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THE PREVALENCE OF INCIDENTAL NON-CORONARY FINDINGS IN 64 SLICE MULTIDETECTOR COMPUTED TOMOGRAPHY ANGIOGRAPHY

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Abstract
In order to evaluate obstructive coronary artery disease, computed tomography angiography is increasingly used for noninvasive coronary angiography. This technique gathers information about the coronary arteries as well as other organs that are irradiated but not typically evaluated, such as the heart, parts of the lungs, bony thorax, breasts, and upper abdomen. The purpose of this research is to determine how often non-coronary discoveries occur during 64-slice multi-detector computed tomography non-invasive coronary angiography procedures. Methods: From April 2013 to January 2015, a retrospective study was conducted at AL-Sader Medical City on a total of 200 cases. The patients were referred for a coronary computed tomography angiography on a 64-slice MDCT scanner. The participants' ages ranged from 55.5 to 60.5 years. From the carina level to somewhat

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below the diaphragm, the scans were obtained. A wide field of view (> 300 mm), including the whole thorax, was used during image reconstruction in order to assess incidental non-coronary abnormalities. Through the use of the mediastinal, lung, and bone windows, images were examined in the axial, coronal, and sagittal planes. The results showed that out of 200 patients, 30 percent had non-coronary abnormalities that were discovered by accident. There were 60 incidental non-coronary findings in total. The most common structure with incidental findings was the lung parenchyma, with 26 lesions (43.3%) reported there. The next most common structure was the mediastinal lymph nodes, with 11/60 (18.3%) reported there. The liver and pericardium each had 4 lesions (6.7%), and the aorta had 3 lesions (5%). The aortic valve, breasts, diaphragm, and vertebral body each had only 2 lesions (3.4%). The pleura, pulmonary artery, and other areas each had a single lesion, accounting for 1.7% of the total.

Conclusion: Further work-up may be necessary for extra-coronary pathology; multidetector computed tomography coronary angiography and cardiac imaging can both give valuable information in this regard. As a result, regular clinical evaluations should include a comprehensive assessment of all organs shown in the scan.

Keywords: Coronary artery disease, incidental non-coronary findings , multidetectors computed tomography.

Introduction

Overview

A non-invasive technique for evaluating coronary arteries, multi-detector computed tomography (MDCT) angiography has been increasingly popular in recent years (1). The latest generation of multidetector computed tomography (MDCT) scanners offer submillimeter-slice collimation and outstanding temporal resolution, allowing for imaging of the coronary arteries (2). You can see parts of the non-coronary arteries on a coronary computed tomographic angiography (CCTA) image (2), even though the major focus is on the coronary structures.Incidental lesions shown during CCTA, such as pulmonary nodules in the thorax (figure 1) and liver cysts in the abdomen (figure 2), can frequently be clinically significant and cause clinicians difficulty. A narrow field of view (FOV) is necessary for studying the coronary arteries with the best possible spatial resolution. Reconstructions with a wider field of view (FOV) can also be obtained to cover the whole thorax, which is useful for evaluating components other than the heart. The literature is divided on the topic of non-cardiac structure estimation during CCTA. Due to their incidence ranging from 15 to 58%, several authors argue that CCTA examinations should disclose accidental non-coronary findings (INCFs) (4).Some say incidental findings don't help patients, but only make them anxious and cost more (11). Using a 64-slice MDCT scanner, we conducted a retrospective assessment of the prevalence of INCFs in an outpatient group that was referred for clinically warranted CCTA in this study.

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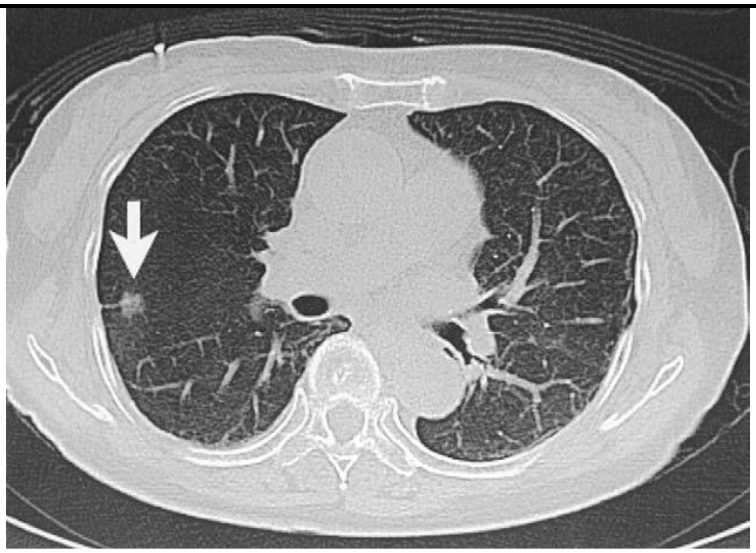

