Normal Values of Echocardiography in Egyptian Population

Thesis submitted for partial fulfillment of the Doctor Degree in Cardiology

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2010

بسم الله الرحمن الرحيم

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Acknowledgement

*I appreciate and thank **Prof. Dr. Maiy Hamdy El Sayed,** Professor of Cardiology, Ain Shams University, the person who gave me the honor by helping me by her precious recommendations and contributive comments that served much in the construction of this work.*

*Thanks are also to **Prof. Dr. Hussam El din Saleh Elghetany,** Professor of Cardiology, Ain Shams University who supported and encouraged me.*

*My sincere thanks for **Prof Dr. Azza Abd Alla El Fiky,** Professor of Cardiology, Ain Shams University who gave me a lot of her time and also read every word written in this thesis.*

*Also, thanks for **Dr. Ghada Samir Khalil El Shahed,** Assistant Professor of Cardiology, Ain Shams University who helped me a lot, in my work by her expertise in doing echocardiography*

*A lot of thanks for **Dr. Alaa Roushdy**, lecturer of Cardiology, Ain Shams University. The kind person who taught me how to do an echocardiogram and supported me in every step in this work.*

*I am also very grateful to **Dr. Wael El Mallah** lecturer of Cardiology, Ain Shams University. Who gave me a lot of his time to fulfil this work.*

List of abbreviation

2D LA LE	Left atrial length by 2D
2D LA WI	Left atrial width by 2D
2D LV DL	Left ventricular diastolic length by 2D
2D LV DW	Left ventricular diastolic width by 2D
2D LV SL	Left ventricular systolic length by 2D
2D LV SW	Left ventricular systolic width by 2D
2D RA LE	Right atrial length by 2D
2D RA WI	Right atrial width by 2D
2D RV DL	Right ventricular diastolic length by 2D
2D RV DW	Right ventricular diastolic width by 2D
2D RV SL	Right ventricular systolic length by 2D
2D RV SW	Right ventricular systolic width by 2D
A TDI	Diastolic wave of atrial contraction by tissue Doppler imaging.
ACS	Aortic cusps separation
AFV	Aortic flow velocity
AO D	Aortic root diameter in diastole.
Aort Annul	Aortic valve annulus
ASE	American society of echocardiography
BMI	Body mass index.
BSA	Body surface area.
Dop Ao	Aortic flow maximum velocity
Dop m A	Mitral flow A wave maximum velocity
Dop m A	Tricuspid flow A wave maximum velocity
Dop mit E	Mitral flow E wave maximum velocity
Dop tric E	Tricuspid flow E wave maximum velocity
E TDI	Early diastolic relaxation wave by tissue Doppler imaging.
EF	Ejection fraction.
FS	Fractional Shortening
FS	Fractional shortening.
IRT	Isovolumetric relaxation time.
IVSd	Interventricular septal thickness in diastole by M mode
IVSD	Interventricular septal thickness in diastole
LA major	Major axis of the left atrium.

LA minor	Minor axis of the left atrium.
LAD	Left atrium diameter.
LAL	Left atrial length
LAS	Left atrium in systole.
LAW	Left atrial width
LV	Left ventricle
LV EF	Left ventricular Ejection Fraction
LVDd	Left ventricular diastolic dimension by M mode
LVDd	Left ventricular diastolic dimension
LVDs	Left ventricular systolic dimension by M mode
LVEDS	Left ventricular end diastolic diameter.
LVPWd	Left ventricular posterior wall diastolic thickness by M mode
LVPWD	Left ventricular posterior wall thickness in diastole
LVSd	Left ventricular systolic dimension
M Ao	Aortic root diameter by M mode
M Ao Cus	Aortic Cusp separation by M mode
M LA	Left atrial dimension by M mode
M RV	Right ventricular dimension by M mode
MAL	Lateral mitral annulus.
MAS	Septal mitral annulus.
Mit Annul	Mitral annulus
MTD	Color M- mode tissue Doppler.
MVG	Myocardial velocity gradient.
NCHS	National center for health statistics.
PAT	Pulmonary flow acceleration time
Pulm annul	Pulmonary valve annulus
PWT	Posterior wall thickness
PW-TDI	Pulsed wave- tissue Doppler imaging.
RA major	Major axis of the right atrium.
RA minor	Minor axis of the right atrium.
RAL	Right atrial length
RAW	Right atrial width
RV	Right ventricle
RV major	Major axis of the right ventricle.
RV minor	Minor axis of the right ventricle.
RVD	Right ventricular diameter.
RVDD	Right ventricular end diastolic diameter.

