Pathological Analysis Department
Title of the lecture : Thalassemia

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Thalassemia

Definition: Thalassemias are a heterogenous group of genetic disorders

4 α ,genes are located on chromosome 16

2 ß ,genes are located on chromosome 11

Homozygous persons: are severely affected ,die early in childhood without treatment

Heterozygous individuals Not sever affected ,Live long life

the Hb consist of **heme** and **globins**

HbA (α2ß2) during one year of the life

	Hb A	Hb F	Hb A_2
Structure	$\alpha_2\beta_2$	$\alpha_2\gamma_2$	$\alpha_2\delta_2$
Normal (%)	96–98	0.5–0.8	1.5–3.2

Types of thalassemia

1- α -thalassemia Deletion of α -chains

2- β-thalassemia Mutation of β -chains

Cases of alpha thalassemia types:

Case 1	- α/αα β/ β	Silent carrier	Absent 1 alpha chain	Heterozygous
Case 2-1	- α/- α β/ β	Minor alfa thalassemia	Absent 2 alpha chains	Homozygous
Case 2-2	- -/αα β/ β	Minor alfa thalassemia	Absent 2 alpha chains	Heterozygous
Case 3	- -/- α β/ β	HbH	Absent 3 alpha chains	Homozygous
Case 4	- - /- - β/ β	Barts hydrops fetalis	Absent 4 alpha chains	Homozygous

HbH disease and life of the fetus:

- Fetus can survive to adult life with.

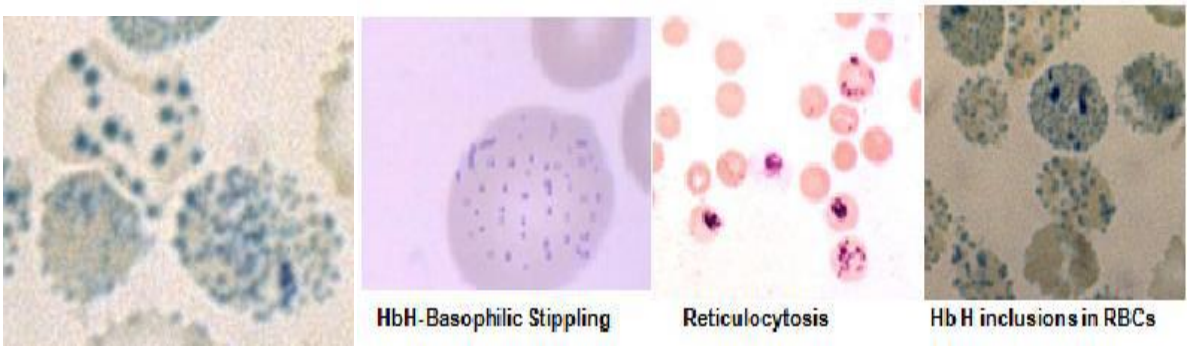
- Severe anemia with hemolysis . -

Occasionally transfusions are required Severe RBC abnormalities

The disease diagnosed early at about 6 months of

The absence of 3 a-chains affect

The absent of 3 alpha chains make **Precipitated Hgb H inside the RBC**



Laboratory finding in HbH disease:

1-CBC		2-Blood film:	3-HbH electrophoresis, the result may be as follow:	
Hb	Low	❖ Hypochromia (++ - +++) ❖ Microcytosis (++ - +++) ❖ Target Cells, Basophilic Stippling, Tear-Drops	HbA	Absent
MCV	Low		HbA2	Normal
RDW	Normal		HbF	Slight elevated
Retic-count	Increase		*HbH	90%

Final Diagnostic tests:

1. Hb Electrophoresis result indicate presence new Hb called HbH

2. DNA analysis searching for the alpha genes on the chromosome 16 (three are absent)

3. Red cell inclusion bodies in reticulocyte preparations (may be reach to 70% of all RBC) by supravital stain, increasing incubation time to cause precipitation giving the appearance of a golf ball

2-Hb-Barts (Hydrops fetalis)