Figure 1. a nodule in the right lung of a 75-year-old woman with suspected coronary artery disease who underwent a 64-slice multidetector computed tomography scan. The nodule was pathologically proved to be adenocarcinoma.

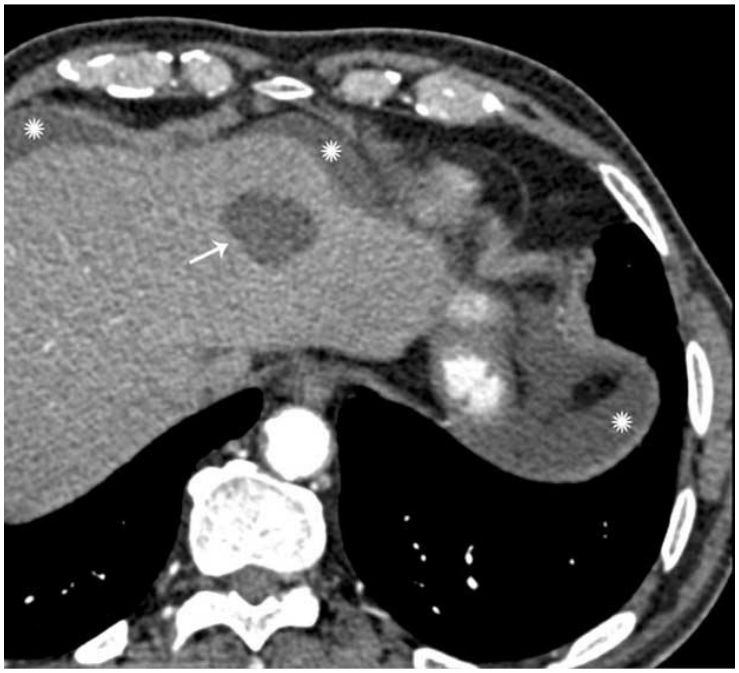

Fig. 2. Liver cyst (arrow) and ascites (asterisk) incidentally detected in 71-year-old man who was referred for coronary CT angiography for congestive heart failure.

Introduction to cardiac computed tomography (CT): This method is advancing rapidly. In about a decade, it went from being an experimental tool to a practical clinical reality (28). Although there is a lot of complicated technical background to this method, the driving force behind its success has

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been technological advancements that aim to reduce radiation dose and scan time while improving temporal resolution, contrast resolution, and image quality. This technique is currently the only non-invasive clinical tool for coronary angiographic assessment (28). In the late 90s, ECG triggering/gating techniques were introduced, which was the most important technological development. There has been an improvement in spatial resolution as well, reaching capabilities of sub-millimetre. Upcoming dual-energy technologies offer greater contrast resolution, high temporal resolution with less than 100 ms in hardware, quick coverage with more than 64 slice detectors, and high spatial resolution with 0.5 mm slice thickness (28).These days, you can get your hands on multi-detector computed tomography (MDCT) scanners, which allow you to acquire 64 slices per rotation all at once. Already, cardiac imaging has benefited greatly from these new instruments' enhanced spatial and temporal resolution. As protocols are optimised, MDCT coronary angiography will eventually achieve diagnostic accuracy comparable to invasive procedures (28).1-Five: Cardiovascular CT Basics:The X-ray tube and detector system are the two most crucial parts of a computed tomography (CT) system (Fig. 13). Having a quick rotation time along with multi-slice acquisitions is crucial for applications related to the heart. (21) These specifications are satisfied by the most recent 64-MDCT scanners. By combining isotropic spatial resolution of 0.4 mm^3 with gantry rotation speeds of 330 ms, they are able to obtain 64 sub-millimetre slices each rotation and consistently achieve outstanding picture quality and visualisation of small-diameter arteries of the coronary circulation. The MDCT methodology for assessing coronary plaque and stent lumens is also redefined by them (21).Until recently, CT scanners could only get one slice every rotation since they only had one row of detectors. Following these systems came another called multi-slice or multi-detector-row. These systems have multiple detector rows arranged in a two-dimensional array, and as the system rotates, a large number of adjacent slices are obtained (21).So, with an increase in picture quality, a larger area of the body may be captured in the same amount of time. Additionally, this has the added benefit of significantly cutting down on examination times. This is crucial because thoracic and abdominal exams necessitate the patient holding their breath in order to ensure that the picture quality is not affected by chest motion (21).Improving picture quality in terms of spatial and temporal resolution is where the new technology really shines in terms of its clinical impact.•It improves the capacity to see vessels with modest diameters, such as the distal coronary branches, thanks to the

