RBC disorders 2
Anemia of diminished production

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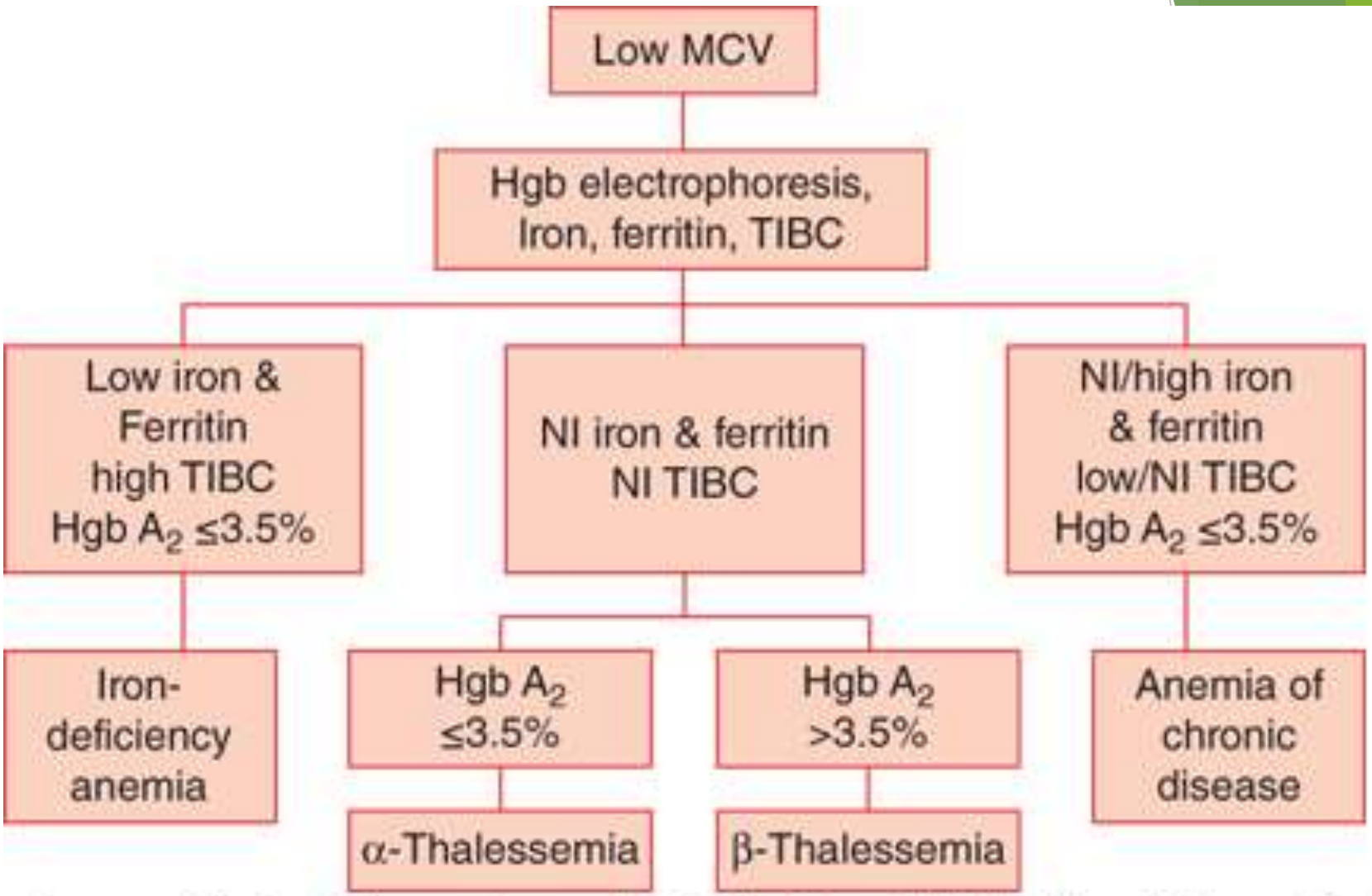


Source: Luis D. Pacheco, George R. Saade, Gary D.V. Hankins: Maternal Medicine
www.obgyn.mhmedical.com

- Iron deficiency anemia
- Anemia of chronic disease
- Megaloblastic anemia
- Others

- anemia in liver disease
- anemia in renal disease
- aplastic anemia
- Myelophthisic anemia

1-Iron deficiency anemia

•Iron deficiency can result from

(1) dietary

(2) impaired absorption,

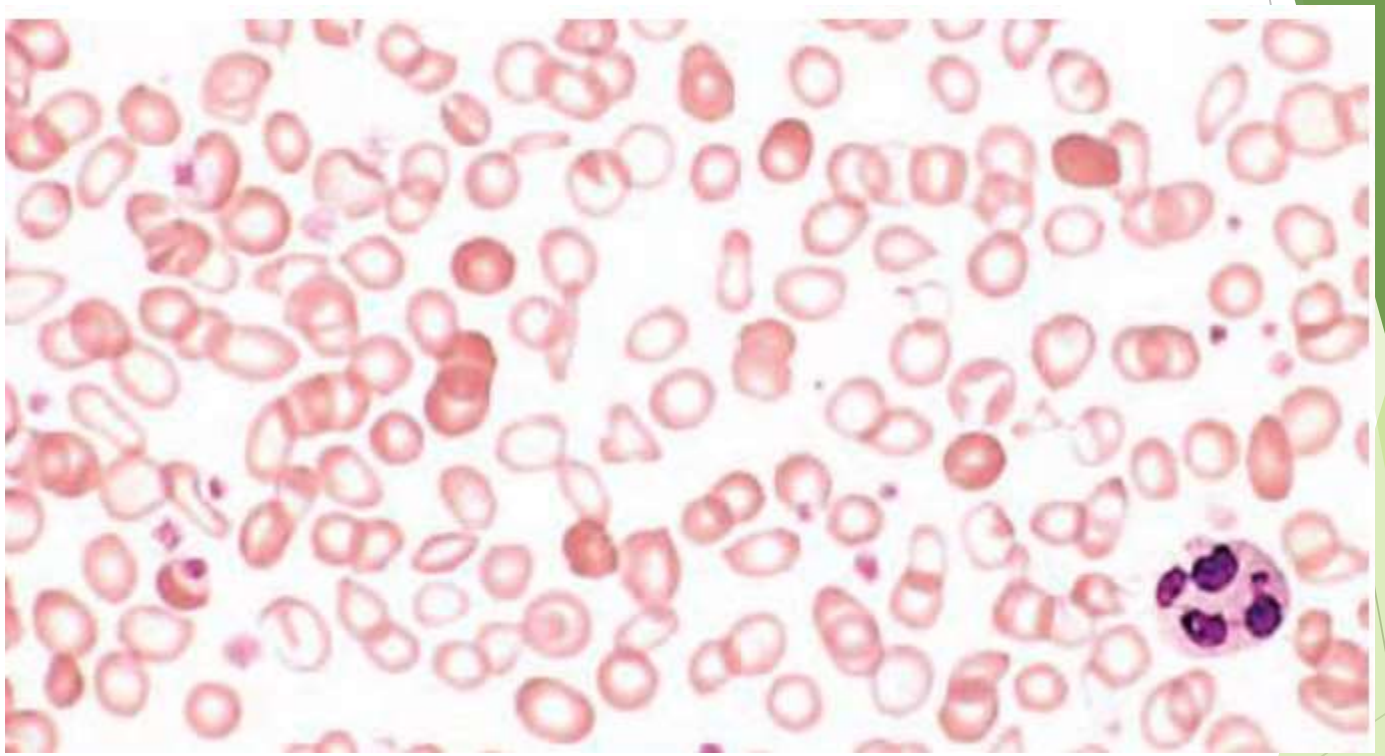
(3) increased requirement,

(4) chronic blood loss.

pathogenesis

- Negative iron balance due to any reason
- Compensation by storage iron
- Progressive deficiency until complete depletion
- Anemia develops accompanied by low ferritin and low transferrin saturation