RVESD	Right ventricular end systolic diameter.
RVL	Right ventricular length
RVW	Right ventricular width
S TDI	Systolic wave by tissue Doppler imaging.
Td M ant A	Maximum velocity of tissue Doppler A wave of anterior wall of mitral valve
Td M ant E	Maximum velocity of tissue Doppler E wave of anterior wall of mitral valve
Td M ant S	Maximum velocity of tissue Doppler S wave of anterior wall of mitral valve
Td M inf A	Maximum velocity of tissue Doppler A wave of inferior wall of mitral valve
Td M inf E	Maximum velocity of tissue Doppler E wave of inferior wall of mitral valve
Td M inf S	Maximum velocity of tissue Doppler S wave of inferior wall of mitral valve
Td M lat A	Maximum velocity of tissue Doppler A wave of lateral wall of mitral valve
Td M Lat E	Maximum velocity of tissue Doppler E wave of lateral wall of mitral valve
Td M lat S	Maximum velocity of tissue Doppler S wave of lateral wall of mitral valve
Td M sp A	Maximum velocity of tissue Doppler A wave of septal wall of mitral valve
Td M sp E	Maximum velocity of tissue Doppler E wave of septal wall of mitral valve
Td M sp S	Maximum velocity of tissue Doppler S wave of septal wall of mitral valve
Td T lat A	Maximum velocity of tissue Doppler A wave of lateral wall of tricuspid valve
Td T lat E	Maximum velocity of tissue Doppler E wave of lateral wall of tricuspid valve
Td T lat S	Maximum velocity of tissue Doppler S wave of lateral wall of tricuspid valve
Tric Annul	Tricuspid annulus

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Introduction

Echocardiography is widely used to diagnose congenital heart defects or exclude cardiac involvement in infectious, neuromuscular, or metabolic disorders.

Echocardiography allows the non-invasive assessment of the dimensions and anatomy of the heart and its functional characteristics.

Because of these aspects this exam has become the key to diagnose, assess the repercussions and follow up on children and adolescents with suspicion of or with cardiopathy ***(Phoon et al., 1999).***

Normal values for dimensions and functions of the heart are very important to avoid misclassification of normal children into the high risk category and the reverse **(Burke et al., 1986).**

Many studies reported that there is a significant difference of left ventricular dimensions and functions according to body size, heart rate, sex and race **(De Simone et al., 2001).**

Other studies showed racial variation in Echocardiography between black and white children, as they found that left ventricular posterior wall in diastole by echocardiography was thicker in black than in white (**Reo et al., 1984).**

The definition of normal values of Egyptian children would be very valuable for pediatric cardiologist in both diagnosis and decision making.

Aim of the study

The aim of this study is to define the normal echocardiographic values for Egyptian children aged 6-18 years. Using M- mode, two- dimensional echocardiography, Doppler measurements, as well as pulsed wave tissue Doppler.

Chapter 1

Pediatric Echocardiography

Echocardiography has become the primary imaging tool in the diagnosis and assessment of congenital and acquired heart disease in infants, children, and adolescents.

Transthoracic echocardiography (TTE) is an ideal tool for cardiac assessment, as it is noninvasive, portable, and efficacious in providing detailed anatomic, hemodynamic, and physiologic information about the pediatric heart **(Henry et al., 1980)**.

The pediatric echocardiogram is a unique examination with features that distinguish it from other echocardiograms **(Fouron et al., 1998).**

Certain views are of added importance for pediatric examinations: the subxiphoid (or sub costal), suprasternal notch, and right parasternal views. The acquisition and proper display of images from these views are critical aspects of the pediatric TTE. In addition, special techniques are required for imaging uncooperative infants and young children, including sedation and distraction tools that will allow performance of a complete examination **(Waggoner et al., 2001, Thys et al., 1996 and Stewart W et al., 1999).**

Indications of pediatric echocardiography:

Knowledge of indications for an echocardiogram is important to obtain the information required for the diagnosis and proper treatment of the pediatric patient **(Cheitlin et al., 1997).**

Children with suggested or known heart disease frequently require serial studies to evaluate the evolution or progression of heart disease. Serial studies may be indicated at routine intervals for monitoring of valve function, growth of cardiovascular structures, ventricular function, and potential sequelae of medical or surgical intervention **(Geva et al., 1995, McElhinney et al., 2001 and Shluysmans et al., 2005).**

1-Congenital Heart Disease:-

Indications for the performance of a pediatric echocardiogram span a wide range of symptoms and signs, including cyanosis, failure to thrive, exercise induced chest pain or syncope, respiratory distress, murmurs, congestive heart failure, abnormal arterial pulses, or cardiomegaly.

Certain syndromes, family history of inherited heart disease, and extracardiac abnormalities that are known to be associated with congenital heart disease constitute clinical scenarios for which echocardiography is indicated even in the absence of specific cardiac symptoms and signs. Abnormalities on other tests such as fetal echocardiography, chest radiograph, electrocardiogram, and chromosomal analysis constitute another group in which the suggestion of congenital heart disease is addressed specifically by echocardiography **(Gutgesell et al., 1990).**

2-Acquired Heart Diseases and Noncardiac Diseases:

An echocardiogram is indicated for the evaluation of acquired heart diseases in children, including Kawasaki disease, infective endocarditis, all forms of cardiomyopathies, rheumatic fever and carditis, systemic lupus erythematosus, myocarditis, pericarditis, HIV infection, and exposure to cardiotoxic drugs. Pediatric echocardiography is indicated in the assessment of potential cardiac or cardiopulmonary transplant donors and transplant recipients. Recently,