

SYSMEX Hematology Analyzer

Patient Name:

ID.NO:

3

Date: 96/ 7/ 2

Doctor:

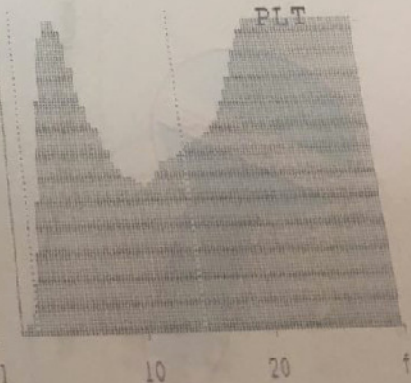
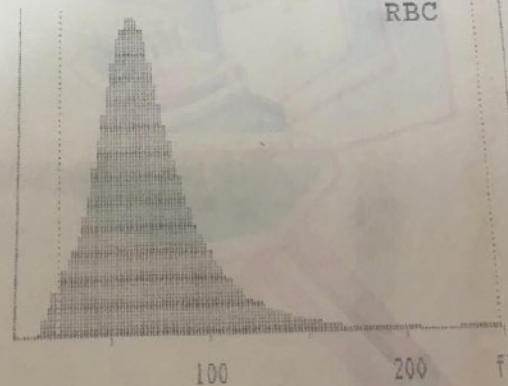
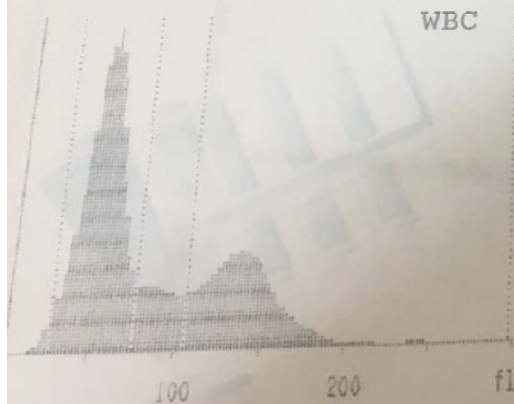
Sex/Age: *محمد اسدي*

Time: 9:27

WBC 19.6 $\times 10^3/\mu l$ [4-10]
 Lymph 56.5 %
 Neut 32.0 %
 Mixed* 11.5 %
 *(Mono+Eos+Baso)

RBC 3.25 $\times 10^6/\mu l$ [3.9-5.8]
 HGB 6.9 gr/dl [12-17]
 HCT 22.7 % [36-53]
 MCV 69.8 fl [80-100]
 MCH 21.2 pg [27-32]
 MCHC 30.4 gr/dl [31-36]
 RDW-CV 30.4 % [11.5-15]
 RDW-SD 72.4 fl [40-53]

PLT 245 $\times 10^3/\mu l$ [150-450]
 PDW ---.--- fl [9.8-17]
 MPV ---.--- fl [8.6-12.7]
 P-LCR ---.--- % [17-47]



Comments:

Signature:

7 months/old/ male

Ginny

94, 9, 2A

ID Patient 96-06-6023
Department

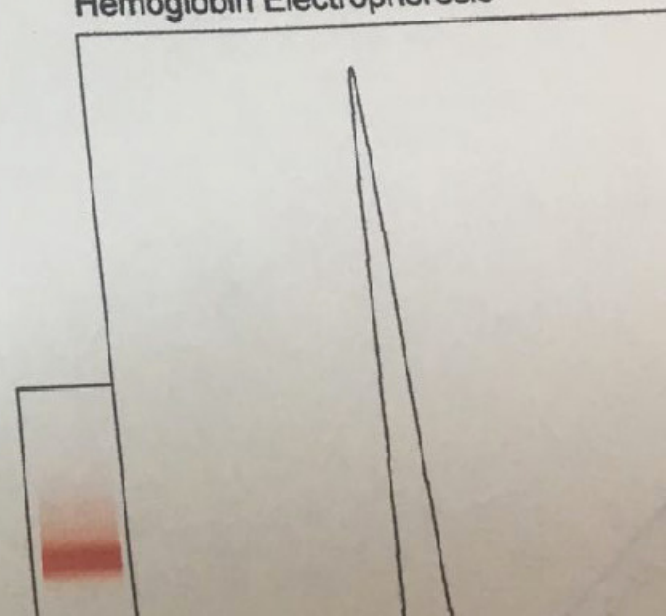
Strip Id:

Hemoglobin Electrophoresis

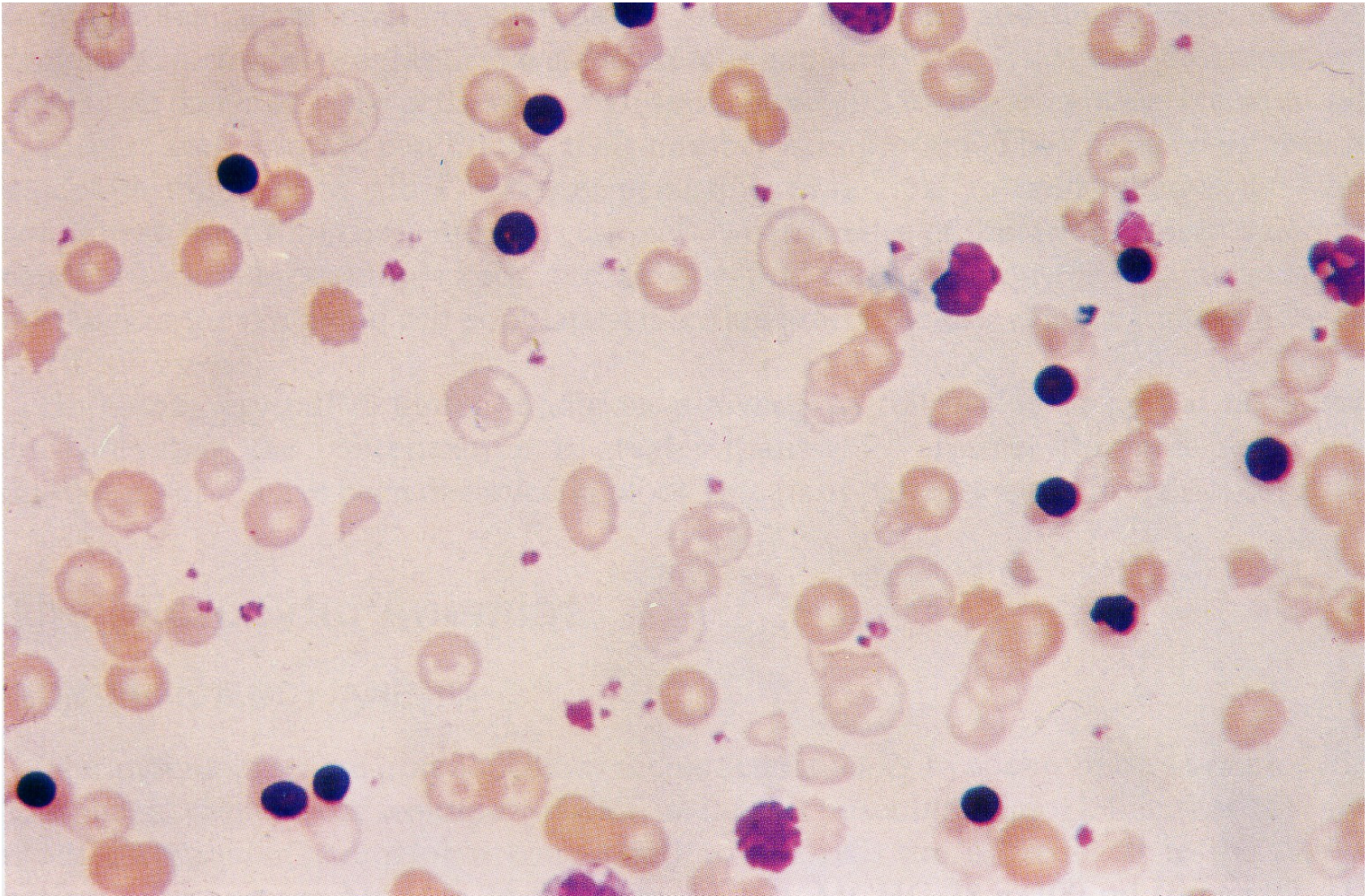
%	% N
96.9	96
0.6	0
2.5	1

7.5↑ 0.0- 0.0

Reviewed by:



