Research Article

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The Role of CT Angiography Above Echocardiography in Evaluations of Congenital Heart Disease in TCH (2013-2018)

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Abstract

Back ground: *Congenital heart disease (CHD) one of the most commonly occurring congenital anomaly, affecting 4-10/1000 live births, Echocardiography is the mainstay of diagnosis, the recent developments in CT techniques increasing role of CT in the evaluation of congenital heart disease that minimize the radiation exposure particularly for children.*

Objective: *This study is performed to assess and high light the role of multi-detector computed tomography (CT angiography) in the evaluation of cardiovascular abnormalities as (Cono- truncal defects) in children and the Clinical indications above trans-thoracic echocardiography.*

Method: *This study included 70 patients, they were referred or following in pediatric cardiology clinic at TCH from January 2013 till October 2018. All patients presented with history or clinical suspicion of Cono- truncal defect were included in the study, for all patient's full history and clinical examination were obtained. An echocardiography examination was done. CT angiography was performed by Philips machine (16 segment).*

Results: *Pulmonary anomalies represent the majority of detected congenital defects in our study, represent 37 cases (53 %) and the commonest pulmonary anomaly is pulmonary stenosis. The majority of patient shows the same finding in echocardiography & CT angiography which represent 47 cases (67.1%), while in 12 cases (17%) CT angiography add more details in regards to the size of the great vessels and the peripheral structure (peripheral pulmonary arteries), while CT angiography rule-out the echocardiography finding in only 11 cases (15 %). Out of 23 cases of patients with Aortic anomaly, 19 cases (82.6%) have the same finding in echocardiography while in 3 cases (13%) the result of CT rolled out the echo finding, and 29 (78.4%) cases out of 37 cases with pulmonary anomalies have same finding in both echocardiography and CT angiography.*

Conclusion: *We conclude that CT angiography is considered a non-invasive diagnostic tool complementary to the cardiac echocardiography in the diagnosis of complex heart defects especially in pulmonary anomalies.*

Recommendation: *Similar study need to be conducted with large sample to confirm the extent of this finding.*

Keywords: CT angiography, Cono-truncal Defect, Echocardiography.

1. Introduction

Congenital heart disease (CHD) is one of the most commonly occurring congenital anomaly, affecting 4-10/1000 live births , 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 [1,2] .

Echocardiography (ECHO) is the mainstay of diagnosis of congenital heart disease. It`s strength includes an absence of radiation, the ability to evaluate intra-cardiac structure, function and the ability to perform hemodynamic assessment. However, it is limited in the evaluation of certain portions of the aorta (particularly the ascending aorta and the transverse arch), the distal pulmonary arteries, the right ventricle, and the pulmonary veins [3] .

The recent developments in CT techniques are characterized by faster speed, longer anatomic coverage, a more flexible ECG-synchronized scan and a lower radiation dose. These advances have noticeably increased the cardiac applications of

CT. This increasing role of CT also includes the evaluation of congenital heart disease [1,4,5]. Minimization of the radiation exposure delivered by CT is an important issue particularly for children [6,7]. Various dose reduction techniques are currently available for cardiac CT as a result of the efforts to reduce the CT dose [9,10], Figure (1).

The purpose of this study is to assess and high light the role of multi-detector computed tomography CT angiography in the evaluation of cardiovascular abnormalities (Cono-truncal defect) in children and the Clinical indications above trans-thoracic echocardiography.

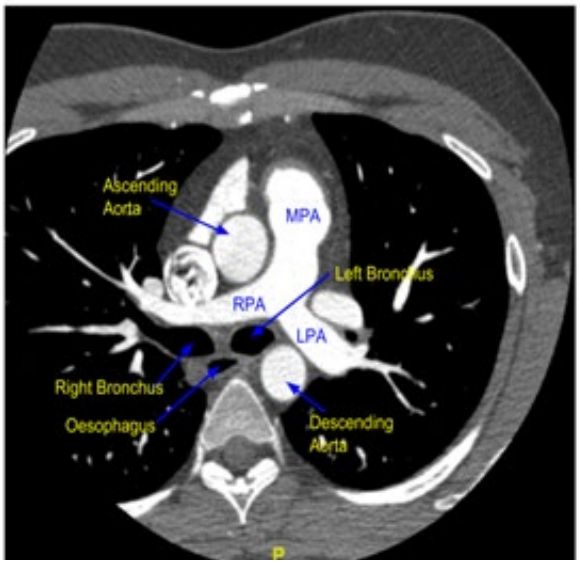

Figure 1: C.T angio at the base of the heart Show Main pulmonary artery (MPA), right pulmonary branch (RPB), Left pulmonary branch (LPB), Ascending Ao, Descending Ao.

