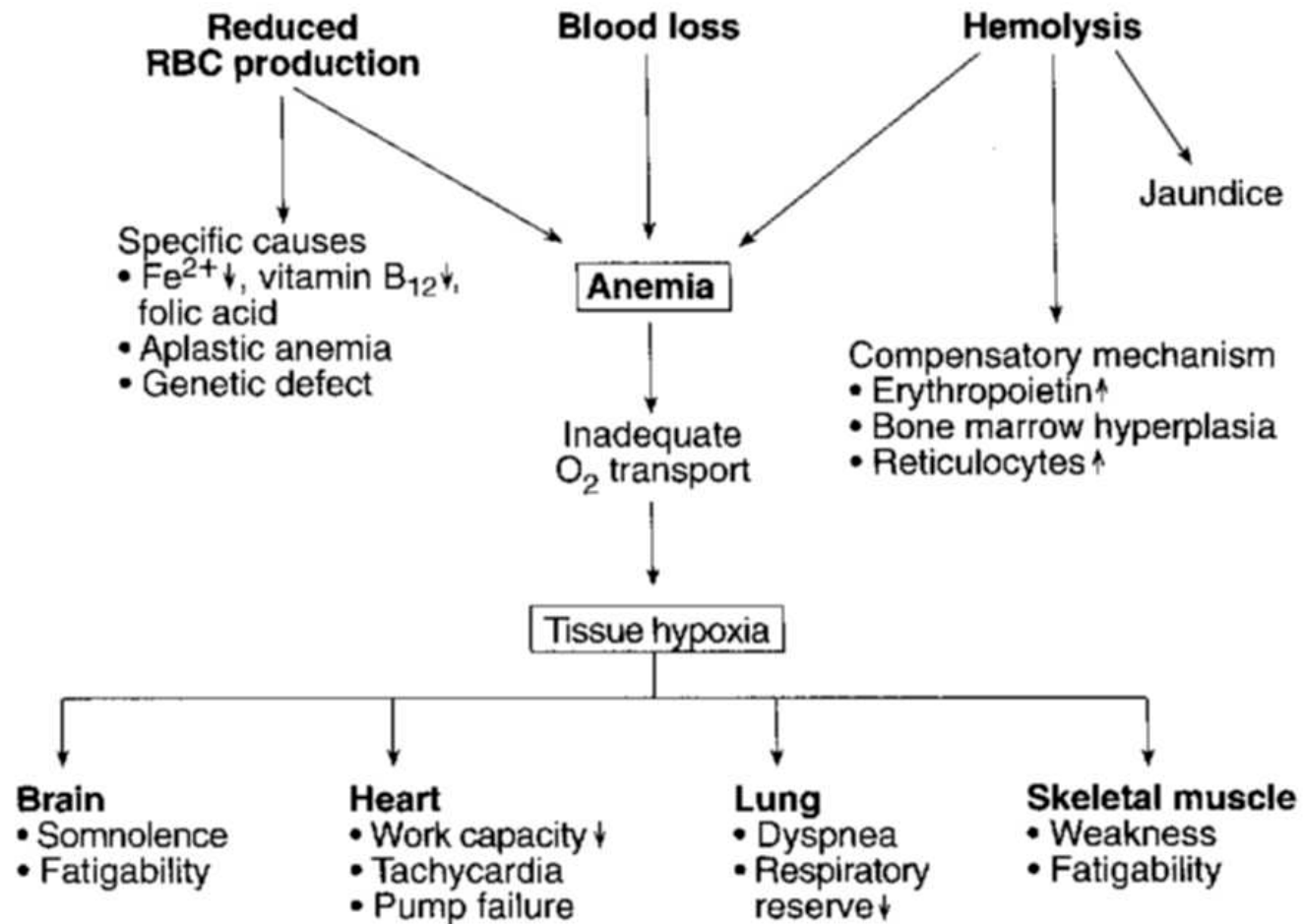
B- How acute or Chronic is the anemia

C- The cause of the anemia: abnormal production, bleeding, hemolysis,

D- Functional status of the heart and lungs

2- All anemias may have symptoms related to the “anemia syndrome”

PATHOLOGY, SYMPTOMS, AND SIGNS OF ANEMIA



The “Anemia Syndrome” due to tissue hypoxia

1- Dizziness

2- Fatigue

3- Shortness of breath especially on exertion

4- Headaches

5- Chest pain/ palpitations

6-? Heart Failure

Signs in Hematology

- 1- Frequently non-specific
- 2- May be characteristic
- 3- Combination of the abnormalities causing the symptoms
- 4- May be very apparent in advanced disease or very subtle in early disease
- 5- Careful examination is needed
- 6- Changing signs require caution and repeated examination

Clinical evaluation of anemia: **Physical Examination**

- **Look for signs of anemia**
- **Look for signs suggestive of type**
- **Examine for splenomegaly/Hepatomegaly**
- **Look for signs suggestive of cause**
- **Examine for signs of systemic disease**