Thalassemia major

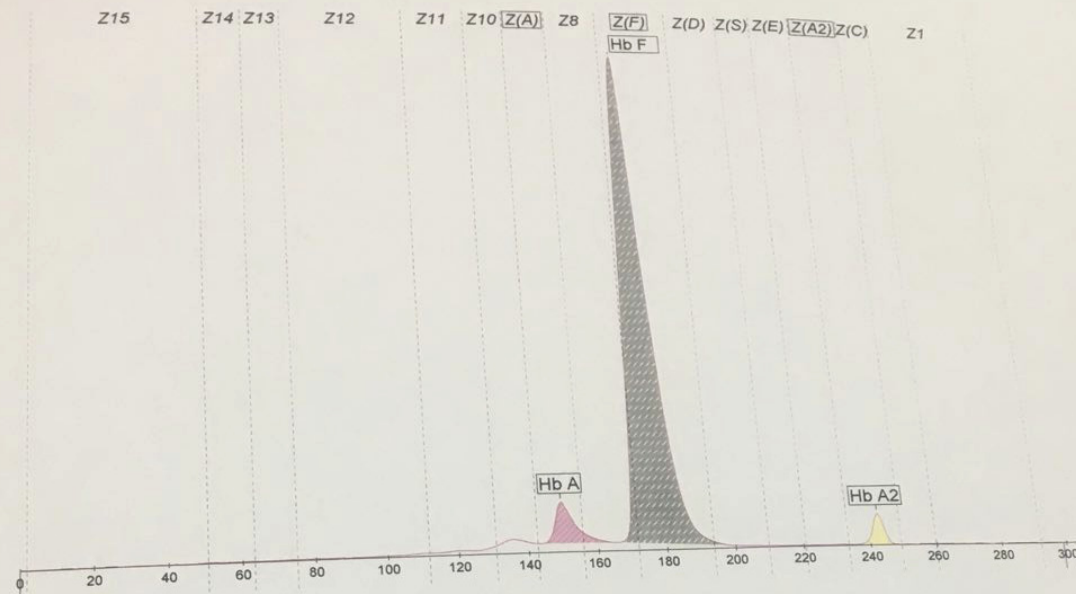


sebia

آزمایشگاه بیمارستان حضرت علی اصغر (ع)
زاهدان - خیابان آزادی - تلفن: ۳۲۲۹۶۸۸

Name:
Mahdiyar Estandi
Date : 24/9/17

Sex:
Age :
Sample # : 22



Hemoglobin Capillary Zone Electrophoresis

Name	%	Normal Values %
Hb A	5.5	
Hb F	91.8	
Hb A2	2.7	

Sebia

آزمایشگاه بیمارستان حضرت علی اصغر (ع)

زاهدان - خیابان آزادی - تلفن: ۳۳۲۹۶۸۸

SYSMEX Hematology Analyzer

Patient Name:

ID.NO: 41

Date: 16/

Doctor:

Sex/Age:

Time: 10:46

WBC 7.7 $\times 10^3/\mu\text{l}$ [4-10]
Lymph 61.6 %
Neut 23.8 %
Mixed* 14.6 %
*(Mono+Eos+Baso)

RBC 3.35 $\times 10^6/\mu\text{l}$ [3.9-5.8]
HGB 7.0 gr/dl [12-17]
HCT 23.1 % [36-53]
MCV 69.0 fl [80-100]
MCH 20.9 pg [27-32]
MCHC 30.3 gr/dl [31-36]
RDW-CV 35.5 % [11.5-15]
RDW-SD --- fl [40-53]

PLT 266 $\times 10^3/\mu\text{l}$ [150-450]
PDW --- fl [9.8-17]
MPV --- fl [8.6-12.7]
P-LCR --- % [17-47]

WBC

RBC

PLT

Hemoglobin Capillary Zone Electrophoresis

Name	%		Normal Values %
Hb A	42.5	<	95.5 - 98.5
Hb F	53.9	>	=< 2.0
Hb A2	3.6	>	2.0 - 3.5

4 yr/old female,
splenomegaly(+),
no history of blood
Tx.

تاریخ جواب: ۱۳۹۹/۰۹/۲۵

تاریخ پذیرش: ۱۳۹۹/۰۹/۲۴

کودک محمد ایوب یارمحمدزانی سن: ۱ سال
 کد: 99/33454 پزشک: جناب آقای دکتر قاسم میری

Hematology

Hematology

CBC*

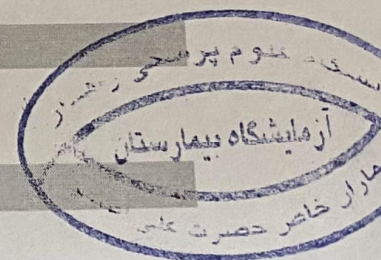
Test	Result	Units	Reference Range	Differential	Result
W.B.C	28.0 H	*1000/micL	4-10	Neutrophils	*00.0
R.B.C	3.51	Mil C/micL		Mixed Cell(Eos.Bas.Mono.)	*00.0
Hb	7.1	gr/dl		Lymphocyte	66.1
Hct	22.4	%			
M.C.V	63.8 L	fl	80-96		
M.C.H	20.2 L	pg	27-33		
M.C.H.C	31.7 L	gr/dl	33-36		
R.D.W	40.6 H	%	10-13.5		
Platelet	1156 H	*1000/micL	140 - 450		

Hematology

RDW_SD	*00.0	fl	37-54
PDW	*00.0	fl	9-17
MPW	*00.0	fl	9-13
P-LCR	*00.0	%	13-43

Comment : 1399/09/24 18:52 زمان تکمیل جواب

Comment : L : Low H : High



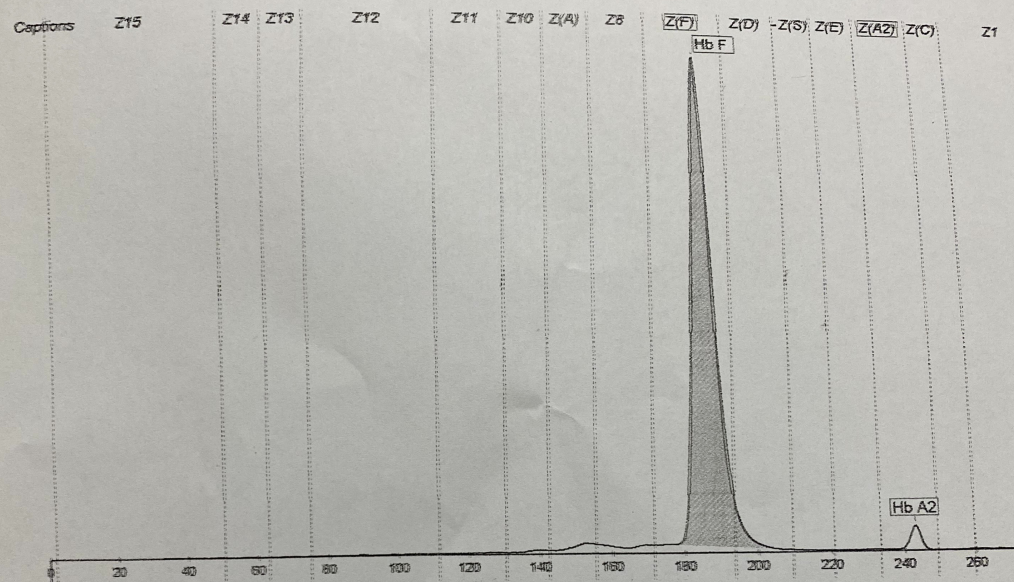
Name: Anas Eim

ID : 2033

Sex: F

Sample Num: 12

Date : 5/4/2020

Haemoglobin Capillary Electrophoresis

Name	%
------	---

Hb F	97.6
------	------

Hb A2	2.4
-------	-----

Normal Range (%)

Hb A 96.5 - 98.5

Hb F ≤ 2

Hb A2 1.5 - 3.5

Comments:

6 years old boy, no history of Tx

SYSMEX Hematology Analyzer

Patient Name: علي محمد الربيع ID.NO: 24 Date: 97/ 9/20

Doctor: Sex/Age: 6 yr Time: 9:54

WBC	8.9	$\times 10^3/\mu\text{l}$ [4-10]	RBC	4.00	$\times 10^6/\mu\text{l}$ [3.9-5.8]	PLT	296	$\times 10^3/\mu\text{l}$ [150-450]
Lymph	53.0	%	HGB	7.4	gr/dl [12-17]	PDW	---	fl [9.8-17]
Neut	---	%	HCT	23.6	% [36-53]	MPV	---	fl [8.6-12.7]
Mixed*	---	%	MCV	59.0	fl [80-100]	P-LCR	---	% [17-47]
*(Mono+Eos+Baso)			MCH	18.5	pg [27-32]			
			MCHC	31.4	gr/dl [31-36]			
			RDW-CV	28.8	% [11.5-15]			
			RDW-SD	---	fl [40-53]			

WBC RBC PLT

دائرة المختبر
مستشفى
الرياض
97/ 9/20

آزمایشگاه بیمارستان علی اصغر (ع) زاهدان

تاریخ جواب: ۱۳۹۷/۰۹/۲۲

تاریخ پذیرش: ۱۳۹۷/۰۹/۲۰

سن: ۶ سال

آقای علی اصغر اربابی

کد: 97/33583 پزشک: جناب آقای دکتر

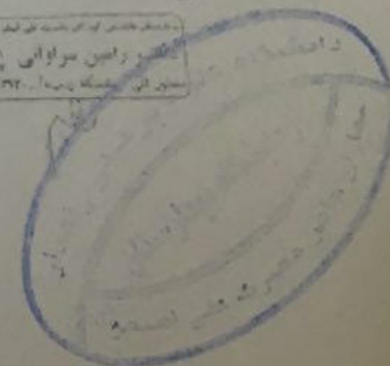
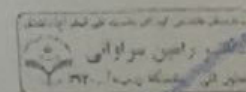
Hormone

Ferritin 325 ng/ml ECL

Hormones and immunologic tests done by fully automated electro chemiluminescence (ECL) cobase e 411

