Nutritional Anemia

营养性贫血

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Soochow University Affiliated Children's Hospital

Main Point –要点

- Master iron metabolism trait
- Master clinical features, diagnosis, therapy and prevention of nutritional anemia
- Know well pathogenesis and laboratory findings of nutritional anemia

(一) nutritional iron deficiency anemia, NIDA-营养性缺铁性贫血

1、Introduction-简介

Definition / describing

Anemia is defined as a pathological process (syndrome) in which hemoglobin (Hb) concentration in red cells is abnormally low, considering variations as to age, gender, sea-level altitude, as a result of several situations such as chronic infections, hereditary blood conditions, deficiency of one or more essential nutrients that are necessary for the formation of hemoglobin e.g.: folic acid, B12, B6 and C vitamins, and proteins.

Therefore, there is no doubt that iron deficiency is the cause of most anemia. It is called iron deficiency anemia. The anemia caused by insufficient dietary iron uptake, in which the iron storage and hemoglobin synthesis decreased.

Clinical characteristics-临床特征

- ↓ iron stores ↓ serum iron
- ↓hemoglobin concentration , hypochromic microcytic anemia
- good response to iron therapy
- 6mo to 3 yrs

2、IRON METABOLISM-铁代谢

CONTENTS

New born 75mg/kg

Children35-70mg/kg

Adults

M 50mg/kg

F 35mg/kg

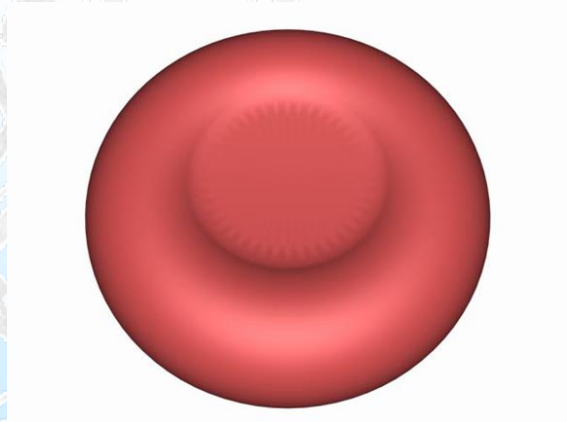
CMOPARTMENT

Hemoglobin	64%
Storage iron	30%
ferritin	
hemosiderin	
Myloglobin	3%
Enzyme iron	0.4%
Serum iron	0.4%