Anemia Classification: Two main approaches

1. Biologic or kinetic approach

- Determined by reticulocyte count

2. Morphology.

- Determined by MCV
- Acute vs. chronic
 - Signs and symptoms

Laboratory Evaluation of Anemia

- Complete blood count including HB, RBC, MCV, RDW
- Reticulocyte count
- Peripheral smear

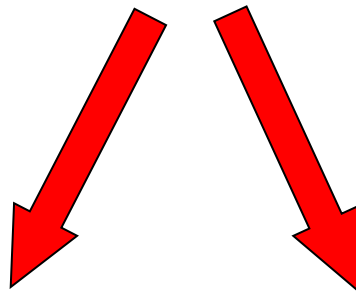
Morphological Classification of Anemia

A- Normocytic/normochromic (normal MCV &MCH): acute blood loss, Hemolysis, ACD, BM failure

B- Microcytic/hypochromic (mcv<78, mch <26): IDA, Thalassemia

C- Macrocytic (MCV>98): megaloblastic anemias

Anemia/ Kinetic



Low Production?

**Short Survival/Destruction?
Bleeding?**

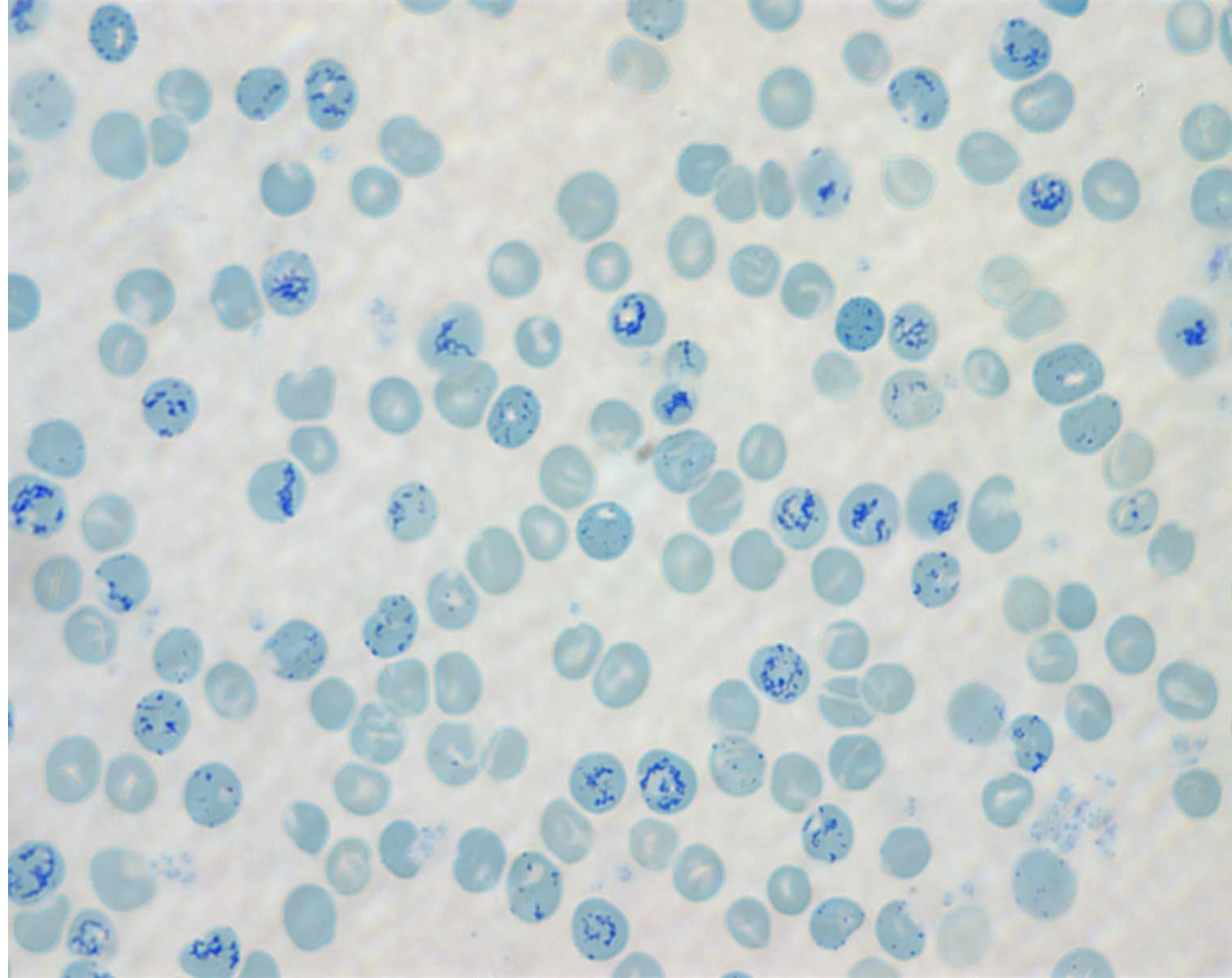
The key test is the Retics count

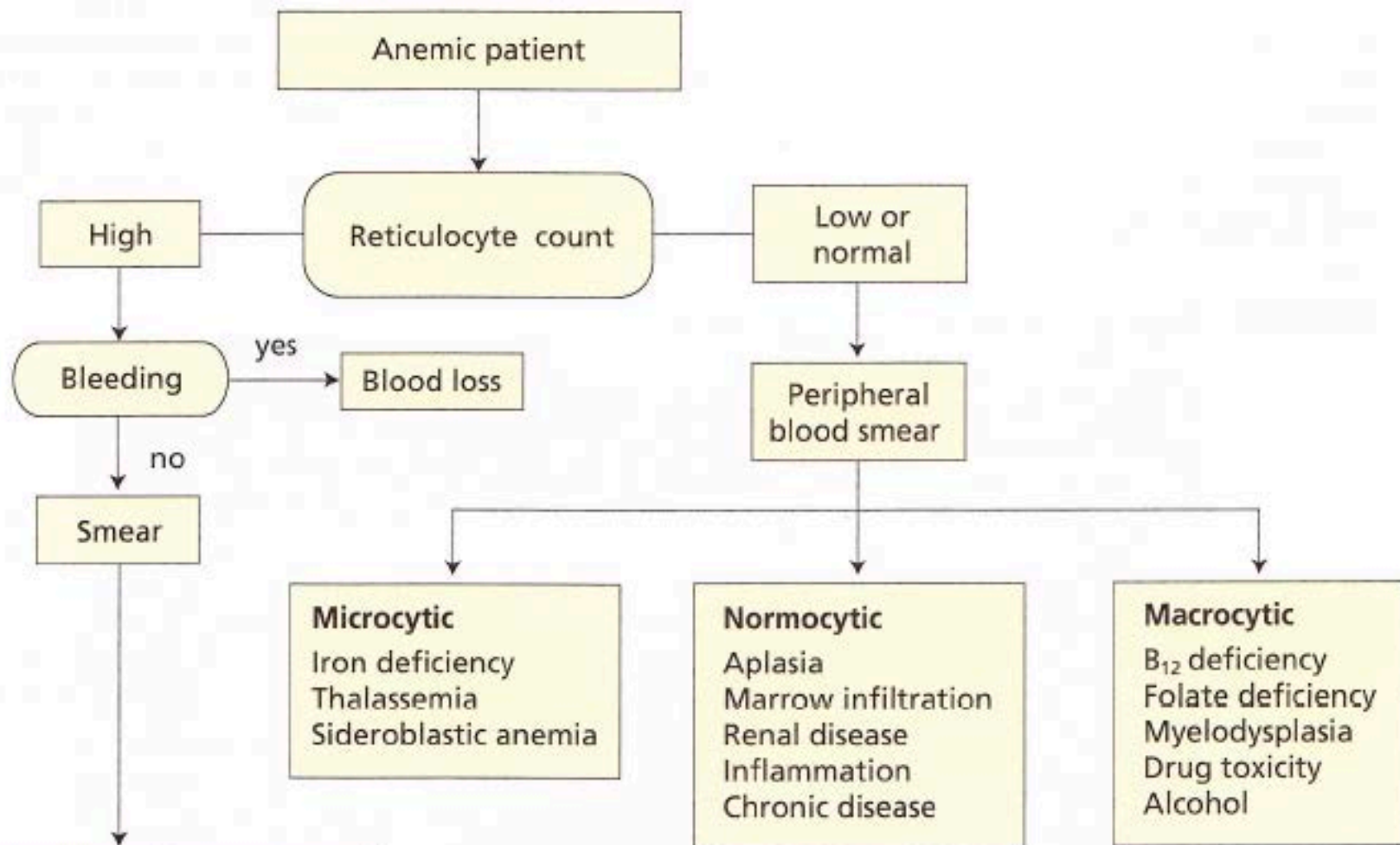
The reticulocyte count

- To be useful it must be adjusted for the patient's hematocrit. When the hematocrit is low reticulocytes are released earlier from the marrow we need to adjust for this phenomenon.
- **Corrected retic.** = Patients retic.(**3%**) x (Patients Hct(30)/45) :
 $3(\%) \times 30/45 = 2\%$
- **Retics index (RPI)** = corrected retic. count/Maturation time
(Maturation time = 1 for Hct=45%, 1.5 for 35%, 2 for 25%, and 2.5 for 15%.) example above: $2/1.75 = \mathbf{1.14}$
- Absolute reticulocyte count = retics % x RBC number.