Comment: زمان تکمیل جواب 1397/09/20 13:26

Best regards, Dr saravani



sebia

آزمایشگاه بیمارستان حضرت علی اصغر (ع)
زاهدان - خیابان آزادی - تلفن: ۳۲۲۹۶۸۸

Name: *Ali asghar Arba*

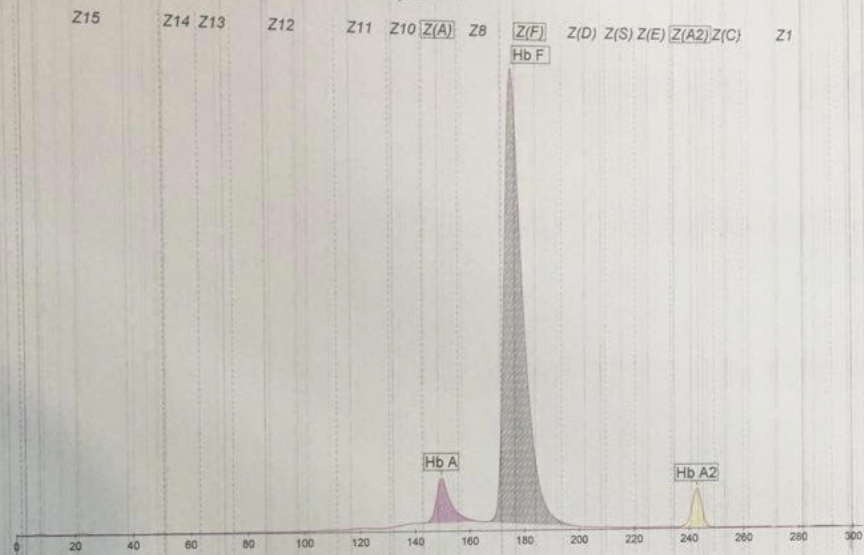
Rack: SEBIA Pos.: 7

Date : 11/12/18

Sex:

Age :

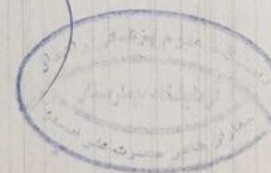
Sample # : 15



Hemoglobin Capillary Zone Electrophoresis

Name	%	Normal Values %
Hb A	6.6	
Hb F	89.4	
Hb A2	4.0	

Comment:



Treatment

- Transfusions
- Iron chelation
- Splenectomy
- Folic acid
- BMT

Course and treatment of thalassemia

Untreated

❖ β thalassemia Major :

Death in first or second decade of life

❖ **Intermedia**: variable life span

❖ **Minor/Minima**: Normal life span

For deciding whom to transfuse

- **Confirmed laboratory diagnosis of thalassaemia major**
- **Laboratory criteria:**
 - Hb < 7g/dl on 2 occasions, > 2 weeks apart (excluding all other contributory causes such as infections) or
- **Laboratory and clinical criteria, including:**
 - Hb > 7g/dl with: - Facial changes - Poor growth - Fractures, and - Extramedullary haematopoiesis

Compatibility testing

- Development of one or more specific red cell antibodies (alloimmunisation) is a common complication of chronic transfusion therapy
- Anti-E, anti-C and anti-Kell alloantibodies are the most common.
- *Before the first transfusion, patients should have extended red cell antigen typing that includes at least C, c, E, e and Kell*
- *All patients with thalassaemia should be transfused with ABO and Rh(D) compatible blood*

بسمه تعالی

سازمان انتقال خون ایران

اداره کل منطقه ای آموزشی استان سیستان و بلوچستان
S&b Educational Regional Blood Transfusion Center



سازمان انتقال خون ایران

شماره: ۲/۱۰۱۳۲۹۷

تاریخ: ۹۴/۰۲/۲۷

پیوست:

همکار ارجمند جناب آقای دکتر میری علی آباد

باسلام

احتراماً نتایج آزمایش نمونه آقای حارث اقبالی قنبرزهی به شرح ذیل اعلام می گردد:

نام بیمار	ABO	Rh (D)	Antibody Screen result	DAT									
متولد				Anti-IgG + Anti- C3d	-								
حارث اقبالی قنبرزهی	B	POS	-	-	-								
1395				-	-								
Auto Antibody	-												
Patient phenotype	K	E	e	C	c	M	N	Fya	Fyb	JKa	JKb	S	s
	0	0	+	+	0	+	+	+	0	0	+	0	+

توضیحات مهم:

۱- در صورت نیاز به تزریق خون Crossmatch ABO&Rh compatible , c negative, E negative, K negative , Leukoreduced RBCs through AHG

۲- جهت ارسال نتیجه تأییدیه آزمایش فنوتیپ بیمار پیشنهاد می گردد سه ماه بعد یا قبل از تاریخ بعدی تزریق خون، بیمار به سازمان انتقال خون مراجعه فرماید.



دکتر سهیلا خسروی

مدیرکل انتقال خون استان سیستان و بلوچستان

اهداء خون سالم اهداء زندگی



www.sbbto.ir
ISO 9001:2008

رس: زاهدان، خیابان آزادی تقاطع مصطفی خمینی، کدپستی ۹۸۱۳۶۵۳۴۱۵، ص پ ۱۷
دورنگار: ۳۳۲۶۰۵۰۰
فک: ۳۳۲۲۹۹۹۹ - ۳۳۲۲۰۰۰۰

- the use of blood that is also **matched for the C, E and Kell antigens is highly recommended** in order to avoid alloimmunisation
- *Before each transfusion it is necessary to perform a full crossmatch and screen for new antibodies*
- Transfusion from first degree relatives should be avoided.



What to transfuse

- Patients should receive transfusions of PRBC, preferably not more than 7 days old.
- Patients should not be given packed red cells more than two weeks old.



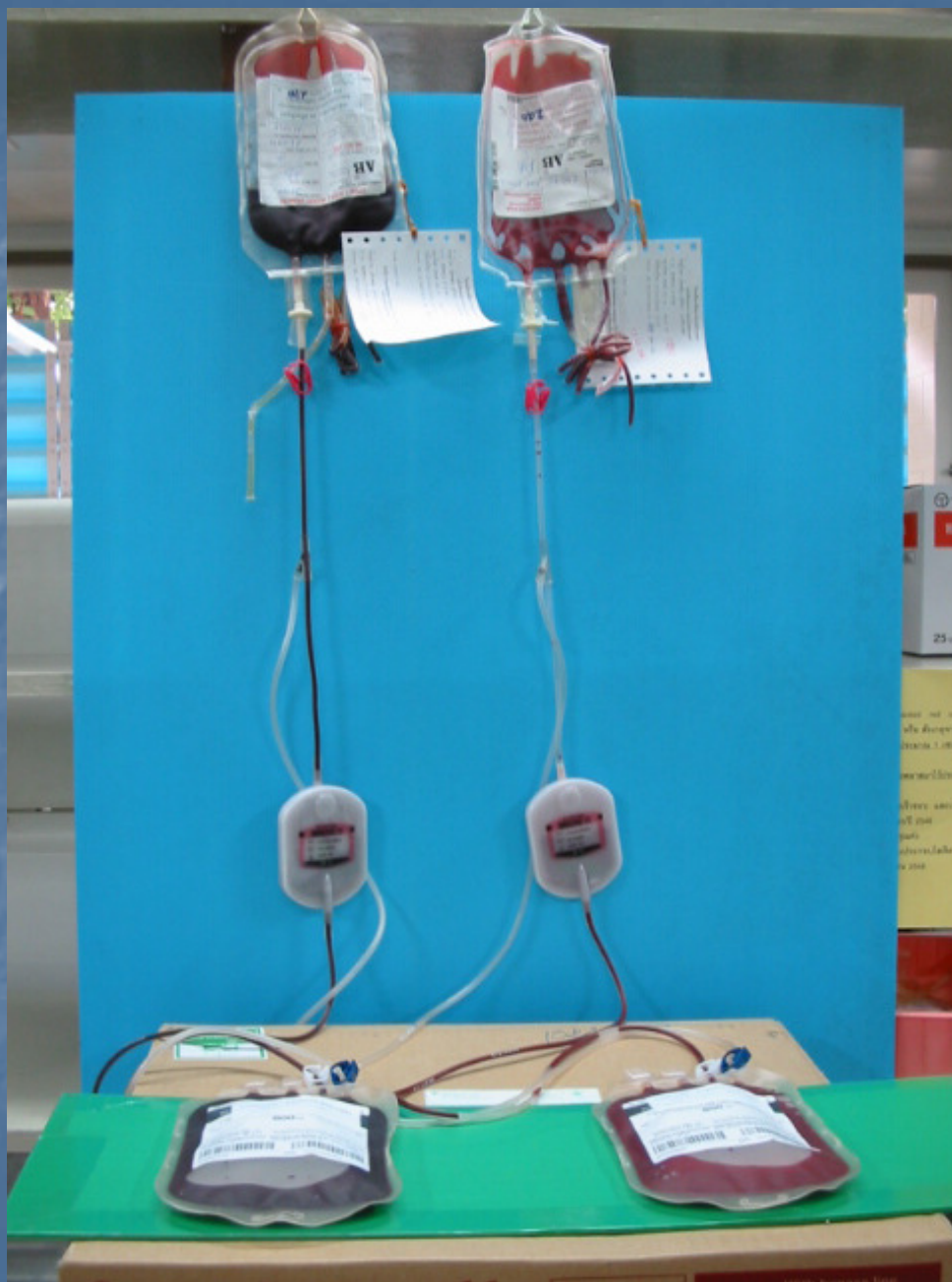
Transfusion programmes

- *The recommended treatment: lifelong regular blood Tx, usually every 2-5 weeks, to maintain the pre-Tx Hb level above 9-10.5 g/dl.*
- *The rate of fall in levels of Hb, which should not exceed 1g/dl/week in splenectomised patients and 1.5g/dl/week in non-splenectomised patients.*

