Institute of postgraduate childhood studies
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Role of Echocardiography in Congenital Heart Diseases in Neonatal Intensive Care Unit

Thesis

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بسم الله الرحمـن الرحيم

" قالُواْ سُبْحَانَكَ لاَ عِلْمَ لَنَا إِلاّ مَا عَلّمْتَنَا

إِنّكَ أَنتَ الْعَلِيمُ الْحَكِيمُ "

صدق الله العظيم

سورة البقرة - الآية (32)

Dedication

Dedicated with all affection to my mother, ***Dr.Zeinab Elnaggar****, my brother* ***Eng.Amir Khattab****, my soulmate & husband* ***Dr.Ramy Mostafa****, my sister* ***Reham Eldeeb*** *and to all my friends especially* ***Sara Abdallah*** *,* ***Reem Zakaria****,* ***Ahmed Ramzy****,* ***Ghada Ghait****.*

Dedicated also to Elzeitoon Medical Region & Saray Elkoba Medical Center especially ***Dr.Suzan Abdelazeem****,* ***Dr.Safaa Hussein*** *and* ***Dr.Mohamed Elkashef****.*

Dedicated to Atfal Masr Hospital,Emergency Department especially ***Dr.Mohamed Taha****,* ***all nurses & workers*** *and all my collegues in the hospital especially* ***Miada Said****,* ***Mai Ghazy****,* ***Ahmed hashim****,* ***Ahmed Elkhawaga****,* ***Amira Ahmed****.*

** to my grandmother & father's soul...

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Abstract:

Background: Congenital heart defects are among the most common major congenital anomalies, and they occur worldwide with an incidence of about 8–12/1,000 live births**.** Many infants die without the diagnosis of complex CHDs, especially in developing countries .Echocardiography is used postnatally in high-risk infants for the diagnosis or exclusion of congenital heart defects and for assessment of cardiovascular function

Aim: to detect the prevalence of simple and complex congenital heart diseases among neonates admitted to the neonatal intensive care unit of Obstetrics and Gynecology Hospital, Ain Shams University over five years and evaluate and asses the clinical indications of echocardiography and its nature in relation to echo findings in the neonatal intensive care unit.

Methods: Echocardiography assessment was performed according to symptoms and signs in a neonate suspected to have congenital heart disease. It comprised 446 neonates admitted to a neonatology unit over five years subdivided to three groups according to the results of echocardiography as regards absence of congenital heart disease (group 1) or presence of simple (group 2) or complex congenital heart disease (group 3).

Results: on studying the distribution of Timing of Echocardiography in all neonates, echocardiography was mostly done in the first week of life (73.8% of cases) especially group two neonate having simple CHD (55.4%).Also, the highest indication for doing echocardiography was the presence of a **murmur** (39.5%), the presence of **non cardiac congenital anomalies** (22.6%) or **bad medical maternal history** (17%) and **cyanosis** (7.8%) with high statistical difference in group three neonates who had complex congenital heart diseases ($P<0.01$).As regards the most common echocardiographic finding in neonates with simple CHD, there was increased cases had PFO+PDA (37.3%), atrial septal aneurysm + PDA (15%), PFO alone (7.9%) and for complex CHD , there were increased cases of D-TGA (26.9%), Fallot's tetralogy (19%), and Hypoplastic left heart syndrome (14.3%).

Conclusion: Cardiac echocardiogram in neonates suspected having congenital heart diseases shows that prevalence of CHD (simple and complex) was 90.3 %.

Keywords

Echocardiography – congenital heart - neonatal intensive care unit

Contents

List of Abbreviations

AP	aorticpulmonary
AS	Aortic stenosis
ASD	Atrial septal defect
AV	atrioventricular
CAVC	complete atrioventricular canal defect
CCHDs	critical congenital heart defects
CHD	Congenital heart diseases
CHF	Congestive heart failure
CoA	Coarctation of aorta
DCM	dilated cardiomyopathy
DNA	Deoxyribose nucleic acid
DORV	Double-outlet right ventricle
D-TGA	D-Transposition of great arteries
ECG	electrocardiogram
EF	ejection fraction
HF	heart failure
HCM	hypertrophic cardiomyopathy
HLHS	Hypoplastic Left Heart Syndrome
HOCM	Hypertrophic obstructive cardiomyopathy
IVC	Inferior vena cava
LV	Left ventricle
LVED	left ventricular end-diastolic dimension
LVES	left ventricular end-systolic dimension
LVEDV	left ventricular end-diastolic volume
LVESV	left ventricular end-systolic volume
LVPW	left ventricular posterior wall
NICU	Neonatal intensive care unit
PA	Pulmonary atresia
PA-IVS	pulmonary atresia with intact interventricular septum
PDA	Patent ductus arteriosus
PFO	Patent foramen ovale
PPHN	Persistent Pulmonary Hypertension of the Newborn
PS	Pulmonary stenosis
PVR	pulmonary vascular resistance