Example: $1.1\% \times 4.96 \times 10^6 = 55,000/\mu\text{l}$

$$12.2\% \times 2.05 \times 10^6 = 250,000/\mu\text{l}$$





Schistocytes = microangiopathy
 Spherocytes = warm antibodies
 or hereditary spherocytosis
 Sickle cells = sickle cell disease
 Bite cells = G6PD deficiency
 Target cells = Thalassemia
 Inclusions = Malaria

Anemia

CBC, reticulocyte count

Index < 2.5

Index \geq 2.5

Red cell morphology

Hemolysis/hemorrhage

Normocytic normochromic

Micro or macrocytic

Blood loss

Intravascular hemolysis

Metabolic defect

Membrane abnormality

Hemoglobinopathy

Immune destruction

Fragmentation hemolysis

Hypoproliferative

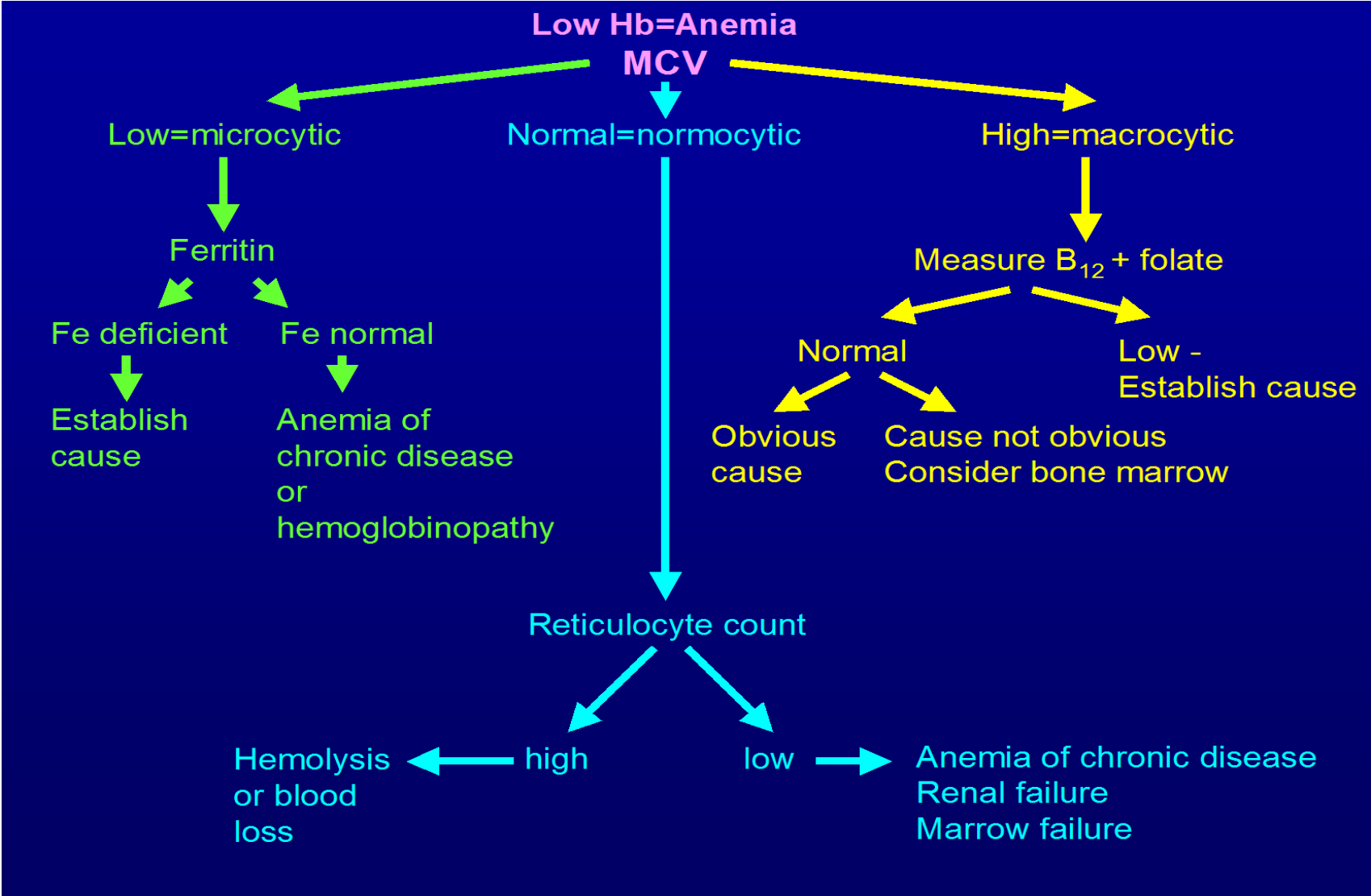
Maturation disorder

Marrow damage
• Infiltration/fibrosis
• Aplasia
Iron deficiency

Cytoplasmic defects
• Iron deficiency
• Thalassemia
• Sideroblastic anemia

↓ Stimulation
• Inflammation
• Metabolic defect
• Renal disease

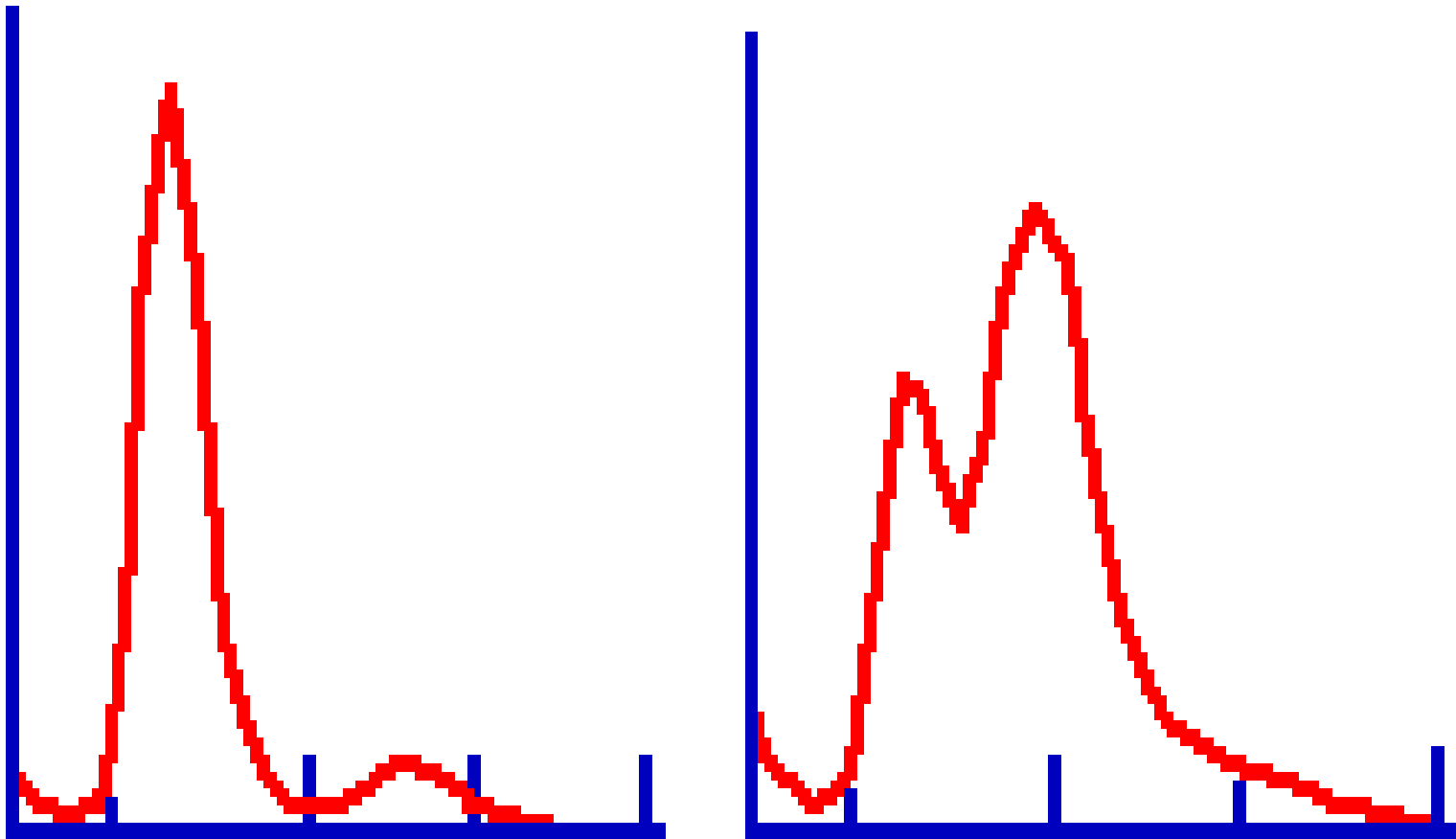
Nuclear defects
• Folate deficiency
• Vitamin B₁₂ deficiency
• Drug toxicity
• Refractory anemia



Evolution of Iron Deficiency Anemia

- **Depletion of body Iron stores only**
- **Iron Deficiency but No anemia**
- **Iron Deficiency with anemia**
- **Ferritin: The Best Marker for Iron Deficiency in “adults”**