Iron sources-铁来源

Hemoglobin iron

Dietary iron



Dietary iron-饮食铁

- High in iron

  Red meat/ liver kidney/ oily fish

- Average iron

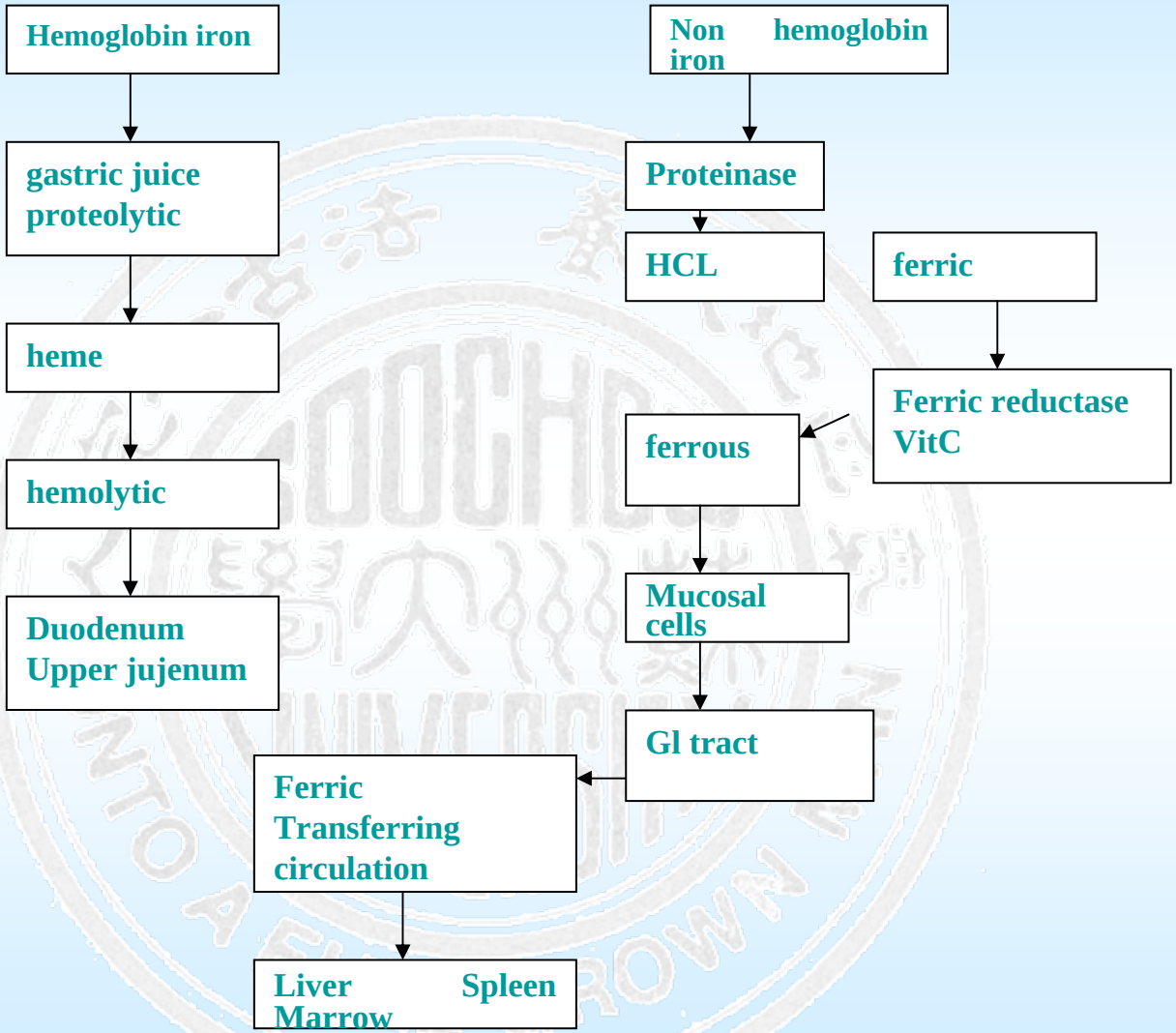
  Beans / fortified cereals/ dark green vegetables/ dried fruit/ nuts and seeds