Recommended blood product

- *Patients with TM should receive **leucoreduced** packed RBC*





Increased transfusion requirements

- 1) *Alloimmunisation (Alloantibody)*
- 2) *Autoantibody*
- 3) *Hypersplenism ☹*
- 4) *Poor quality blood (eg. Low HCT)*
- 5) *Infection (eg. HPV-B19)*
- 6) *Bleeding*
- 7) *Use of medication (e.g. ribavirin)*



- A higher target pre-transfusion Hb level of 11-12 g/dl may be appropriate for patients with heart disease or other medical conditions and for those patients with inadequate suppression of bone marrow activity at the lower Hb level.
- *The post-transfusion Hb should not be greater than 14-15g/dl*

Blood products for special patient populations

- **Washed red cells**
to remove the maximum amount of plasma and proteins.



they usually have to be used within 24 hours.

- **Frozen RBC**
- **Irradiated RBC**



Indications for regular Tx in TI

- Growth failure
- Cosmetic facial abnormalities
- Bone abnormalities
- Massive splenomegaly
- Hypersplenism
- Progressive anemia, fatigue
- Cardiopulmonary complications

transfusion reactions

- *Acute reactions*
- *Hemolytic(Intravascular)(AHTR)*
- Febrile non hemolytic transfusion reactions
- Anaphylactic transfusion reactions
- Allergic reactions
- Transfusion Related Acute Lung Injury(TRALI)
- *Delayed reactions*
- *Hemolytic(Extravascular), DHTR*
- Post-transfusion purpura(PTP)
- GVHD
- Transfusion associated circulatory overload (TACO)
- Iron Overload
- Infectious Complications

Acute Hemolytic Transfusion Reaction





complications

Usually due to iron overload

- Cardiac complications
- Liver disease
- Endocrine dysfunction (diabetes, hypothyroidism, hypoparathyroidism, growth retardation, hypogonadism)
- Failure of compliance with chelation regimen
- Spontaneous bone fractures
- hypersplenism
- Extra-medullary hematopoiesis
- Gallstones
- Leg ulcers
- Blood born infections (HIV, Hepatitis, etc)
- Transfusion reactions (errors)

Iron Loading From Blood Transfusions

- 1 unit of blood contains approximately 200 mg of iron
 - Normally, total body iron is approximately 3 to 4 g
 - Chronic transfusion-dependent patients have an iron excess of 0.3 to 0.7 mg/kg/day, equivalent to 4 to 10 g of iron per year
- Iron accumulates with repeated blood transfusion

Initiation of Therapy for Iron Overload

- Chelation treatment is generally initiated **after 10 to 20 transfusions** or when serum **ferritin > 1000 µg/L**
- Alternatively, if iron loading is unclear, **LIC** may be measured

3 major classes of iron chelators:

❖ Hexadentate (**deferoxamine** [DFO], Desferal), in which 1 atom of iron is bound to 1 DFO molecule

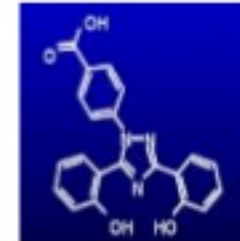
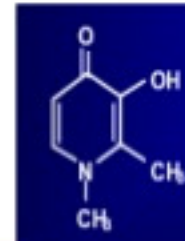
❖ bidentate (**deferiprone**, L1 [DFP]), in which 1 atom of iron is bound to 3 DFP molecules

DFP (L1) is a synthetic compound **originally** identified in the 1980s in **London**, hence the designation **L1**

tridentate (**deferasirox** [DFX], Exjade), in which 1 atom of iron is bound to 2 DFX molecules,
DFX, approved in 2005 for use in transfusional overload patients



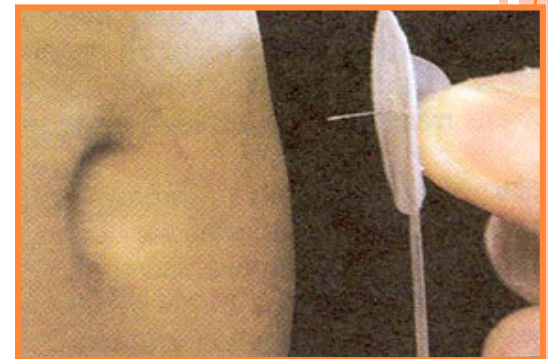
Iron Chelators



	Deferoxamine	Deferiprone	Deferasirox
Brand Name	Desferal	Ferriprox	Exjade
Half-life	20 minutes	2-3 hours	8-16 hours
Route	SQ, IV infusion	PO	PO
Dose (mg/Kg/d)	20-60	75-100	20-40
Frequency	5-7 days/week	3 times daily	Once daily
Iron Excretion	Urine/Stool	Urine	Stool
Side Effects	Vision, Hearing, Growth, Local Reactions, Allergy	Gastro-intestinal symptoms, Kidney dysfunction, Hepatitis	Gastrointestinal symptoms, agranulocytosis/ neutropenia, Arthralgia

DESFERRIOXAMINE

- Clinical use: Since 1970's
- Available for > 4 decades with improving survival
- not absorbed from gut
- Short half-life (20 min), so must be given by continuous infusion
 - 8–12 h/d, 5–7 d/w (40–50 mg/kg SC)
- Commenced after 10–20 transfusions or when ferritin >1000 µg/L
- Audiometric, retinopathic, and growth effects at high doses and low iron loading
- Compliance often is poor, leading to variable outcome



Courtesy of Dr. J. Porter





SIDE EFFECTS OF DESFERRIOXAMINE

- Retinopathy , night blindness, colour vision, visual field, Visual Acuity
- Ototoxicity : high frequency SNL, tinnitus, deafness
- CNS, coma
- Growth retardation

- Bony changes
- Yersinia infection
- Sensitivity



TOXICITY OF DEFEROXAMINE

- Local erythema ,painful subcutaneous nodule at infusion site
- Allergic reaction
- Neurosensory toxicity
 - high frequency hearing loss
 - night & color blindness
- Cartilagenous dysplasia: interfere linear growth



