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Full Length Research Paper

Characterization of Cardiac Diseases Using Multi-Slice Spiral Computed Tomography

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This study was designed to characterize the cardiac diseases using MSCT, To determine the diagnostic value of MSCT in the cardiac diseases. 52 consecutive patients attending at Khartoum state Hospitals-Sudan their weight ranged 38-100 kg, during the period from 2016 to 2017, all Subjects underwent multi slices CT study for coronary artery angiography and calcium scoring test, measurements were represented by mean and standard deviation, using the SPSS windows version 16 and excel. Results of this study revealed that most of the cases had coronary stenosis (21.2%) followed by Atherosclerosis13.5% and 2% had stenosis and rupture, most of the affected cases were males, their ages above 46 years and their weight above 60 kg. It concluded that 64-128 slice CT allows a non-invasive assessment of significant CAD with a high diagnostic and well characterized, strongly significant relationship were observed between final diagnosis and age P value (0.001), however there is no significant difference between the final diagnosis and gender of patients P value (0.488), moreover there is significant correlations between the final diagnosis and weight P value (0.001)

Keywords: Coronary disease; Coronary angiography; Diagnostic accuracy; Multi-slice Computed tomography

INTRODUCTION

Coronary artery disease (CAD) is one of the causes of death, and its prevalence is increasing among different countries in over the world (Lloyd-Jones et al., 2010; Gaziano et al., 2010). In 2001, CAD reported was done to be responsible for deaths and disability-adjusted life years lost worldwide (WHO, 2002). According to recent statistics from World Health Organization in 2007, cardiovascular deaths account for 33.7% of all deaths worldwide, whereas cancer represents 29.5%, other chronic diseases, injury and communicable diseases contribute to 26.5%, 7%, and 4.6%, respectively (http://www.who.int/whostat2007/en/index.html, 2011).

Invasive coronary angiography (ICA) is the accepted reference standard for the assessment of coronary artery stenosis. Current multi-slice computed tomography (MSCT) scanners provide essential results in the

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evaluation of CAD, but some segments not evaluative because of motion artifacts or severe vessel wall calcification (Ropers et al., 2003; Mollet et al., 2004; Martuscelli et al., 2004).

The developed 64-slice CT scanner was increasing temporal and spatial resolution (Flohr et al., 2004).

Present study aimed to characterize the cardiac diseases using MSCT and to determine the diagnostic value of MSCT in the cardiac diseases.

MATERIALS AND METHODS

Patients: This study was done at some Sudanese hospitals in Khartoum during the period from 2016 to 2017. The Sample included Sudanese patients with different clinical symptoms. The patient underwent to multi slices CT study for coronary artery angiography and calcium scoring test by using CT. 52 patients (29 males and 23females) their ages ranged (16-76) years were enrolled in the study. verbal consent was obtained from the patients. The non-contrast study was performed followed by the 64-128 detector during 5 seconds breath hold. Axial two dimensional and three dimensional images were reconstructed using an AW work station for patients with a heart rate more than 70 beats per minute, a beta-blocker was used to slow down the heart rate prior to CT scans, different post-processing techniques including maximum-intensity projection (MIP), curved multiplanar reconstruction (CPR), and volume rendering (VR) were applied. Exclusion criteria were: unstable angina, allergic to iodinated contrast material, renal insufficiency, severe respiratory function impairment, heart failure, and pregnancy.

Equipment used: CT machine images were conducted using 64-128 slices. The scan parameter were0.5mm, 120 KV, 300-500 MA. Image type original \primary \axial .scan option helical CT. Body part examined Chest.Patient position supine scout view AP\LAT. Slice thickness was 0.5 mm. Injection rate 3-5. Protocol name coronary cardiac CT. No gantry detector tilt. X-ray tube current 430 focal sot 1.6\1.4 group pixel spacing.

Methods

The technique used**:** Patient takes one capsule of beta blocker one day before the examination one at night and the last one in the day of the examination morning. Patient fasting at least 6 hours before the examination and must stop smoking and drinking tea and coffee before the examination. The RFT test and blood pressure must be to seen. Insure that the cannula is in the vein and also the ECG tools in the right side. The patient should be given good instructions. The patient is in supine position feet first. Two views were taken AP and LAT to localize the area of the study then calcium scoring test must be done first, and then CCTA. The amount of the contrast was about 70-100 ml.