- Poor in iron

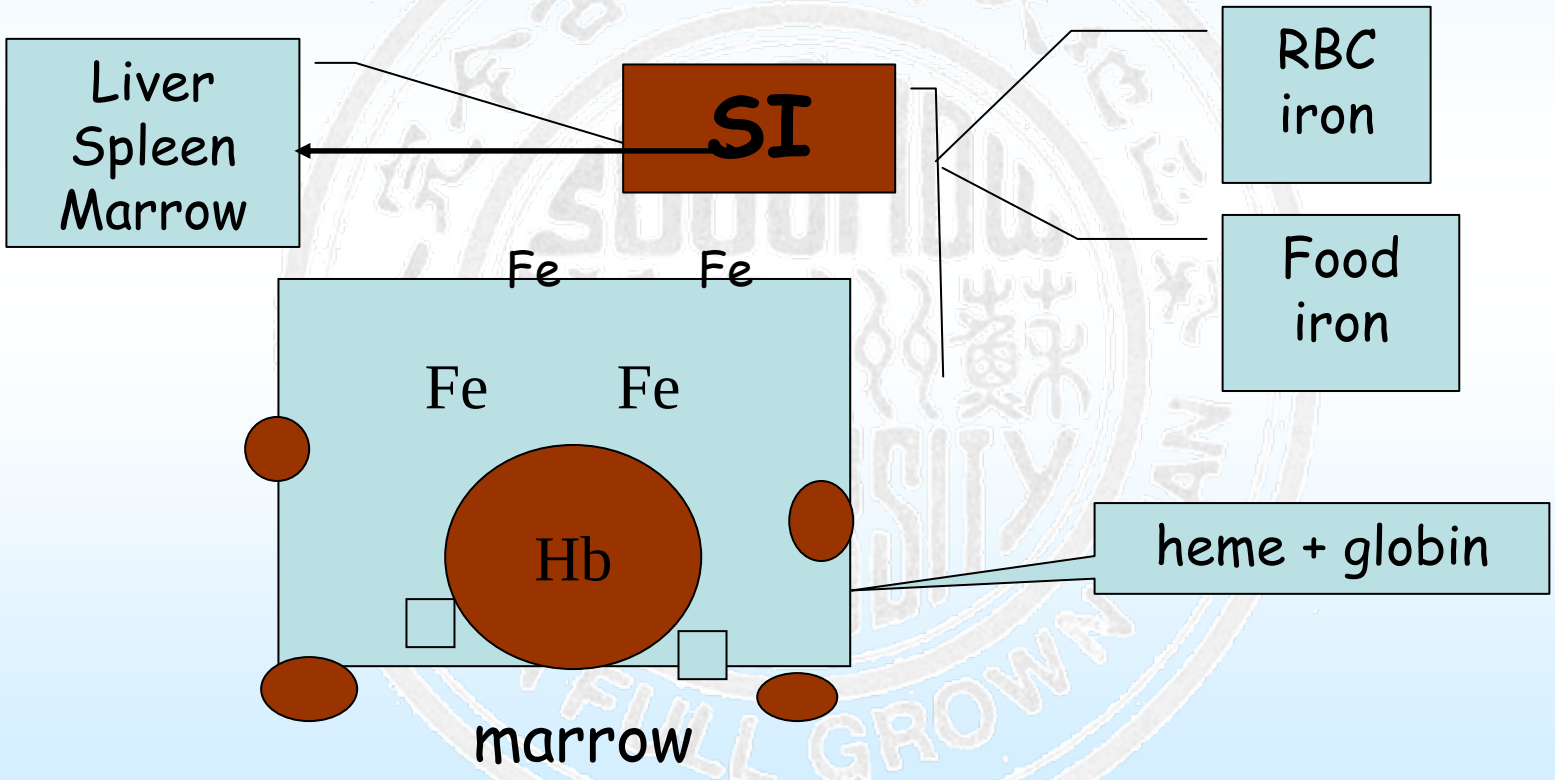
  milk

Iron absorption-吸收

- general absorption 1-20%
- Meat/ fish/ chicken 10-25%
- Cereals/vegetables 1%
- Breast/cow's milk 50%/10%


Hemoglobin iron
gastric juice proteolytic
heme
hemolytic
Duodenum Upper jujenum
Non hemoglobin iron
Proteinase
HCL
ferric
Ferric reductase VitC
ferrous
Mucosal cells
Gl tract
Ferric Transferring circulation
Liver Spleen Marrow

Iron stores and utilizing-储存和利用



Requirement and excretion –需求和排泄

	demand	excretion
adults	1mg/d	1mg/d
4mo-3yr	1mg//kg	(15ug/kg/d)
premature	2mg/kg	

3、ETIOLOGY & PATHOGENESIS
-病因和病理生理

ETIOLOGY--病因

- Poor iron stores
- Poor dietary intake of iron*
- Overdevelop
- Chronic bleeding

Poor iron stores-铁贮存不足

- Premature birth
- Multiple birth /Low weight birth
- Cord blood
- Mother iron reserve