راست

چپ

روز دوم →

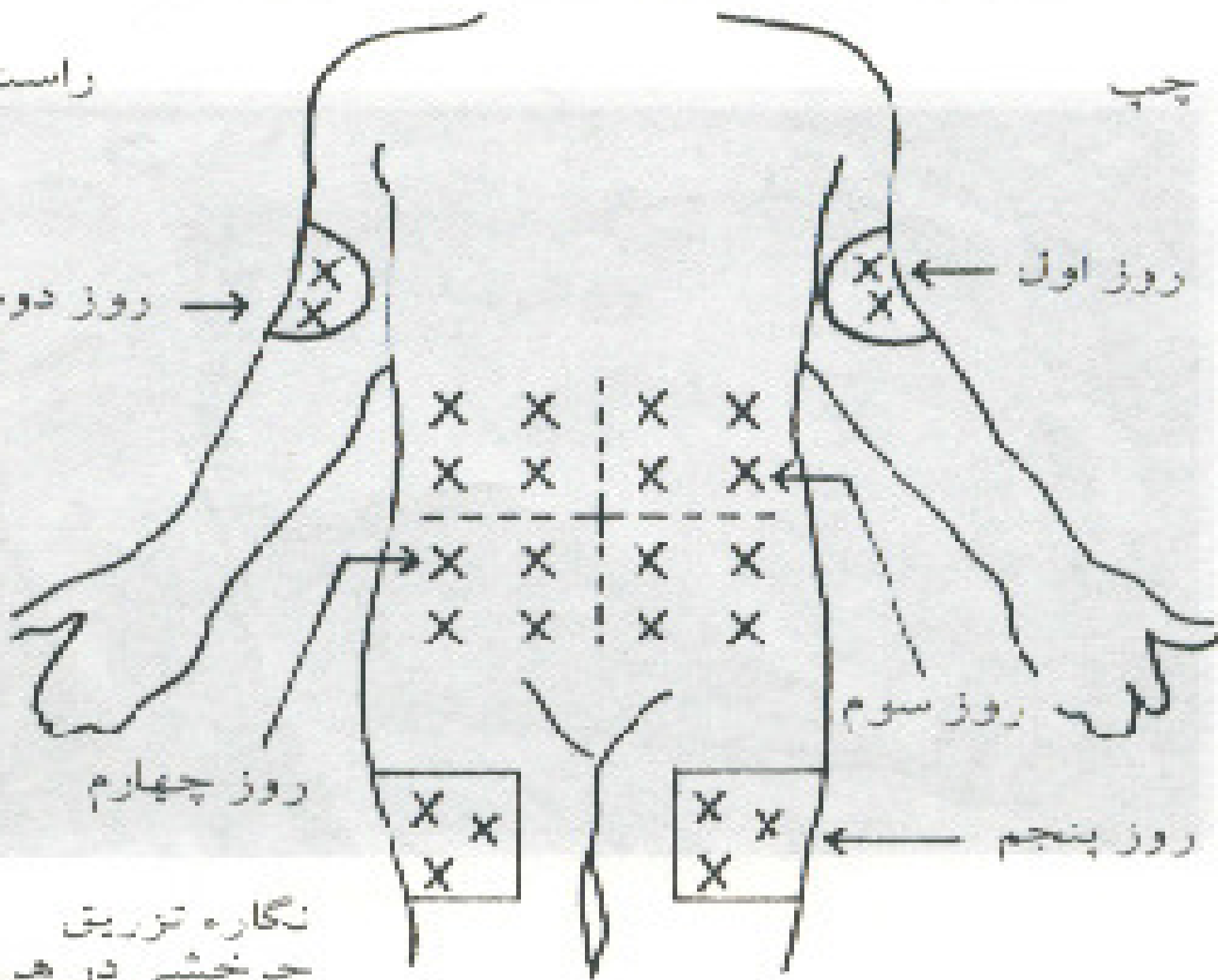
روز اول ←

روز سوم

روز چهارم

روز پنجم ←

نگاره تزئینی
چرخشی در هر ماه



DEFERIPRONE

○ History

- Patented 1982; licensed in EU 1999

○ Pharmacology

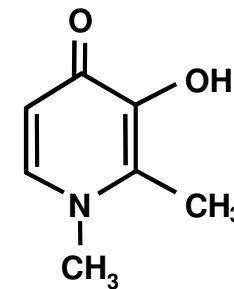
- Bidentate, short plasma half-life — given TID
- Urine excretion

○ Efficacy

- Indicated for *treatment of iron overload in patients with thalassaemia major when desferrioxamine therapy is contraindicated or inadequate*
- May be less effective than desferrioxamine in reducing LIC
- Possible cardioprotective effect

○ Side effects

- Neutropaenia/agranulocytosis (weekly neutrophil count recommended)
- Nausea, vomiting, abdominal pain
- Arthralgia and arthritis



EU = European Union; LIC = liver iron concentration.



DEFERIPRONE: *SUMMARY*

○ Advantages

- Orally active
- Enhanced removal of cardiac iron
- Increased effectiveness when combined with desferrioxamine

○ Disadvantages

- Short plasma half-life and rapid inactivation by metabolism
- Administered 3 times daily—may negatively impact patient compliance and outcome
- May not achieve negative iron balance at 75 mg/kg/day
- Risk of agranulocytosis and need for weekly blood counts



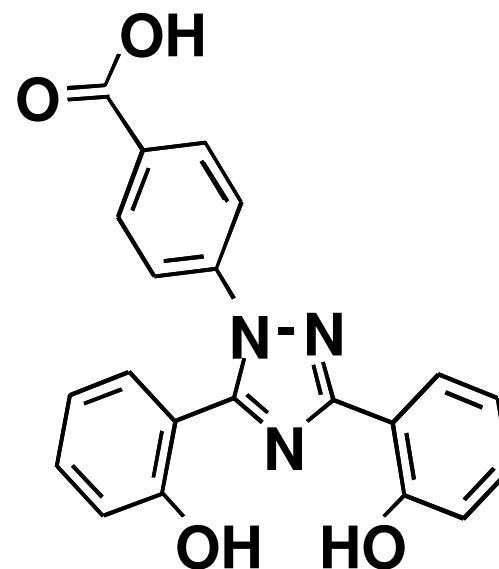
EFFECTS OF MONOTHERAPY AND COMBINED THERAPY

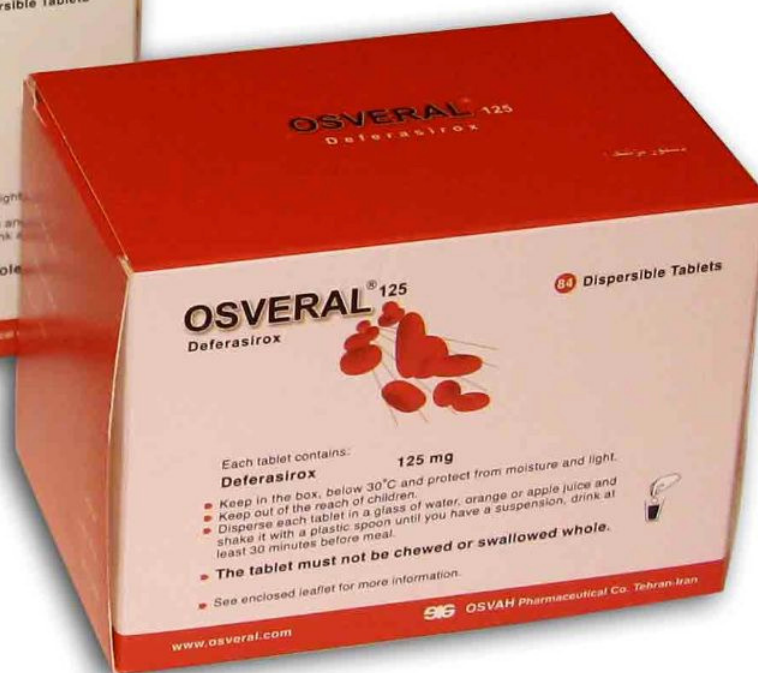
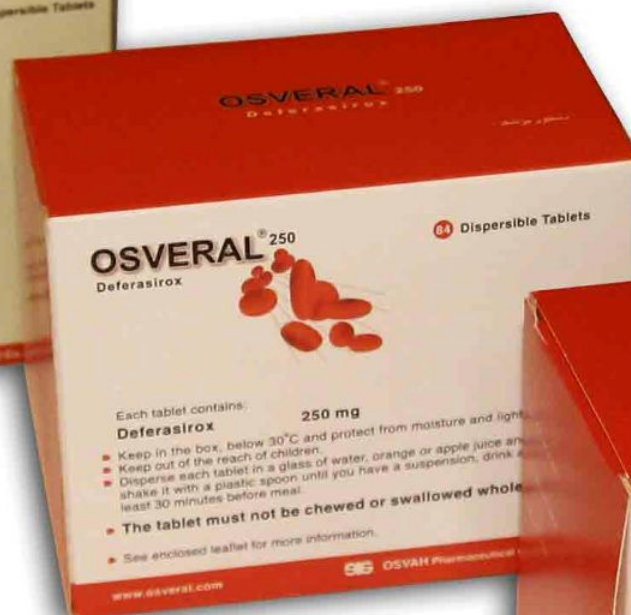
- DFO 40 mg/kg/d given at night
 - No protection during the day
- DFP 75 mg/kg/d given during the day
- DFO 40mg/kg/d given at night + DFP 75 mg/kg/d given during the day
 - Provides 24 hour protection



DEFERASIROX (EXJADE, OSVERAL, DEFERAZEX, JADENU, NANOJADE, AVESIROX)

- Half-life of 8 to 16 hours supports once-daily dosing
- Primarily excreted in faeces
- Given as once-daily drink







INITIAL DOSING

- Initiate therapy after the transfusion of approximately 20 U (equivalent to 100 mL/kg) of PRBC or when there is evidence from clinical monitoring that iron overload is present (e.g., the serum ferritin level is $> 1000 \mu\text{g/L}$)
- The recommended initial daily dose is 20 mg/kg
- An initial daily dose of 30 mg/kg may be considered for patients with severe iron overload (e.g., serum ferritin $> 2500 \mu\text{g/L}$)



SIDE EFFECTS

- GI side effects
- Skin rash
- increases in serum Cr
- increases in transaminases
- Proteinuria



MONITORING OF THERAPY

- Ferritin: monthly
- Bun, Cr: monthly
- AST, ALT: monthly
- Urine Random Pro/Cr: monthly



