Neurodevelopment and somatic catch up growth in children Following cardiac surgery

Thesis

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بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

وَاللَّهُ أَخْرَجَكُم مِّنْ بُطُونِ أُمَّهَاتِكُمْ لاَ تَعْلَمُونَ شَيْئاً وَجَعَلَ لَكُمُ السَّمْعَ وَالأَبْصَارَ وَالأَفْئِدَةَ لَعَلَّكُمْ تَشْكُرُونَ (78) أَلَمْ يَرَوْا إِلَى الطَّيْرِ مُسَخَّرَاتٍ فِي جَوِّ السَّمَاءِ مَا يُمْسِكُهُنَّ إِلاَّ اللَّهُ إِنَّ فِي ذَلِكَ لآيَاتٍ لِّقَوْمٍ يُؤْمِنُونَ (79)

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Abstract

Congenital HD (Canotic and Acyanotic) affected growth, IQ. Although cyanotic HD had lower functional outcome than acynotic neurodevelopmental and somatic catch up growth of children can be observed in patients whose did proper cardiac surgery in proper time.

Corrective surgery had better result than palliative surgery especially in those with educated mother and moderate or high socioeconomic level.

Key word:
Body weight, Height, Body mass index, Neurodevelopment, Congenital heart disease, Postoperative cardiac surgery.

Abstract

Background: Infants with congenital heart disease (CHD) have a high incidence of protein-energy malnutrition which is more pronounced in developing countries. Possible etiologies include inadequate intake (due to fatigue, oral aversion, dyspnea, and/or early satiety), increased energy expenditure (including tachypnea and tachycardia), malabsorption (due to increased right-side heart pressure, lower cardiac output, and/or altered gastrointestinal function) and/or ineffective use of energy. In addition to the neurological state of children with congenital heart disease (CHD) is often abnormal at birth, before surgical intervention. As mortality rates after infant open-heart surgery (OHS) continue to dramatically decline, the neurodevelopmental outcome of survivors has come under increasing scrutiny. There is increasing electrophysiological and clinical signs of brain injury in young infants undergoing surgical correction. Early surgical repair of cardiac defects is important in offering the best prospective for future neurodevelopment and growth however, there is no available statistical data about postoperative neurodevelopment and early somatic catch up growth in the postoperative cardiac patients at Cairo University Children Hospital (CUCH).

Objective: To evaluate the early somatic catch up growth potentials following cardiac surgery for children with CHD at Cairo University Hospital. Multivariate regression study analysis of the effect of age at surgery (<2years vs. >2years), type of CHD (Acyanotic vs. Cyanotic heart disease), type of cardiac surgery (Palliative vs. Corrective) and the severity of the preoperative growth failure on the early somatic catch up growth. Also, Social Quotient for children are done to evaluate level of neurodevelopment following cardiac surgery.

Patients and methods: Retrospective clinical data collection single center study analysis for our Postoperative Cardiac children at Cairo University Children Hospital (CUCH). 122 patients (selected from 494 patients come to outpatient clinic from September 2007 to August 2008) were enrolled and evaluated preoperatively and periodically at immediate postoperative period 1, 3, and six months postoperatively. For all cases; Full history taking, Nutritional history, serial Anthropometric measurements by special tools including, body weight, height and body mass index

were evaluated. Corresponding normative data for Egyptian children and adolescents were used. Wt, Ht centiles by (Egyptian growth chart) and full clinical examination, Evaluation of neurological status, by (Vineland adaptive behavior scale), Socioeconomic status assessment by**:** (Al Sherbiny &Fahmy Social class Scale, 1988).

Exclusion criteria Included; non compliant patients with significant extra cardiac and chromosomal abnormalities.

Results: 122 patients with CHD (72 acyanotic and 50 cyanotic) with mean age (17.7±15.9 months). Palliative operation in 22 children and Corrective procedure was done in 100 cases. Postoperative cardiac patients showed statistical significant (P value < 0.05) acceleration potential in the first six months regarding the following parameters; BW (13.5±3.6kg, centile 52.2±23.6), Ht (88.8±12.1 cm, centile 49.7±24.8) and BMI (17±1.5) compared to preoperative data, BW (8.2±3.1 kg, centile 13.5±12), Ht (72.6±12.4, centile 15.2±15.1), BMI (15.1±1.8).

Total correction showed statistical significant better postoperative catch up mean weight and height centile was (30.5±23.4 and 37.7±24.9), compared to palliative (20.09±21.8 and 29.36±21.4). Multivariate regression analysis revealed that cyanosis and preoperative weight retardation were the main statistically significant risk factors affecting the weight catch up preoperatively (coefficient regression-0.26 and 0.31). While the age at cardiac surgery was the main factor affecting the height catch up growth postoperatively (Coefficient regression -0.18). Mean of Social Quotient for all cases was (**103.11**) Average, more prevalent at educated mother and moderate or high socioeconomic state.

Conclusion: There is statistical significant early somatic catch up growth potential acceleration and neurodevelopment in our postoperative cardiac patients at CUCH. Early corrective cardiac intervention gives the best prospects for optimal growth, and neurodevelopment, especially in those with educated mother and moderate or high socioeconomic level.

Key words: Body weight, Height, Body mass index, Neurodevelopment, Congenital heart disease, Postoperative cardiac surgery.