morphology



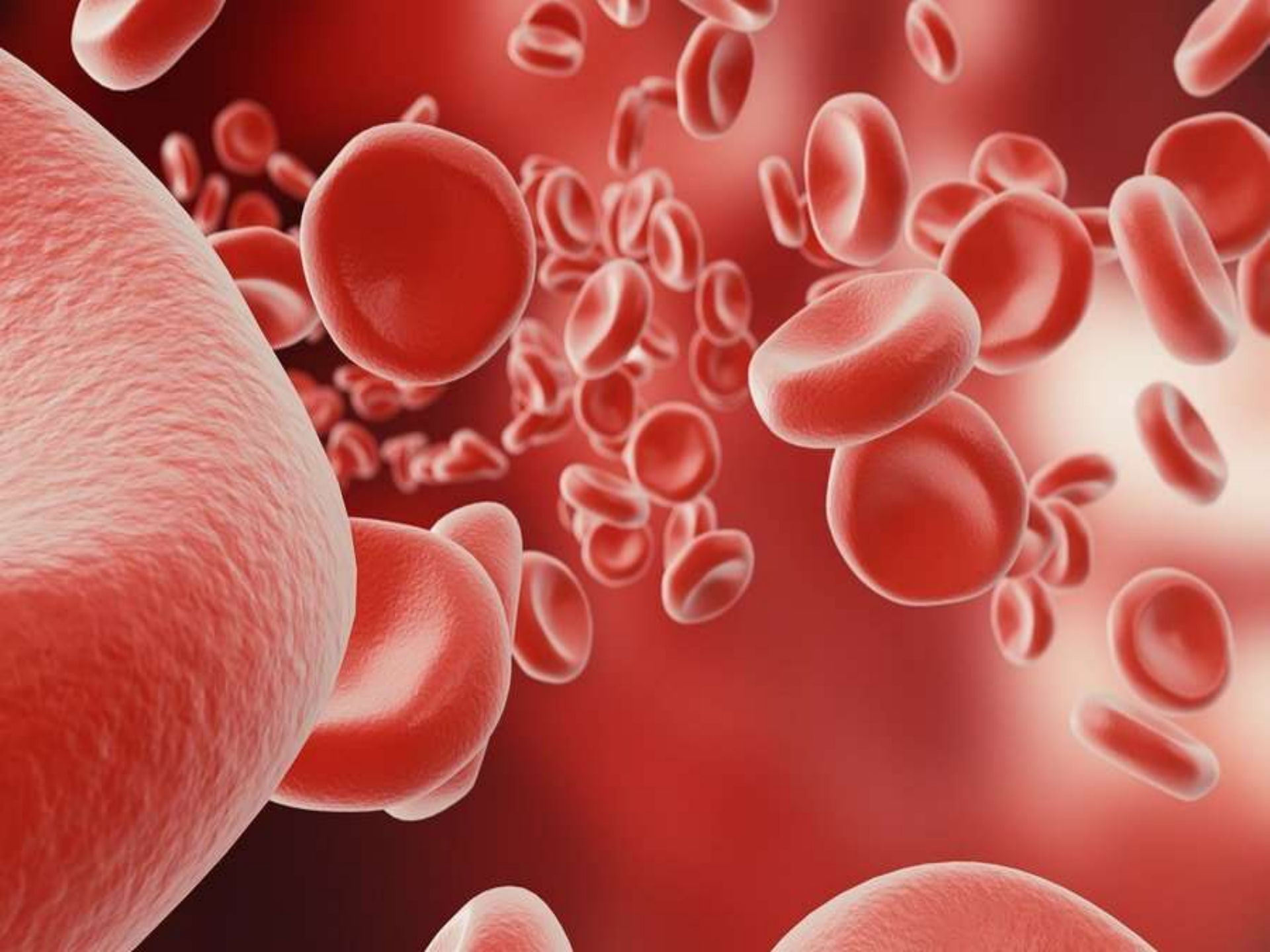
Lab findings

- Low hemoglobin and hematocrit
- Low MCV
- Low MCH
- Low iron levels
- Low ferritin
- **High TIBC**
- **High RDW**
- Low hepcidin
- Low transferrin saturation

RDW

- RDW or red blood cell distribution width is a measure of how equal your red blood cells are in size. It can help your doctor diagnose various blood-related disorders and diseases.

- In addition, it is also increased in seemingly unrelated disorders and diseases that nevertheless affect blood cell production and lifespan.



RDW

- A normal red blood cell is shaped like a disk with a depressed center. It is very flexible, which enables it to change shape – this is needed for a red blood cell to squeeze through the narrowest of blood vessels called capillaries .

- Normally, red blood cells are relatively equal in shape and size.
- However, in some conditions and diseases, red blood cells can have a distorted shape or be smaller or larger than normal while still maintaining their core function (oxygen and carbon dioxide transport).

RDW

- Red blood cell distribution width (RDW) is the variation of the size/volume of your red blood cells.
- Basically, it tells you how equal or unequal your red blood cells are in size. It is a part of a complete blood count, which also measures your hemoglobin, hematocrit, and red and white blood cell counts.
- Low values mean that your red blood cells are roughly similar in size, which is normal and desirable.
- Higher values mean that your red blood cells are produced in different sizes.
- In other words, there is some issue with red blood cell production or survival

2-Anemia of chronic disease

- Anemia of chronic disease is impaired red cell production associated with **chronic diseases that produce systemic inflammation**

- The most common cause of **anemia among hospitalized** patients.
- Examples include chronic microbial inflammation, autoimmune inflammation, and malignancy.

Lab findings

- Low HB and Hct

- Can be hypochromic microcytic or normochromic normocytic.

- High ferritin and low TIBC(exactly opposite to iron deficiency anemia)

3- Macrocytic Anemia: > 99 fl

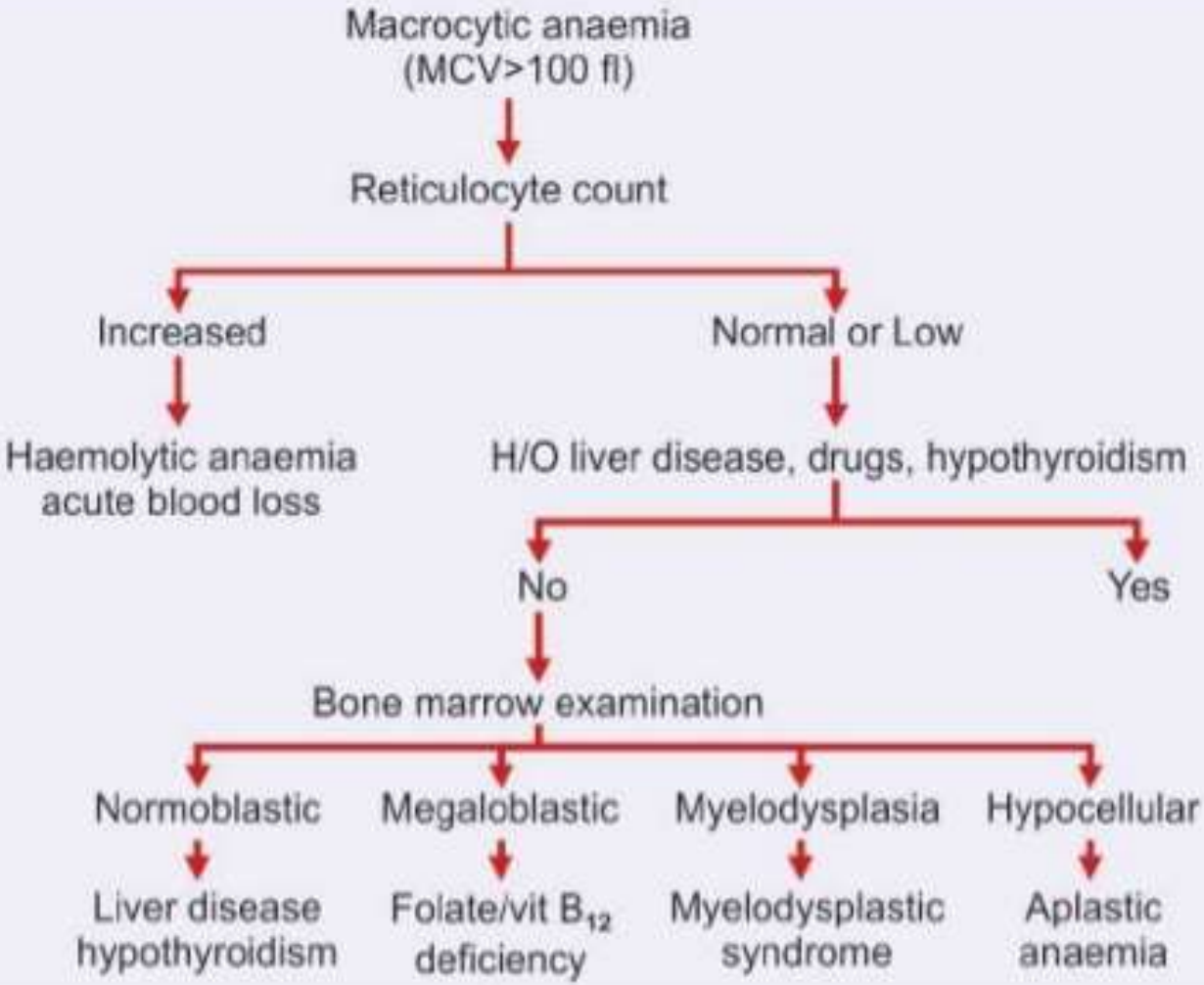
(B12 and/or Folate Deficiency)

*look for Reticulocyte count, if increased think of secondary macrocytosis:

