

Chapter 3

Results

Thirty-nine thalassemic patients were screened. Four patients were subsequently not fit in the hemoglobin typing criteria which came out one week later. The patients excluded were one B-thalassemic homozygote, one AE bart and two hemoglobin H disease. Thirty-five patients remained and was used for the analysis. No patient was ruled out because of concomitant iron deficient anemia, systemic illness etc.

Twelve were male, twenty three were female. The mean age was 25.9 years. (range 14-52 years). Fourteen cases were splenectomized 14 \pm 7 years ago (range 2-27 years). Descriptive characteristics of 35 cases of B-thal/HbE patients was illustrated in Table 4.1 through 4.5

Table 4.1 Demographic data of 35 B-thal/HbE patients

age (yr)	25.9 \pm 8 (14-52)
sex	male 12 female 23
height (cm)	152 \pm 9 (125-167)
weight (kg)	43 \pm 7 (24-57)
? splenectomy	yes 14 no 21
blood transfusion* (unit)	38.7 \pm 37 (0-120)
functional class NYHA	fc I 10 cases fc II 24 cases fc III 1 case
desferal therapy (time)	0 29 cases 1 1 case 3 1 case 5 2 cases 6 2 cases

* from birth to now

Table 4.2 Physical examination of 35 B-thal/HbE patients **

2° sex failure	yes 3 cases, no 30 cases
jaundice	mild 21 cases moderate 12 cases severe 2 cases
ascite	none
pedal edema	none
bronzing	yes 8 cases, no 27 cases
mongoloid facies	yes 17 cases, no 18 cases
cardiomegaly	yes 3 cases, no 32 cases
lung crepitation	yes 2 cases, no 33 cases
hepatomegaly (span, cm)	15.5±3 (9-23)
splenomegaly*	8.1±4 (2-15)
pulse rate per minute	83±11 (59-107)
respiration rate	22±3 (12-28)
body temperature (°c)	37.3±0.3 (36.8-37.9)
systolic blood pressure	104±11 (90-130)
diastolic blood pressure	61±11 (40-90)

* centimeters below left costal margin

** ordinal parameters are presented as mean ± SD (minimum - maximum)

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Table 4.3 Laboratory data of 35 B-thal/HbE patients **

cardiothoracic ratio (%)	52.9 \pm 7 (37-67)
average hemoglobin (gm%)	6.9 \pm 1 (4.1-10.3)
present hemoglobin (gm%)	7.6 \pm 1 (5.3-11.6)
fasting plasma glucose (mg%)	91.7 \pm 14 (33-134)
bilirubin, direct (mg%)	0.58 \pm 0.98 (0.1-6.0)
bilirubin, total (mg%)	3.8 \pm 2.4 (0.5-12.4)
albumin (gm%)	3.9 \pm 0.5 (2.8-4.6)
globulin (gm%)	3.6 \pm 1 (1.8-5.6)
SGOT (U/dl)	53.2 \pm 3 (12-136)
SGPT (U/dl)	45.5 \pm 30 (7-108)
% hemoglobin F	21.2 \pm 7 (5-33)
% hemoglobin E	54.3 \pm 13 (26-82)
serum ferritin (ug/L)	2849 \pm 2512 (52-9445)
serum iron (ug/dl)	225.7 \pm 83.6 (105-500)

** Values are presented as mean \pm SD (minimum - maximum)

Table 4.4 Chest x-ray findings of 35 B-thal/HbE patients

Chambers enlargement

normal 15, RVH 8, LVH 3, BVH 9

vascularity

normal 18, high flow 3, pulmonary HT 9, pulm congested 5

extramedullary erythropoiesis

no 27, yes 8

bone change

none 5, mild 11, moderate 14, severe 5

Table 4.5 Electrocardiogram findings of 35 B-thal/HbE patients

rhythm	sinus rhythm	35 cases
axis ($^{\circ}$)	52 ± 23	(0-90)
hypertrophy	atrial enlargement	none
	ventricular hypertrophy	definite LVH 2 cases probable RVH 3 cases probable BVH 1 case
ST-T change	slight T inversion in V_1-V_4 with no associated ventricular hypertrophy (pt. age 21, 25) 2 cases	
	T inversion in V_1-V_3 with probable RVH 3 cases	
	T inversion in V_4-V_6 with definite LVH 2 cases	
	T inversion in V_1-V_6 with probable BVH 1 case	
arrhythmia	APC 1 case	
	PVC 1 case	

Female patients were enrolled about twice more than male patients (23 vs 12 cases). Most patients are underweighted (mean = 42.8 kg). Blood transfusion varied quite considerably from 0 to 120 unit. Most patients reported fc II of New York Heart Association Criteria (24 cases). Desferal therapy was quite limited because of socioeconomic problem, only a few cases received this particular therapy (6 cases).