increase in spatial resolution (21).•With fewer blooming artefacts, it improves calcium quantification. The stent lumen can be seen because it helps to reduce blooming artefacts in stents.The existence of coronary plaques can be more precisely defined and their features, such as volume and attenuation, can be more accurately measured. Numerous other features of non-invasive coronary imaging are affected by the enhancement of temporal resolution:The capacity to freeze pictures during the cardiac cycle is enhanced.It makes it possible to locate more reconstruction windows in the cardiac cycle.•When evaluating left ventricular function, it improves the system's performance.•Scan time is reduced. Each kind of scanner has its own unique set of technical specs, and advancements in this field are constant and quick. There are a lot of variables that affect the exact temporal resolution of the MDCT scans:1-Rotating speed of the garland.2. the field of view (FOV) size and location inside the scan volume.3-The algorithms used for post-processing and picture reconstruction. Reconstructing a single tomographic image with

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retrospective or prospective ECG control is actually possible with data taken at half a gantry rotation (Fig. 14).The most recent MDCT scanners in 1999 have a temporal resolution of about 165 ms (23-25). If the heart rate (HR) is less than 70 beats per minute (bpm), this is enough to capture photographs of the heart during diastole, when cardiac motion is minimal, without noticeable motion artefacts.

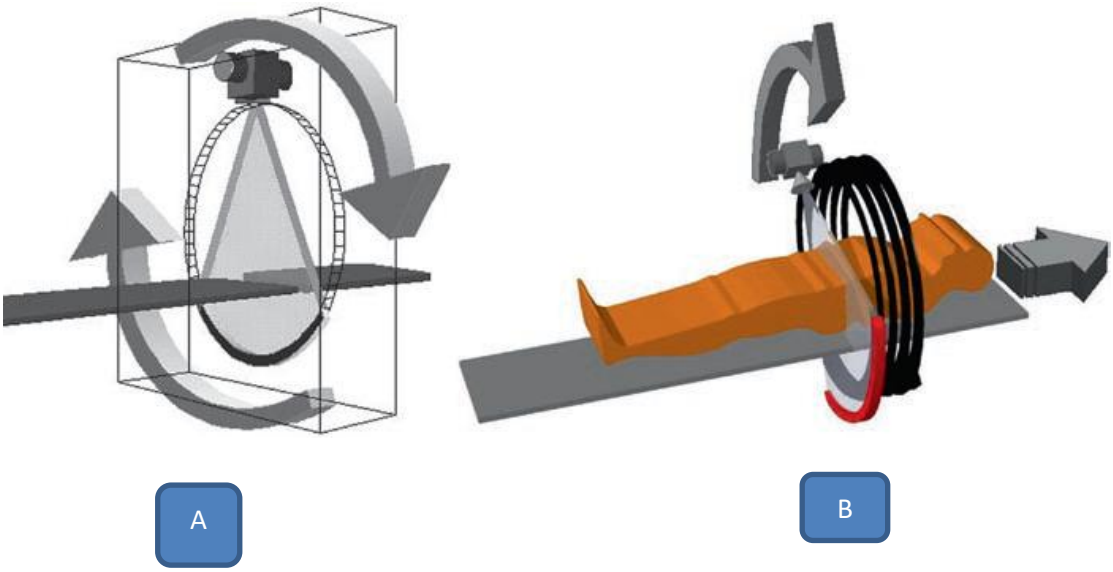

Fig. 13Geometry of a CT scanner(27). A CT scanner is designed with an X-ray tube and a detector that rotate around the table (a). During the rotation the table moves in order to generate the volume dataset (b).