1- Recent hemorrhage
2-Treated anemia
3- Hemolytic anemia

*All of the above cause Macrocytosis with Reticulocytosis

Evaluation of macrocytic anaemia



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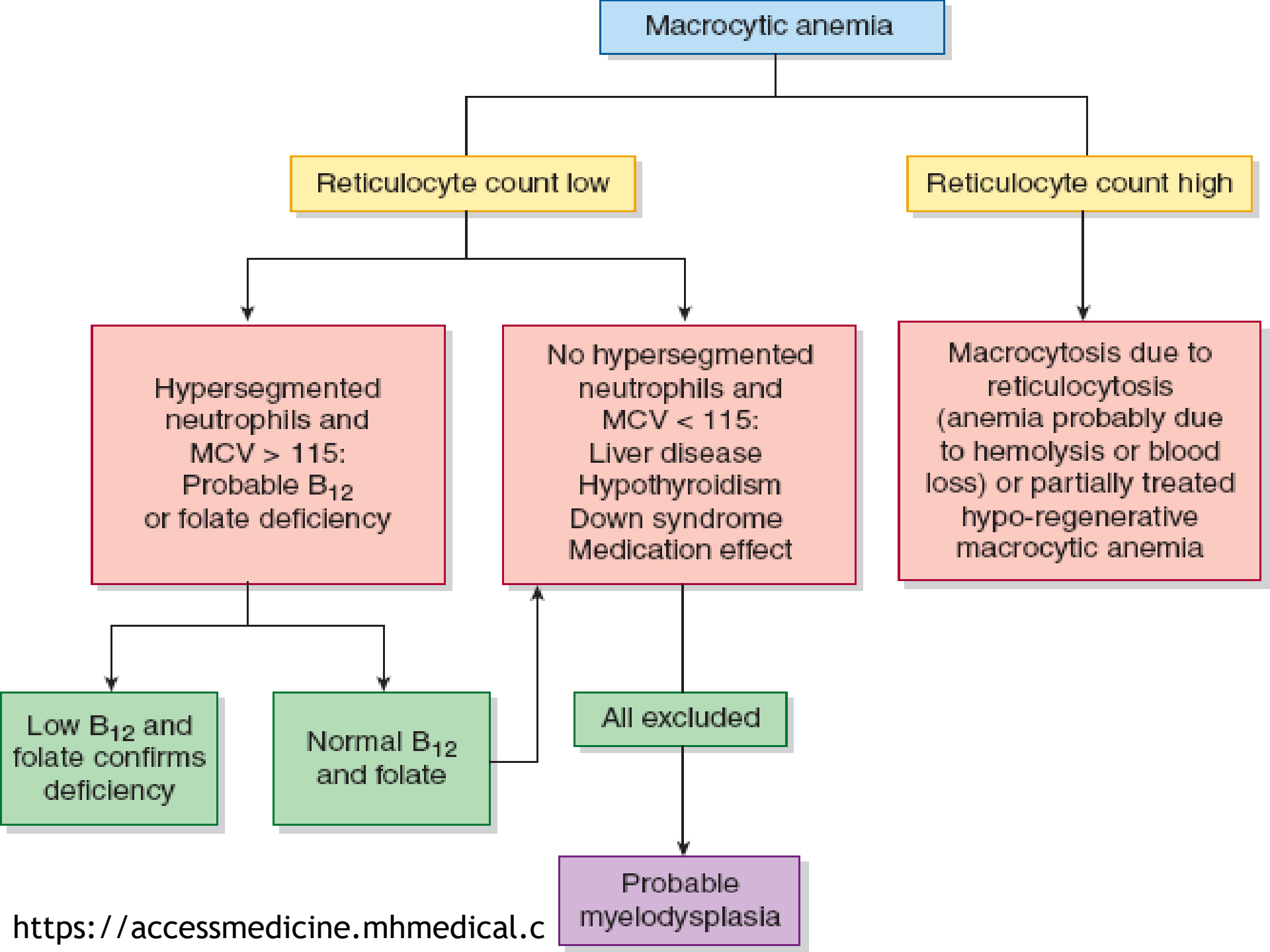
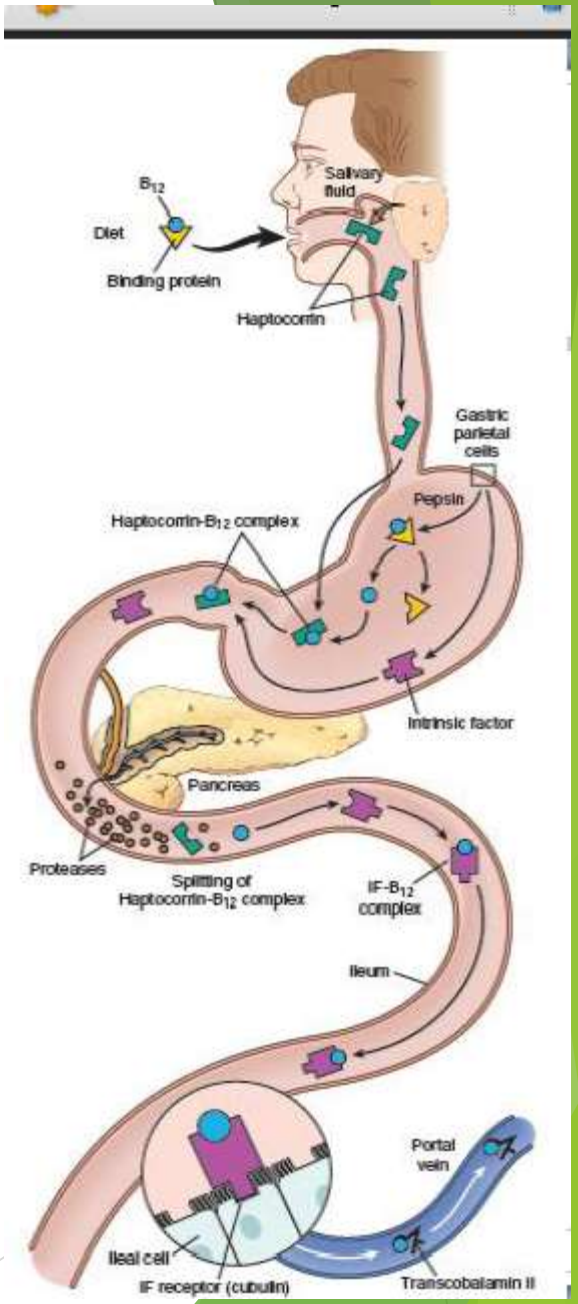


https://accessmedicine.mhmedical.c

Vitamin B_{12} Deficiency
Decreased Intake
Inadequate diet, vegetarianism
Impaired Absorption
Intrinsic factor deficiency
Pernicious anemia
Gastrectomy
Malabsorption states
Diffuse intestinal disease (e.g., lymphoma, systemic sclerosis)
Ileal resection, ileitis
Competitive parasitic uptake
Fish tapeworm infestation
Bacterial overgrowth in blind loops and diverticula of bowel



Pernicious anemia
Autoimmune attack on gastric mucosa.
three types of antibodies
1-parietal canalicular antibodies
2-blocking antibodies
3-intrinsic factor–B12 complex antibodies

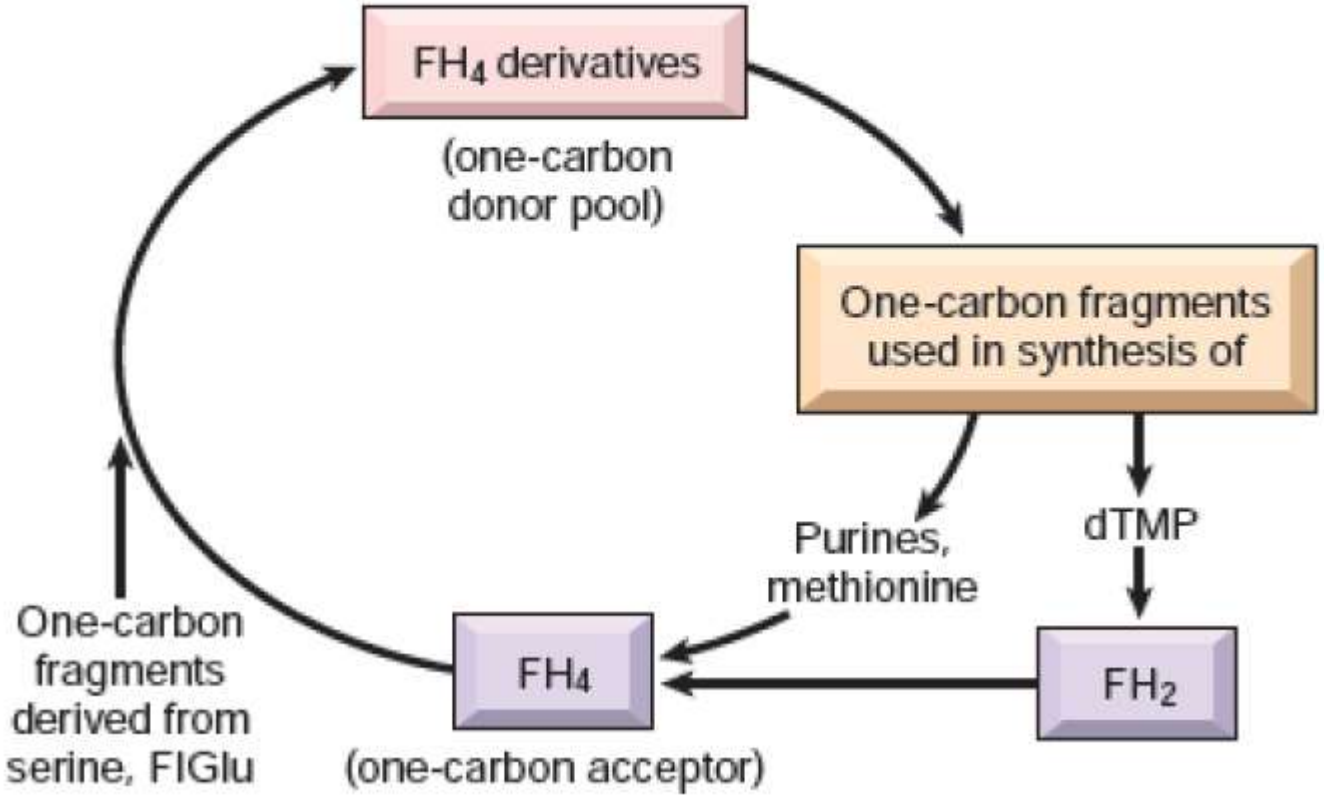
Clinical manifestations

- Related to anemia similar to those found in folate deficiency
- Additionally, leukopenia with hypersementedneutrophils can be seen