Poor dietary intake of iron*
-饮食摄入铁不足

- Milk and cereals
- Factors influencing absorption
- Diarrhea and infection

Overdevelop-发育需求

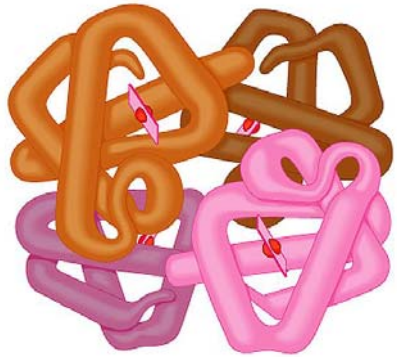
- 3-5mo/ 1yr
- Premature birth
- Puberty

Chronic bleeding-慢性失血

- Cow's milk
- Hookworm infection
- Menstruating
- Others

Pathogenesis-病理生理

iron ↓ + **protoporphyr**



↓ **heme** + **globins** **hemoglobin**↓

- Hypochromic / microcytic anemia
  - ID. Iron deficiency-铁缺乏
  - IDE. Iron deficiency erythropoiesis-缺铁性红细胞生成
  - IDA. Iron deficiency anemia-缺铁性贫血
- Enzymes
- Immune function
- Skin/mucosal

4、CLINICAL MANIFESTATIONS
-临床表现

Features

- Age
- The onset of the IDA
- The degree of anemia

- Pallor
- Extramedullary hematopoiesis
- Mild/ Severe condition
  - Digestive system
  - Cardiac function
  - Neurology/ intellectual
  - Immune function