2. Patients and Methods

This study included 70 patients (39 males and 31 females) with age ranges from 2 days to 20 years, they were referred or following in pediatric cardiology clinic at Tripoli Children Hospital (TCH) over a period of 6 years (January 2013- October 2018). All patients presented with history or clinical suspicion of Cono-truncal defects (Pulmonary artery & Aorta) were included in the study, for each patient full history and clinical examination were obtained including (age of presentation, Sex, Address, mode of presentation). An echocardiography examination was done for each patient included in the study by machine (Philips C inviser -probe 4S & 8S and warm sonographic gel). The patient was placed reclining position with comfortable environment in a dark room use appropriate pillow and blanket.

The Ct angio was performed by Philips machine (16 segment) and the consent was taken from the patient parents, the renal functions should be performed before the test (Urea, electrolyte and creatinine). the patient should be fasting for at least 2–3 h prior to the examination, and Proper hydration was advised for at least 4 h before contrast injection. General anesthesia used for the patient during the procedure.

3. Results

Seventy (70) patients have suspicion of Cono-truncal defect were enrolled in this study. All patients undergone echocardiography examination and the diagnosis were confirmed by CT angiography. The Male out numbering the female as the ratio is 1.25:1 (were 39 males (55.7%), and 31(44.3%) female) as shown in figure (2). Nearly one fourth of patients (20=28.6%) diagnosed at neonatal period, 34 patients (48.6%) from one month to one year. the rest of patients has been diagnosed beyond the first year of life. table (1).

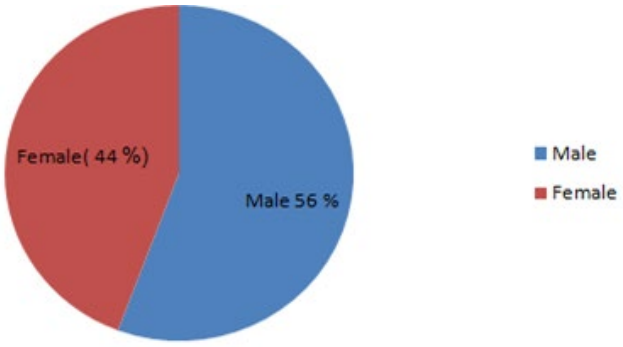

Figure 2: Shows the percentage of affected Males as compared to the affected females.

Age of presentation	n	%
- Neonate	20	28.6 %
- 1 month –less 6months	34	48.6 %
- 6months- less than 1 year	6	8.6 %
- 1 year- less 6 years	7	10.0 %
- 6 years- less than 12 years	3	4.3 %

Table 1: Shows the distribution of patients according to the of Age at time of presentation.

Cyanosis is the most common mode of presentation as it is seen in 30 patients, which represents (43%) followed by heart murmur 21 patients (30%) and respiratory distress 10 patient (14.3 %). Figure (3). Pulmonary anomalies represent the majority of detected congenital anomalies in our study, which represent 37 cases (53 %) and the commonest pulmonary anomaly is pulmonary stenosis, compared to Aortic anomaly and Aorto-pulmonary anomalies as shown in figure (4). most of our patient with pulmonary anomaly waiting for corrective surgery (19 %), while most patient with Aortic anomaly (13%) undergone corrective surgery as shown in Figure (5).

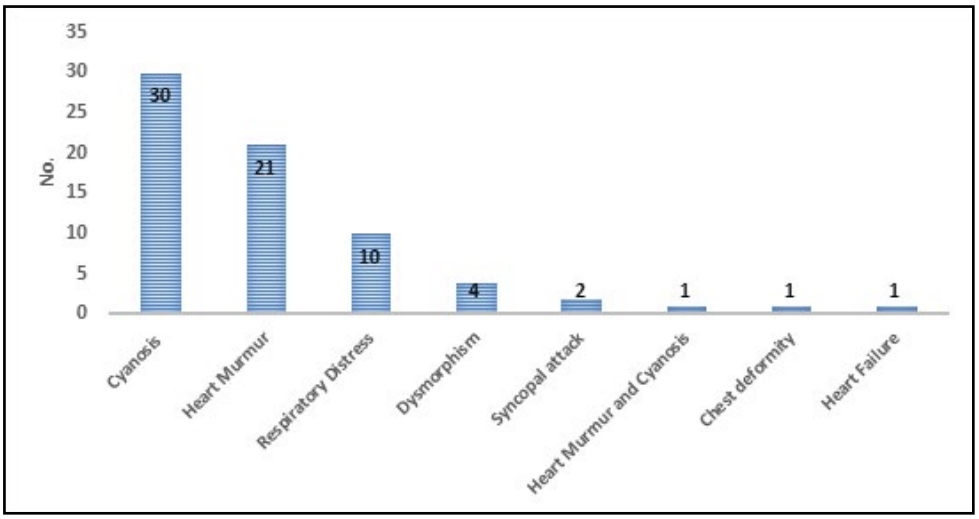

Figure 3: Shows the percentage for Mode of presentation for patients included in this study.