- Neurological symptoms:
  - ✓ Numbness
  - ✓ Unsteady gate
  - ✓ Loss of position sense

- Increase risk of malignancy in patient with pernicious anemia

Folate


FH_4 derivatives
(one-carbon donor pool)
One-carbon fragments used in synthesis of
Purines, methionine
dTMP
One-carbon fragments derived from serine, FIGlu
FH_4
(one-carbon acceptor)
FH_2

Folic Acid Deficiency

Decreased Intake

Inadequate diet, alcoholism, infancy
Impaired Absorption
Malabsorption states
Intrinsic intestinal disease
Anticonvulsants, oral contraceptives
Increased Loss
Hemodialysis

Increased Requirement

Pregnancy, infancy, disseminated cancer, markedly increased hematopoiesis

Impaired Utilization

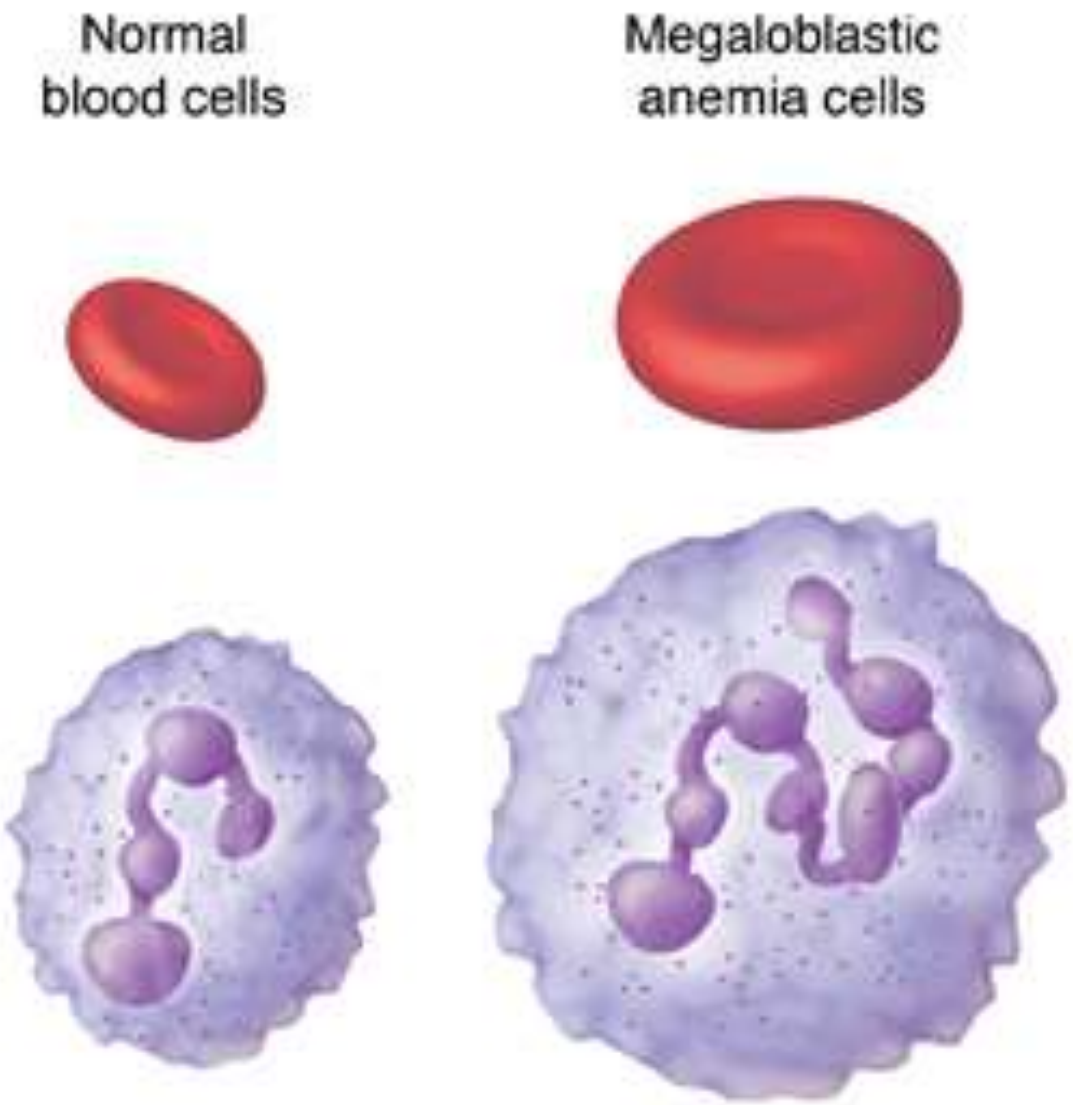
Folic acid antagonists

Unresponsive to Vitamin B_{12} or Folic Acid Therapy

Metabolic Inhibitors of DNA Synthesis and/or Folate Metabolism
(e.g., Methotrexate)

Clinical manifestations

- Nonspecific symptoms of anemia, weakness, fatigue…etc
- GI symptoms due to the effect on GI epithelial lining cells.
- NO neurological symptoms
- Diagnose by serum and RBC folate levels.



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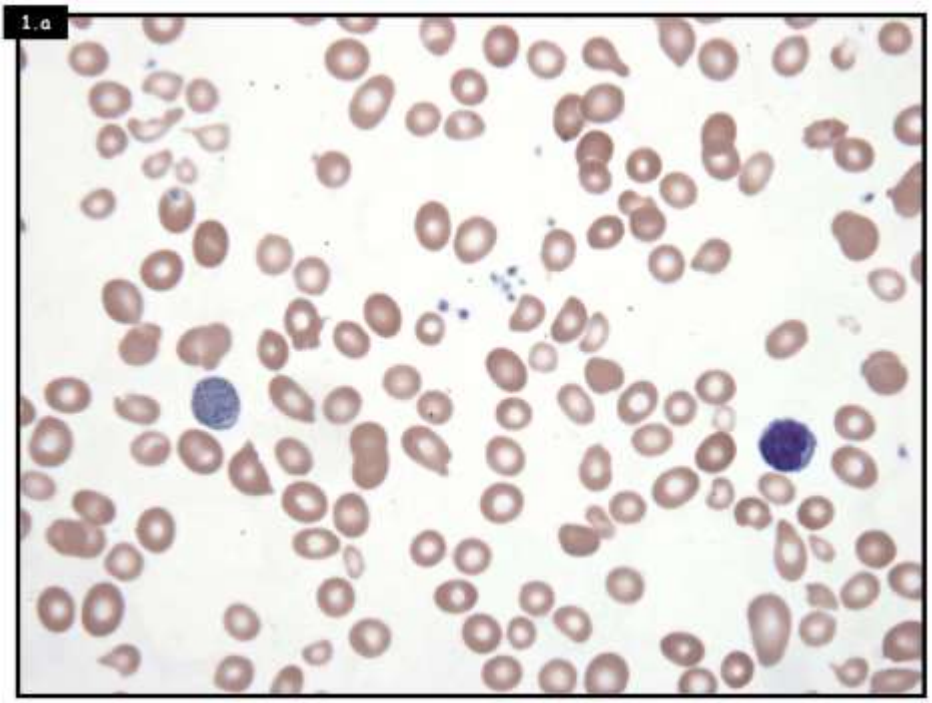
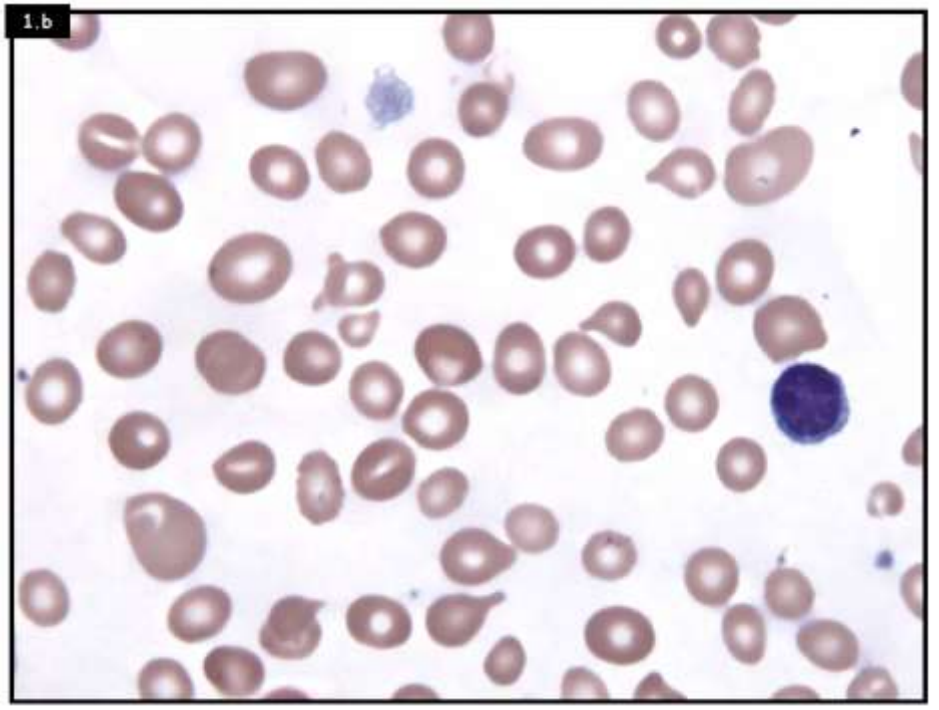
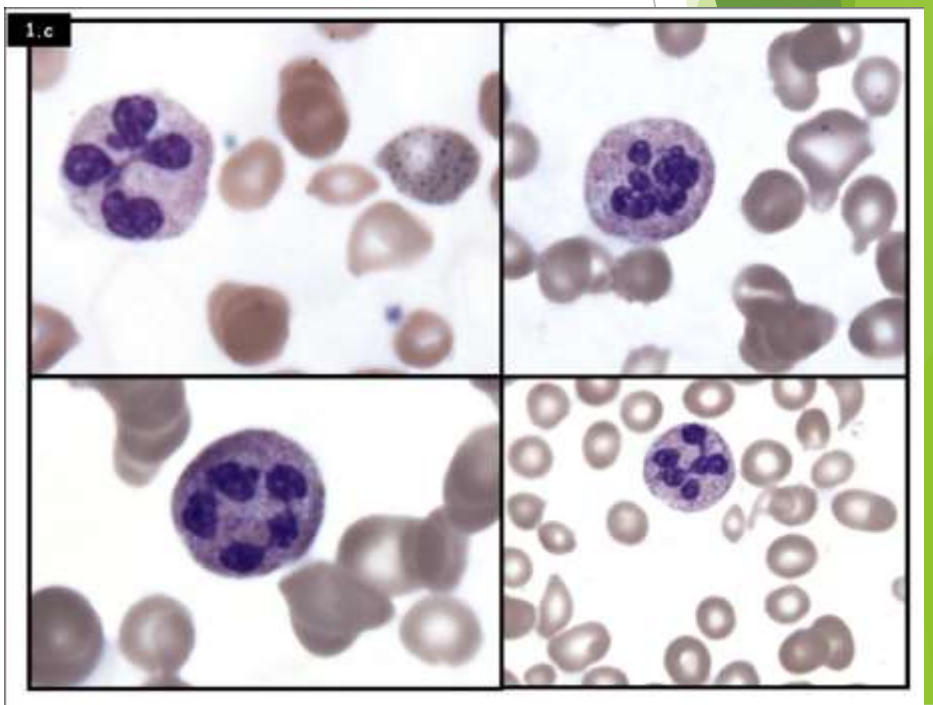