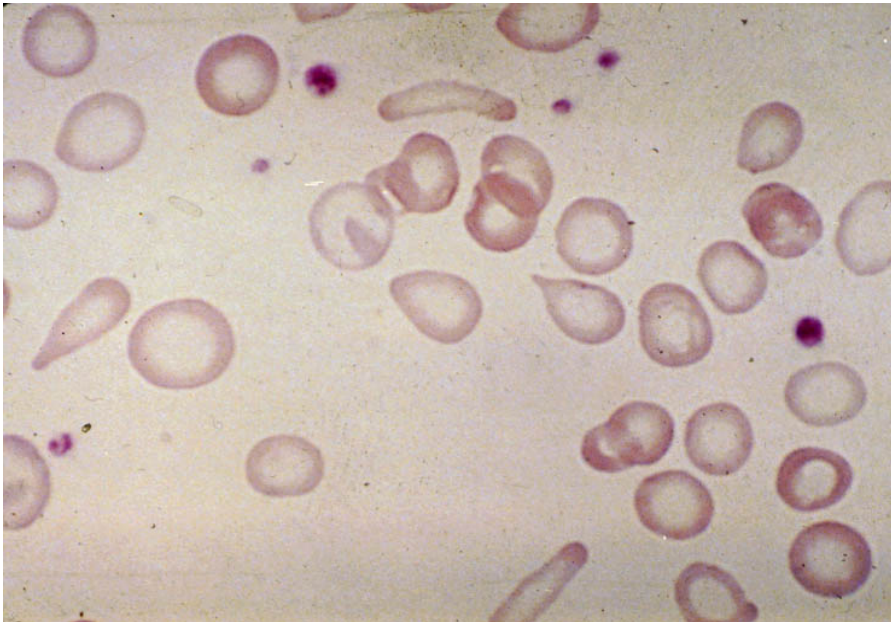
RDW: Normal + Abnormal



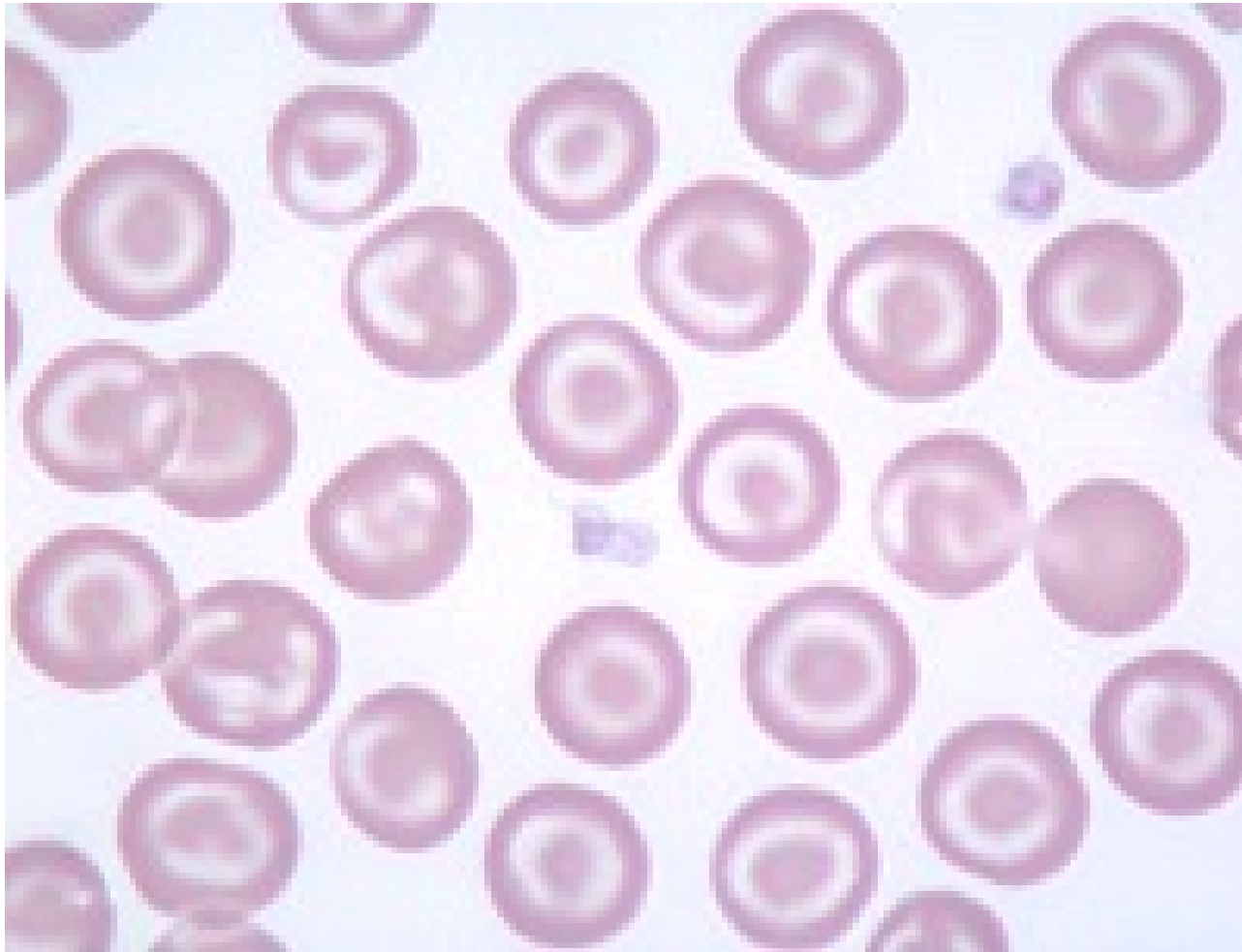
divide the standard deviation of the RBC volume by the MCV
and multiply by 100

Severe Hypochromia & Anisocytosis, Poikilocytosis: Iron Deficiency Anemia

Normal Smear



Hypochromia with target cells but without Anisocytosis: Thalassemia Trait



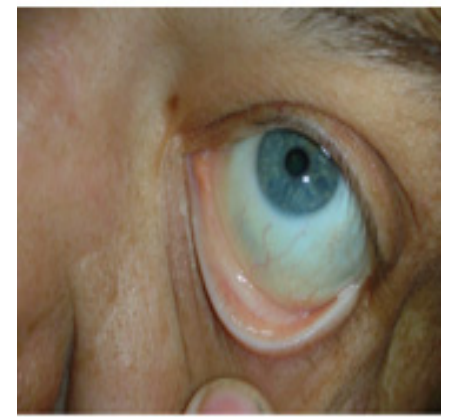
Case one

24 yr old female complains of

Dizziness, Fatigue, Shortness of breath especially on exertion and Headaches for the last 2 months. She has been losing scalp hair.

