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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Dina Hamdy Ahmed Elsayed

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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

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

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

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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