Original article:

Role of computed tomography in patient with congenital heart disease

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Abstract

Introduction- Computed tomography (CT) is a noninvasive technique that provides complete anatomical and morphological evaluation of congenital heart disease (CHD). CT proved to be an important modality for decision-making in patients with congenital heart diseases.

Materials and methods- 18 patients of different age groups diagnosed with congenital heart disease on 2D Echocardiography which are reffered for cardiac CT scan were included in this study.

Results- This study included 18 patients.We found the following anomalies: Tetralogy of Fallot (8 patients), Coarctation of aorta (4 patients), patent ductus arteriosus (1 patient) , Septal defects (2 patients of ASD and 1 patient of ASD + VSD) patient) , Truncus arteriosus and aortopulmonary window (1 patient) , Left atrial isomerism (1 patient).

Discussion- CT is a useful imaging modality for the morphologic evaluation of CHD. Reformatted images from multisection spiral CT can accurately and systematically delineate the normal and pathologic morphologic features of the cardiovascular structures.

Conclusion - CT provides comprehensive evaluation of different anatomic structures, including the heart, pulmonary and systemic thoracic vasculature and lungs in patients with congenital heart diseases. CT has become a valuable imaging modality alongside echocardiography or as a substitute for invasive angiography in the assessment of patients with CHD.

INTRODUCTION

Congenital heart disease (CHD) is one of the most prevailing congenital anomalies, affecting 4-10/1000 live births, of which 50% are complex CHD1. An accurate and complete evaluation of the cardiac and extra-cardiac vascular anatomy is essential for diagnosis and for planning the management of patients with complex CHD.The MDCT allows volume acquisition in a short period of time, even for neonates and infants, thus significantly reducing respiratory artifacts and sedation doses for pediatric patients.

Echocardiography and catheter cardioangiographyare the primary cardiac imaging modalities, but both have weaknesses.Echocardiography is limited by a small field of view, an acoustic window, and operator dependence.Catheter cardioangiographyis limited by the overlapping of adjacent vascular structures, difficulty in demonstrating systemic and pulmonary vascular systems simultaneously.Catheter-related complications (especially in young children), and relatively high doses of ionizing radiation and iodinated contrast material.

MRI has several disadvantages compared with CT .These limitations include poorer spatial resolution [2, 3];

The presence of image-degrading artifacts from implanted metal, such as intravascular stents and embolization coils [4]; Higher cost [2, 5]; limited availability [2, 3]; contraindication in imaging of patients with pacemakers [4, 6]; and increased need for general anesthesia in younger children [3]. MRI also takes longer time than CT and more often requires onsite physician monitoring to assure diagnostic image quality. Finally, MRI is limited in the evaluation of the airways and lungs structures that CT depicts well [5, 7, 8]. On the other hand, measures to reduce radiation exposure are evolving, including reduction of tube current based on weight and size, modulation of tube current depending on anatomic position or phase of cardiac cycle (ECG-modulated pulsing), or reduction of tube voltage9.

COMPUTED TOMOGRAPHY TECHNIQUE

The 128-slice scanner (Siemens SOMATOM) was used and scan performed from thoracic inlet to L1-L2 level.Detector collimation was 28 x 0.6mm. Slice thickness was 3 mm.Contrast medium was non-ionic, 1-1.5ml/kg in a concentration of 350mg/ml at flow rate of 3-4 ml/sec in paediatricage group and 5-6 ml/kg in adult age group. A weight-based low-dose CT protocol (120 kVp, 30-80 mA) was used.The region of interest varied from one type of study to another.

Materials and methods-

STUDY DESIGN is Descriptive Cross Sectional Observational study.STUDY SAMPLE18 patients of different age groups diagnosed with congenital heart disease on 2D Echocardiography which are refferedfor cardiac CT scan were included in this study and study place is Pravararural hospital, Loni

INCLUSIONCRITERIA:

All age group and both gender patients with congenital heart disease diagnosed by 2DEchocardiography & reffered for cardiac CT scan study who will qualify underlying criteria:

1.Patientwhowillgivewritten&informedconsent.