Most patients have hepatomegaly (mean = 15.5 cm). Eight patients have liver span equals to or less than 12 cm. All nonsplenectomized cases have splenomegaly (ranges from 2 to 15 centrimeters below left costal margin). Liver spans in the splenectomized cases were larger than the nonsplenectomized cases' span (14.4 vs 17.1 cm, $p < 0.05$, Table 8.1)

Two male patients, age 20 and 21, have infantile penis and three female patients, age 19, 25, 27, have scarce menstruation or not

at all.

The average pulse rate was within normal limits, though 2 patients have mild sinus tachycardia. Both have marked anemia (Hb = 6.2 and 5.4 gm%). The second one died one month later because of congestive heart failure. Blood pressure of B/E patients are in normal limit and tend to be low (systolic mean = 104 ± 11 /diastolic mean = 61 ± 11 mmHg) (Table 4.2). Body temperature have a mean of 37.3 ± 0.3 °C. Hemolysis has been accused of causing low grade temperature in thalassemic patients. Most patients have marked anemia and seven patients must have blood transfused regularly (almost every month). Average hemoglobin have a mean of 6.9 ± 1 gm/dl. Hemoglobin level at the time of echocardiographic study have a mean of 7.6 ± 1 gm/dl. Indirect bilirubin is much higher than direct bilirubin which is the feature of hemolytic jaundice. Percent HbF, determined by alkaline denaturation method, have a mean of $21.2 \pm 7\%$ while percent HbE determined by starch gel electrophoresis, have a mean of $54.3 \pm 13\%$. Thus a combination of % HbF and % HbE in a particular patient is not equal to 100%.

Chambers enlargement, identified by cardiac silhouette, is as follows: normal 15 cases, RV prominence 8 cases, LV prominence 3 cases and biventricular prominence 9 cases. Pulmonary hypertension pattern has been found in 9 cases out of 35 cases. Eight cases have extramedullary erythropoiesis (Table 4.4).

Of 35 cases, all are in sinus rhythm with a mean of electrical axis = 52 ± 23 degrees. The ECG criterion were derived from standard text book(33,34). If the patients were 16 years' old or younger Keith's criteria(33) were applied. If the patients were older than 16 years, adult criteria of ventricular hypertrophy were used(34). Six cases have ventricular hypertrophy as follows: definite LVH 2 cases, probable RVH 3 cases, probable biventricular hypertrophy 1 case (Table 4.5). Chamber dilatation identified by electrocardiogram does not correlate with those identified by roentgenogram, however.

Other abnormalities detected were 2 cases of ST-T

abnormalities, 1 case of atrial premature beats and 1 case of ventricular premature beats. The latter two cases of arrhythmia were not associated with other abnormalities (Table 4.5).

Table 5 showed echocardiographic findings in 35 cases of B/E patients. Main pulmonary artery (MPA) can be measured only in 16 cases. Others could not be seen clearly.

Table 5. Descriptive characteristics of 35 B/E echocardiograms

* MPA index (cm/sqm ²)	1.8±0.4	(range 1.1-2.3)
LA index (cm/sqm ²)	2.7±0.5	(range 1.5-4.0)
AO index (cm/sqm ²)	1.9±0.4	(range 1.5-3.4)
RV index (cm/sqm ²)	2.0±0.4	(range 1.3-3.5)
LVes index (cm/sqm ²)	2.4±0.4	(range 1.8-3.6)
LVed index (cm/sqm ²)	3.7±0.6	(range 2.8-5.4)
Heart rate (beat per minute)	82.6±10.8	(range 59-107)
SV index (cm ³ /sqm ²)	66.6±20.0	(range 30.8-117.4)
CO index (litre/minute/sqm ²)	5.5±2.1	(range 2.8-12.1)
IVS index (cm/sqm ²)	0.7±0.2	(range 0.4-1.3)
PW index (cm/sqm ²)	0.7±0.1	(range 50-81)
Ejection fraction (percent)	70±7	(range 50-81)
% fractional shortening	33.9±5.6	(range 21-43)

* n = 16

When the above data was compared to 12 volunteers (Table 6.2), almost every parameters measured was higher than the control's ($p < 0.001$) except MPA, EF and %FS. EF and % FS are tended to be lower than the control's but not achieve statistically differences ($p > 0.05$). Similarly, EF and % FS were not different between severely affected patients versus mildly affected patients; rarely transfused patients, occasionally transfused patients and frequently transfused patients; and splenectomized versus nonsplenectomized cases ($P > 0.05$) (Table 7).