Data collection and analysis**:** Well trained and experienced CT technicians, physicians, well knowledgeable in CT and radiation exposure, cardiac anatomy and pathology. All patients' images were evaluated by expert and qualified radiologist reporting on calcium scoring and other pathology. The data was collected using data sheet which contained the patient name, age, weight, sex then the images is taken to the radiologist for diagnosis. All the data were analyzed using SPSS program and the results were displayed as shown below.

RESULTS

Table 1. Cross tabulation final diagnosis and gender

Final diagnosed	Female	Male	Total
Aorta calcification	0	1	1
Aortic aneurysm	0	2	2
Atherosclerosis	4	3	7
Ca score 0 normal	0	1	1
Coronary stenosis	4	7	11
Coronary stenosis and rupture	1	0	1
Extensive evidence Ca score 470	1	0	1
Extensive evidence ca score 2000	0	1	1
Infarction	0	1	1
Mild evidence ca score 28	1	0	1
Mild evidence ca score 70	0	1	1
Minimal evidence ca score 4	0	1	1
Moderate evidence ca score 196	0	1	1
Moderate evidence ca score 200	1	0	1
Moderate evidence ca score 232	0	1	1
Moderate evidence ca score 243	1	0	1
Normal	8	8	16
Pericardial effusion	1	0	1
Trauma	0	1	1
Ventricular aneurysm	1	0	1
Total	23	29	52

P value =0.488

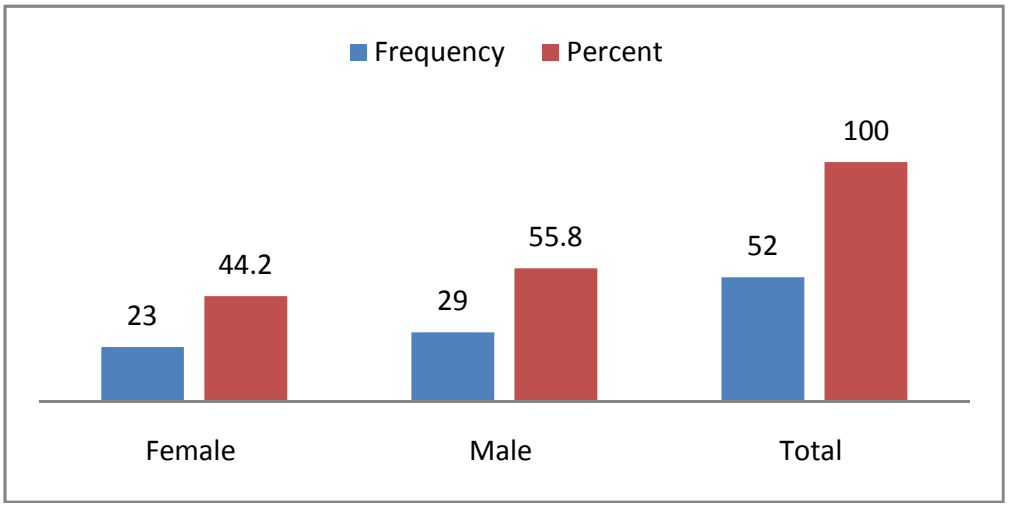

Figure 1. Frequency distribution of gender

Table 2. Cross tabulation final diagnosis & age

Final diagnose	Age					Total
	15-30 years	31-45 years	46-60 years	61-75 years	more than 75 years	
Aorta calcification	0	0	1	0	0	1
Aortic aneurysm	0	1	0	1	0	2
Atherosclerosis	0	0	6	1	0	7
Ca score 0 normal	0	0	1	0	0	1
Coronary stenosis	0	3	3	5	0	11
Coronary stenosis and rupture	0	0	0	1	0	1
Extensive evidence Ca score 470	0	0	0	1	0	1
Extensive evidence ca score 2000	0	1	0	0	0	1
Infarction	0	0	0	1	0	1
Mild evidence ca score 28	0	0	1	0	0	1
Mild evidence ca score 70	0	0	1	0	0	1
Minimal evidence ca score 4	0	1	0	0	0	1
Moderate evidence ca score 196	0	0	0	1	0	1
Moderate evidence ca score 200	0	0	0	0	1	1
Moderate evidence ca score 232	0	0	1	0	0	1
Moderate evidence ca score 243	0	0	0	0	1	1
Normal	2	8	6	0	0	16
Pericardial effusion	0	0	0	1	0	1
Trauma	1	0	0	0	0	1
Ventricular aneurysm	0	0	1	0	0	1
Total	3	14	21	12	2	52