2.CyanoticorAcyanoticcongenitalheartdiseasepatients.

EXCLUSIONCRITERIA:

1.Patients who had history of allergy to Intravenous iodinated contrast agent.

2.Patientswithderangedrenalfunctiontests.

3.Patientswithlifethreateningcardiacarrhythmias.

4.Pregnancy

TypicalPathologicConditions

ExtracardiacAbnormalities

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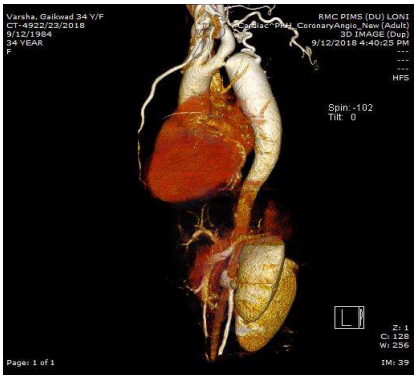
Coarctation of the Aorta —

The narrowing is located just distal to the left subclavian artery.



Aortopulmonary Window.—

Aortopulmonary window is a communication between the ascending aorta and the pulmonary trunk in the presence of separate aortic and pulmonary valves (15,17

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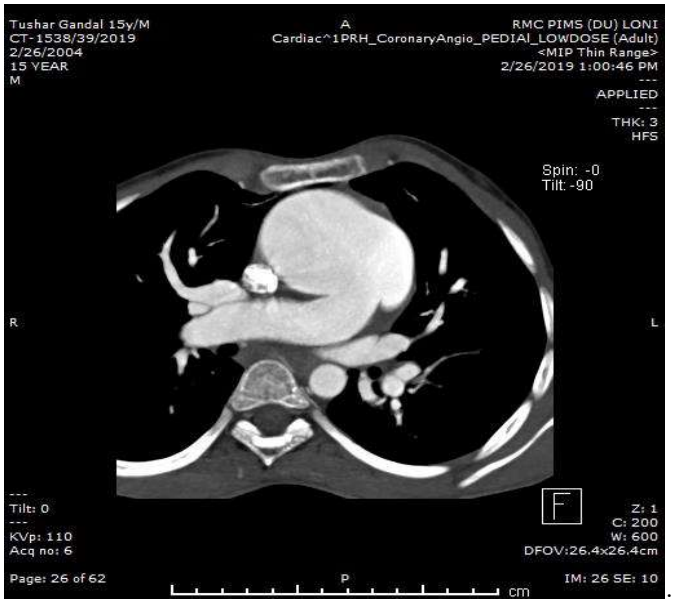

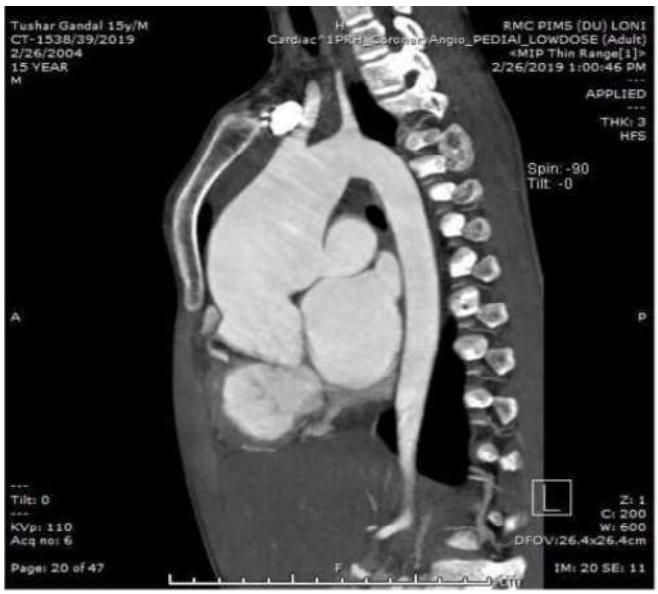

Patent Ductus Arteriosus.'

PDA is defined as persistent patency of the ductus arteriosus beyond functional closure after birth (15). Uncomplicated PDA connects the proximal descending aorta below the origin of the left subclavian artery with the roof of the main pulmonary artery near the orifice of the left pulmonary artery (12).