Bart's hydrops syndrome occurs when no chains are made, even in the fetus; these infants are usually stillborn at between 28 and 40 weeks, and if born alive, they die within the first hour

β -Thalassemia

Major β -Thalasseamia (Cooley's Anemia)

β Thalasseamia major (Cooley's Anemia)

1. Defect in both beta chains (the tow beta chains are absent)

2. Presents with severe anemia at 6 months

3. HbF not developed to HbA in the first year of the life

4. The result remain the HbF all life with sever hemolysis

5. Most patients need regular transfusion.

6. The main problem of those patients is iron loading.

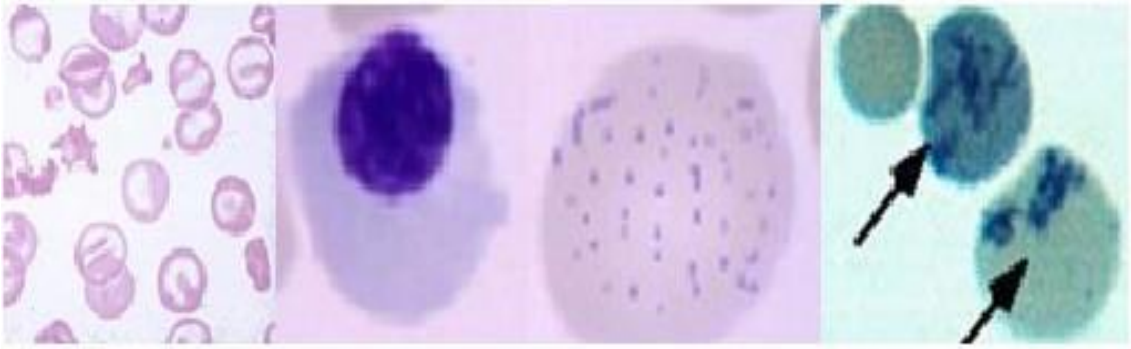
Cases of β-thalassemia typesCases of β-thalassemia types

Homozygous	Major Beta thalassemia (Cooley's anaemia)	Absent 2 beta chains	aa/aa b^0/b^0	Case 1
Heterozygous	Minor Beta thalassemia	Absent 1 beta chains	aa/aa b/b^0	Case 2

^{0} :Indicates no production of globin chain by gene
$^+$: Indicates diminished, but some production of globin chain by gene: defects in production of Hb ß that leads to microcytosis

Laboratory finding in β -Thalasseamia major (Cooley's Anemia)

1-CBC		2-Blood film:	3-HbH electrophoresis, the result may be as follow:	
Hb	2-5g/dl	Hypochromia (++ - +++) Microcytosis (++ - +++) Target Cells, Basophilic Stippling, Tear-Drops Heinz Bodies Nucleated RBC +++ (bone marrow response)	HbA	Absent
MCV	Low		HbA2	Normal
RDW	Normal		HbF	Slight elevated
Retic-count	>15%		*HbF	90%



Target cells NRBC Basophilic stippling Reticulocytes

Diagnostic tests:

1. Hb Electrophoresis result indicate presence of HbF about 90%

2. DNA analysis searching for the β genes on the chromosome 11 (three are absence of two beta chains)

- β Thalasseamia trait (Minor)

- Heterozygous for β + **or** β °

-RBC is elevated over **5.5 million per cum**

-Not needs blood transfusion, No hemolysis signs

-Patient is asymptomatic phenotype

Laboratory finding in β -Thalasseamia minor (trait)

1-CBC		2-Blood film:	3-Hb electrophoresis, the result may be as follow:	
Hb	8-10g/dl	1. microcytic, hypochromic 2. Target Cells, 3. Basophilic Stippling,	HbA	Over 60%
RBC c	>5.5 million /L		HbA2	4-7% It is the diagnostic test
MCV	50-70FL		HbF	Normal
RDW	Normal			
Retic-count	Mild raised			

Diagnostic tests:

-Hb Electrophoresis result indicate presence of HbA2 about 4-7%

-DNA analysis searching for the β genes on the chromosome 11 (three are absence of one beta chains)