Kanem J Med Sci 2023; 17(2): 15-20
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ISSN 2006-4772
https://doi.org/10.36020/kjms.2023.1702.004

Original Article

Thoracic CT angiographic imaging findings of patients seen in the Cardio-thoracic Centre of Babcock University Teaching Hospital: a retrospective review.

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Abstract

Background: Multidetector computed tomography (MDCT) of the thoracic vasculature is a valuable tool for the detection and follow-up of both congenital and acquired abnormalities of the great vessels. Advances in our knowledge of cardiovascular disorders, coupled with technological innovations, have enabled the increased use of minimally invasive cardiovascular diagnostic modalities and surgical interventions, particularly in Africa. It is now a widely employed technique for the study of the thoracic vasculature. **Objective**: The study aims to assess the value of MDCT in the detection of thoracic vascular abnormalities among patients referred from the hospital's cardiothoracic centre to the radiology department. **Methodology**: A retrospective study was done on seventy-three (73) patients referred by the Cardio-thoracic Centre of Babcock University Teaching Hospital (BUTH) for cardiothoracic angiographic (CTA) imaging of the chest for clinically suspected/diagnosed cardio-thoracic diseases. Images and reports from a 160-slice multi-detector Toshiba CT machine were obtained from archived records. Data were processed and analyzed using the Statistical Package for Social Sciences (SPSS) software (version 26; SPSS Inc, Chicago, IL, USA). **Results**: The study comprised 38 males and 35 females (total of 73 patients), with the elderly age groups between 60 years and above making 23.3%. The presenting complaints were varied, with 14.3% of the patients having a background of hypertension (HTN). Cardiomegaly was the most frequent finding (18.2%), followed by aortic aneurysm/dilatation (12.7%). The least occurrence was mediastinal mass, constituting 1.2%. However, 6.8% had normal chest CT scan results. **Conclusion**: Chest CTA has a high diagnostic performance for detecting great vascular abnormalities.

Keywords: *Angiography, Babcock University. Multidetector Computed Tomography, Thorax.*

Introduction

Computed tomography (CT) of the chest is a cross-sectional evaluation of the thoracic cage and its contents such as the heart, great vessels, airways, mediastinal contents, associated bones, and soft tissues, and may be indicated to check the chest and its organs for possible blockages, injuries, infections, tumours, and other unexplained chest pain as well as in patients suspected to have congenital heart or greater vascular abnormalities.[1] Since its introduction about five decades ago, CT has become an integral part of clinical practice.[2, 3] Computed tomography has recently produced a profound impact on modern medical practice,[4] hence, today's clinicians depend on its ability to evaluate and classify mediastinal masses and pulmonary interstitial diseases. [5,6]

Computed tomographic angiography (CTA) of the chest is a type of medical investigation that combines a CT scan with concurrent automated injection of a special water-soluble non-ionic contrast medium to produce clearer outlines of blood vessels and structures in the chest or any other part of the body.[1, 7-9] It is a robust tool for the assessment of the anatomy and pathology of the vascular tree with a submillimeter spatial and high temporal resolution.[10] Advances in our knowledge of cardiovascular disorders coupled with technological innovations have enabled the increased use of minimally invasive cardiovascular surgeries and transcatheter interventions, with resultant reduced mortality, morbidity and hospital stay.[11, 12] Therefore, CTA imaging plays an important role in the pre-

Cite this article as: Baduku TS, Thompson MU, Yusuf AO, Sanusi T.; Thoracic CT angiographic imaging findings of patients seen in the Cardio-thoracic Centre of Babcock University Teaching Hospital: a retrospective review. Kanem J Med Sci 2023; 17(2): 15-20

Received: 1st August 2023 **Accepted: 1st April 2024** **Published: 30thApril 2024**

procedural evaluation of patients and for peri-procedural imaging guidance,[13] with angiography showing excellent resolution of three-dimensional (3D) capabilities to determine the relationship of vasculature to each other and with adjacent structures.[11,14] This article attempts to summarize the clinical indications and the thoracic CT image findings in the Cardiothoracic Centre of Babcock University Teaching Hospital, Ilisan Remo, Nigeria.

