



**Assessment of Low peak Kilo voltage,
Electrocardiogram gated multi-detector
Computed Tomography in congenital heart
disease at pediatric age group**

Thesis

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Contents

List of Abbreviations	I
List of Tables	III
List of Figures	IV
Introduction and Aim of the Work	1
Review of literature	
- Embryology and Radiological anatomy	5
- Pathology and CT manifestations	32
-MDCT technique and principles of radiation dose.....	89
Patients and methods	111
Results	117
Illustrative cases	134
Discussion	153
Summary and conclusion	167
References	170
Arabic summary	1

List of Abbreviation

AEC	: Automated exposure control
ASDs	: Atrial septal defects
AV	: Aortic valve
AV	: Atrioventricular
Cf	: Conversion factor
CHD	: Congenital heart disease
CMR	: Cardiac magnetic resonance
CPR	: Curve planar reformation
CRT	: Cardiac resynchronization therapy
CS	: Coronary sinus
CTDI	: Computed tomography dose index
CTDIvol	: Computed tomography dose index volume
CTDIw	: Computed tomography dose weighted
DLP	: Dose length product
DORV	: Double outlet right ventricle
ECG	: Electrocardiogram
ECHO	: Echocardiography
GCV	: Great cardiac vein
IAA	: Interrupted Aortic Arch
IVC	: Inferior vena cava
LA	: Left atrium
LCA	: Left coronary artery
LMV	: Left marginal vein
MAPCAs	: Major aorta pulmonary collateral arteries
MDCT	: Multi-detector computed tomography
MIP	: Maximum intensity projection
MPA	: Main pulmonary artery

List of Abbreviation

MPR	:	Multiple planar reformation
MV	:	Mitral valve
OMA	:	Obtuse marginal artery
PAPVR	:	Partial anomalous pulmonary venous connection
PDA	:	Patent ductus arteriosus
PDA	:	Posterior descending artery
PIV	:	Posterior interventricular vein
PVLV	:	Posterior vein of the left ventricle
RA	:	Right atrium
RI	:	Ramus intermedius
RV	:	Right ventricle
SVC	:	Superior vena cava
TAPVR	:	Total anomalous pulmonary venous connection
TCM	:	Tube current modulation
VR	:	Volume rendering
VSD	:	Ventricular septal defect

List of Tables

Table	Table Title	Page
1	Study sample age distribution categories	117
2	Effective dose range to patient categories	118
3	Effective dose range to each patient individually	119
4	List of findings count and percentage	120
5	VSD results	121
6	ASD results	122
7	Aortic coarctation results	123
8	Right aortic arch results	123
9	Overriding of aorta results	124
10	Pseudocoarctation of aorta results	125
11	Aortic ectasia results	125
12	Pulmonary stenosis results	126
13	Pulmonary dilatation results	127
14	Left SVC results	127
15	Anomalous pulmonary venous return results	128
16	TGA results	129
17	PDA results	129
18	DORV results	130
19	Valvular anomalies results	131
20	Ventricular hypertrophy results	131
21	Fallot tetralogy results	132
22	Findings found in this study only	133

List of Figures

Figure	Figure Title	Page
1	Looping of the primitive heart tube	8
2	Diagram illustrates looping (bending) of the primitive cardiac tube	10
3	A 3D volume rendered depiction of the normal heart	20
4	Normal aorta CT	22
5	An axial CT view at the level of the bifurcation of the pulmonary artery	23
6	Normal pulmonary veins CT images	24
7	Normal appearance of the right ventricular out flow tract (RVOT)	26
8	Normal appearance of the left atrial appendage CT image	27
9	Normal bronchial branching pattern CT Coronal image	29
10	Normal coronary arteries CT image	30
11	Oblique multiplanar views illustrating the heart in a CT five chamber view and four chamber views	31
12	Illustration of interatrial septum	35
13	Cardiac CT shows Ostium primum atrial septal defect (ASD)	36
14	Ostium secundum atrial septal defect (ASD)	37