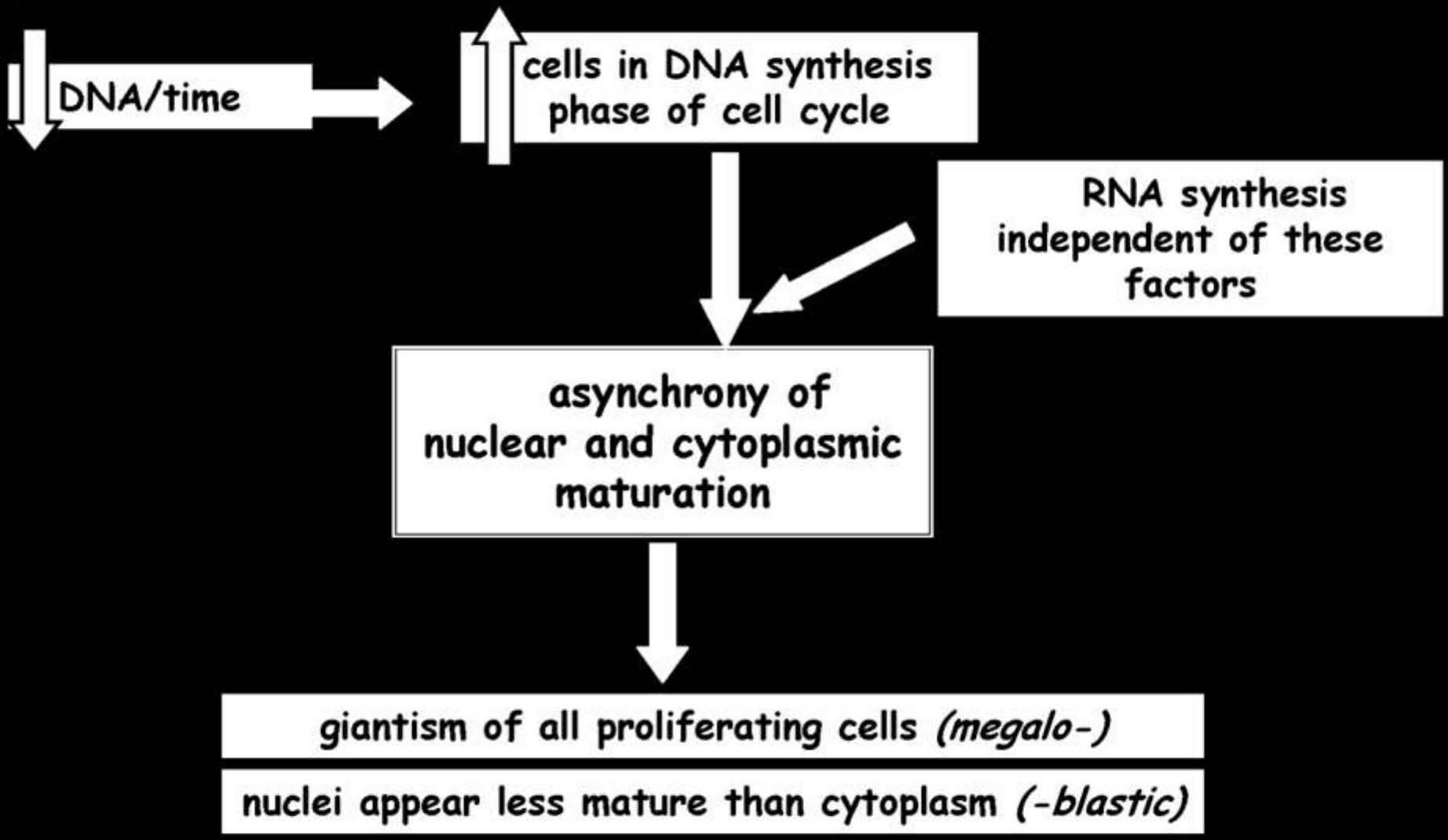


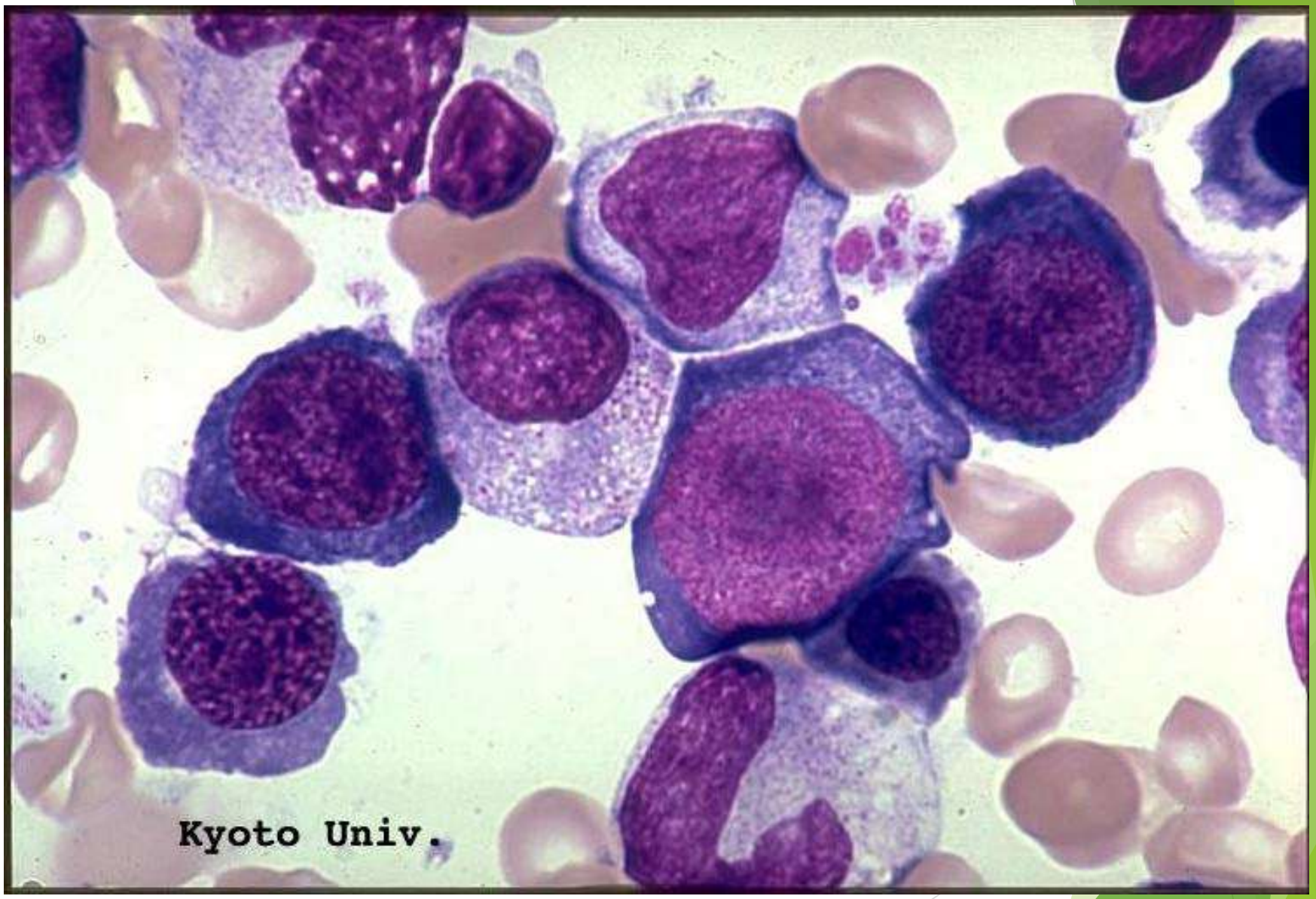
Macro-ovalocytes

Moderate anisopoikilocytosis

Neutrophilic hypersegmentation

Impact of defective DNA synthesis





http://pathy.med.nagoya-u.ac.jp

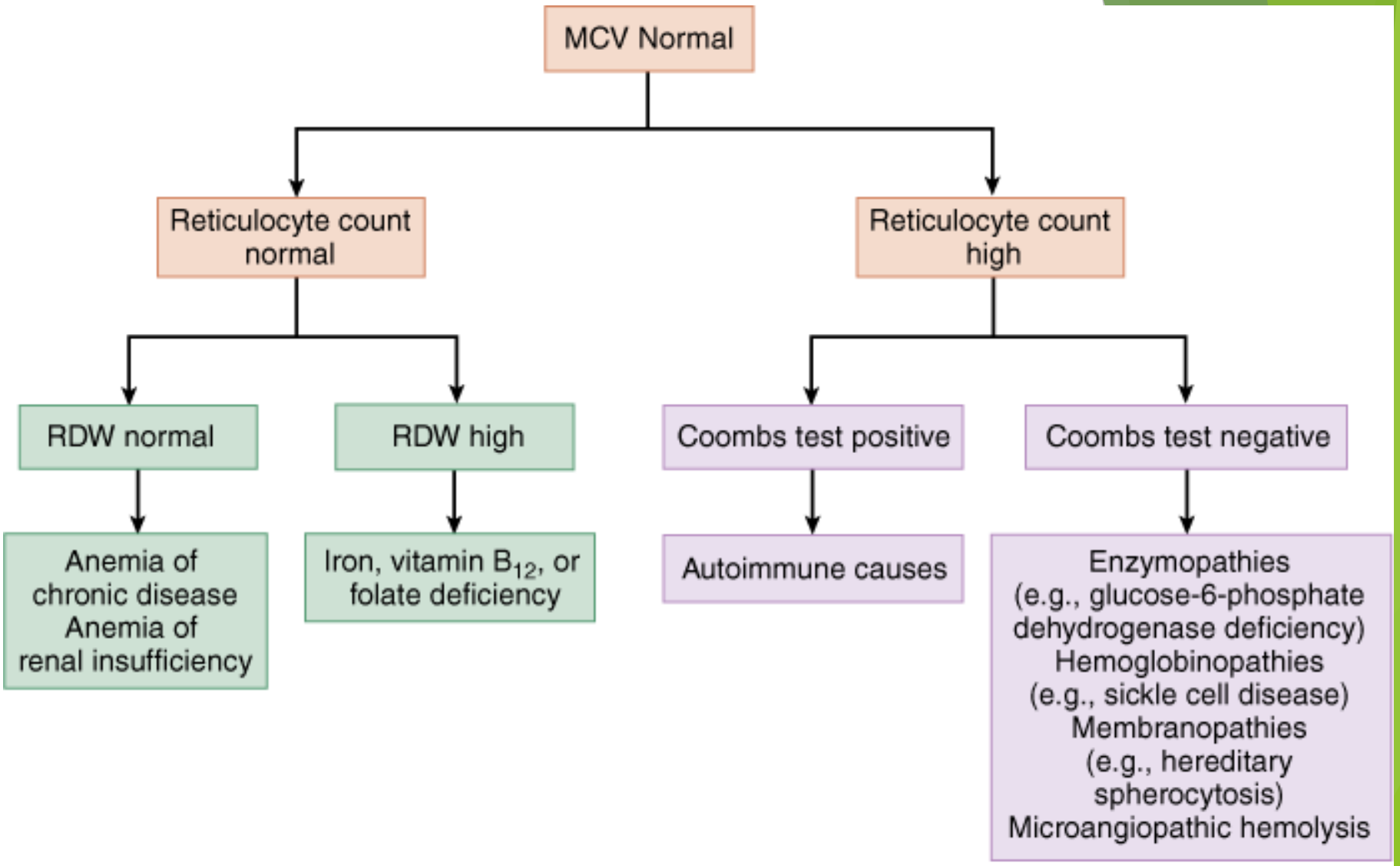
4-Normocytic/Normochromic

1)Anemia OCD

…Cytokine (IL-6) induced Hepcidin production
Hepcidin binds ferroportin and induces it is internalization and degradation…so:
Decrease RBC life span
Decrease Iron Mobilization from stores
Increase iron stores
Lab findings: Low iron, High Ferritin, Low Transferrin, Low TIBC

2)UNDER-PRODUCTION

…Dec.Reticulocyte count
*Pure red cell aplasia
*Aplastic anemia
*Myelophthisic



Source: Tintinalli JE, Stapczynski JS, Ma OJ, Cline DM, Cydulka RK, Meckler GD: *Tintinalli's Emergency Medicine: A Comprehensive Study Guide, 7th Edition*: http://www.accessmedicine.com

