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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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
H2O2 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 *locus control region*
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
$O2^{\cdot}$ 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