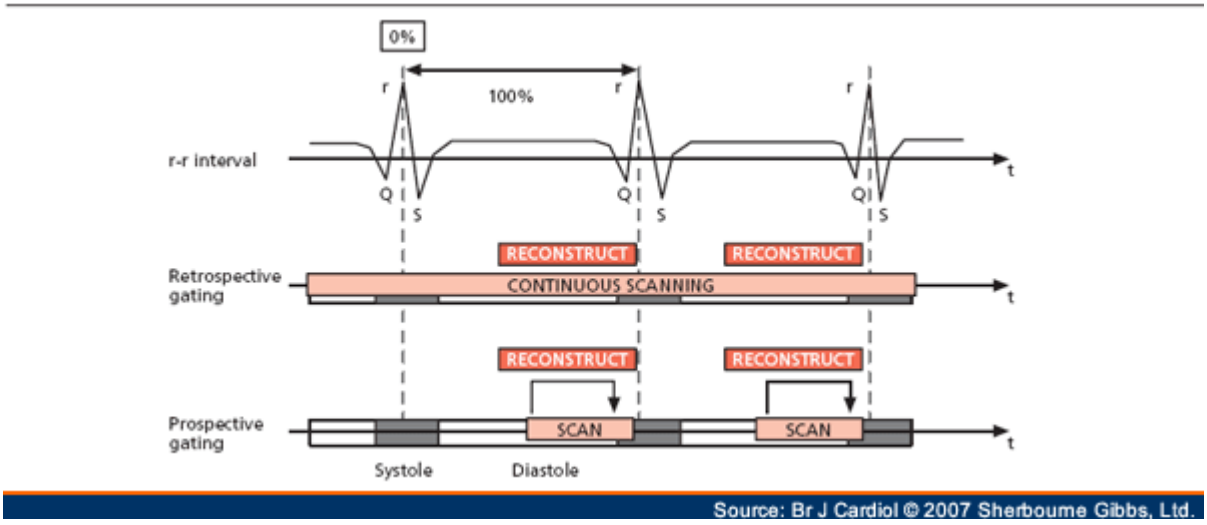

Fig. 14 Retrospective ECG gating vs. prospective ECG triggering(27).

We see the two most common methods for synchronising cardiac CT ECGs.We can see the retroactive ECG gating in the top panel.The method relies on capturing the ECG track while delivering low-pitched spiral X-rays continuously. Then, at will, the operator can choose which part

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of the cardiac cycle to recreate. We can see the potential ECG activation on the bottom panel. Sequential scanning, sometimes known as "step and shoot" mode, is its foundation.Radiation is only administered during the predetermined phase of the cardiac cycle when the scan is initiated. Obtaining satisfactory results necessitates either a very low heart rate (HR) or an extremely high temporal resolution.Sections 1-6: CT Parameter Definitions:Cardiac CT images are primarily generated by the following parameters:

One measure of spatial resolution is the distance that may be drawn between two nearby spots.

The bare minimal time needed to finish a single volumetric survey is known as 2-coverage resolution (27).3-Time resolution is the shortest amount of time needed to create a single axial image (27).

The ability to distinguish between two nearby attenuation values (Hounsfield Units) against a specific background noise is known as 4-contrast resolution (27).5-The beam width along the longitudinal axis at the scanner isocenter is referred to as collimation, or an X-ray beam (27).Figure 16 shows that the 6-pitch represents the helix width produced by the spinning gantry and table feed. The number of detectors used to describe a scanner has no bearing on the scan pitch, which is typically described as the beam/volume pitch (table feed/slice collimation) (27).The z-axis shows the patient's translation speed, as shown in the 7-table feed. The pace of the scan is determined by the table feed, which is fast (27).8- The number of photons that are generated and actually pass through the patient is proportional to the X-ray tube current (mAs). The contrast-to-noise ratio (or picture quality) is enhanced by increasing the mAs. 9-The photon energy is represented by the X-ray tube voltage (kV), which is typically 120-140 kV for cardiac CT. Protocols with 80/100 kV and increasing the mAs have recently been proposed as a means to conduct MDCT with a reduced patient dosage (27).

10-The depth along the image's longitudinal axis is called the effective slice width.