She does not eat red meat and has reported heavy menstrual bleeding.

Her physical exam showed



Case Onecontinuation

Lab: Hb 8, MCV 72, RDW 19, MCH 20pg. WBC 8000/Normal dif.Plts 380000

Bld Film: microcytic, hypchromic, anisocytosis, poikilocytosis, Retics (corrected) 0.8%

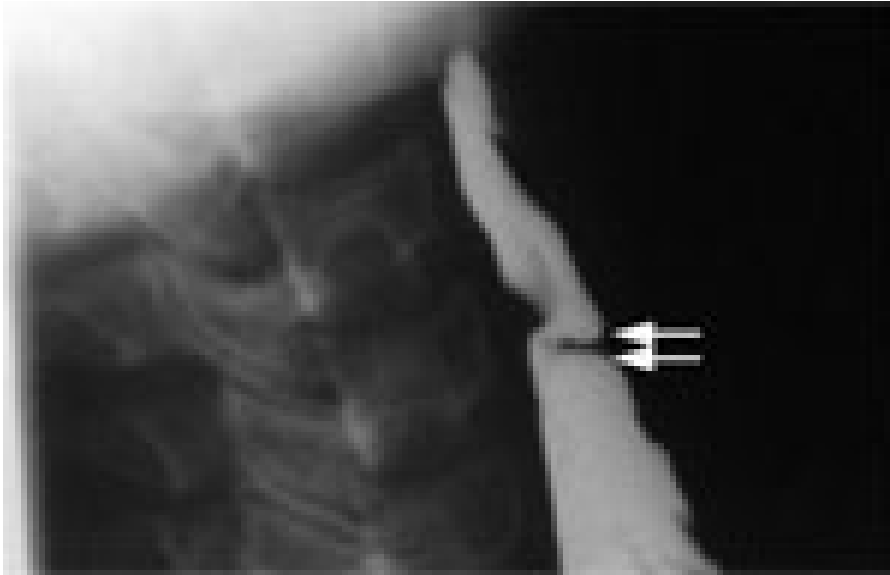
Serum Ferritin 2

Hb Electrophoresis?? Serum B12, Folate??

S Fe, TIBC??, BM ??? GI endoscopy??, Investigate for bleeding disorder: VWD?, celiac disease?

Gyne consultation

Xray and endoscopy showed



Diagnosis

Causes of True (classical) iron deficiency

1-blood loss.2- iron-poor diet 3- increased iron needs.4- poor iron absorption (gluten enteropathy)

Diagnosis of this case: Iron Deficiency Anemia.

secondary to poor red meat intake +
?? Mild bleeding disorder
which needs to be investigated

Treatment/ Follow up of Case 1

1- Oral Iron: Fe gluconate, sulphate

2- educate

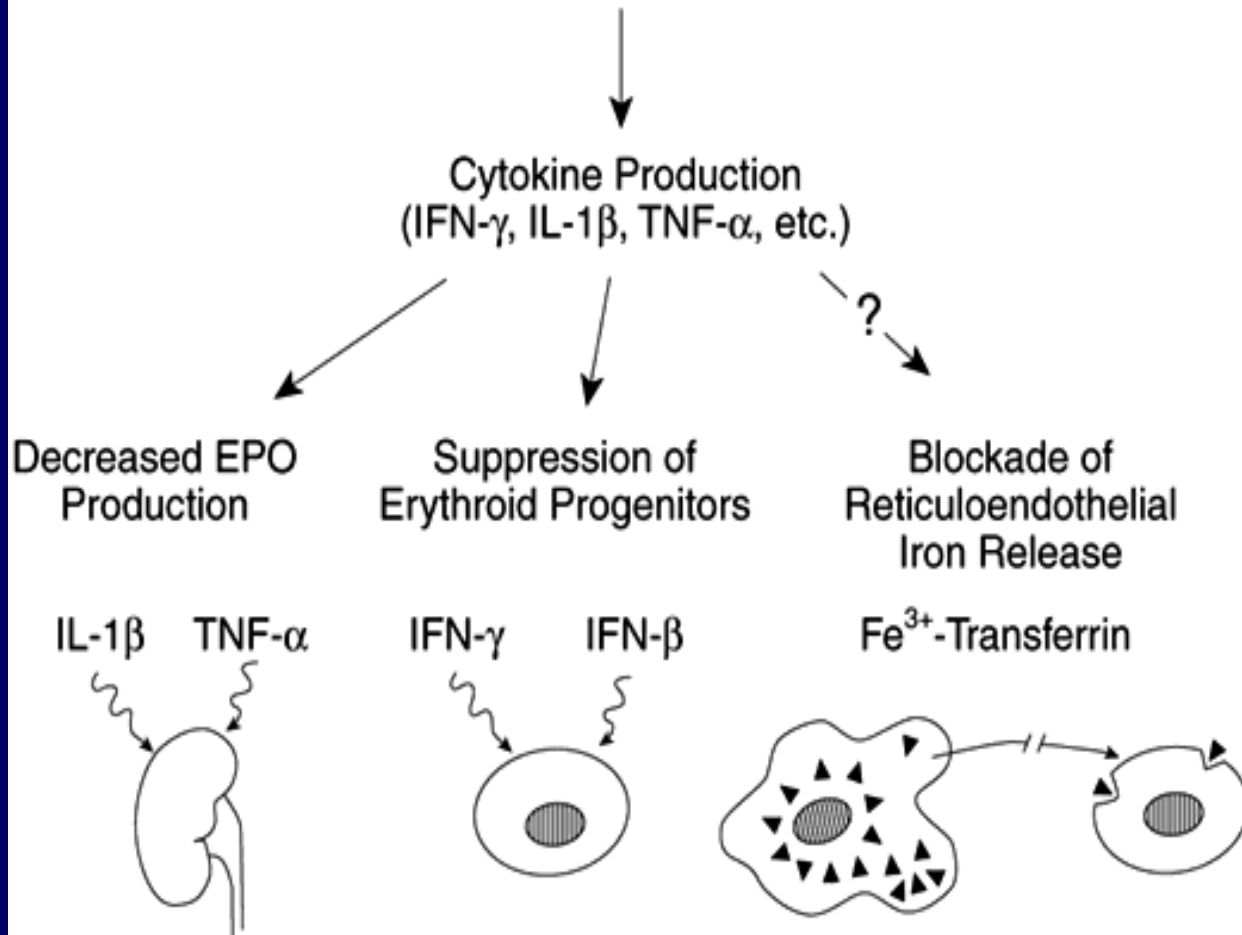
3- IV Fe?? Fe sucrose/carboxymaltose or new Fe dextran

