

Left Ventricular Deformation in Different Types of Beta-thalassaemia

by

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"Isn't health a miracle? And life itself?"

Anton Chekhov

DEDICATION

To my beloved parents who taught me to love books and knowledge and made every effort to help me learn, succeed and follow my dreams; to you I am indebted for every moment of joy in my life

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Abstract

Title

Left Ventricular Deformation in Beta-thalassaemia Major and Intermedia

Background

Among all haemoglobinopathies 1-thalassaemias pose the most important global public health problem, with cardiac dysfunction being the most important determining factor for the survival in both transfused and non-transfused patients. Current guidelines don't recommend LV strain or rotation assessment for those patients, however; they can allow for early identification of patients at risk of future overt dysfunction.

Aims

To assess the value of speckle tracking-derived strain in detecting early LV systolic deformation abnormalities in both b-thalassaemia intermedia and b-thalassaemia major, who had been compliant to treatment since their infancy and whose m-mode derived ejection fraction and LV dimensions were normal, as well as to illustrate the pattern of LV systolic deformation in the two main b-thalassaemia phenotypes, and its possible difference from normal age-matched pattern.

Methods

The study population comprised 3 groups: group 1 included 26 patients with 1-thalassaemia major, group 2 included 24 patients with b-thalassaemia intermedia, and group 3 included 21 age-matched normal individuals. All subjects had arterial pressure measured, serum ferritin, and conventional echocardiography in addition to the evaluation of speckle tracking-derived LV strain and rotational mechanics.

Results

Systolic and diastolic arterial blood pressures were significantly lower in both 1-thalassaemia groups than in normal (P: 0.000), All enrolled individuals, including both 1-thalassaemic patients groups had normal ejection fraction. There was no statistically significant difference in LV cavity dimensions or indexed volumes among the 3 groups. The global radial and circumferential strain were significantly different among groups with values lower in both 1-thalassaemia groups than in the normal control group (P: 0.000) with no significant difference between the 2 b-thalassaemia

groups (P: 0.6518). There was a significant difference in the peak LV twist, and peak systolic apical rotation (P:0.000 for both parameters), being lower in b-thalassaemia groups, with no significant difference between the 2 b-thalassaemia groups (P: 0.055), and (P:0.37088) for peak twist and peak apical rotation respectively. No significant correlation was found between serum ferritin and any of the speckle tracking parameters

Conclusion

Young patients with both b-thalassaemia intermedia and well-treated b-thalassaemia major have lower left ventricular global radial and circumferential strain values than normal as well as different rotational pattern.

Keywords: thalassaemia, major, intermedia, speckle tracking, twist

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List of abbreviations

2D	two-dimensional
AHSP	a-haemoglobin stabilising protein
ADP	adenosine diphosphate
ALA	o-Aminolevulinic acid
ALAS	o-aminolevulinic acid synthase
ASE	American society of echocardiography
ATP	adenosine triphosphate
BCL11A	B-cell lymphoma 11 A protein encoding gene
CMR	cardiovascular magnetic resonance
COUP-TFII	chicken ovalbumin upstream promoter-transcription factor II
DMT1	divalent metal transporter 1
DNA	deoxy ribonucleic acid
DTI	Doppler tissue imaging
EACVI	European association of cardiovascular imaging
EAE	European association of echocardiography
EF	ejection fraction
EKG	electrocardiogram
EKLF	erythroid Kruppel-like factor
FtH1	ferritin heavy chain
FtMt	mitochondrial ferretin
GATA-1	"GATA"-binding transcription factor-1
GDF 15	growth and differentiation factor 15
HFPEF	heart failure with preserved ejection fraction
Hb	haemoglobin
HCV	hepatitis C virus
HS	hypersensitive site
HIV	human immunodeficiency virus
H ₂ O ₂	hydrogen peroxide
HIFs	hypoxia-inducible transcription factors
Ig	immunoglobulin
IL	interleukin
IMD	intimal-medial thickness
IRE/IRP	iron-responsive element/iron-regulatory protein
IVP	intra-ventricular pressure
IVS	intervening sequence
KLF1	erythroid Kruppel-like factor 1
LCR	<i>locus control region</i>
LGE	late gadolinium enhancement
LV	left ventricular
LVDCs	L-Type voltage-dependent channels
MCV	mean corpuscular volume
MCH	mean corpuscular haemoglobin content
MMPs	matrix metalloproteinases
mRNA	messenger ribonucleic acid

NDT non-transfusion-dependent thalassaemias
 NF-E nuclear factor, erythroid
 NT-proBNP N-terminal pro-B-type natriuretic peptide
 NTBI non-transferrin-bound iron species
 O₂⁻ superoxide
 PyrR *pyrimidine nucleotide* mRNA-binding regulatory protein
 RBC red blood cell
 RES reticuloendothelial system
 ROI region of interest
 ROS reactive oxygen species
 SEM scanning electron microscopy
 SSP stage selector element binding protein
 T2-STIR T2-weighted short Tau inversion recovery
 TDT transfusion-dependent thalassaemias
 TFR transferrin receptor
 TNF tumor necrosis factor
 TWGF twisted Gastrulation Factor
 Ub polyubiquitin
 UPS ubiquitin-proteasome
 VG velocity gradient