



Original Article

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Evaluation of Ischemic Heart Diseases Using Computed Tomography Scan in Riyadh Region

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ABSTRACT

This study was performed to evaluate Coronary Arteries imaging by Computer Tomography (CT) and its ability to diagnose ischemic conditions among emergency department patients presented. To measure the sensitivity of coronary CT in the diagnosis of cardiac conditions, the study also assessed the correlation between variables such as age, sex, troponin level, Electrocardiogram (ECG), and symptoms with results of CT coronary. The research was done in the Emergency Department of Prince Sultan Cardiac Center, Riyadh, Saudi Arabia from January to June 2022. It includes 50 patients (males to females' ratio was 70% to 30%). All patients were diagnosed to have CT coronary abnormality.

The results showed that related to patient symptoms, asymptomatic 6%, atypical chest pain 28%, chest pain 24%, palpitation 8%, and multiple symptoms 34%. The correlation between findings on ECG was that only (8%) had abnormal troponin levels. Calcium CT 28% and CT coronary were found to be abnormal in 48% of the patients, abnormal CT findings were found to be (52%) of the patients. The most commonly reported symptoms by the patients were asymptomatic chest pain. There was no statistically significant association was seen between patients' gender and symptoms or between symptoms reported and age. patients aged above 50 years had significantly higher CT findings (75%) than other age groups ($p=0.004$). However, there was no statistically significant association observed between CT findings and symptoms, ECG findings, and troponin hormone levels. The study recommended that the CT coronary is the best way to diagnose ischemic coronary diseases.

Key words: *Computer tomography (CT), Coronary arteries, Coronary artery disease (CAD), Ischemic coronary diseases, ECG*

INTRODUCTION

Myocardial infarction (coronary artery disease) involves heart difficulties caused by narrowed heart arteries. Less blood flow and oxygen enter the cardiovascular system when arteries are constricted [1, 2]. Angina, heart attack, and death are all possible outcomes of untreated coronary artery disease [3-5].

Through recent advancements in technology, computer tomography (MSCT) enables doctors to visualize the heart and coronary arteries [3-5]. Increased mortality and morbidity from coronary artery disease (CAD) have been

reported across the globe. Interventional procedures are carried out via enhanced cardiac catheterization, even though invasive cardiac angiograms were once performed and are still frequently recommended to establish the diagnosis of coronary artery disease. Recent technological advances have made noninvasive imaging a critical component in the diagnosis of coronary artery disease (CAD). As long as costs are kept reasonable and care is provided based on value, it is possible to examine therapy and prognosis [3-7].

Cardiologists use a variety of methods to diagnose and assess the risk of coronary artery disease such as ECG, Troponin, and D-dimer levels in the blood are also associated with CT, MRI, and nuclear medicine [8-10]. Imaging modalities and laboratory tests are available to determine the functional and anatomical extent of coronary stenosis and to help choose the best course of treatment. We will evaluate and discuss their benefits and limitations, as well as their use in diagnosing patients with CAD. Moreover, it will also help to prevent the use of multiple diagnostic tests for a comprehensive assessment of different types of stenosis, such as calcified plaques or non-utilizing these multiple modalities, with an emphasis on anatomy vs biology [8-10]. Cardiac computed tomography (C.T.) has been increasingly popular in recent years as a tool for predicting the progression of coronary artery disease. Cardiac C.T. results are closely linked to future cardiac events in studies based on a single center's experience [8-10]. To evaluate individuals with a non-ST-elevation acute coronary syndrome (NSTE-ACS), current algorithms take into consideration information, electrocardiogram (E.C.G.), and high-sensitivity heart troponins (hs-troponins) (hs-troponins). While primarily designed to rule out NSTE-ACS safely, these algorithms could also be used to rule in NSTE-ACS in select cases. Still, these algorithms will not provide a conclusive work-up in many patients [8-10].

This study was performed to evaluate Coronary Arteries by Computer Tomography (CT) and its ability to diagnose ischemic conditions among patients presented in the emergency department. In addition, to measure the sensitivity of Coronary CT in the diagnosis of cardiac conditions, the study also assessed the correlation between variables such as age, sex, troponin level, ECG, and symptoms with results of CT coronary.