PDA with COA

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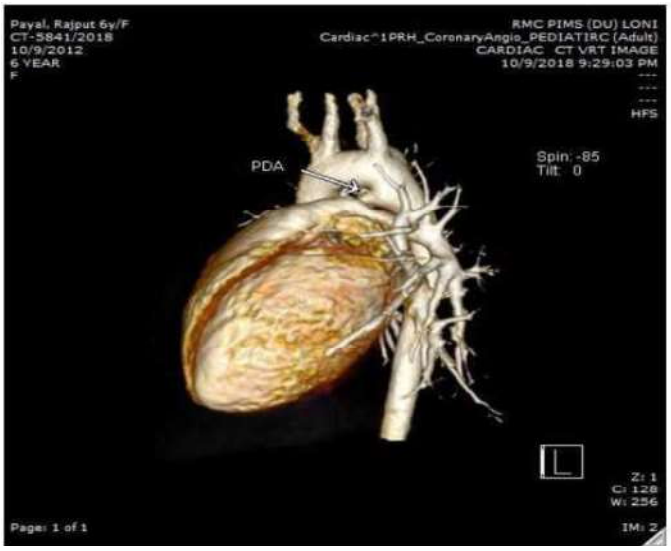
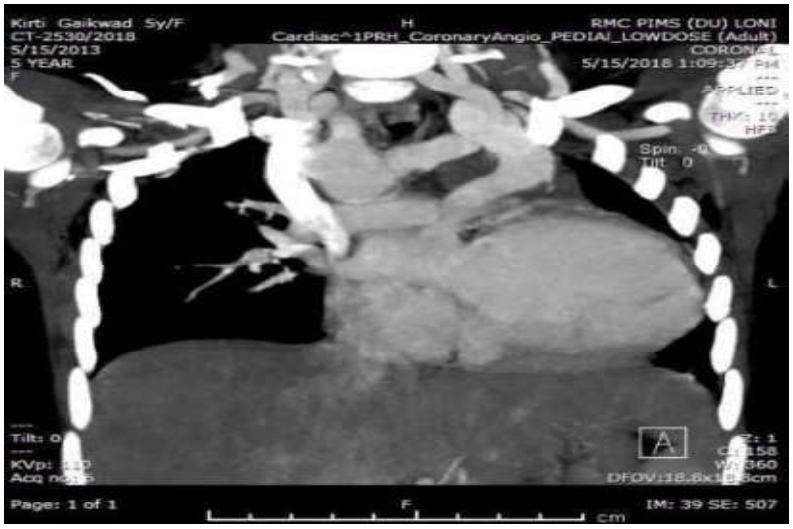