Materials and Method

A retrospective study was done on seventy-three (73) patients referred by the Cardio-thoracic Centre for CTA imaging of the chest for clinically suspected/diagnosed cardio-thoracic disease. The study was carried out in the Department of Radiology, Babcock University Teaching Hospital, Ilisan-Remo, for 18 months, (between 1st October 2020 and 30th April 2022). This institution has one of the few cardio-thoracic centres within the country, with many other patients being referred from other tertiary health institutions within the country. Permission to carry out the study was obtained from the Research and Ethics Committee of Babcock University Teaching Hospital before the commencement of the study.

Images and reports were obtained from a 160-slice multi-detector Toshiba CT machine, which was archived. Patients who underwent chest CTA based on clinical diagnosis of cardiovascular disease within the study period were reviewed and data such as age, gender, clinical information, and radiological imaging findings were retrieved using a data capture sheet. The inclusion criteria included patients of both sexes and all age groups referred from the BUTH cardio-thoracic centre. Patients from outside of this centre were excluded from the study.

Frequency tables and charts were processed and analyzed using the Statistical Package for Social Sciences (SPSS) for Windows software (version 20; SPSS Inc, Chicago, IL, USA).

Results

Within the period under review, 2106 patients had CT done for different ailments in the Radiology department, and only a fraction of 3.5% of them underwent CTA. Thirty-eight (38) of them were males (52.1%) while 35 were females (47.9%).
The highest frequency of patients was found within the age groups who were 70 years and above, constituting 17.8%, while the least frequency was within the 60-69 years age group, making 5.5% (Table 1) Infants constituted 8.2% of the patients, which is considered significant.

Twenty-nine patients (27.6%) presented with a history of heart diseases, suggestive of tetralogy oh Falot (TOF) or ventriculo-septal defect (VSD) (Table 2) followed by those who presented with background hypertension (14.3%).

Cardiomegaly was the most frequent finding, constituting 18.2%, followed by aortic aneurysm and or dilatation (12.7%). The least occurrences were tracheal abrasion oesophageal mass, constituting 0.6% each. (Table 3). DeBakey types 1, 3, and 2 constituted 8.6, 2.4, and 1.2% respectively. Patients with TOF constituted 6.8% while those with VSD were 3% of the population. Three (3) percent of the population also had dextrocardia/situs inversus. However, 6.8% had normal chest CT scan results.

Table 1. The age distribution of the patients.

Age	Number of patients	Percentage (%)
0-1	6	8.2
1-9	8	11.0
10-19	5	6.8
20-29	6	8.2
30-39	10	13.7
40-49	10	13.7
50-59	11	15.1
60-69	4	5.5
70+	13	17.8
Total	**73**	**100**

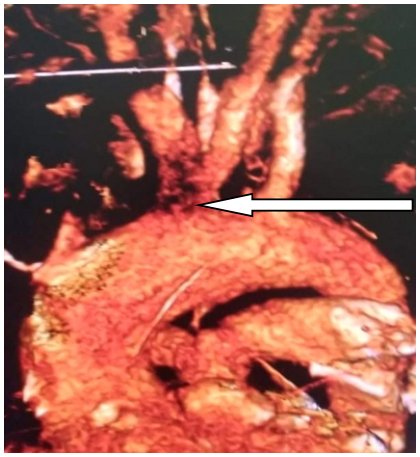

Fig. 1 shows a congenital single root of the brachiocephalic trunk and left common carotid artery before dividing distally after about half a centimetre (see arrow).

Table 2: The clinical information of the patients at presentation.