☞ List of Figures ☜

Figure	Figure Title	Page
15	Axial oblique image from cardiac CT shows superior sinus venosus atrial septal defect	38
16	CT scan :axial view showing a membrnous VSD	40
17	CT axial view showing midmuscular ventricular septal defect	41
18	Diagram of the common normal patterns and variations of pulmonary vein anatomy	43
19	Contrast-enhanced multidetector CT shows an anomalous pulmonary vein and an atrial septal defect	45
20	Sagittal maximum intensity projection image and volume- rendered images showing patent ductus arteriosus	46
21	CT scan with contrast, sagittal projection, showing the ventriculoarterial discordance	48
22	Van Praagh classification of truncus arteriosus	50
23	Non-obstructive supracardiac (type 1) TAPVR	53
24	Axial ,coronal oblique and Sagittal oblique CT images show a VSD, an overriding aorta, chamber hypertrophy and subvalvular stenosis that narrows the RVOT	55
25	Ebstein anomaly diagram	56

Figure	Figure Title	Page
26	Axial CT angiographic images showing left aortic arch with aberrant right subclavian artery	57
27	Cardiac CT shows aortic coarctation with hypo plastic aortic	58
28	Sagittal oblique volume-rendered CT angiographic image shows aortic pseudocoarctation	60
29	Coronal MIP CT angiographic image shows a double aortic arch, with a larger and higher right arch and a smaller left arch	61
30	Coronal oblique volume-rendered CT image shows the right sided aortic arch	62
31	Interrupted aortic arch Type A IAA	63
32	Interrupted aortic arch Type B IAA	64
33	Interrupted aortic arch Type C IAA	65
34	Sagittal oblique volume-rendered CT image shows aortic arch	66
35	Coronal MIP image shows apex of left cervical aortic arch is above level of clavicle	67
36	3D image depicts the anomalous right pulmonary vein	68
37	Congenital atresia of the pulmonary veins by axial CT images	69

Figure	Figure Title	Page
38	Axial contrast-enhanced multidetector CT image shows a right inferior pulmonary vein varix	70
39	Contrast-enhanced multidetector CT Coronal MIP image depicts an anomalous vein connecting the left atrium to the inferior vena cava	71
40	MDCT image depicting a pulmonary arteriovenous malformation	72
41	Pulmonary sling.: (Illustration showing an anomalous left pulmonary artery and an axial CT image showing an anomalous left pulmonary artery	74
42	CT scan shows abnormal enlargement of the main pulmonary trunk, with mild dilatation of the right and left pulmonary arteries	75
43	Contrast-enhanced axial MDCT image shows proximal interruption of left pulmonary artery, with multiple collateral vessels	76
44	Persistent left SVC, by Axial contrast-enhanced CT images	77
45	Coronal contrast-enhanced reformatted chest CT image shows fusiform aneurysmal dilatation of the upper mid SVC	78

☞ List of Figures ☜

Figure	Figure Title	Page
46	Coronal abdominal CT shows Azygos continuation of the IVC	79
47	Duplication of the IVC with a left-sided IVC draining into the left renal vein in coronal CT image	80
48	Coronal abdominal CT shows Left-sided IVC below the level of the renal veins	81
49	MIP reformatted images showing an open mitral valve , a normal pulmonic valve and a normal aortic valve	82
50	Schematic drawings of tricuspid atresia. The right ventricle is hypo plastic. An atrial septal defect supplies blood flow to the left heart	83
51	CT images of the RVOT show mild thickening of the valve leaflets, narrowing at the sinutubular junction and dilated coronary arteries	84
52	Axial MIP reformatted image shows bicuspid aortic valve with calcification	85
53	Axial CT MIP image shows four chambers of heart	88
54	Increased coverage with increased detectors number	90
55	MDCT 64, of different generations	90