5、LABORATORY FINDINGS-实验室检查

IDA: **microcytic/hypochromic + SI↓**

- Peripheral blood：

  Hemoglobin level

  RBC　　MCV < 80fl,

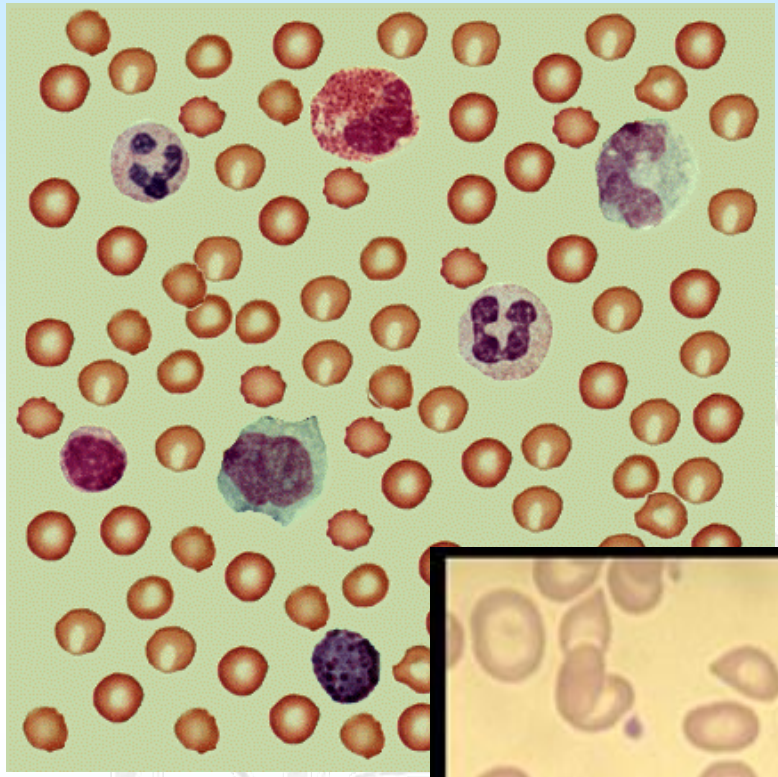
  MCH < 26ug,

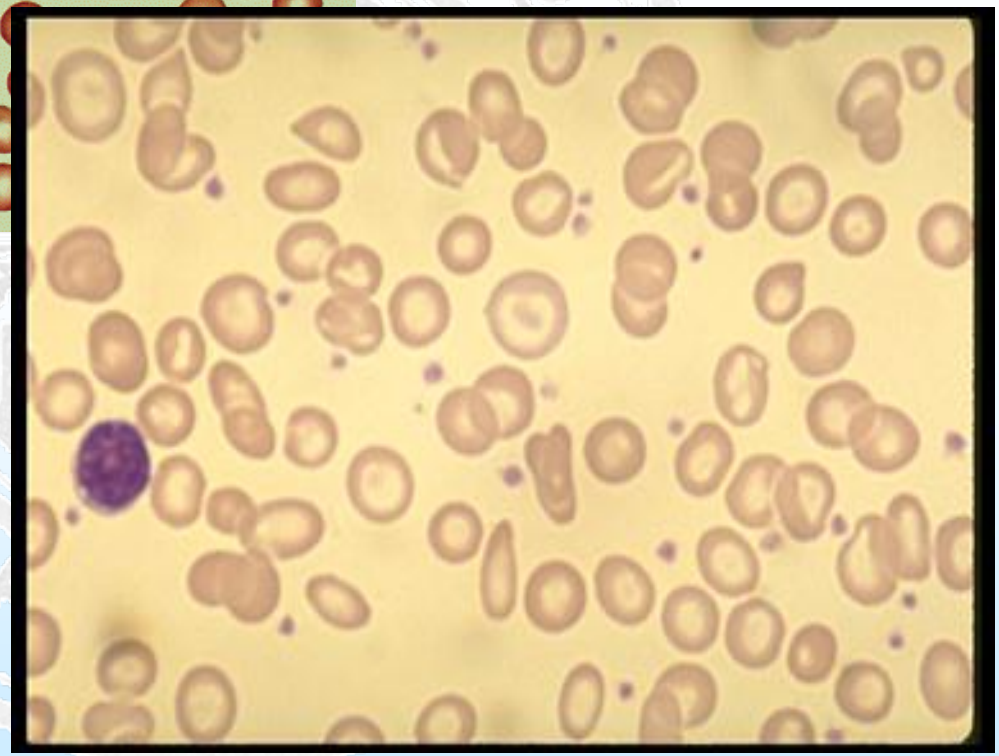
  MCHC < 0.31

- Bone marrow

  Erythroid hyperplasia

  Stainable iron↓





Concepts –概念

- SI-血清铁

  serum iron

- TIBC-总铁结合力

  total iron binding capacity

- TS-转铁蛋白饱和度

  transferrin saturation

IDA: **hypochromic/microtytic anemia+ SI ↓**

SI： **< 9-10.7umol/L (12.8-31.3umol/L)**

or < 50-60ug/dl (75-175ug/dl ）

TIBC： **> 62.7umol/L (>350ug/dl)**

TS： **< 15% （30-50%）**

IDE: SF ↓ ,FEP ↑ （**>0.9umol/L or> 50ug/dl)**

ID： SF **< 12ug/L /** marrow iron

	Normal	ID	IDE	IDA
Marrow iron	+ ~ + +	↓	↓	0
SF (ug %)	100±60	↓	↓↓	<10-20
FEP			↑	↑
SI TIBC TS				↓ ↑ ↓
Hb MCV MCH				↓ ↓ ↓↓

6、DIAGNOSIS & DIFFERENTIAL
-诊断和鉴别

Diagnosis

Impression：age, feeding, PBL

Diagnosis：biochemical change

Proven by therapy

Differential

- Chronic & inflammatory diseases-慢性或炎症性疾病
- Thalassemia-地中海贫血
- Pulmonary hemosiderosis-肺含铁血黄素沉着
- Siderblastic anemia-铁粒幼细胞性贫血

7、TREATMENT-治疗

- General care
- Eradicate the causes*
- Iron therapy*
- transfusion

Iron therapy-铁剂

- Elemental iron： 4-6mg/kg/d
- Oral medication
  - -Types
  - -Administration
    - Between meals
    - Vitamin C
    - Course