Aplastic Anemia

- *Aplastic anemia refers to a syndrome of chronic primary **hematopoietic failure** and attendant **pancytopenia**(anemia, neutropenia, and thrombocytopenia)*, that is secondary to suppression of multipotent myeloid stem cells.
- Idiopathic
- Secondary:

* Idiosyncratic

* Predictable, reversible, dose dependent :

XRT, myelotoxic drugs, drugs, chemicals, &Viral infections

Acquired

Idiopathic
Acquired stem cell defects
Immune mediated

Chemical Agents

Dose related
- Alkylating agents
- Antimetabolites
- Benzene
- Chloramphenicol
- Inorganic arsenicals

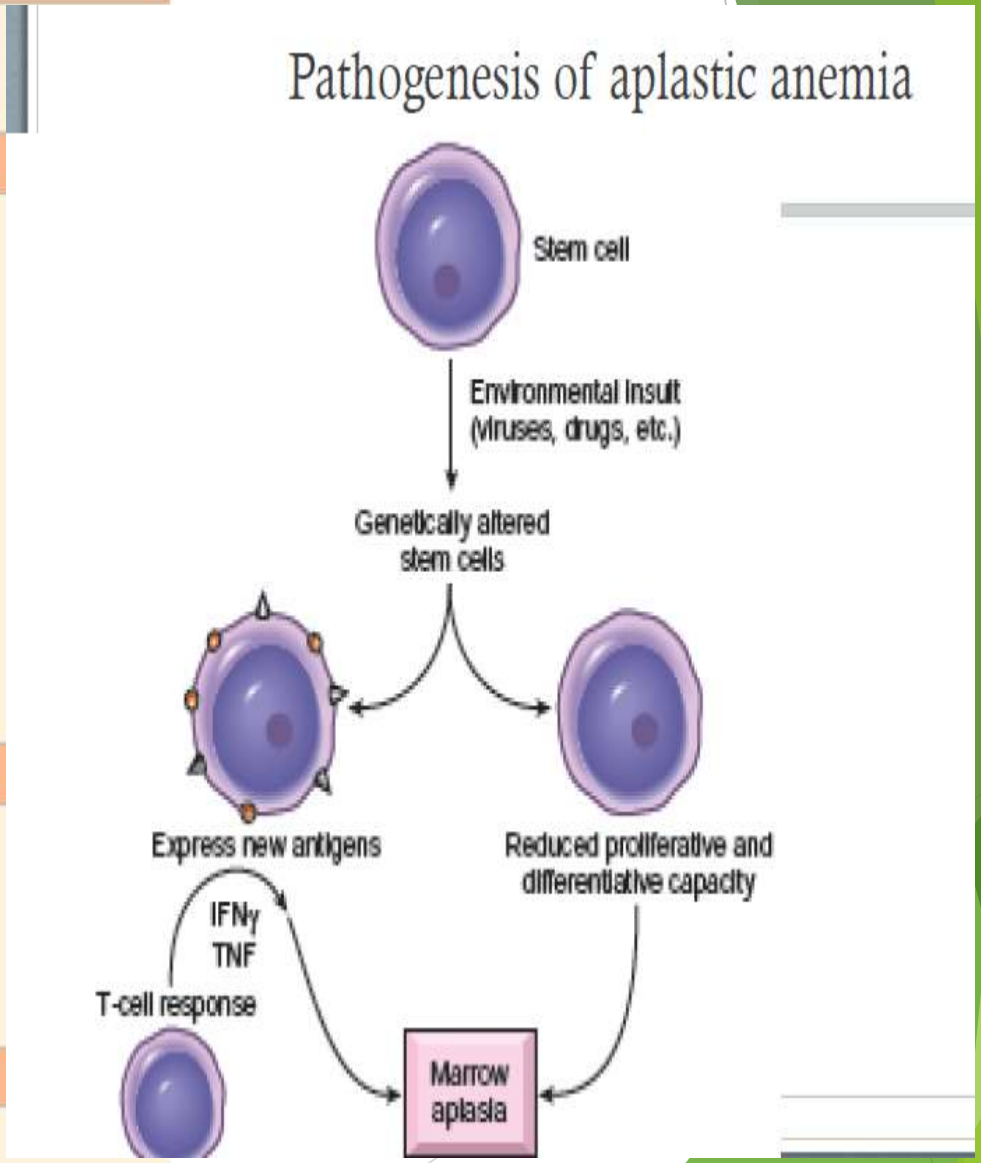
Idiosyncratic
- Chloramphenicol
- Phenylbutazone
- Organic arsenicals
- Methylphenylethylhydantoin
- Carbamazepine
- Penicillamine
- Gold salts