P value = 0.001

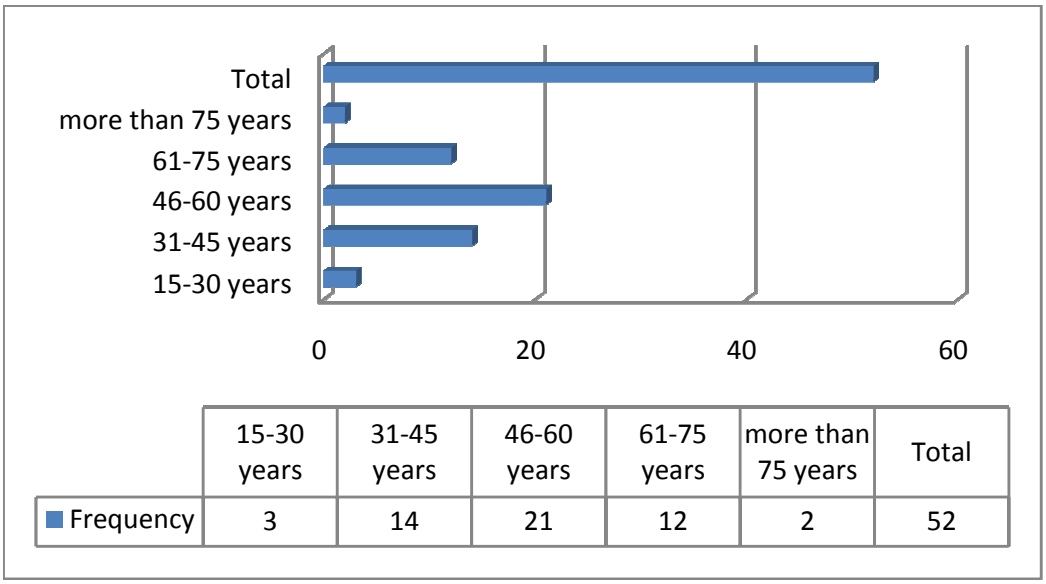

Figure 2. Frequency distribution of age group

Table 3. Cross-tabulation final diagnosis and weight

Final diagnosed	weight					Total
	35-50 kg	51-65 kg	66-80 kg	81-95 kg	more than 95 kg	
Aorta calcification	0	0	1	0	0	1
Aortic aneurysm	0	0	1	1	0	2
Atherosclerosis	0	0	7	0	0	7
Ca score 0 normal	0	1	0	0	0	1
Coronary stenosis	0	0	8	3	0	11
Coronary stenosis and rupture	0	0	0	1	0	1
Extensive evidence Ca score 470	0	0	1	0	0	1
Extensive evidence ca score 2000	0	0	1	0	0	1
Infarction	0	0	0	1	0	1
Mild evidence ca score 28	0	0	0	0	1	1
Mild evidence ca score 70	0	0	0	1	0	1
Minimal evidence ca score 4	0	0	1	0	0	1
Moderate evidence ca score 196	0	0	1	0	0	1
Moderate evidence ca score 200	0	0	1	0	0	1
Moderate evidence ca score 232	0	0	1	0	0	1
Moderate evidence ca score 243	0	0	1	0	0	1
Normal	2	8	5	1	0	16
Pericardial effusion	0	0	1	0	0	1
Trauma	1	0	0	0	0	1
Ventricular aneurysm	0	0	0	1	0	1
Total	3	9	39	9	1	52

