بسم الله الرحمن الرحيم

MONA MAGHRABY

شبكة المعلومات الجامعية

التوثيق الالكتروني والميكروفيلم

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جامعة عين شمس

التوثيق الإلكتروني والميكروفيلم

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MONA MAGHRABY

Comparative Study between Cardiac Computed Tomography and Magnetic Resonance Imaging in Assessment of Cavopulmonary Anastomoses

Thesis

Submitted for Partial Fulfillment of
M.D. Degree in **Radiodiagnosis**

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Dedication

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ABSTRACT

Background

Multi-slice computed tomography (MSCT) angiography is the gold standard imaging modality to evaluate the patency of Glenn shunt and the presence of veno–veno collaterals. The goal of this study is to evaluate the ability of two cardiac magnetic resonance imaging (MRI) techniques to assess the patency of Glenn shunt and the presence of veno–veno collaterals compared to MSCT angiography.

Results

Patients with Glenn shunt had MSCT angiography and cardiac MRI using two techniques: TWIST (Time-resolved angiography With Stochastic Trajectories) and the three-dimensional (3D) post-contrast whole heart techniques. MSCT angiography and cardiac MRI images were post-processed for quantitative and qualitative assessment of Glenn shunt and veno–veno collaterals. Our study included 29 patients (17 male, 59%) with Glenn shunt, the median age was 22 years (range 3–36 years). 3D post-contrast whole heart images give similar results compared to MSCT angiography results in the evaluation of Glenn shunt and veno–veno collaterals, 100% agreement in Glenn shunt visualization and agreement was 86.2% in the detection of veno–veno collaterals with a perfect agreement (kappa = 1) as regards their proximal connection to superior vena cava (SVC). While TWIST showed lower agreement compared to MSCT angiography results, 87.5% agreement in Glenn shunt visualization and agreement was 68.9% in the detection of veno–veno collaterals with poor agreement (kappa = 0.266) as regards their proximal connection to SVC.

Conclusions

3D post-contrast whole heart MRI images have similar results as MSCT angiography in the evaluation of superior cavo-pulmonary anastomosis and can be a good and safer alternative to MSCT angiography.

Keywords: MSCT, TWIST,MRI, 3D post contrast whole heart

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List of Abbreviations

Abb.	Full term
1D	*One-dimensional*
3D	*Three-dimensional*
Aao	*Ascending aorta*
AEC	*Automated exposure control*
ANT	*Anterior*
ASD	*Atrial septal defect*
AV	*Atrioventricular*
BDG	*Bidirectional Glenn shunt*
BT	*Blalock-Taussig*
CAVC	*Complete atrioventricular canal*
CCA	*Conventional cardiac angiography*
CHD	*Congenital heart disease*
CMR	*Cardiovascular magnetic resonance*
CT	*Computed tomography*
DAD	*Descending aorta at diaphragm*
DORV	*Double outlet right ventricle*
DTGA	*Dextro-Transposition of the Great Arteries*
ECG	*Electrocardiogram*
FF	*Fontan fenestration*
FSV	*Functional single ventricle*
FT	*Fontan tunnel*
GRE	*Gradient echo*
HF	*Hemi-Fontan*
HLHS	*Hypoplastic left heart syndrome*
IA	*Innominate artery*
ICC	*Interclass correlation*
ITV	*Inferior thyroid vein*
IVC	*Inferior vena cava*
LA	*Left atrium*

List of Abbreviations (cont...)

Abb.	Full term
LPA	*Left pulmonary artery*
LSA	*Left subclavian artery*
LT	*Lateral tunnel*
LTGA	*Levo-Transposition of the Great Arteries*
LV	*Left ventricle*
LVOTO	*Left ventricular outflow tract obstruction*
MAPCA	*Major Aortopulmonary Collateral Arteries*
MBT	*Modified Blalock-Taussig*
MIP	*Maximum intensity projections*
MPA	*Main pulmonary artery*
MPR	*Multiplanar reformatting*
MRA	*Magnetic Resonance angiography*
MRI	*Magnetic Resonance Imaging*
MSCT	*Multi-slice computed tomography*
PA	*Pulmonary artery*
PC-MRI	*Phase contrast MRI*
PCPVs	*Pericardiophrenic veins*
PS	*Pulmonary stenosis*
PV	*Pulmonary vein*
RA	*Right atrium*
RPA	*Right pulmonary artery*
RSA	*Right subclavian artery*
RT BCV, LT BCV	*Right and left brachiocephalic veins*
Rt IMV, Lt IMV	*Right and left internal mammary veins*
Rt SIV, Lt SIV	*Right and left superior intercostal veins*
RV	*Right ventricle*
SC	*Subclavian*

List of Abbreviations (cont...)

Abb.	Full term
SNR	*Signal to noise ratio*
SSFP	*Steady-state-free-precession*
SVC	*Superior vena cava*
TA	*Tricuspid atresia*
TAPVR	*Total anomalous pulmonary venous return*
TCM	*Tube current modulation*
TCPC	*Total Cavopulmonary connection*
TV	*Tricuspid valve*
TWIST	*Time-resolved angiography With Stochastic Trajectories*
Venc	*Velocity encoding*
VRT	*Volume-rendered technique*
VSD	*Ventricular septal defect*

INTRODUCTION

The incidence of congenital heart diseases is about 2.5–3/1000 live births ***(Mahani et al., 2016).***

Single-ventricle physiology, also called ‘univentricular circulation,’ ‘common ventricle’ or ‘functionally single ventricle encompasses several groups of lesions characterized by the lack of two well-developed ventricles, one of which is typically hypoplastic or rudimentary ***(Kempny et al., 2014).***

Because of remarkable advances in survival over the past 40 years, the worldwide population of individuals with single ventricle heart disease living with Fontan circulation has grown to ≈70 000, with nearly half aged >18 years. Survival to at least 30 years of age is now achievable for 75% of Fontan patients. On the other hand, single ventricle patients account for the largest group of the 6000 to 8000 children hospitalized with circulation failure ***(Reddy et al., 2020).***

The treatment modalities of single ventricle physiology may involve palliative methods. The aim of the palliative surgical methods is a deviation of the systemic venous return into the pulmonary arterial circulation without passing through a ventricle ***(Hong et al., 2017).*** These surgical methods include (Glenn shunt, Kawashima, and Fontan procedures) but the Glenn shunt is the most used in Egypt. Glenn shunt procedure was first done in 1958 by Dr. William Glenn shunt and it is still