

# Comparative Study Between Multi-Detector Computed Tomography and Echocardiography in Evaluation of Congenital Vascular Rings

By

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## Introduction

- Vascular rings are unusual anomalies represent less than 1% of all congenital cardiac anomalies, in which there is abnormal development of aortic arch complex resulting in formation of a ring formed by great vessels that encircling both trachea and esophagus leading to breathing and swallowing difficulties, patients with vascular rings usually presented by wheezing, stridor, recurrent chest infection, feeding difficulty, and aspiration pneumonia according to degree

➤ The most common types of vascular rings anomalies are double aortic arch (DAA) (40-70%) and right aortic arch with aberrant left subclavian and left ligamentum arteriosum (30%).

➤ Two other vascular rings that are rare ( $\leq 1\%$ ) include right aortic arch with mirror-image branching and left ligamentum arteriosum and left aortic arch with retro esophageal right subclavian artery and right ligamentum

➤ Echocardiography was the initial imaging modality for diagnosis of congenital aortic arch anomalies, however this modality is operator dependent and had limited acoustic window leads to inadequate evaluation of

➤ Conventional angiography is considered to be the golden standard in diagnosis of congenital heart disease including aortic arch anomalies, however it has many disadvantages as it is invasive procedure, need general anesthesia and also risk of radiation to neonates and contrast agent toxicity.

➤ Multi-detector computed tomography (MDCT) with increased z-axis coverage, higher spatial resolution, and higher temporal resolution (faster 360 rotation times) make the evaluation of great vessels and their branches is possible with faster imaging times and fewer motion artifacts, and less amount of contrast material.

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➤ MDCT one of most important non invasive diagnostic tool used in detection of vascular ring anomalies.

➤ Regarding its widespread availability; MDCT and 3D imaging are increasingly considered as a viable “one-stop shop” for evaluation of cardiovascular structures in

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- The recent developments in CT techniques are characterized by faster speed which reduced need for sedation, longer anatomic coverage and a lower radiation dose.
- Minimization the radiation exposure delivered by CT particularly for children is an important issue as various dose

## Aim of the Work

***The aim of the present study*** to evaluate role of MDCT in diagnosis of congenital vascular rings compared to echocardiography.

## Patients & Methods

- This Prospective study of 21 patients with history and clinical examination suspicious of vascular rings anomalies, all of them were underwent full history taking including: age, sex, residence, consanguinity, manifestations of respiratory compression and feeding difficulties. General and cardiac examinations were done for all patients.
- Chest radiography were done for all patients.

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## Echocardiography examinations

- After complete study for cardiac structure .The transducer is positioned in the suprasternal notch, starting with downward angulation then sweep upward to allow identification the position of aortic arch relative to trachea and the branching pattern of great

## Multi-detector CT

- All patients were underwent multi-detector CT. Scanning was performed using a 128-row CT scanner.

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## Results

- This study was conducted on 21 patients (11 male and 10 female), age at the time of presentation ranged from one month to 10 years (mean 14 months) were diagnosed as vascular rings anomalies by MDCT confirmed by surgical results which was done in

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➤ The pediatric patients were presented by stridor, different level of wheezing and recurrent chest infection, feeding difficulties were present in seven patients especially those with aberrant subclavian artery, dysphagia is often the first symptom in older patients.

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## Types of vascular ring anomalies

Types of vascular ring lesion	Numbers of cases	Percent
<b>DAA</b>	14	66.66%
With dominant right side aortic arch	8	57.14%
With dominant left side aortic arch	2	14%
With balanced two aortic arches	2	14%
With atretic left arch	2	14%
Right side aortic arch with aberrant left subclavian	4	19.04%
Left side aortic arch with aberrant right subclavian	2	9.52%
Pulmonary sling	1	4.76%

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## Associated intra-cardiac and extra-cardiac lesion with our cases

Types of vascular ring lesion	Intra-cardiac associated lesions		Extra-cardiac associated lesions	
	Lesion	No.	Lesion	No.
Double aortic arch	ASD	2	Tracheobronchial stenosis	2
	APVD	1	Tracheal stenosis	4
Right side aortic arch with aberrant left subclavian	PDA	1	Sequestered lung segment	1
	Kommerell diverticulum	1		
	PA stenosis	1		
Left side aortic arch with aberrant right subclavian				
Pulmonary sling	per membranous VSD	1	Pneumonia	1

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➤ Echocardiography succeeded in diagnosis of nine cases with DAA and failed in five giving a sensitivity 64%, four cases were diagnosed (right aortic arch) by echocardiography: three of which were DAA with large right arch and smaller left arch and one case had DAA with left atretic arch diagnosed by MDCT, One case was diagnosed as (left aortic arch) by echocardiography, but it was diagnosed as DAA with a larger left arch and smaller right arch by MDCT.

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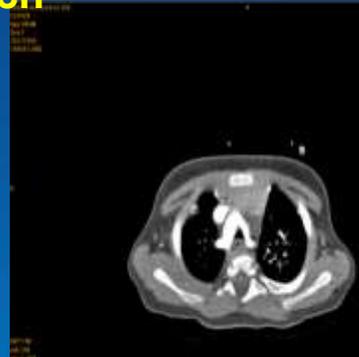
➤ Echocardiography succeeded in diagnosis two case of (right aortic arch with aberrant left subclavian) with sensitivity 50% and failed in two, which pre-diagnosed as right aortic arch, one case with pulmonary artery sling misdiagnosed as perimembranous VSD by echocardiography, from total 21 patients echocardiography diagnosed only 11 cases with 52% sensitivity.

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## Double Aortic Arch with dominant right arch



(A) The CT volume-rendered image shows that the aortic arch split into two arches surrounding the trachea



(B) An axial CT section image. The aortic arch split into two arches surrounding the trachea and esophagus.

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## Right Aortic arch with aberrant left subclavian



(A) 3D Multislice CT image posterior aspect view revealed: the left subclavian artery arising from the left posterior side of the Aortic arch.



(B) Frontal view the aberrant left subclavian artery arising from the left posterior aspect of the Aortic arch .

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## Conclusions

***From this study we concluded that:***

- MDCT is an excellent diagnostic tool in optimum diagnosis of vascular rings and other extra cardiac lesion compared to echocardiography

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