P value =0.001

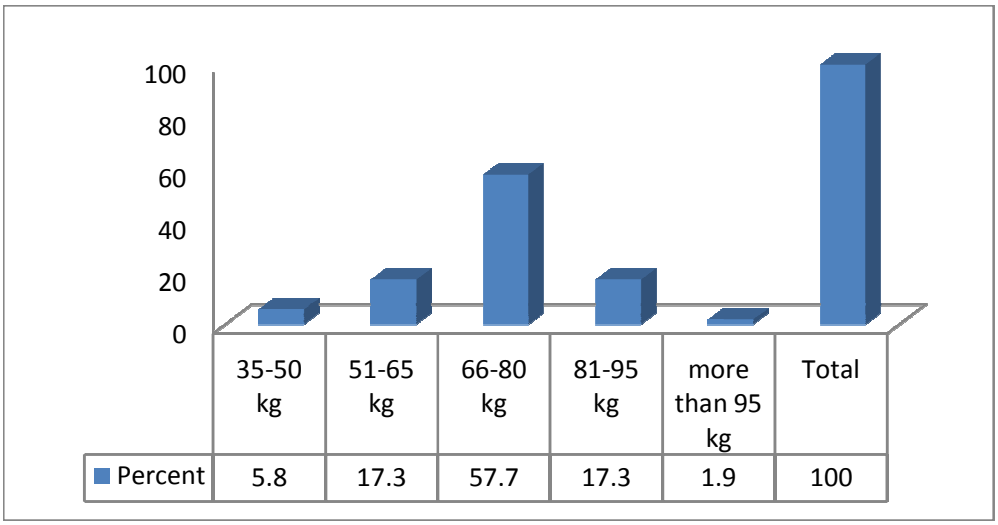

Figure 3. Frequency distribution of weight

Table 4. Frequency distribution of final diagnosis

Diagnosis	Frequency	Percent	Cumulative Percent
Aorta calcification	1	1.9	1.9
Aortic aneurysm	2	3.8	5.8
Atherosclerosis	7	13.5	19.2
Ca score 0 normal	1	1.9	21.2
Coronary stenosis	11	21.2	42.3
Coronary stenosis and rupture	1	1.9	44.2
Extensive evidence ca score 2000	1	1.9	46.2
Extensive evidence Ca score 470	1	1.9	48.1
Infarction	1	1.9	50.0
Mild evidence ca score 28	1	1.9	51.9
Mild evidence ca score 70	1	1.9	53.8
Minimal evidence ca score 4	1	1.9	55.8
Moderate evidence ca score 196	1	1.9	57.7
Moderate evidence ca score 200	1	1.9	59.6
Moderate evidence ca score 232	1	1.9	61.5
Moderate evidence ca score 243	1	1.9	63.5
Normal	16	30.8	94.2
Pericardial effusion	1	1.9	96.2
Trauma	1	1.9	98.1
Ventricular aneurysm	1	1.9	100.0
Total	52	100.0	

DISCUSSION

To become a clinically accepted tool for the examination of patients with suspected CAD, the main requisite for CT coronary angiography include the complete visualization of all coronary arteries (Martuscelli et al., 2004). A direct comparison of study results is not permitted. Nevertheless, the data reported here in using a 64-128 slice CT scanner suggest a certain improvement regarding diagnostic accuracy (Flohr et al., 2004). In this study 55.8% of the patients were male as shown in figure 1 and this result as inconsistent with the results of Galaleldeen W (Galaleldeen et al., 2006) M, and L Nour Alkareem L (Nour-Elkareem and Ahmed, 2012). The mean of weight was 65 the highest accumulation was in the group of 60-80 kg was 57%Fig (3). Coronary atherosclerosis starts and progresses slowly until clinically manifested as symptomatic angina pectoris

(Rholms and Beger, 1953). In this study, 21.2% of the cases had coronary stenosis, and 2% had stenosis and rupture. The early atherosclerosis was 13% Table 4. The occurrence of coronary artery calcification is common in patients with known coronary artery diseases and increase dramatically as a function of age (Moltistremple and Cutting, 1971) as in this study most of the patients had calcification above the age of 46 and as in our study the age 46-75 (23)63% of all patient Fig(2) (Smith et al., 2001; Ropers et al., 2003).

A strongly significant relationship were observed between final diagnosis and age P value = 0.001 Table (2), however there is no significant difference between the final diagnosis and gender of patients P value =0.488 Table 1, moreover there is significant correlations between the final diagnosis and weight P value =0.001 Table 3.

CONCLUSION

In conclusion, our initial results suggest that 64-128 slice CT allows a non-invasive assessment of hemodynamically significant CAD with a high diagnostic accuracy and well characterized. Extensive arterial wall calcifications still impair vessel assessment. Further prospective studies have to analyze vessel size and heart rate.

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