 List of Figures 

Figure	Figure Title	Page
56	Low (100 Kvp) CT image provides better aortic enhancement than does the high (120 kVp) tube setting	93
57	Normalized effective dose per dose-length product (DLP) for adults and pediatric patients of various ages over various body regions	97
58	Case 1	135
59	Case 2	137
60	Case 3	139
61	Case 4	140
62	Case 5	142
63	Case 6	144
64	Case 7	146
65	Case 8	148
66	Case 9	150
67	Case 10	152

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ABSTRACT

Back ground: Congenital heart disease (CHDs) is the most common birth anomaly worldwide and it has a significantly increasing prevalence rate. Traditional evaluation for assessment depends on echocardiography (ECHO) and conventional angiography. Recent technological advances in computed tomography (CT), is increasingly used for noninvasive evaluation and proper diagnosis.

Aim of work: To examine the validity of administering low exposure dose by MDCT with the aid of ECG gating technique and post processing 3D reconstruction in diagnosis and follow up of congenital heart disease in pediatrics.

Patients & methods: This study was performed on 40 patients with age ranged from 3 days to 16 year old with suspicious or clinically /echocardiographically known to have congenital heart disease . The study was performed with MDCT machines (64 and 80 slices spiral CT)with ECG gating technique . The radiation dose was kept to minimum by reducing the kilo voltage to 80 kvp . All patients underwent Nonionic contrast agent injection.

Results: we found that there is overall no significant difference between the low Kvp ECG gated MDCT and high Kvp MDCT in detecting congenital cardiac anomalies moreover, in our study we detected some anomalies which were not reported by high Kvp protocol in other studies.

Conclusion: low Kvp ECG gated MDCT is superior to conventional method of CT scanning in assessment of congenital heart anomalies as it reaches to the same diagnosis with less radiation dose and hazards

Key words: ECG gated, congenital, low Kvp, MDCT, pediatrics.

Introduction

Congenital heart disease (CHDs) is the most common birth anomaly worldwide and it has a significantly increasing prevalence rate (*Bjornard et al., 2013*). It affects about 1 % of total births per year in united states of America (*Reller et al., 2008*), and considered the cause of 30-50% of birth defect mortality in infants and children (*Pertini et al., 2002*).

Owing to the previously mentioned prevalence and mortality rates, proper diagnosis and assessment of CHDs should be performed. Primary evaluation of CHDs traditionally depends on echocardiography (ECHO) and conventional angiography, these two techniques have some limitations such as being operator dependant, insufficient evaluation or proper imaging of coronary arteries and great vessels, missing extra cardiac assessment, being invasive in case of angiography with a potential risk for vascular injury, bleeding and infection (*Saad et al., 2009*).

The development of recent technological advances in computed tomography (CT), like multidetector CT (MDCT), is increasingly used in addition to ECHO for noninvasively evaluation of the morphological features of

vessels and cardiac chambers in patients with CHDs in a short time (*Nakagawa et al., 2015*). For infants with congenital heart disease, electro cardiogram (ECG)-gated cardiac CT angiography (CTA) is the modality of choice for imaging the coronary arteries, airway and extra cardiac vascular structures. Fast scanning times and high-quality evaluation of both complex cardiac and coronary anatomy have enabled CTA to aid in patient management and treatment planning (*Richardson and Chau, 2013*).

MDCT provides high-quality three-dimensional (3-D) images using 3D methods such as volume rendering and maximum intensity projection, the resulting images are valuable for assessing complex cardiovascular birth defects especially for surgeons (*Itatani et al., 2013*).

The degree of radiation exposure associated with MDCT is of concern, most notably in pediatric patients as they are more sensitive than adults to the effects of ionizing radiation, therefore, it is essential to balance image quality with radiation dose delivered when performing CTA in children. The dose should be kept as low as reasonably achievable (ALARA) (*Paul et al., 2011*). The estimated radiation doses for prospective and retrospective ECG-gated protocols have been reported to be ranging from 1-10