Ineffective
Erythropoiesis

EMH

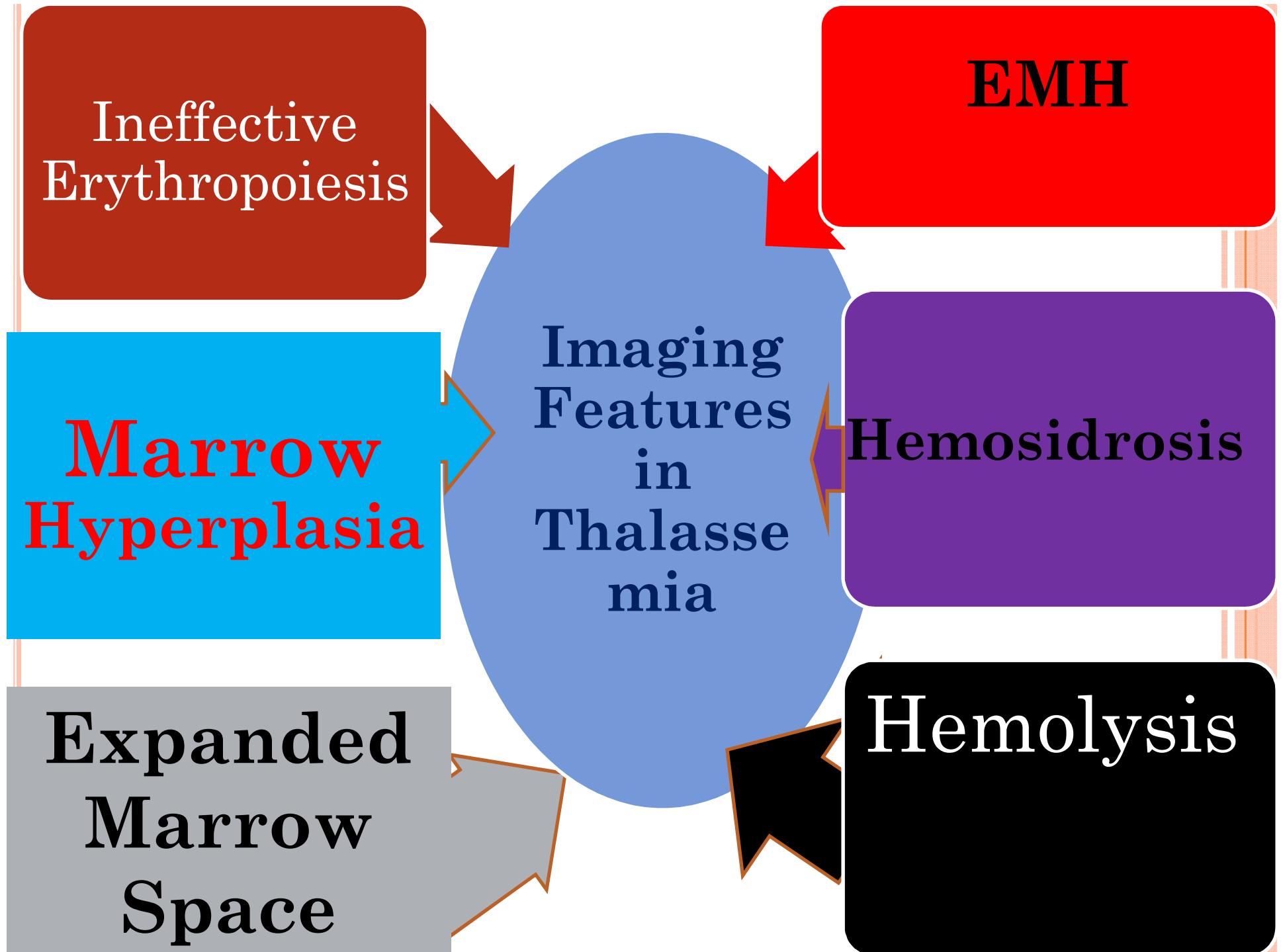
**Marrow
Hyperplasia**

Imaging
Features
in
Thalasse
mia

Hemosidrosis

Expanded
Marrow
Space

Hemolysis



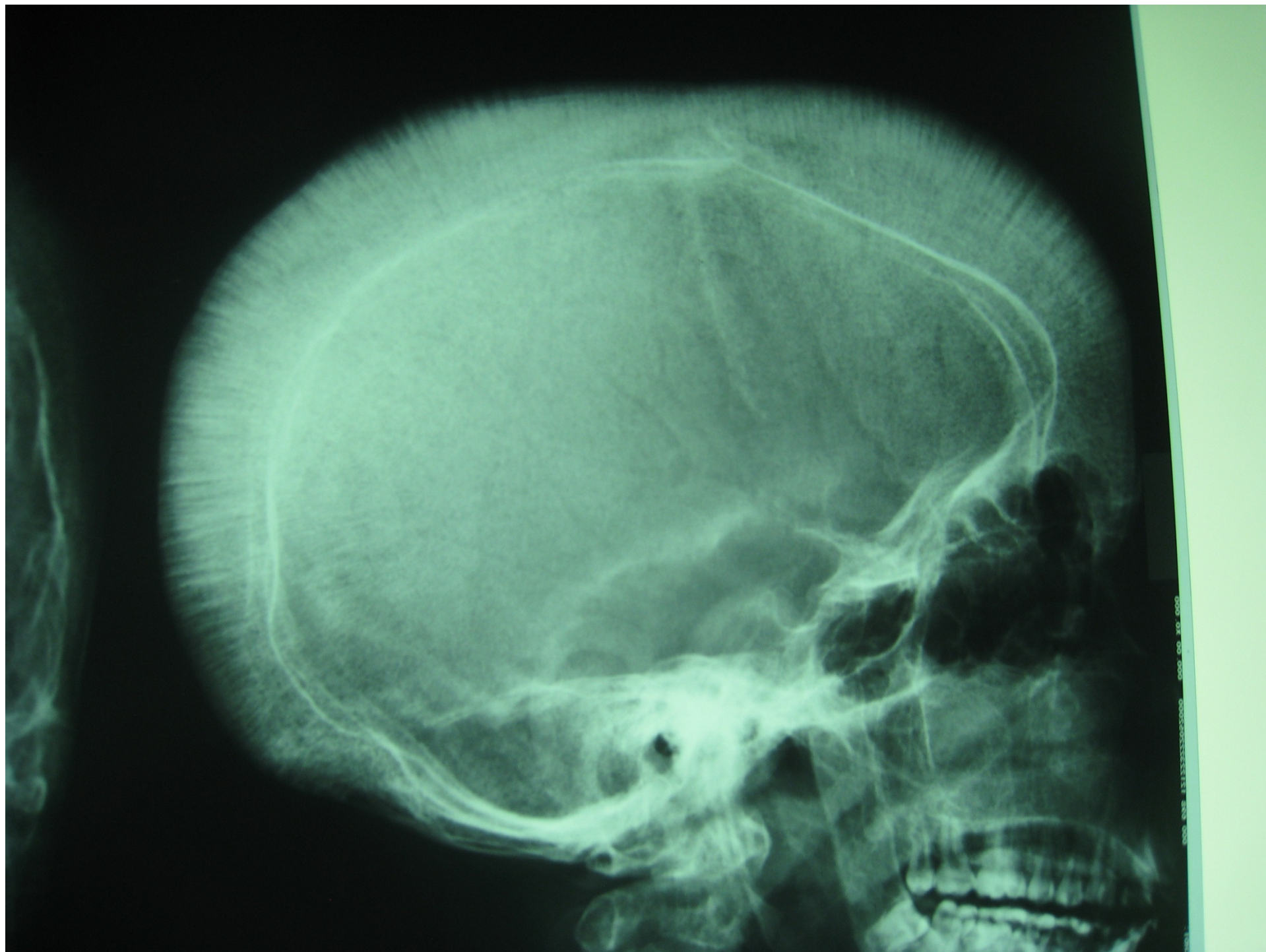
**Skeletal
Imaging
Features in
Thalassemia**