Left SVC —

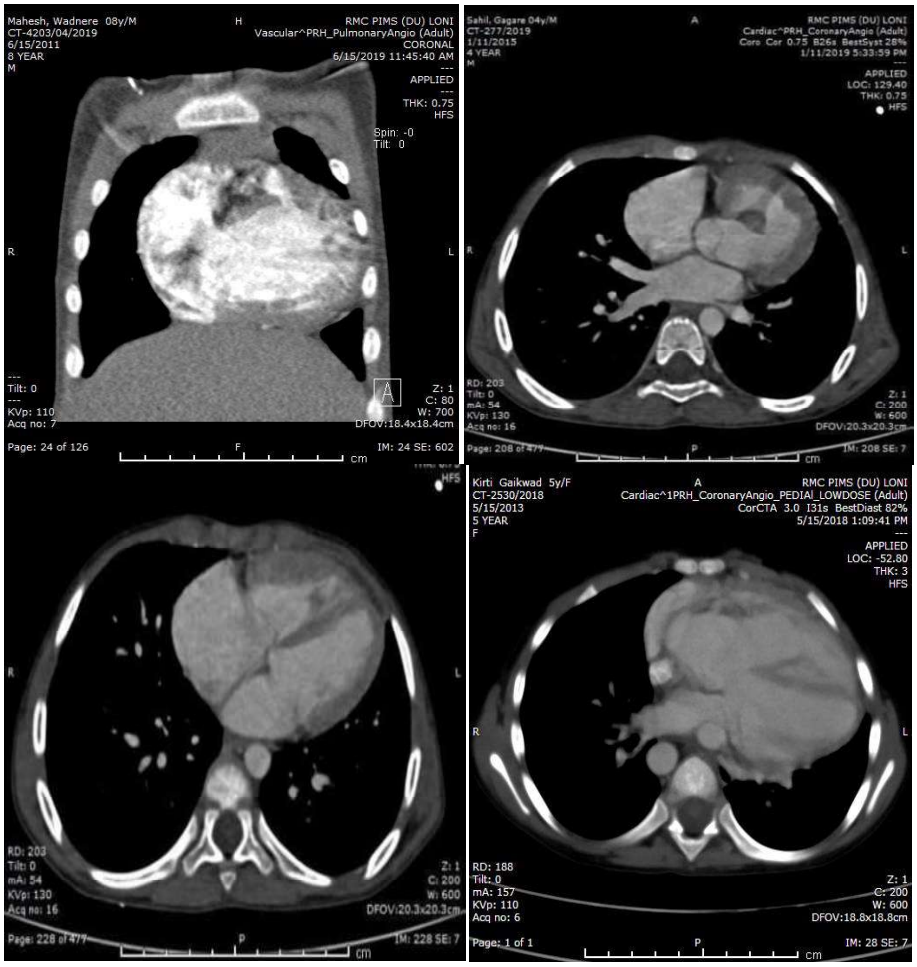
Left SVC is a common abnormality that drains into the right atrium via a dilated coronary sinus (13,16,17,19)



Persistent left SVC

Cardiac Abnormalities

Tetralogy of Fallot—The morphologic features of tetralogy of Fallot include subpulmonary infundibular stenosis, ventricular septal defect (VSD), overriding of the aorta, and right ventricular hypertrophy (10,11,14,16,17).



Subpulmonary infundibular Large sized posterior muscular Overriding of aortaRight ventricularHypertrophy

Stenosis VSD

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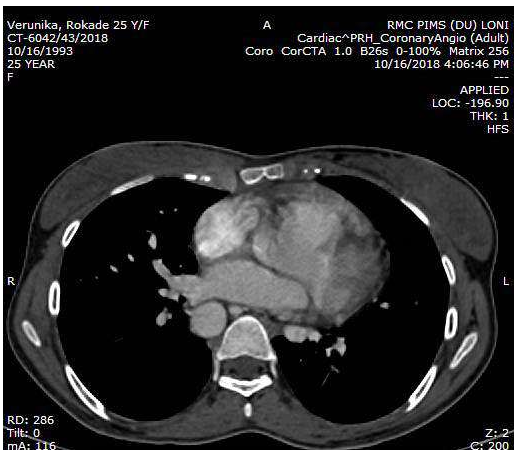
Ventricular Septal Defect—

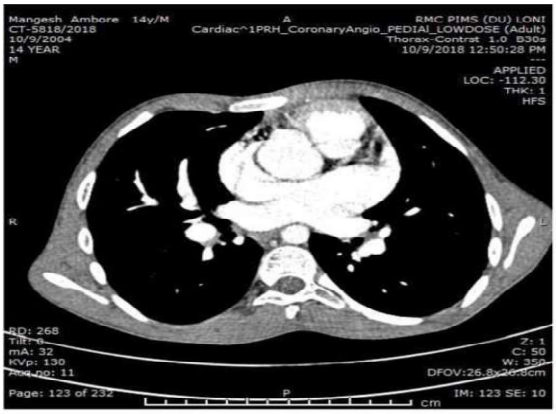
VSD is a hole or holes of variable size in the interventricular septum (16,20).