Roentgenography has been traditionally used to identify pulmonary hypertension. Of 17 nonsplenectomized cases, 2 were identified to have pulmonary hypertension (11.7%). Interestingly, six of 10 splenectomized cases (60%) were identified to have pulmonary hypertension ($p = 0.03$). When right ventricle index (RVI) were compared between splenectomized and nonsplenectomized cases, RVI in the former were larger ($P < 0.05$) (Table 8.3). However, MPA in splenectomized patients were not bigger than in nonsplenectomized patients. This is probably due to inadequate sample size.

Table 6.1 Comparison of B-Thal/HbE patients with volunteers (clinical data)

	N	patients	N	volunteers	Sig.
CLINICAL DATA					
age (yr)	35	25.9±8.4	12	29.3±10.3	ns
height (cm)	35	152.4±9.0	12	162.1±7.7	** P<0.01
weight (kg)	35	42.8±7.3	12	56.8±8.7	*** P<0.001
cardiothoracic ratio (%)	35	52.9±6.7	7	44.8±4.2	*** P=0.001
present hemoglobin (gm %)	35	7.6±1.4	12	14.0±1.1	*** P<0.001
FBS (mg %)	35	91.7±14.1	12	87.4±6.9	ns
bilirubin direct (mg %)	35	0.6±1.0	12	0.1±0.05	* P<0.05
bilirubin total (mg %)	35	3.8±2.4	12	0.6±0.3	*** P<0.001
albumin (gm %)	35	3.9±0.4	12	4.1±0.3	ns
globulin (gm %)	35	3.6±1.0	12	2.8±0.2	*** P<0.001
alkaline phosphatase (U/L)	35	29.5±12.2	12	15.9±5.3	*** P<0.001
SGOT (U/L)	35	53.2±31.0	12	18.0±3.8	*** P<0.001
SGPT (U/L)	35	45.5±29.9	12	11.2±10.1	*** P<0.001

Table 6.2 Comparison of B-Thal/HbE patients with volunteers (Echocardiogram)

	N	patients	N	volunteers	Sig.
ECHOCARDIOGRAPHIC STUDIES					
main pulm artery index	16	1.8±0.4	6	1.4±0.2	ns
left atrium index	35	2.7±0.5	12	1.7±0.2	*** P<0.001
aorta index	35	1.9±0.4	12	1.6±0.2	*** P<0.001
right ventricle index	35	2.0±0.4	12	1.3±0.2	*** P<0.001
LV end systole index	35	2.4±0.4	12	1.8±0.2	*** P<0.001
LV end diastole index	35	3.7±0.6	12	2.9±0.2	*** P<0.001
stroke volume index	35	66.6±20.0	12	44.8±7.2	*** P<0.001
heart rate	35	82.6±10.8	12	66.7±12.0	*** P=0.001
cardiac output index	35	5.5±2.1	12	3.0±0.6	*** P<0.001
ejection fraction	35	0.70±0.07	12	0.74±0.06	ns
% fractional shortening	35	33.9±5.6	12	36.5±4.8	ns
IVS index	35	0.7±0.2	12	0.5±0.1	*** P<0.001
LV posterior wall index	35	0.7±0.1	12	0.6±0.1	*** P=0.001

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Table 7 Comparison of ejection fraction and percentage shortening between cases versus control, less anemic versus more anemic patients, splenectomized versus nonsplenectomized cases, and according to amount of blood transfusion

	PATIENTS	CONTROLS	STAT.	
EF	70 \pm 7	74 \pm 6	NS	
% FS	34 \pm 6	36 \pm 5	NS	
	SEVERE	MILD	STAT.	
EF	70 \pm 7	71 \pm 7	NS	
% FS	33 \pm 5	35 \pm 6	NS	
	SPLENECTOMIZED	NONSPLENECTOMIZED	STAT.	
EF	71 \pm 8	70 \pm 7	NS	
% FS	33 \pm 6	34 \pm 5	NS	
	BLOOD TRANSFUSION REQUIREMENT			
	RARE	OFTEN	FREQUENT	STAT.
	(0-9 UNITS)	(10-80 UNITS)	(> 80 UNITS)	
EF	72 \pm 7	68 \pm 8	73 \pm 6	NS
% FS	35 \pm 6	32 \pm 5	35 \pm 5	NS