Clinical information	Frequency	Percentage (%)
History of heart disease/TOF/VSD	29	27.6
History of HTN/Headache	15	14.3
Breathlessness/easy fatiguability/chest pain	15	14.3
History of confirmed Aortic aneurysm/DISSECTION	8	7.6
Pedal swelling/DVT	7	6.7
Aortic/mitral valve dx	6	5.7
Suspected Pericardial effusion	5	4.8
LVA/RVA	4	3.8
Palpitation/tachycardia	4	3.8
Work-up for surgery/Bentall procedure	4	3.8
Dilated LA	2	1.9
Left atrial myxoma	2	1.9
Double outlet rt. Ventricle	2	1.9
Aortic atherosclerosis	2	1.9
TOTAL	**105**	**100**

Table 3: The pattern of chest CT findings of the patients.

CT findings	Frequency	Percentage (%)
Cardiac enlargement	24	14.5
Aortic Aneurysm/Debakey type 1	21	12.7
Aortic atherosclerosis	13	8.0
TOF	11	6.8
Aneurysm/Debakey type 3	11	6.8
Pulm consolidation/	10	6.1
Aneurysm/Debakey type 2	9	5.5
Pericardial effusion	8	4.8
Plural effusion	7	4.2
Pulmonary hypertension/embolism	7	4.2
VSD	5	3.0
Aortic valve prosthesis	5	3.0
Dextrocardia/situs inversus	5	3.0
Major aorto-pulm collat. arteries (MACA)	5	3.0
Aortic root thrombosis	4	2.4
Double outlet Rt/Lt ventricle	4	2.4
Aortic/arterial stenosis	4	2.4
Duplicate SVC	3	1.8
Calcified aortic valve	3	1.8
Atrial myxoma	2	1.2
Common origin of BCC and 4 SCA	2	1.2
Mediastinal masses	2	1.2
Total	**165**	**100**

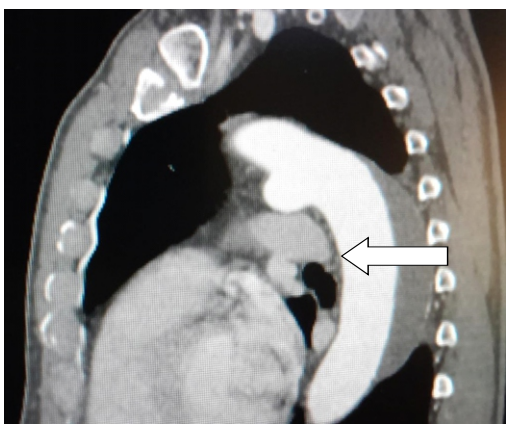

Fig. 2a is a sagittal image showing aortic dissection of the proximal aspect of the descending aorta posteriorly (arrow)

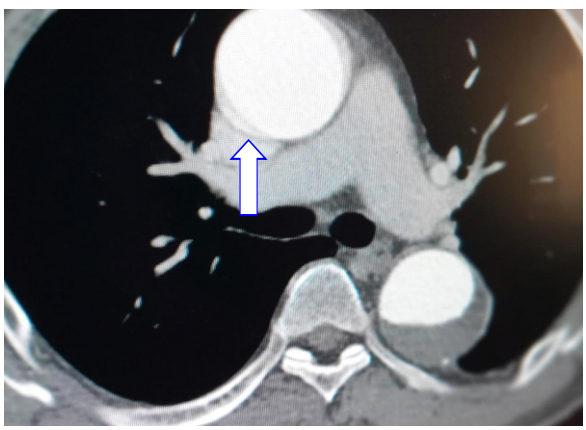

Fig. 2b shows an axial slice of 2a. the aortic dissection is noted posteriorly (arrow)

Discussion

Computed tomographic angiography is an imaging technique that has revolutionized medical imaging,[15] It is also fast and provides detailed 3-dimensional views of the internal organs and structures.[1, 7, 16] It provides a road map of the anatomy of chest vasculature and is also valuable in pre-operative evaluation for cardiac surgeries,[9] hence its use in our cardio-thoracic centre. Fortunately, it is relatively more available in the African continent compared to the previous decades.[17]