Osteoporosis

**Expansion of
marrow space**

EMH

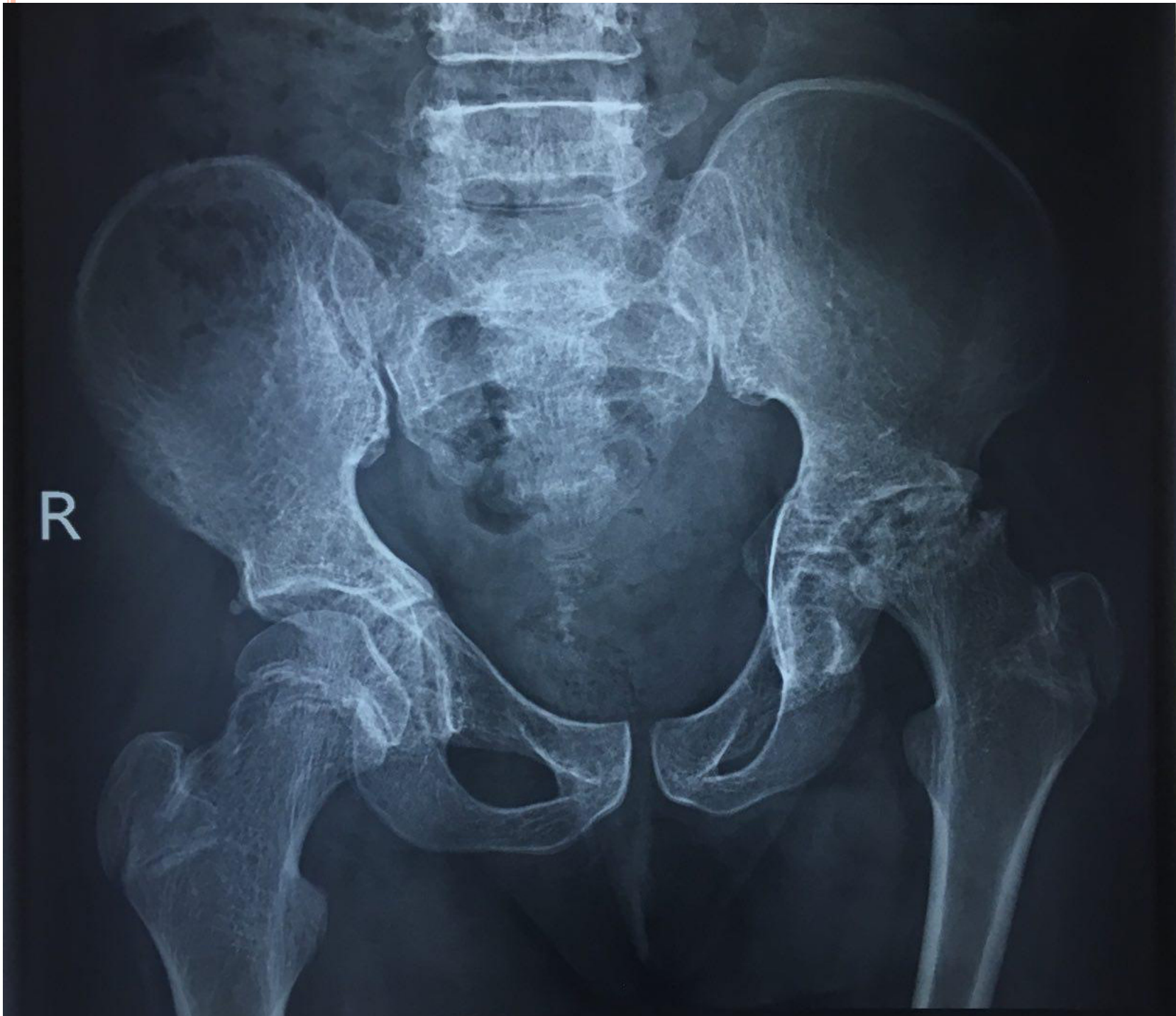
Fracture





Radiological changes in b
thalassaemia intermedia. (a)
Moderate thalassaemic changes in the
hands. (b) The right elbow showing the
lacy appearance of the lower end of
the humerus. (c) Left shoulder
showing severe bone changes. (d)
Pelvis showing bone changes in the
upper end of the femora and femoral
necks and the lacy appearance of the
pelvic bones.



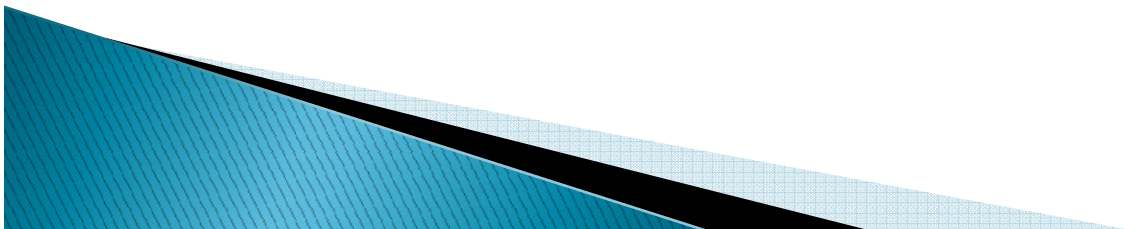


18
YR/O
LD
GIRL



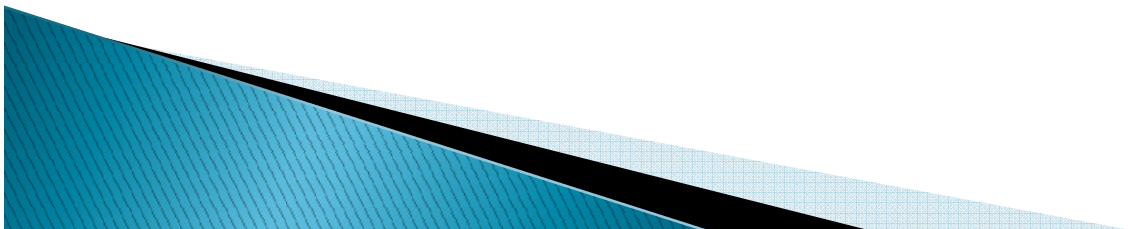
Screening

- ▶ CBC to look for MCV and MCH
 - Will be reduced in both thalassemias (microcytic anemia)
- ▶ Hb Electrophoresis to look for A_2 : Will be elevated in B-thal, normal on A-thal. May also be elevated in HbS

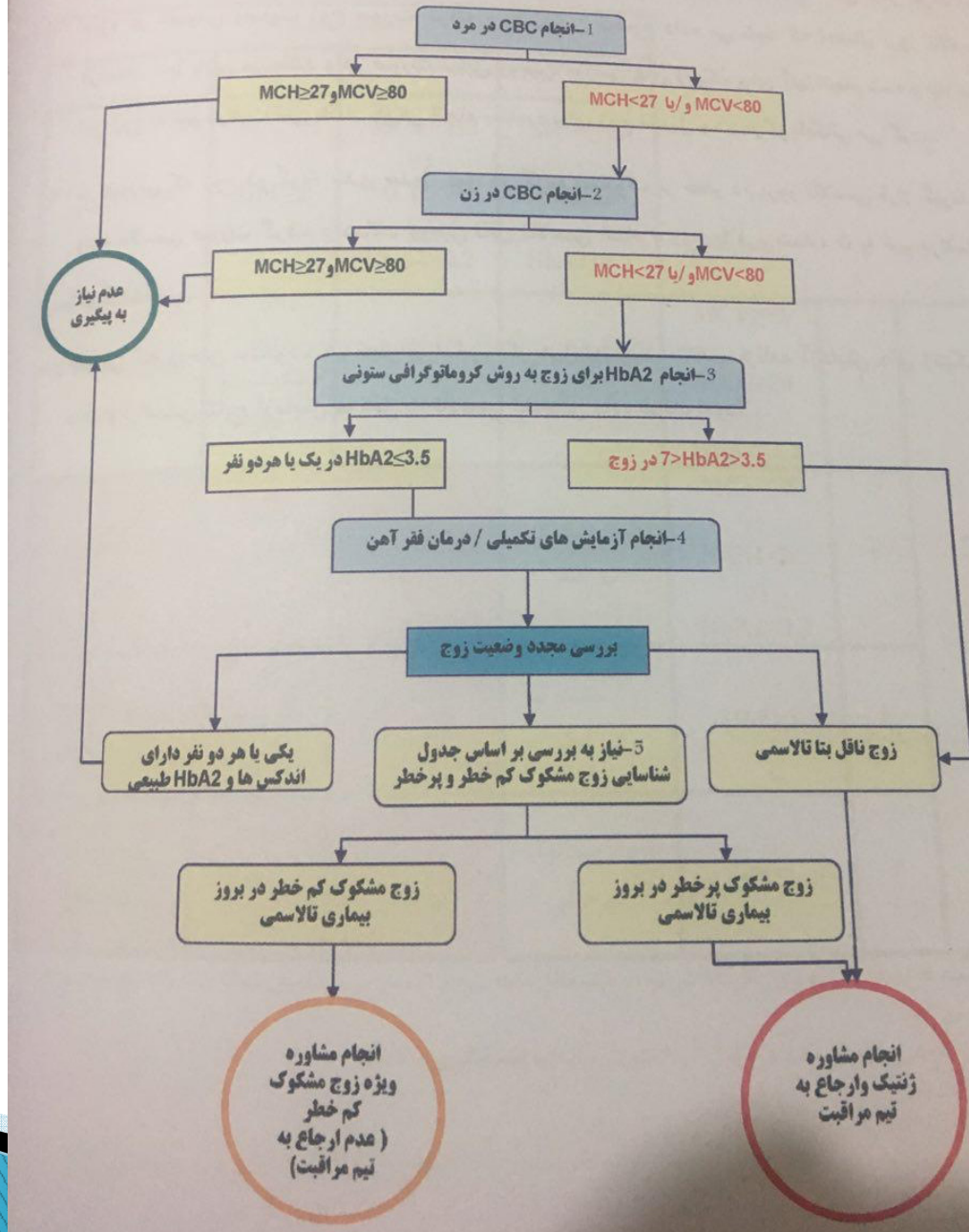


Screening

- ▶ Hb Electrophoresis may also identify abnormal hemoglobins
 - Structural Hb Variants
 - Some Hb Bart's or Hb H
 - Won't find unstable variants except in exceedingly small quantities – may be missed
- ▶ Iron studies to rule out iron deficiency



الگوریتم کشوری مراحل انجام آزمایش های تالاسمی
(جهت شناسایی زوجین ناقل بتا تالاسمی)



جدول شناسایی زوج مشکوک کم خطر و پرخطر در بروز بیماری بتا تالاسمی ماژور

خصوصیات مرد				جدول الف			
۴	۳	۲	۱				
ناقل بتا تالاسمی	$HbF \geq 3$	$MCV < 75$ و/یا $MCH < 26$ و/یا $HbA2 > 3.2$	$MCV \geq 75$ و $MCH \geq 26$ و $HbA2 \leq 3.2$				
*زوج مشکوک کم خطر	زوج مشکوک کم خطر	زوج مشکوک کم خطر	زوج مشکوک کم خطر	$MCV \geq 75$ و $MCH \geq 26$ و $HbA2 \leq 3.2$	۱	خصوصیات زن	
زوج مشکوک پرخطر	زوج مشکوک پرخطر	زوج مشکوک پرخطر	زوج مشکوک کم خطر	$MCV < 75$ و/یا $MCH < 26$ و/یا $HbA2 > 3.2$	۲		
زوج مشکوک پرخطر	زوج مشکوک پرخطر	زوج مشکوک پرخطر	زوج مشکوک کم خطر	$HbF \geq 3$	۳		
*زوج ناقل تالاسمی	زوج مشکوک پرخطر	زوج مشکوک پرخطر	*زوج مشکوک کم خطر	ناقل بتا تالاسمی	۴		

*در این قسمت در صورتی که مرد یا زن ناقل تالاسمی بوده و طرف مقابل سابقه بیماری تالاسمی در خویشاوندان نزدیک داشته باشد زوج بعنوان پرخطر طبقه بندی می گردد.