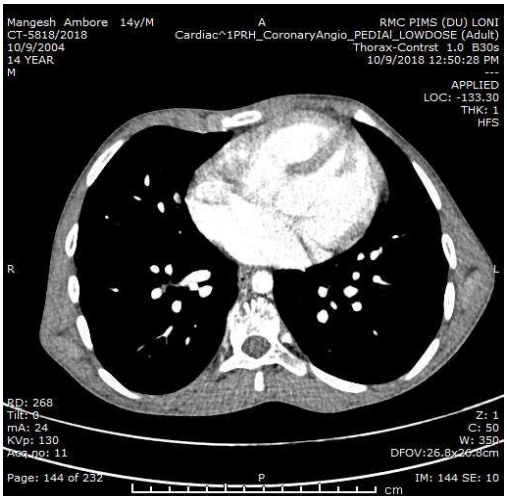


Subaortic VSD

Atrial Septal Defect—

Atrial septal defects are charecterisedby abnormal opening in the atrial septum allowing communication between the right and left atria.

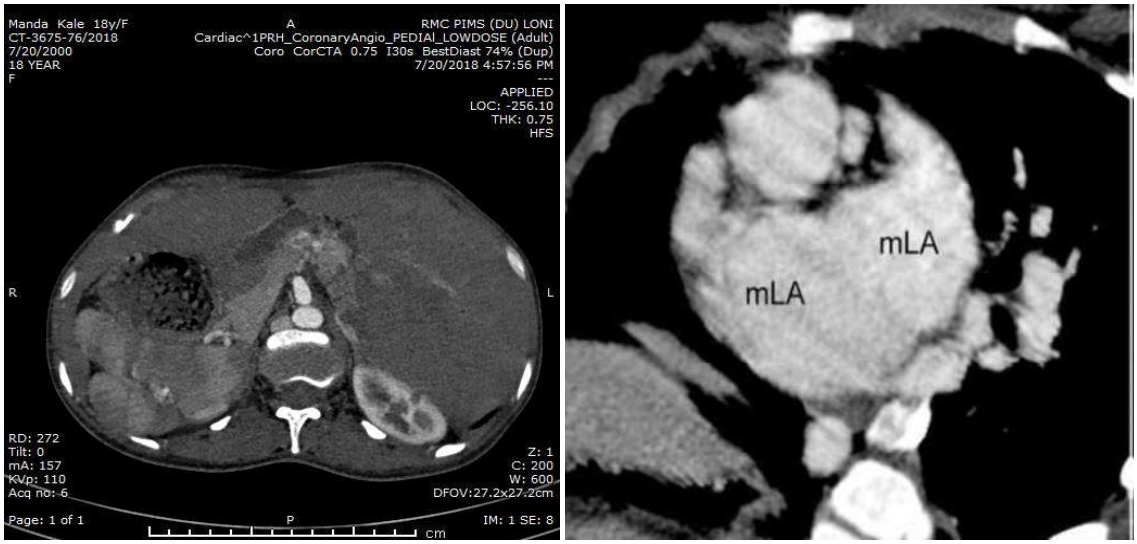




Connection Problems

l.**LeftAtrial Isomerism.**

In left isomerism, bilateral atria have a finger-like appendage with a narrow opening characterizing the morphologic left atrial appendage (15,16,17,21) both main bronchi are symmetrically long, and the upper lobe bronchi are bilaterally hyparterial. polyspleniais commonly associated with left isomerism.



Left atrial isomerism. **(a)** On a CT scan, both atria have a long appendage with a narrow opening and therefore represent morphologic left atria (mLA).

Table 1) **Distribution of cardiovascular malformations in 18 patients as diagnosed by MDCT .Cardiovascular malformation**

Distribution of cardiovascular malformations in 18 patients as diagnosed by MDCT .Cardiovascular malformation	**Diagnosis by MDCT in 18 patients**
1. Tetralogy of Fallot	8
2. Coarctation of aorta	4
3. ASD + VSD	1
4. ASD	2
5.PDA	1
6. Aorto-pulmonary window	1
7.Left isomerism	1
Total	18

Conclusion

CT provides comprehensive evaluation of different anatomic structures, including the heart, pulmonary and systemic thoracic vasculature and lungs in patients with congenital heart diseases.CT has become a valuable imaging modality alongside echocardiography or as a substitute for invasive angiography in the assessment of patients with CHD.

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