In our study, those who were 70 years and above constituted a significant number (17.8%) as shown in Table 1. This agrees with Rajiah[18] and Krueger[15] who, in their separate studies, found out that most of these cases present to cardiothoracic centres and emergency departments mainly in the sixth and seventh decades of life, with a male predominance. Lee et al[19] and Smith-Bindman et al[20] also confirmed that patients undergoing CT are often middle-aged and older and may have been due to heart and lung comorbidities. In our findings, the gender ratio was almost equal, which is at variance with the findings of these authors. Also, infants constituted 8.2% of the patients, which is considered significant.

In our study, 3.8% of patients presented with chest pain. This presentation is relatively low compared to 5.2 % by Chaturvedi et al.[21] Chest pain is the second leading presenting symptom of patients in emergency units and departments, thus making thoracic CT angiography one of the most commonly ordered examinations.[22] It is one of the most common presenting symptoms at many emergency departments, representing up to 10 % of admissions in many United States health facilities.[23] However, the low percentage in our environment is probably due to the generally lower level of hospital presentation in the African community when compared to the developed world.[24]

In our findings, DeBakey type-1 was seen in 21 people, constituting 12.7%, followed by type-3 with 6.8% (11) and type-2 with 5.4%. Feldman and Roman found out that aortic aneurysms account for only 0.1-3.5 % of all congenital heart defects.[25] Compared to the findings of Yuan et al, DeBakey type 1 constituted the highest frequency, followed by type 2.[26] affects men two to four times more frequently than women and the mean age at diagnosis is 60-70 years.[27] Also, our finding shows duplication of the superior vena cava of 1.8%. This condition is a rare abnormality, with an incidence of 0.3% in the general population whereas it varies between 10-11% in patients with congenital heart disease.[28] However, Runge found congenital heart disease in up to 11% of their patients.[29] Three (3) percent of the population also had dextrocardia/situs inversus. The available statistics for both children and adults are very scanty, but babies born with isolated dextrocardia (no defects or syndromes) have a normal life expectancy. A person can live with dextrocardia for a long time.[30] However, babies born with heart defects or genetic syndromes may need treatments or surgeries to manage those conditions.[31,32]

Three percent (3%) of our patients had ventricular septal defects. Ventricular septal defects are the most common cardiac defects, though intrauterine diagnosis of fetal VSD can be difficult, particularly for small and isolated VSDs.[33]

Myxomas constituted 1.2% of the patients in our study. Cardiac myxomas are the most common primary neoplasm and account for about half of all primary benign cardiac tumors.[34-36] Majority (75%) of myxomas arise within the left atrium and are predominantly found in females.[32] Most are sporadic, but with occasional familial predisposition, with few pediatric cases reported in the literature.[30] However, 6.8% had normal chest CT scan results.

Both CT and MRI have excellent spatial and temporal resolutions, wide fields of view, and multiplanar imaging capabilities and are hence commonly used imaging examinations for evaluating a variety of congenital and acquired cardiothoracic lesions.[17] However, MDCT is more commonly used because of its rapid scan times, multiplanner reconstruction capabilities, and wider availability.[10, 37] CT is faster, cheaper, less sensitive to movement artifacts, and provides higher spatial resolution than MRI.[38] Limitations of CT include the use of potentially nephrotoxic iodinated contrast media and radiation exposure.[11]

Conclusion

CTA is a robust tool in the assessment of the anatomy and pathology of the vascular tree, with a submillimeter-high spatial and temporal resolution. It also offers a rapid, reliable, and non-invasive technique that can be used for the evaluation and preoperative assessment of thoracic vascular and extra-vascular anatomy with suspected cardiovascular disease. Its main advantage over conventional angiography is its 3-D spatial resolution of thoracic vasculature and its non-invasive nature.

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