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Abbreviations and Acronyms

A

AAA	Aortic arch anomalies
AAP	American Academy of Pediatrics
ACC	American College of Cardiology
Ach	Acetylcholine
AHA	American Heart Association
AI	Adequate intake
ALA	α- Linolenic acid
ARA	Arachidonic acid
ASD	Atrial septal defect
ASO	Atrial switch operation
APOE	Apolipoprotein E
APSD	Aortopulmonary septal defect
APVC	Anomalous pulmonary venous connection
APW	Aortopulmonary venous connection
ATP	Adenosine triphosphate
AV	Atrioventricular
AVSD	Atrioventricular septal defect

B

BT	Blalock-Taussig
BAS	Balloon atrial septostomy
BDCPA	Bidirectional cavopulmonary anastomosis
BDG	Bidirectional Glenn
BMI	Body mass index
BMR	Basal metabolic rate
BP	Blood pressure
BPV	Blood pressure Variability

C

CAVC	Complete Atrioventricular Canal
CAVSD	Complete atrioventricular septal defect
CCHD	Cyanotic congenital heart disease
CC-TGA	Corrected transposition of great artery
CCVDs	Congenital cardiovascular defects
CDC	the Centers for Disease Control and Prevention
CICU	Cardiac intensive care unit
CHARGE	Coloboma, heart anomaly, choanal atresia, retardation, Genital and ear anomalies.
CHCU	the Children Hospital, Cairo University
CHD	Congenital heart disease
CHF	Congestive heart failure
CNS	Central nervous system
COA	Coarctation of aorta

CPB	Cardiopulmonary bypass
CT	Computerized tomography
	D
DA	Dactus arteriosus
DHA	Docosa hexanenoic acid
DHCA	Deep hypothermic circulatory arrest
DORV	Double outlet right ventricle
DRIs	Dietary reference intakes
D- TGA	Dextro- transposition of the great artery
	E
EA	Ebstein's anomaly
EAR	Estimated energy requirement
ECHSA	The European congenital heart surgeons association
ECMO	extracorporeal membrane oxygenation
EEG	electroencephalogram
EGA	Estimated gestational age
ET-1	plasma endothelin-1
	F
FIQ	Mean full-scale IQ
FISH	Fluorescence in situ hybridization
FTT	Failure to thrive
	G
GAG	glaucoseamin amino glycan
GH	Growth hormone
GHRH	Growth hormone releasing hormone
	H
HF	High frequency
HLHS	Hypoplastic left heart syndrome
HRV	Heart rate variability
	I
IAA	Interrupted aortic arch
IGF-1	Insulin growth factor -1
IGFBP-3	Insulin growth factor binding protein -3
INO	Inhaled nitrous oxide
IVC	Inferior vena cava
	J
Jak_2	Receptor associated Janus Kinase.
Jet	Junctional ectopic Tachycardia.
	K
Kcal	Kilo calories
	L
LA	Linoleic acid
LC-PUFA	Long chain poly unsaturated fatty acid

LF	Low frequency
LLSE	Lower left sternal edge
L-TGA	Levo- transposition of the great artery
LV	Left ventricle
LVOT	Left ventricular outflow tract
	M
MAPCAs	Multiple major aortopulmonary collateral arteries
mBTS	modified Blalock-Taussig Shunt
MDI	Mental Development Index
MGRS	Multicenter growth reference study
MHC	Maternal childhood centers
MR	Mental retardation
MRI	magnetic resonance imaging
MVSD	muscular ventricular septal defect
mMVSDs	multiple muscular ventricular septal defects
	N
Na HCO3	Sodium bicarbonate
NBDPS	The national Birth defect prevention study
NCHS	National center for health statistics
NCS	National children's study
NIRS	Near-infra red spectroscopy
NO	Nitric oxide
NP	Nasopharyngeal
NS	Noonan syndrome
NS	Nutritional support
	O
OHS	Open heart surgery
OF	Over feeding
	P
PA	Pulmonary artery
PA	Pulmonary atresia
PAB	Pulmonary artery banding
PAIVS	Pulmonary atresia with intact ventricular septum
PBF	Pulmonary blood flow
PDA	Persistent or Patent ductus arteriosus
PDI	Psychomotor Development Index
PFO	Patent foramen ovale
PGE1	Prostaglandin E1
PH	Pulmonary hypertension
PPHN	Pesistent pulmonary hypertension of newborn
PPHT	Persistent pulmonary hypertension
PPS	Peripheral pulmonary stenosis
PTA	Pesistent truncus arteriosus;

PVL	Periventricular leukomalacia
PVR	Pulmonary valve replacement
	R
RA	Right atrium
RAH	Right atrial hypertrophy
RDA	Recommended daily allowance
RLFP	Regional low-flow cerebral perfusion
RPA	Right pulmonary artery
RV	Right ventricle
RVOT	Right ventricle outflow tract
RV-PA	Right ventricular pulmonary artery
rSO_2	regional oxygen saturation
	S
SaO_2	arterial oxygen saturation
SBE	Subacute bacterial endocarditis
SBP	Systolic blood pressure
SES	Socioeconomic status
SQ	Social Quotient
SSFP	Steady state free precession
STAT 5b	Single transducer activator of transcription 5b
SVAS	Sinus venosus atrial septal defect
SVC	Superior vena cava
SVD	Sinus venosus defect
SvO2	Venous oxygen saturation
SVT	Supra ventricular tachycardia
	T
TAPVR	Total anomaly pulmonary venous return
TAR	transatrial re-endocardialization
TEE	Total energy expenditure
TGA	Transposition of the great artery
TOF	Tetralogy of fallot
TV	Tricuspid valve
	U
UF	Under feeding
UL	tolerable Upper intake level
ULSE	Upper left sternal edge
UVH	Univentricular heart
	V
VABS	Vineland Adaptive Behavior Scale
VLBW	Very low birth weight
VSD	Ventricular septal defect
	W
WPW	Wollfian Parkinson White syndrome

	Y
Y/S	yes/no.