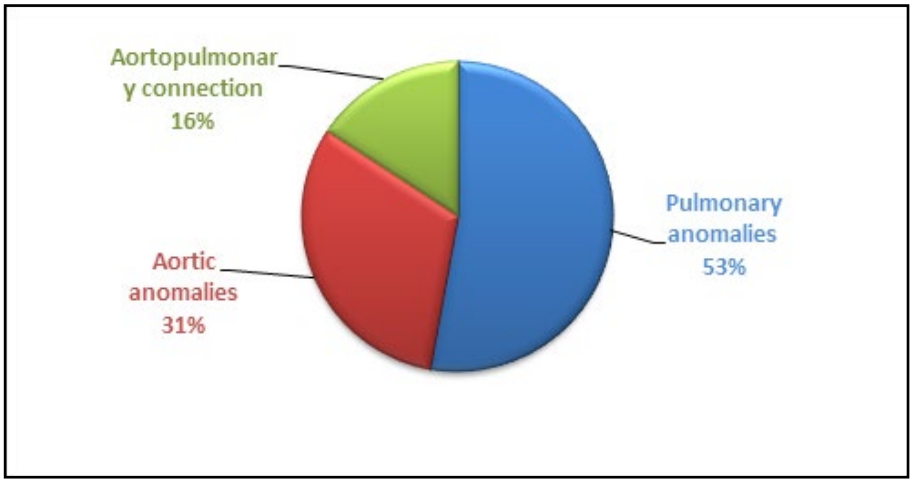

Figure 4: Distribution of patients according heart defects.

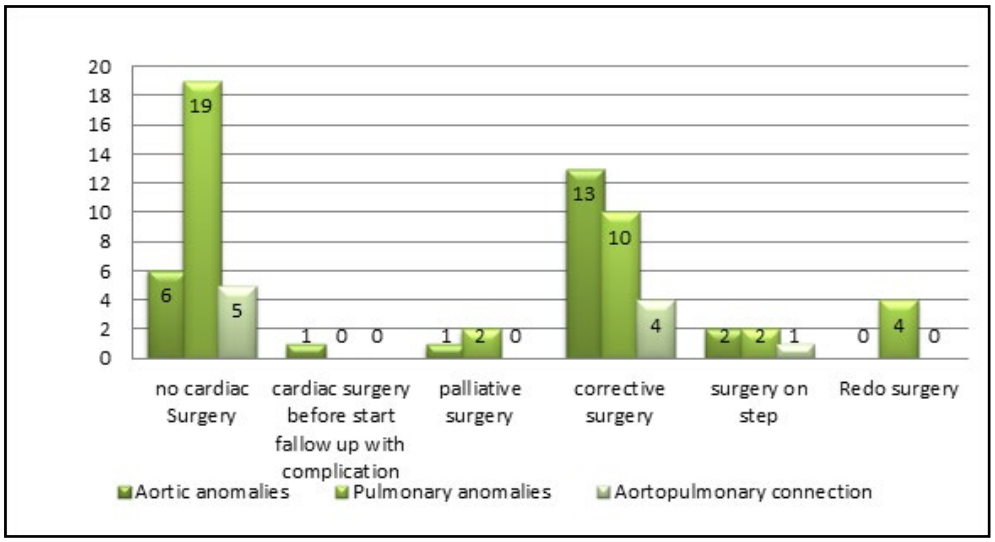

Figure 5: Shows the Percentage of Patients Underwent Cardiac Surgery in Relation to their Cardiac Anomaly.

The majority of patient shows the same finding in both echocardiography & CT angiographies which represent 47 patients (67.1%), while in 12 cases (17%) CT angiography add more details in regards to the size of the great vessels and the peripheral structure (e.g.: peripheral pulmonary arteries), and CT angiography rule-out the echocardiography finding in only 11 cases (15 %) as shown in Table (2).

CT angiography Finding	n	%
Same finding as echocardiography	47	67.1 %
Same finding with more details	12	17.1 %
CT finding rule out echo finding	11	15.7 %
Total	70	100 %

Table 2: CT Angiography Finding In Comparison With Echocardiography Finding.

Out of 23 cases of patients with Aortic anomaly, 19 case (82.6%) have the same finding in echocardiography while in 3 cases (13%) the result of CT rolled out the echo finding, regarding pulmonary artery anomaly; 29 patients (78.4%) cases out of 37 cases have same finding in both echocardiography and CT angiography. table (3).