RD	Respiratory distress
RV	Right ventricle
SA	sino-atrial
SF	shortening fraction
SV	single ventricle
SVC	superior vena cava
TA	Tricuspid atresia
TAPVR	Total anomalous pulmonary venous return
TEE	Tranesophageal echocardiography
TGA	Transposition of great arteries
ToF	tetralogy of Fallot
VSD	Ventricular septal defect

List of figures

List of Tables

Introduction

Introduction

Congenital heart diseases (CHD) are relatively common with a prevalence ranging from 3.7 to 17.5 per 1000 live births **(Bolisetty, 2004)**.

It can be defined as a structural abnormality of the heart or intrathoracic great vessels which is actually or potentially of functional significance. It represents a spectrum of conditions, from those that may be fatal in the neonatal period, to those with which a normal lifespan would be expected **(Clarke, 2005).**

Most deaths from congenital heart defects occur in the first year of life and these are most likely to be related to extra-cardiac anomalies, cardiovascular collapse during the changes from fetal to newborn physiology, heart failure **(Bache, 2002)**.

The relationship between congenital heart disease, malnutrition, and growth retardation is well documented. Infants with congenital heart disease are prone to malnutrition for several reasons including decreased energy intake, increased energy requirements, or both. Different types of cardiac malformations can affect nutrition and growth to varying degrees **(Gilger, 1990)**.For these defects, timely recognition in the newborn period is vital to prevent death or cardiovascular collapse with its attendant morbidity **(Hall, 2003)**.

Current guidance recommends a routine clinical examination for all newborns and again at 6–8 weeks of age **(Hall, 2003)**.

In the neonatal period a diagnosis of CHD may be considered for two reasons: (1) a heart murmur or other cardiovascular abnormality identified in an asymptomatic infant or (2) the development of symptoms

and signs that could be attributable to congenital heart diseases **(Clarke, 2005).**

In one population-based study, more than half of babies with undiagnosed congenital heart defects were missed by routine neonatal examination and more than one-third by 6 weeks **(Wren, 1999)**.One strategy to avoid this is to advance the time of diagnosis from postnatal to fetal life (antenatal screening) by ultrasound in the early 1980's which gives the parents an opportunity for information and counseling with options for a planned delivery and intervention or termination of pregnancy **(Bricker, 2000)**.

Although many lesions are diagnosed antenatally by ultrasonography, serious and potentially lethal critical congenital heart defects (CCHDs) may not be apparent on prenatal ultrasound, on subsequent physical examination after birth, or on follow-up after discharge. When detected early, CCHDs are either cured or ameliorated by surgery in the vast majority of cases; therefore, a universal screening test for CCHD would be beneficial if it were demonstrated to have acceptable sensitivity and specificity and to offer information that could not be provided by routine examination and observation **(Richmond, 1999)**.

Echocardiography has become the most important non-invasive tool in the diagnosis and management of cardiac diseases. Two dimensional echocardiography provides a full anatomical evaluation in most congenital heart defects. Physiologic data on the direction of blood flow can be obtained with the use of pulsed wave, and color flow Doppler **(Daniel, 2006)**.

Prenatal or fetal echocardiography can diagnose congenital heart diseases by 18 weeks of gestation and this prenatal diagnosis allows for delivery in a well equipped place for such conditions where many

congenital heart defects are surgically repaired based on the echocardiogram with no need for cardiac catheterization **(Daniel, 2006)**.

It must be noted also that initial evaluation of a neonate with suspected congenital heart disease includes four-extremity blood pressure, chest x-ray, electrocardiogram and hyperoxia test (which is perhaps the most sensitive and specific tool in the initial evaluation) **(Stephanie,2008)**.

The ability to identify affected newborn infants, when totally asymptomatic, and institute programs and treatments that prevent serious morbidity and mortality is a great privilege for the pediatrician **(Wren, 2000)**.