MATERIALS AND METHODS

Fifty patients above 30 years have done coronary CT, exclusion: below 30 years. The study will be in cooperation with the Prince Sultan Heart Center in Riyadh. This study is planned to start in Jan.2021 to JUN 2022. C.T. machine multislice SEMINSE 64 and automatic injector with dual head. ECG Machine

The patient lie supine with their feet first after changing his clothes then use an electrode to connect ECG to check the heartbeats using a cannula 18 gauge in the upper limb prefer RT side. Training patient for hold respiration. The first scan is a calcium score without contrast to check calcium in coronary arteries, it acquires with the prospective technique which can select only one phase in the cardiac cycle to scan with scan slices not helical to reduce patient dose technique. Then injection with a flow rate of 5-6 ML per second with the volume of related to eight patients (1 ML per KG) by automatic injection device use sure start technique machine will start when sure contrast in coronary arteries scan with breath hold. Use the sure start technique by selecting one slice below carina 2 m and selecting descending aorta as the region of interest (ROI), measure the Hounsfield unit inside the aorta and scan automatically when Hounsfield unit in ROI to 180, after contrast inject 50 ml saline to push contrast from the cardiac and decrease streak artifact in left brachiocephalic vein. Using retrospective analysis to make multiple images with different heart phases from the cardiac cycle. After acquisition uses more multiplane reconstruction techniques and 3d volume rendering to show coronary arteries related to the cardiac surface.

Population and sampling of study

This study has variables including age, gender, and symptoms that correlate with other variables CT report, troponin test level, and echo result. Patients prepare to be fast 4 hours before the exam and give patients beta blockers to reduce heartbeats to less than 70 beats per minute also check renal test function to see creatinine level it must be at a normal level of 0.4 to 1.4 mg.

The results

This study was conducted to evaluate Coronary CT in their ability to diagnose ischemic conditions among patients presented in the emergency department.

Our analysis included clinical data of 50 IHD patients who underwent CT scans. The baseline characteristics showed that 24 (48%) were above the age of 50 years, 35 (70%) were males, 14 (28%) had atypical chest pain, and 17 (34%) had multiple symptoms. It was found that 28 (56%) of the patients had abnormal findings on ECG and only 4 (8%) had abnormal troponin levels. Calcium CT and CT coronary were found to be abnormal in 28%

and 48% of the patients, respectively. Abnormal CT findings were found to be 26 (52%) of the patients (Table 1).

Table 1. Baseline characteristics (n=50)

		Frequency	Percent
Age	30-35 years	5	10.0
	36-40 years	5	10.0
	41-50 years	16	32.0
	>50 years	24	48.0
Gender	Female	15	30.0
	Male	35	70.0
Symptoms	Asymptomatic	3	6.0
	Atypical chest pain	14	28.0
	Chest pain	12	24.0
	Palpitation	4	8.0
	Multiple symptoms	17	34.0
ECG findings	Normal	19	38.0
	Abnormal	28	56.0
	Not available	3	6.0
Troponin level	Normal	24	48.0
	Above normal	4	8.0
	Not available	22	44.0
Calcium CT	Normal	36	72.0
	Abnormal	14	28.0
Coronary CT	Normal	26	52.0
	Abnormal	24	48.0
CT findings	Normal	24	48.0
	Abnormal	26	52.0

The most commonly reported symptom by the patients was asymptomatic chest pain, and about 34% had multiple symptoms, as given in Table 1. When we assessed the relationship between patients' gender and symptoms, no statistically significant association was seen ($p=0.396$). Also, there was no statistically significant relationship observed between symptoms reported and age (Table 2).

Table 2. Relationship of symptoms with age and gender of the patients

		Symptoms					X^2	P value	
		Asymptomatic	Atypical chest pain	Chest pain	Palpitation	Multiple symptoms			
Gender	Female	N	1	6	1	1	6	4.075	0.396
		%	6.7%	40.0%	6.7%	6.7%	40.0%		
	Male	N	2	8	11	3	11		
		%	5.7%	22.9%	31.4%	8.6%	31.4%		
Age	30-35 years	N	1	1	0	1	2	16.538	0.168
		%	20.0%	20.0%	0.0%	20.0%	40.0%		
	36-40 years	N	0	0	3	1	1		
		%	0.0%	0.0%	60.0%	20.0%	20.0%		
	41-50 years	N	1	7	1	2	5		
		%	6.3%	43.8%	6.3%	12.5%	31.3%		
	>50 years	N	1	6	8	0	9		
		%	5.7%	22.9%	31.4%	8.6%	31.4%		

The abnormal CT findings were comparatively more among the male patients (57.1%) than females, but there was no statistically significant association seen ($p=0.266$). When we assessed the incidence of abnormal CT findings with patients' age, it was observed that those aged above 50 years had significantly higher CT findings (75%) than other age groups ($p=0.004$). However, there was no statistically significant association observed between CT findings and symptoms ($p=0.958$), ECG findings ($p=0.647$), and troponin hormone levels ($p=0.530$) (Table 3).