Table: Ferrous salts ant the iron contents

Ferrous Salts	4mg/kg/d
Ferrous sulfate （20%）	20mg/kg/d
ferrous fumarate (30%）	13mg/kg/d
Ferrous gluconate（11%）	40mg/kg/d

IRON THERAPY RESPONSE (from Nelson)

Time	response
12-24 hr	Replacement of iron enzymes, subjective improvement
36-48 hr	Initial marrow response: erythroid hyperplasia
48-72 hr	Reticulocytes peaking 5-7
4-30 days	Hemoglobin level ↑
1-3 month	Replenish of stores

Transfusion-输血

- Indications
  - Severe anemia
  - Infection
  - Pre-operation
- Component： red blood cells
- Volume：Hb <30g/L, 3-5ml/kg
  Hb 30-60g/L, 5-10ml/kg
- Attentions

8、PREVENTION-预防

- Education
- For pregnant women
- For interm

  Breast milk/cow's milk

  Iron rich supplementary food

  Iron-fortified food
- For premature infant

Review: these contents after class, try to make the summary on

- The characteristics of iron metabolism in fetus and infants
- The etiology of IDA
- Laboratory findings according to the stages
- Differentials: esp with thalassemia
- Important treatment

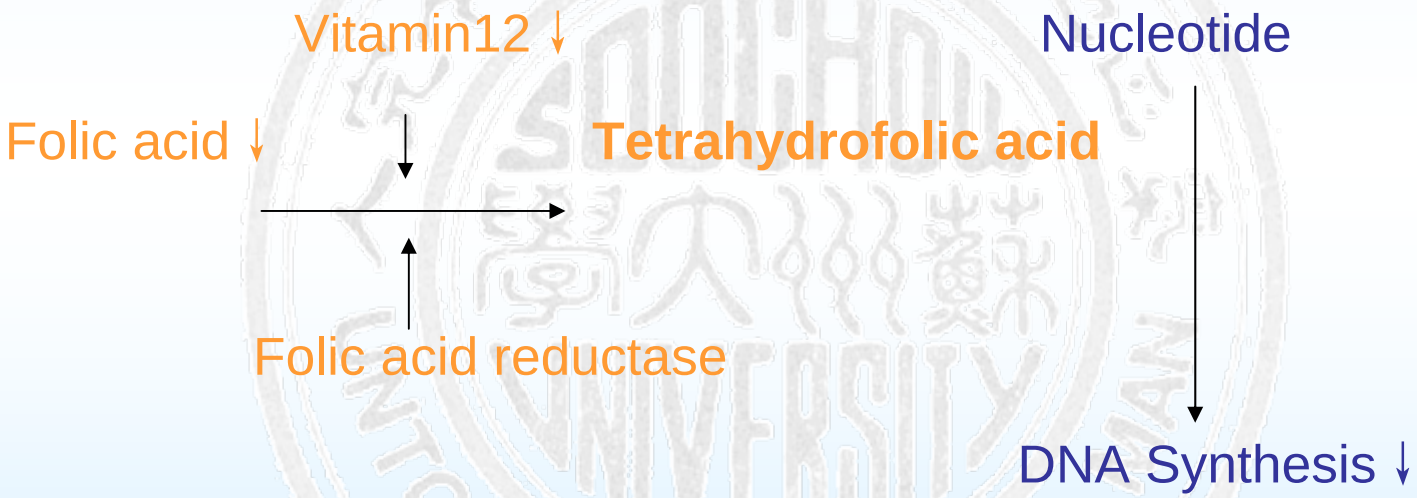
(二) Megaloblastic Anemia

-巨幼细胞性贫血

Similar aspects to IDA

- **Age**
- **Anemia by inadequate dietary intake**

Pathogenesis



Manifestation & Differential

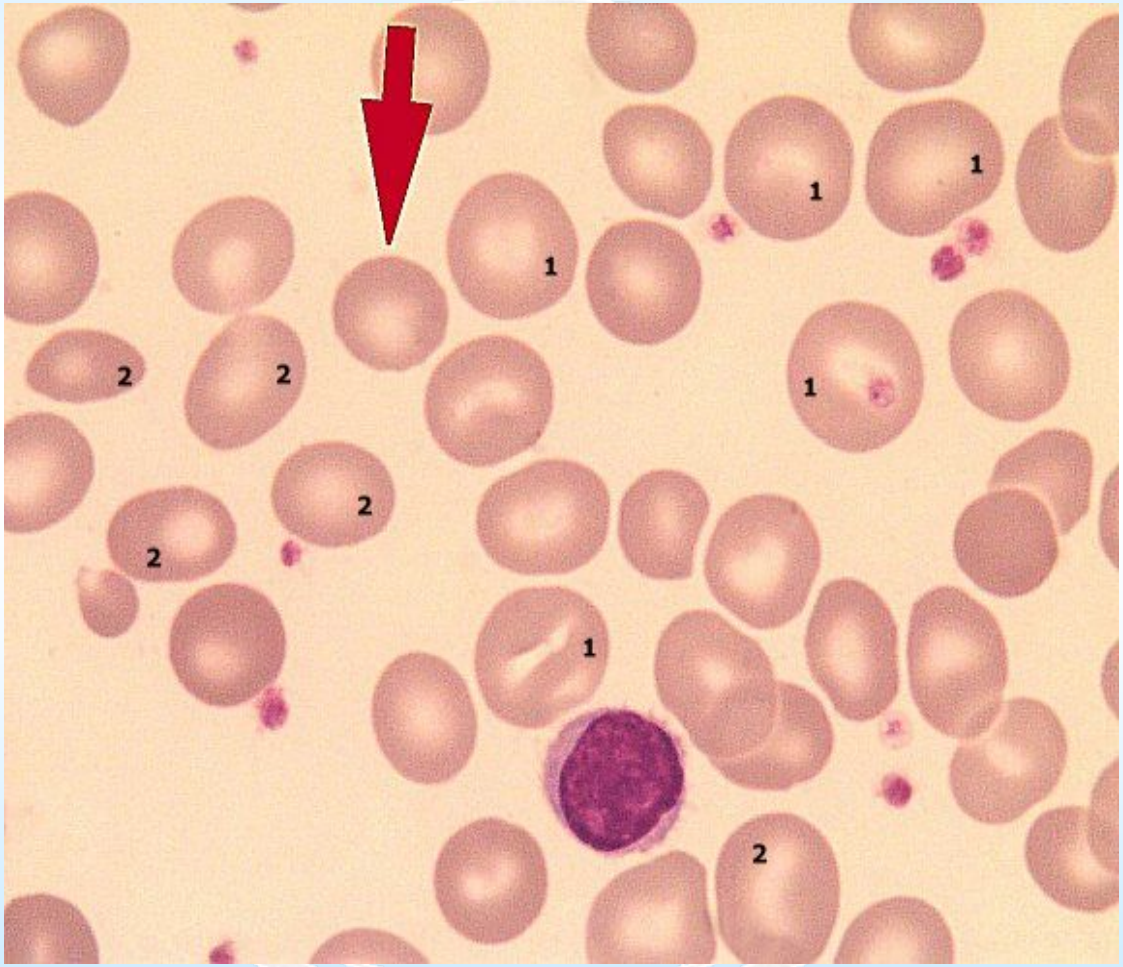
- Pale and puffy
- neurological involvement
- Lab findings

  -Macrocytic normochromic anemia

  -Neutropenia with/ thrombocytopenia

  -Marrow film: megaloblastic forms of nucleated RBC

  -Serum Vit B12 and /or folic acid


1
1
1
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2
2
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2

TREATMENT

General care

Drug therapy

-Vitamin B12： 25-100ug/次，2-3 times/w，weeks or to Hb normal；One high dose：500ug im

-Folic acid： 5-10mg, tid, 2-3w，

-Effect

-Other drug： Vitamin C； B6；iron in recovery

Transfusion

Thank You