Table 8.1 Comparison of B-Thal/HbE patients by Splenectomy
(demographic data)

	N	NONSPLENEC	N	SPLENECTOMIZED	Sig.
HISTORY and PHYSICAL EXAM					
age (yr)	21	26.3 \pm 10.2	14	25.2 \pm 5.0	ns
height (cm)	21	153.9 \pm 7.3	14	150.1 \pm 10.9	ns
weight (kg)	21	44.5 \pm 6.1	14	40.3 \pm 8.5	ns
duration of symptoms (yr)	21	12.7 \pm 9.6	14	16.1 \pm 7.1	ns
blood transfusion (U)	18	35.9 \pm 40.6	12	42.9 \pm 31.5	ns
liver span (cm)	21	14.4 \pm 3.4	14	17.1 \pm 3.1	* P<0.05
average hemoglobin (gm %)	21	7.2 \pm 1.5	14	6.4 \pm 1.2	ns
pulse rate (bpm)	21	80.6 \pm 10.2	14	85.8 \pm 11.6	ns
respiration rate (cpm)	21	21.0 \pm 3.2	14	22.8 \pm 2.3	ns
body temperature (celsius)	21	37.2 \pm 0.3	14	37.4 \pm 0.3	* P<0.05
systolic BP (mmHg)	21	104.0 \pm 12.0	14	105.0 \pm 9.4	ns
diastolic BP (mmHg)	21	60.0 \pm 12.6	14	62.5 \pm 9.3	ns

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Table 8.2 Comparison of B-Thal/HbE patients by splenectomy (blood test)

	N	NONSPLENEC	N	SPLENECTOMIZED	Sig.
LABORATORY FINDINGS					
cardiothoracic ratio (%)	21	50.8±7.0	14	55.9±5.0	* P<0.05
present hemoglobin (gm %)	21	7.7±1.6	14	7.3±1.1	ns
FBS (mg %)	21	89.0±11.7	14	95.7±16.7	ns
bilirubin direct (mg %)	21	0.6±1.2	14	0.6±0.3	ns
bilirubin total (mg %)	21	3.0±1.4	14	5.0±3.0	* P<0.05
albumin (gm %)	21	4.1±0.4	14	3.7±0.5	* P<0.05
globulin (gm %)	21	3.3±0.7	14	4.1±1.1	* P<0.05
alkaline phosphatase (U/L)	21	24.1±9.6	14	37.6±11.4	*** p=0.001
SGOT (U/L)	21	36.6±16.2	14	78.0±31.7	*** P<0.001
SGPT (U/L)	21	38.9±32.6	14	55.3±23.1	ns
% Hb F	21	22.7±6.6	14	18.9±6.4	ns
% Hb E	21	55.4±10.8	14	52.6±15.5	ns
serum ferritin (microgram/L)	20	1911±1764	11	4555±2838	* P<0.05
serum iron (microgram %)	20	192 ±51.0	11	287 ±97.8	** p=0.01

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Table 8.3 Comparison of B-Thal/HbE patients by splenectomy (echocardiography)

	N	NONSPLENEC	N	SPLENECTOMIZED	Sig.
ECHOCARDIOGRAPHIC STUDIES					
main pulm artery index	9	1.7±0.4	7	1.9±0.2	ns
left atrium index	21	2.5±0.4	14	3.0±0.5	* P<0.05
aorta index	21	1.7±0.2	14	2.1±0.5	* P<0.05
right ventricle index	21	1.9±0.3	14	2.2±0.5	* P<0.05
LV end systole index	21	2.3±0.3	14	2.6±0.5	ns
LV end diastole index	21	3.5±0.4	14	4.0±0.7	* P<0.05
stroke volume index	21	59.4±13.2	14	77.3±24.0	* P<0.05
heart rate	21	80.8±10.9	14	85.3±10.5	ns
cardiac output index	21	4.8±1.4	14	6.6±2.4	* P<0.05
ejection fraction	21	0.70±0.07	14	0.71±0.08	ns
% fractional shortening	21	33.5±5.4	14	34.6±6.1	ns
IVS index	21	0.7±0.1	14	0.8±0.2	ns
LV posterior wall index	21	0.7±0.1	14	0.7±0.2	ns

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