Physical Agents

Whole-body irradiation
Viral Infections
Hepatitis (unknown virus)
Cytomegalovirus infections
Epstein-Barr virus infections
Herpes zoster (varicella zoster)

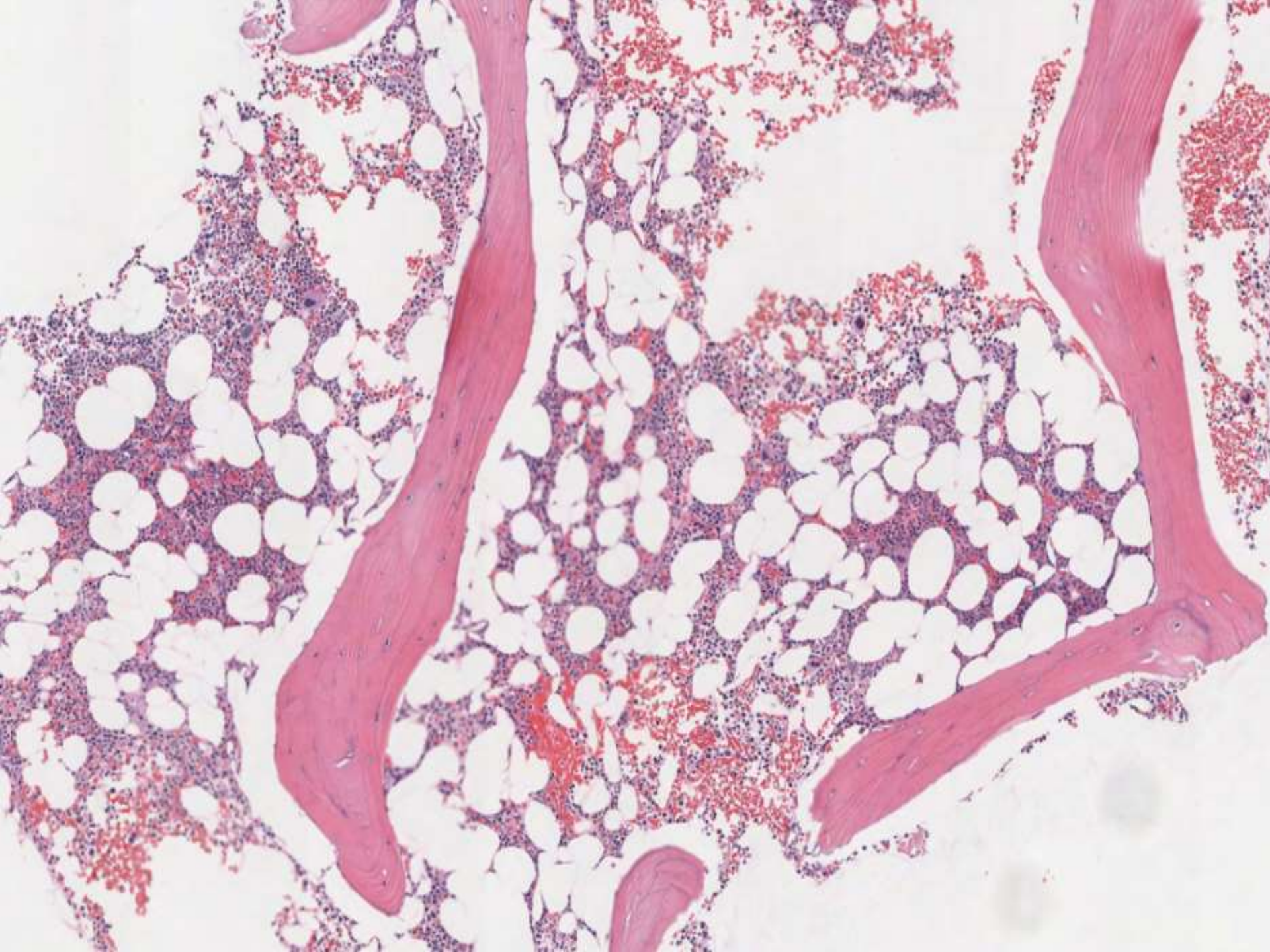
Inherited

Fanconi anemia
Telomerase defects



Clinical features

- Any age with no gender predilection
- Stigmata of pancytopenia
- Normocytic and occasionally macrocytic anemia.
- No splenomegaly
- No increased reticulocyte count
- Bone marrow exam is a must for diagnosis
- Respond well to immunosuppressive therapy, BM transplantation is the treatment of choice with 5 year survival of more than 75%.

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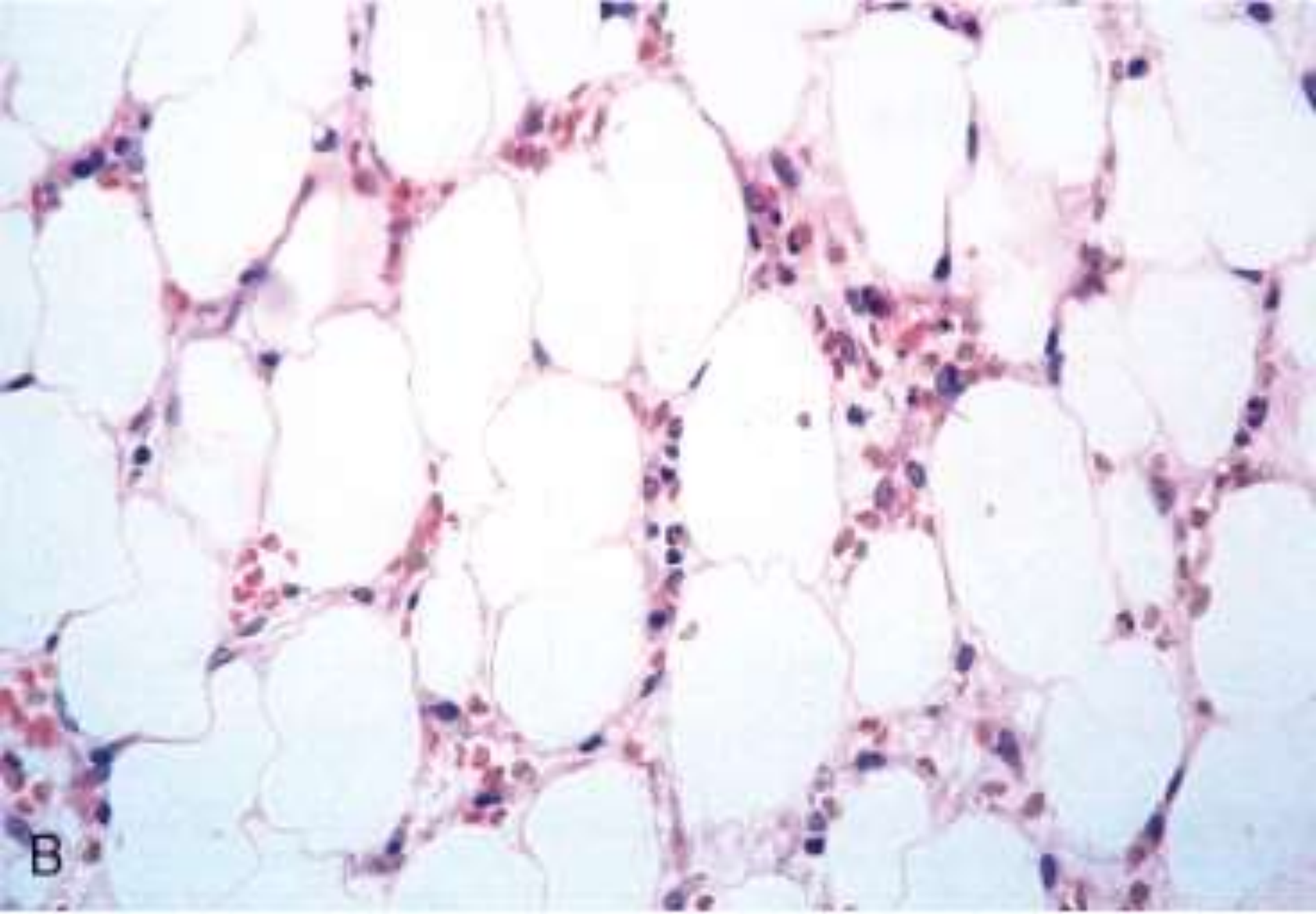


5- Anemia in liver disease

- Multiple etiologies:
- Iron deficiency is the most common
- Hypersplenism
- Therapy related hemolytic anemia and suppression of EPO receptor
- Alcoholic-cirrhosis-induced folate deficiency