11-The distance between successive axial slices that have been rebuilt is called the reconstruction increment. The spatial resolution along the longitudinal axis is primarily impacted. To achieve 50% overlap in slices, the reconstruction increment is often set at a specific value.The field of view (12 FOV) indicates the size of the reconstructed image (27).Typically, CT uses a constant 13-image matrix, which represents the number of reconstructed pixels per picture (i.e., 512 x 512 pixels). In terms of in-plane spatial resolution, a narrow FOV enhances image quality (27).14- Interpolation is a software algorithm that uses known surrounding points to approximate a missing value. Both three-dimensional and spiral CT image reconstructions take advantage of this operation (27).Convolutional filters, called 15-Kernels, adjust a voxel's value based on the values of neighbouring voxels (27).You can use convolution kernels to make CT scans look sharper or smoother. To improve the edges of structures with high contrast, such as calcifications and stents, sharp kernels and filters are used (27).

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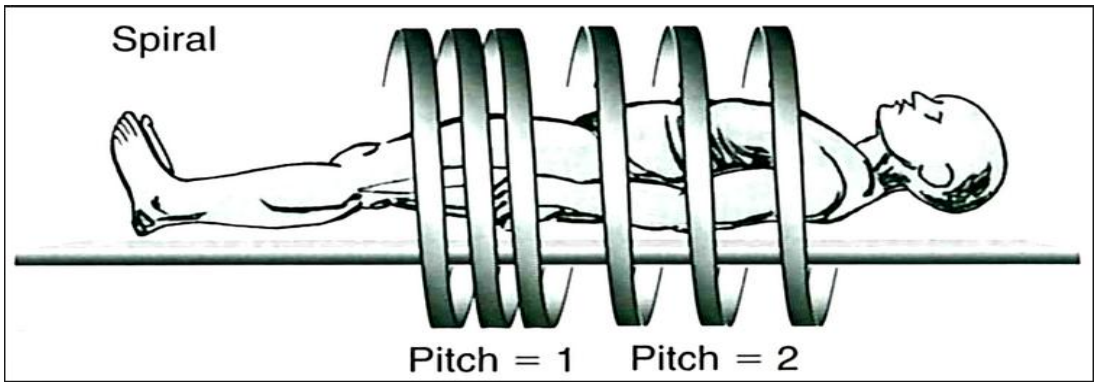

Fig.15Pitch.Examples of increasing pitch(27).

Chapters 1–7: CT Scan Scoring Coronary Calcium: CT was able to detect coronary calcium with ease due to the significantly higher roentgenographic attenuation of calcium compared to the surrounding tissues (Fig. 10). Calcified coronary plaques are strongly associated with a CT tissue density of 130 HU or higher, according to histologic investigations (26, 36, 33).The total amount of atherosclerotic plaque (calcific and non-calcific atherosclerosis) correlates with the amount of calcium in the coronaries, even though calcific plaques make up only 20% of the total amount of plaque in the coronaries (27). Therefore, coronary atherosclerosis is proven when coronary calcium is detected.1–8: Radiation dose: In the early days of cardiac CT, radiation dose was a major concern. Dose increases were unavoidable due to improvements in spatial resolution and the inherent retroactive character of scan geometry. A dosage range of 10–25 mSv was achieved using 64-slice CT without the use of any specialised reduction methods. One method that was initially used to lower radiation exposure was ECG-controlled prospective tube current modulation, which was based on retrospective ECG gating (Fig. 17). Based on the patient's heart rate (the lower the HR, the lower the dose), this method can decrease radiation exposure by as much as half (26). Radiation dose has been significantly reduced (range: 1-4 mSv) without a noticeable degradation of picture quality due to the recent use of prospective ECG triggering (26). We were able to do this by carefully timing the patient's radiation exposure and avoiding oversampling during capture (pitch = 1.0).