Follow up: check CBC every month :
expected Hb rise $\pm 1\text{g}/ 10$ days. Check
Ferritin at 3 months. Follow other
investigations and consultations

Differential Diagnosis of Microcytic Anaemia

- Thalassaemia syndromes
- Certain haemoglobinopathies (Hb C)
- Anaemia of chronic inflammatory diseases
- Certain forms of sideroblastic anaemia
- Genetic forms of iron deficiency anaemia

Pathogenesis of the Anemia of Chronic Disease



Case one B

60 yr old male complains of :Dizziness, Fatigue, Shortness of breath especially on exertion and Headaches for the last 2 months. He has constipation and weight loss 5 kg over 2 months.

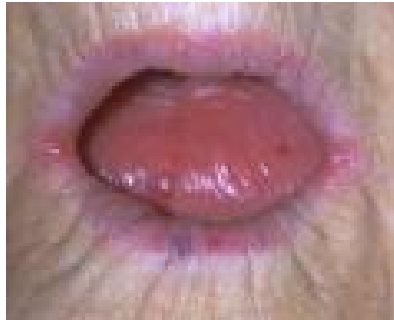
Lab: Hb 8, MCV 72, RDW 19, MCH 20pg. WBC 8000/Normal dif.Plts 380000

Bld Film: microcytic, hypchromic, anisocytosis, poikilocytosis, Retics (corrected) 0.8%

Serum Ferritin 2. FOB x 3 positive in 2.

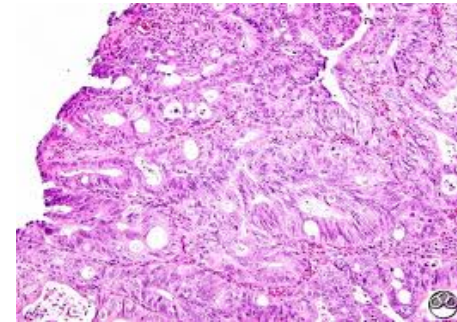
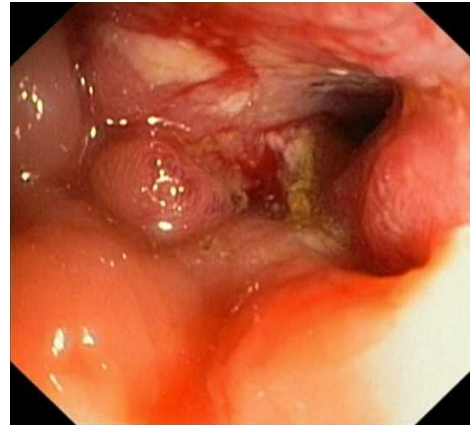
Case One B

Findings:



**Diagnosis: Colon adenocarcinoma
Mod. dif.**

**Always Look for a
cause for IDA.
Anemia must have a
full identification**



Anemia is **not a final diagnosis**

IRON DEFICIENCY ANEMIA **IS NOT A DIAGNOSIS**
PER SAY.

ALWAYS PUT A LABEL TO IT:

**IDA DUE TO UPPER GI BLEEDING DUE TO
GASTRIC CANCER**