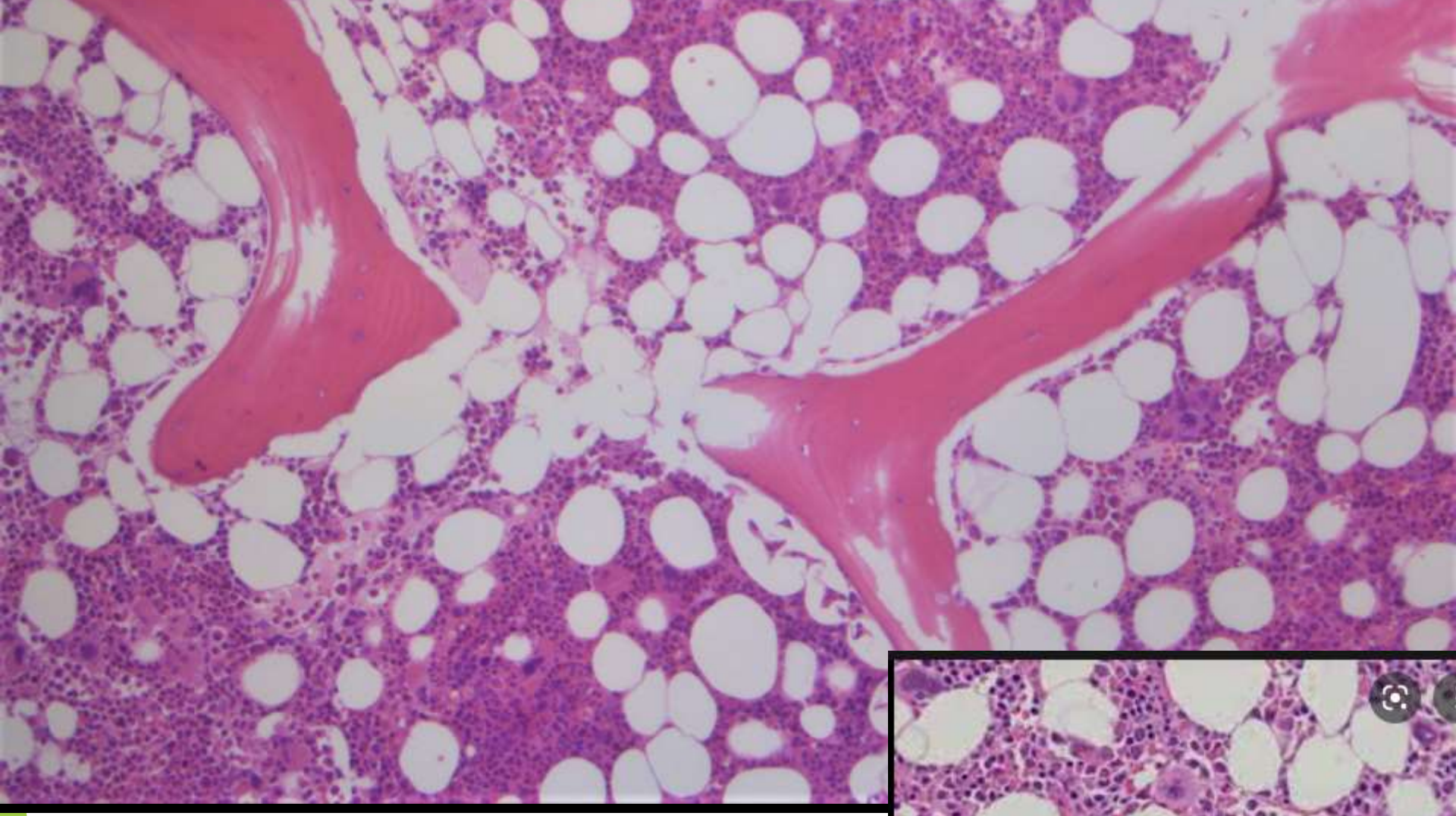
6-Anemia of renal disease

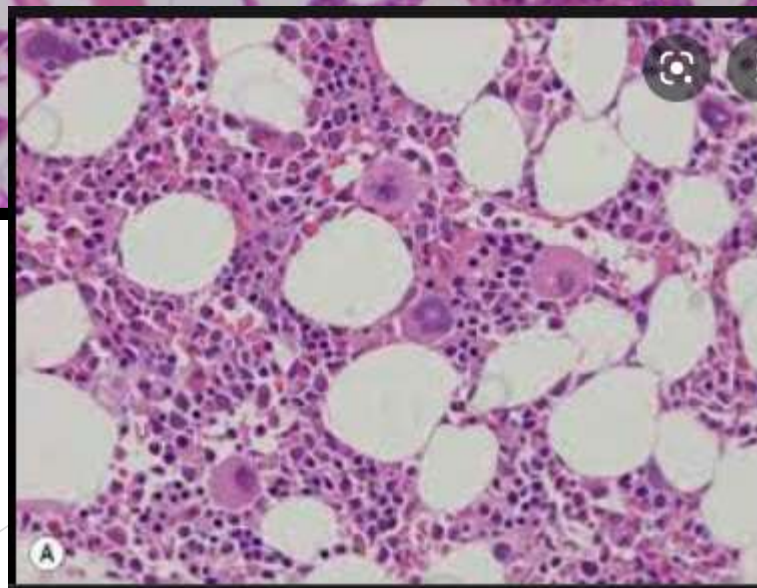
- Related to decrease EPO production by the damaged kidney.
- High levels of inflammatory cytokines
- Hemolysis
- Chronic bleeding
- Folate deficiency in patients on dialysis.

Myelophthisic anemia

Extensive infiltration of the marrow by tumors or other lesions.

- Metastatic cancer (lung, breast, prostate)
- Tuberculosis
- Lipid storage disorders
- Osteoscelrosis
- Leukoerythroblasticreaction on peripheral blood.

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Bone Metastases-Colon Cancer
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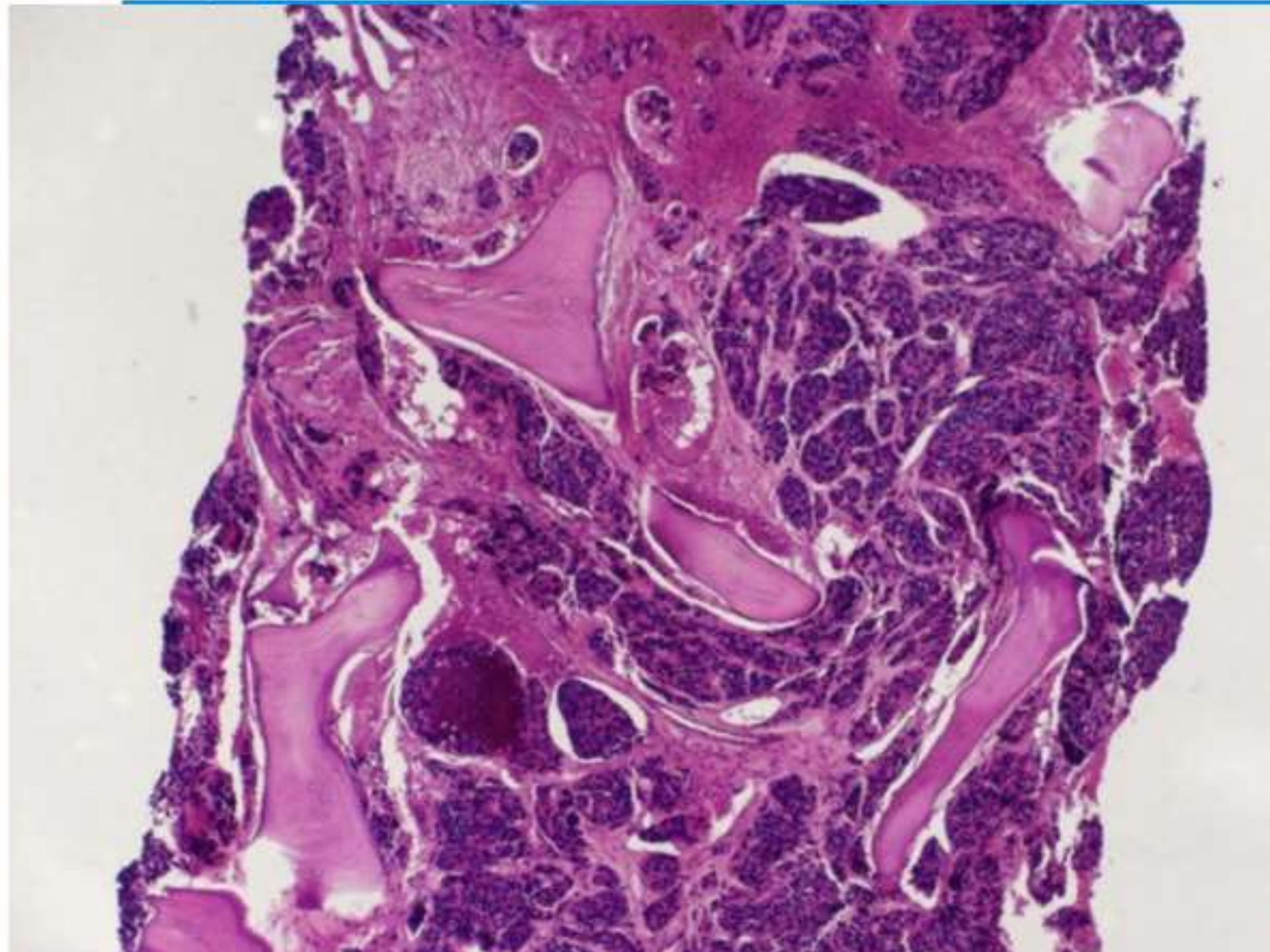

THANK YOU