Table 3. Relationship of CT findings with age and gender of the patients

		CT findings			Total	χ^2	P value
		Normal	Abnormal				
Gender	Female	N	9	6	15	1.236	0.266
		%	60.0%	40.0%	100.0%		
	Male	N	15	20	35		
		%	42.9%	57.1%	100.0%		
Age	30-35 years	N	2	3	5	13.391	0.004
		%	40.0%	60.0%	100.0%		
	36-40 years	N	5	0	5		
		%	100.0%	0.0%	100.0%		
	41-50 years	N	11	5	16		
		%	68.8%	31.3%	100.0%		
	>50 years	N	6	18	24		
		%	25.0%	75.0%	100.0%		
Symptoms	Asymptomatic	N	2	1	3	0.647	0.958
		%	66.7%	33.3%	100.0%		
	Atypical chest pain	N	7	7	14		
		%	50.0%	50.0%	100.0%		
	Chest pain	N	5	7	12		
		%	41.7%	58.3%	100.0%		
	Palpitation	N	2	2	4		
		%	50.0%	50.0%	100.0%		
	Multiple symptoms	N	8	9	17		
		%	47.1%	52.9%	100.0%		
ECG findings	Normal	N	8	11	19	0.871	0.647
		%	42.1%	57.9%	100.0%		
	Abnormal	N	15	13	28		
		%	53.6%	46.4%	100.0%		
	Not available	N	1	2	3		
		%	33.3%	66.7%	100.0%		
Troponin Hormone level	Normal	N	13	11	24	1.271	0.530
		%	54.2%	45.8%	100.0%		
	Above normal	N	1	3	4		
		%	25.0%	75.0%	100.0%		
	Not available	N	10	12	22		
		%	45.5%	54.5%	100.0%		

RESULTS AND DISCUSSION

Imaging has an important role in the evaluation and management of patients with acute and chronic chest pain. The new chest pain guideline has important implications on when and how we should use cardiac testing [1, 2,

11-17]. Measuring cardiac troponin (cTn) I and T levels is currently considered to be a cornerstone for making the diagnosis of acute coronary syndrome (ACS) [16]; therefore, this study was conducted to evaluate ischemic heart disease as well as to correlate between symptoms, CT finding the result of CT coronary angiography and troponin level. This study revealed that patients above the age of 50 years are more likely to have a heart problem, 14 (28%) had atypical chest pain, and 17 (34%) had multiple symptoms. It was found that 28 (56%) of the patients had abnormal findings on ECG, and only 4 (8%) had abnormal troponin levels. On the other hand, we found that Calcium CT and CT coronary were found to be abnormal in 28% and 48% of the patients, respectively.

Abnormal CT findings were found to be 26 (52%) of the patients. The abnormal CT findings were comparatively more among the male patients (57.1%) than females, but there was no statistically significant association seen ($p=0.266$). When we assessed the incidence of abnormal CT findings with patients' age, it was observed that those aged above 50 years had significantly higher CT findings (75%) than other age groups ($p=0.004$) so can consider age as the highest risk factor for coronary artery diseases.

According to Ronen Rubinshtein, et. al., when evaluating patients with acute chest pain, this can be accomplished by using various clinical decision pathways that integrate information on high-sensitivity troponin as well as other clinical variables to categorize patients into low-, intermediate-, and high-risk categories [17]. According to Ronen Rubinshtein, et. al., there was no statistically significant correlation between Clinical findings and symptoms ($p=0.958$) [17]. Recent studies indicated that 64-slice cardiac MDCT may be a useful diagnostic tool for ED patients who have chest discomfort of unknown etiology since it allows for early, noninvasive viewing of coronary architecture. For the diagnosis of acute coronary syndrome, ED MDCT demonstrated a significant positive predictive value [1, 2, 11-17].

Also, no statistically significant correlation between CT finding and ECG findings ($p=0.647$) agree with a study conducted by E Mafic, *et al.*, [1] titled Stress ECG vs. CT coronary artery disease in the real world concluded that coronary angiography is higher significant accuracy compared with ECG and could use as a first-line study in patients at moderate risk [2].

In the end, there is no significant association between CTCA results and troponin hormone levels ($p=0.530$) (Table 3). Recently, it has been found that elevations in cTn levels from causes other than ischemic heart disease are associated with worse prognoses [16].

CONCLUSION

This study concluded that there is a significant correlation between CT abnormal results and age and there is no significant association between CT abnormal results and ECG which cannot consider ECG as the first line for evaluation of coronary ischemic disease instead of that consider CT coronary angiography is first line for diagnosis, its support by other variable which not find also significant correlation between CT abnormal on side vs troponin level and clinical symptoms on the other side. This study concluded also CTCA is a gold approach for the diagnosis of most coronary diseases and it can be the standard line to confirm ischemic heart diseases.

Recommendations

At the end of this study, the study recommended the best way to diagnose coronary artery disease. The ECG or biomarker level cannot be used as a conclusive diagnosis, and we do not make any decisions about therapy until the CT coronary angiography confirms the diagnosis. Other studies must examine the patient clinically well and study the relationship between ECG, and troponin. The sample size should be increased for further studies. CTCA result must confirm the diagnosis. CTCA is necessary before any treatment planning for CAD. Routine CTCA screening may be considered for older ages.

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