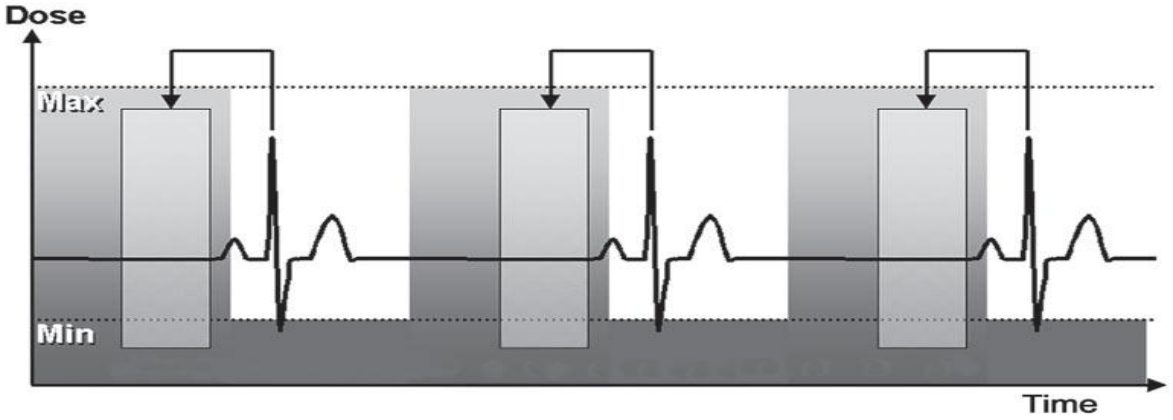

Fig. 16Prospective tube current modulation(26).While the reconstruction can be reliably performed in the end-diastolic phase (especially at low and regular HRs), tube current can be modulated and reduced to 4–20% of the peak during the systolic phase.

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Patients and Methods

Design, location, and timing of the study: From April 2013 to January 2015, a retrospective study was conducted at AL-Sader Medical City in the Al-Najaf Health Directorate. A total of 200 patients, consisting of 110 females and 90 males, with an average age of 55.5 years, underwent consecutive CCTA examinations at a single site (a cardiac center). Prior to the CTA, a CT scan was obtained for calcium scoring. Chest pain, an abnormal, equivocal, or non-diagnostic stress test, assessment of cardiomegaly or congestive heart failure, or assessment of the cardiac etiology of syncope were all reasons for CCTA to be performed. Initial testing for coronary artery disease included referring patients with an intermediate risk for the condition to a coronary CTA. The American College of Cardiology (ACC) (12) has established the aforementioned as valid reasons to perform CCTA.

The exclusion criteria includes:

1.Individuals who have undergone thoracic surgery in the past are not eligible.

2-People with thoracic or extra-thoracic conditions are well-documented.

3. there are a number of patient-related factors that can affect the diagnostic quality of CTCA. These include irregular heart rhythms (such as atrial fibrillation or frequent extra systoles) and the inability to sustain a breath hold for at least 15 to 20 seconds. Contrast agents can be dangerous, so CCTA is not recommended for patients with myeloma, renal function impairment, or a history of contrast reactions.

The prevalence of Incidental Non Coronary Findings in 64 slice Multidetector Computed Tomography Angiography.

Name : **age:** **gender :**

Work: **referring doc :** **address :**

Investigations : **ECG :** **ECHO :**

CATH: **Others :**

Referring reason :

Chest pain : **SOB:** **others:**

Past medical history :

Past thoracic surgical history :

Incidental Non Coronary Findings :

Structure

- Lung Parenchyma
- Mediastinal Lymph nodes
- Liver
- Pericardium
- Aorta
- Heart valves
- Breast
- Diaphragm
- Vertebral body
- pleura
- Pulmonary artery
- others

Figure 17 shows the questioner's formula that was utilized for this research.

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Examination and Equipment:

To ensure the best possible image quality and diagnostic accuracy in CCTA, the patient underwent the CT scan in a quiet, pleasant environment free from any distractions that could have affected their heart rate. Patients are advised to refrain from speaking or moving too much during the scan, as well as from coffee, smoking, and the beta blocker metoprolol 50 mg for one day before the exam, as these can all raise heart rates. An Aquillon 64, V4.51 ER 010, a 64-slice scanner from Toshiba Medical Systems in Tochigi, Japan, was used to conduct the CT coronary angiography, which included retrospective ECG gating. Figure 18 depicts the exam room along with the scanner.