CT finding	Type of Congenital Heart Disease		
	Aortic anomalies	Pulmonary anomalies	Aorto-pulmonary connection
Same finding	19 (82.6%)	29 (78.4%)	9 (90.0%)
Same finding with more details	1 (4.3%)	1 (2.7%)	0 (0%)
CT finding role out echo finding	3 (13.0%)	7 (18.9%)	1 (10.0%)
Total	23 (100%)	37 (100%)	10 (100%)

Table 3: A comparison between CT angiography and Echocardiography finding according to Type of Congenital Heart Disease

We compare also the relation of CT angiography and echocardiography finding with age of presentation and It is observed that The majority of cases who presented during the first 6 months of life (24 cases) have the similar finding in both echocardiography and CT angiography, while the other cases presented in different ages as show in table (6).

Age of presentation	CT angio finding in comparison with Echocardiography		
	Same finding n (%)	Same finding with more details n (%)	CT finding role out echo finding n (%)
Neonate	11 (23.4%)	5 (41.7%)	4 (30.0%)
1months-less 6months	24 (51.1%)	6 (50.0%)	4 (40.0%)
6months- less than 1 year	4 (8.5%)	0	2 (20.0%)
1 year- less 6 years	6 (12.8%)	0	1 (10.0%)
6 years- less than 12 years	2 (4.3%)	1 (8.3%)	0
Total	47 (100 %)	12 (100 %)	11 (100 %)

Table 4: The Relation of Echocardiography & Ct Finding With Age of Presentation

4. Discussion

In this study Seventy patient (39 males and 31 females) were enrolled and the age ranges were (2 days-20 years). CT cardiac angiography was done after Echocardiography, and we assessed the agreement between echocardiography and CT angiography results. Among the seventy (70) cases who are included in this study; it is found that congenital heart disease more prevalent in male gender which represent (56%) while (44 %) in female as shown in table (1). This result is going with Mangal R et al finding; who observed that most cases enrolled in his study were male (60 %) of cases, compared to (40%) in female gender (14). While Aiyil LI, Zhenpen Peng et al; observed that, the detected CHD were prevalent more in female (53%) [11].

The age distribution was from 2 days -20 years old, it was observed that most of cases included in the study were presented in the first month of life as shown in table (2), which is going with the result of Mangal R et al; who observed that most of cases included in his study presented in the first 6 month of life especially those with cyanotic heart disease [12].

The detected cardiac anomalies in the study are classified into three major group, Aortic anomalies, pulmonary anomalies and Aorto-pulmonary connection defect. The pulmonary anomalies represent the majority of detected congenital abnormalities in this study about (53%) in comparison to Aortic and Aorto-pulmonary connection as shown figure (2). this in agreement to Osama L et al. who reported that the majority of patient in their study had pulmonary anomalies [13].

Regarding Aortic abnormalities, echocardiography was able to detect 19 cases of Aortic abnormalities while CT angiography

detect 23 cases. these Aortic abnormalities (CoA, hypoplasia of Aortic arch, right sided Aortic arch), in 4 cases we report discrepancy in the result between the echocardiography and CT angiography finding; out of this 4 cases one of them show hypoplasia of Aortic arch while in the other 3 cases CT angiography roll out the echocardiography finding. This is in agreement with Marwa Ali et al; who reported that CT angiography was able to detect 14 cases of Aortic abnormalities while echocardiography had detected only 10 cases, these abnormalities in the form of (CoA, arch hypoplasia, Rt side Aortic arch and overriding of Aorta). The 4 cases representing discrepancy between echocardiography and CT angiography in Marwa Ali et al study were 2 cases show CoA and the other 2 cases Rt side Aortic arch. These 4 cases were detected by CT angiography. (12) Also Osama et al study reported that CT angiography detect 3 cases of Rt sided Aortic arch and echocardiography detect only 2, this result in agreement with our finding [13].

In regards to pulmonary artery anomalies, CT angiography detect 30 cases of pulmonary stenosis while echocardiography detects only 29 cases so one case is missed, this finding is similar with the result of Marwa group who report that the echocardiography detects 7 cases of pulmonary anomalies while CT angiography detect 9 cases [14].

In case of Aorto-pulmonary connection in our study namely PDA and Aorto-pulmonary window, the echocardiography was detected 9 cases out of 10 cases, while CT angiography role out one case. this result is in agreement with Aiyin Li et al; who reported that the diagnostic accuracy of echocardiography and CT angiography in diagnosis of Aorto- pulmonary connection are 96.30% and 98% respectively with high uniformity[11].

5. Conclusion

We conclude that CT angiography is considered a non-invasive diagnostic tool complementary to the cardiac echocardiography in the diagnosis of complex heart defects especially in pulmonary anomalies.

Recommendation

Similar study need to be conducted to explore the comparison between echocardiography and CT angiography in more details.

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