**زوج ناقل تالاسمی هستند که قبلا در مراحل ۳ و ۴ الگوریتم برای آنها تصمیم گیری شده است.

CBC و الکتروفورز یک زوج قبل از ازدواج را مشاهده کنید

آقا: RBC: 6.9, Hb:15, MCV: 72, MCH: 22

Hb A: 65%, A2: 3%, F:1%, S: 31%

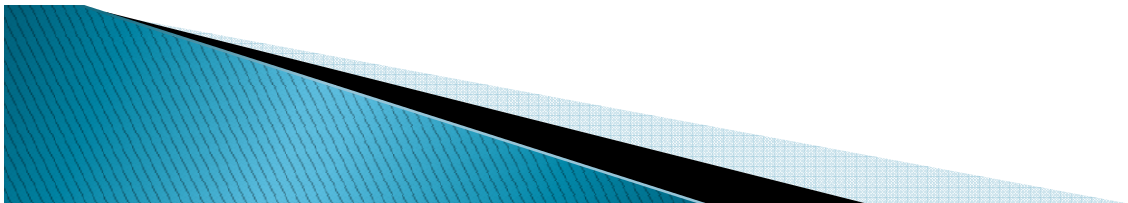
خانم: RBC: 5.09, Hb:11.5, MCV:79, MCH:23

Hb A: 95.8%, A2: 3.7%, F: 0.5

الف تشخیص هر کدام از زوجین چیست؟

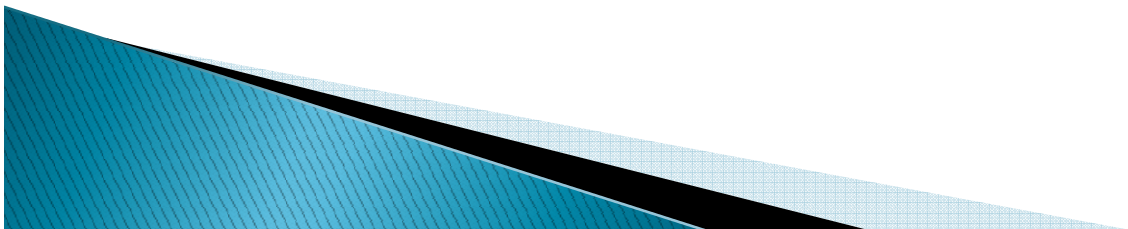
ب چه توصیه برای ازدواج این دو فرد دارید

ج فرزندان این زوج به چه اختلالاتی ممکن است مبتلا شوند(با درصد ذکر شود)



Mutation Identification

- ▶ Not usually a diagnostic tool. You can narrow down the diagnosis well with non-molecular blood testing, smears, etc.
- ▶ Necessary for prenatal diagnosis
- ▶ Helpful in estimating severity

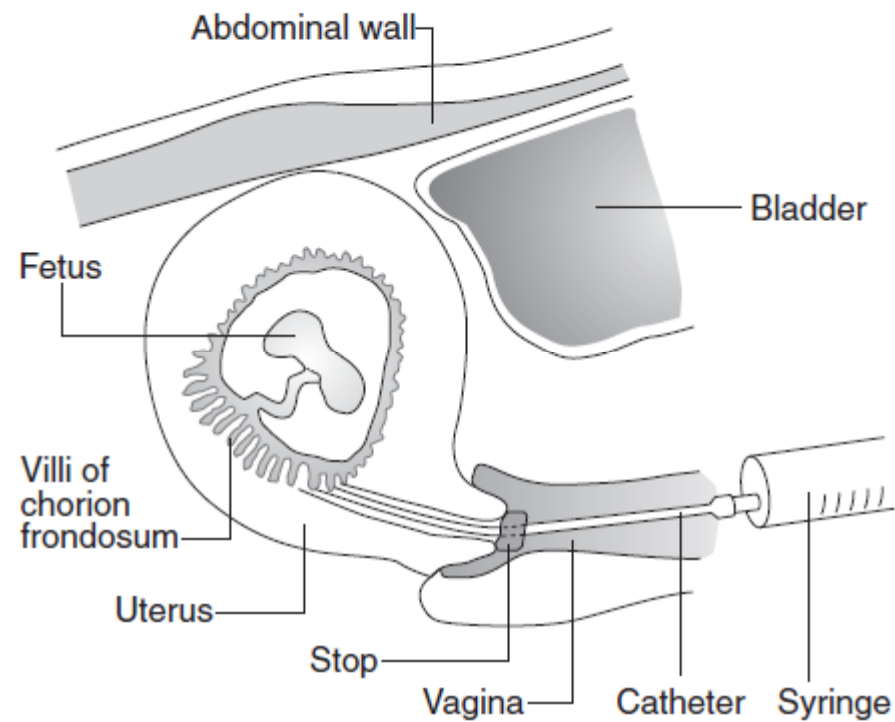


Options for couples at risk for having a child with a severe form of thalassaemia

- ❖ Avoid pregnancy
- ❖ Adoption
- ❖ Risk having an affected child
- ❖ Prenatal diagnosis: termination if fetus is affected
- ❖ Pre-implantation diagnosis
- ❖ Use of egg or sperm donor with normal globin genotype



Chorionic villus sampling



Some characteristic findings in the genetic interactions between β thalassaemia, $\delta\beta$ thalassaemia or hereditary persistence of fetal haemoglobin (A) and the common β -chain variants (B)

(A)		
Thalassaemia type	Homozygote	Heterozygote
β^0 thalassaemia	Thalassaemia major: HbF 98%; HbA ₂ 2%; no HbA	Thalassaemia minor: HbA ₂ 3.7–7.0%; HbF 1–3%; α/β 2.0
β^+ thalassaemia (severe)	Thalassaemia major: HbF 70–95%; HbA ₂ 2%; trace of HbA	Thalassaemia minor: HbA ₂ 3.7–7.0%; HbF 1–3%; α/β 2.0
Mild β^+ thalassaemia	Thalassaemia intermedia to thalassaemia major: HbF 20–80%; HbA ₂ 2–5%	Thalassaemia minor: HbA ₂ 3.5–7.0%; α/β 1.5–2.0
‘Silent’ β thalassaemia	Asymptomatic to mild thalassaemia intermedia: HbF 10–30%; HbA ₂ 2–5%	Usually ‘silent’: HbA ₂ 3.3–3.5%; α/β 1.2–1.5
Normal HbA ₂ β^+ or β^0 thalassaemia	Thalassaemia major: HbA ₂ absent to trace; HbF 95–100%; HbA absent to trace	Thalassaemia minor: HbA ₂ normal; HbF 1–3%; α/β 2.0
Deletion HPFH	Asymptomatic; normal to increased Hb levels with mildly hypochromic microcytic red blood cells; HbF 100%; $\alpha/\gamma \sim 1.5$	Mild anaemia; normal RBC indices; HbA ₂ normal; F-cell distribution–pancellular
Non-deletion HPFH	Asymptomatic; normal Hb levels with normal red blood cell indices; HbF 20–40%; HbA ₂ 1–1.5%; $\alpha/\text{non-}\alpha \sim 1.2$	Normal to mild anaemia; borderline red blood cell indices; HbA ₂ normal; F-cell distribution–pancellular
$\delta\beta$ thalassaemia	Mild anaemia to thalassaemia major: hypochromic microcytic red blood cells; HbF 100%; α/γ 2.5–5.0	Mild anaemia; hypochromic microcytic red blood cells: HbA ₂ normal; HbF 5–20%; F-cell distribution–heterocellular
Hb Lepore	Severe thalassaemia intermedia to thalassaemia major: HbF 80%; Hb Lepore 20%	Thalassaemia minor: Hb Lepore 8–20%; HbF 2–4%

Some characteristic findings in the genetic interactions between β thalassaemia, $\delta\beta$ thalassaemia or hereditary persistence of fetal haemoglobin (A) and the common β -chain variants (B)

(B)		
HbS/ β^0 thalassaemia	Sickle-cell anaemia	HbS 75–100%; HbF 0–20%; HbA ₂ 4–6%; no HbA
HbS/ β^+ thalassaemia (severe type)	Sickle-cell anaemia	HbS 50–80%; HbF 0–20%; HbA 10–30%; HbA ₂ 4–6%
HbS/ β^+ thalassaemia (mild type)	Sickle-cell trait	HbS 50–65%; HbA ~ 25%; HbA ₂ 4–6%; HbF ~ 5%
HbE/ β^0 thalassaemia	Thalassaemia intermedia to thalassaemia major	HbE 30–40%; no HbA, rest HbF
HbE/ β^+ thalassaemia	Thalassaemia intermedia to thalassaemia major	HbE 50–70%; HbF 15–30%; HbA trace to 10%