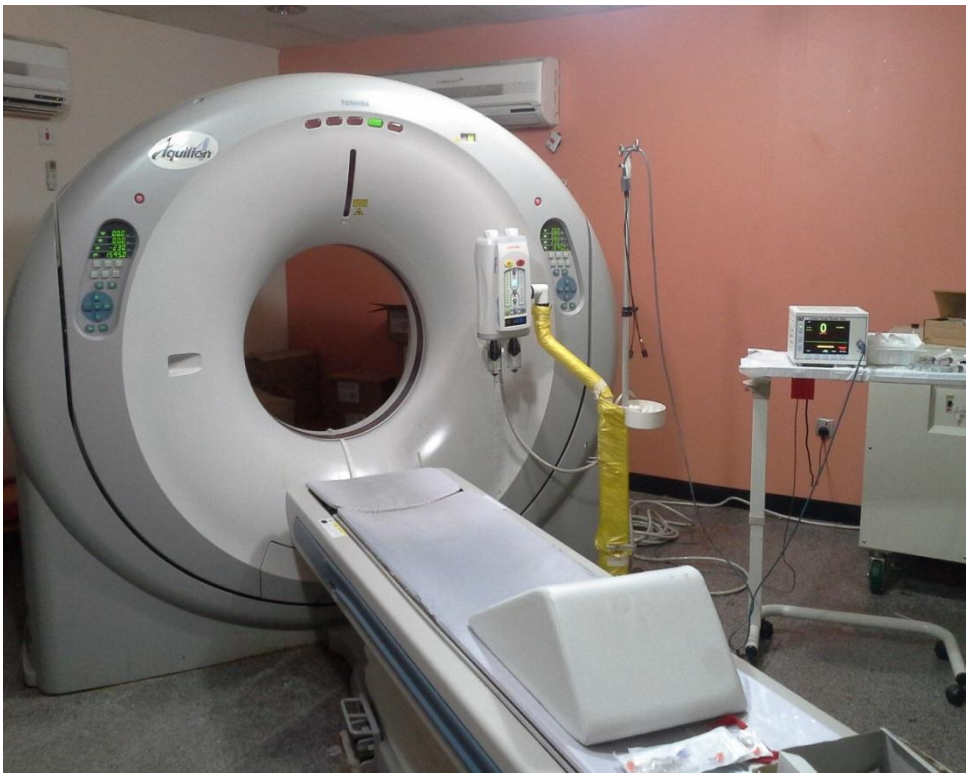

Figure 18. CT-Angiography examination room. This room present at the open cardiac center of AL-Sader Medical city in Al- Najaf.

Protocol

Prior to the use of multi-slice CT, a non-contrast CT was obtained to quantify total heart calcium and individual coronary artery calcium scores using the Agatston and volumetric methods, with a slice thickness of 3 mm for the sequence scan. The procedure began with an intravenous injection of 80–100 ml of contrast medium (Omnipaque, 350 mg/mL iodine) at a rate of 5 ml/s and was followed by 40 ml of normal saline. In just one breath hold, we were able to capture the image from the aortic arch all the way to the diaphragm level. Scan protocols that were activated by electrocardiograms were carried out. A 0.5 mm (increment 0.3 mm) slice thickness was used for CT image reconstruction with a smooth kernel (B25f). A specialized workstation (VITREA 2 WORKSTATION, Vital Images, Plymouth, Minnesota, USA) was used for image analysis after CT data sets were transmitted. Images were rebuilt with a wider field of view (> 300 mm) at a slice thickness of 0.6 mm, encompassing the entire thorax, in order to assess incidental extracoronary abnormalities. A mediastinal window (450 width, 35 level), a lung window (1500 width, -700 level),

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and a bone window (1500 width, 450 level) were all used for all examinations as they were reviewed in the axial, coronal, and sagittal planes. Lung parenchyma, mediastinal lymph nodes, liver, pericardium, aorta, breasts, diaphragm, and vertebral bodies were adjudicated as INCFs. Pleura, pulmonary artery, latissimus dorsi muscle, and various lesions also revealed further discoveries.

Statistical Analysis: Information on individuals who had incidental lesions was entered into a database. Data manipulation was carried out using the Windows version of the statistical package for the social sciences (SPSS), version 21, 2013. Numbers, percentages, frequencies, and standard deviations were used to describe the data. Extrapolating from the frequency of each incidental lesion to the total number of patients evaluated (N=200), we get the prevalence of each lesion. The data were presented using cross-tabulation and frequency distribution tables, along with figures and CT scans for lesions.

Results

A total of 200 patients were examined in this retrospective study, The INCFs were reported in 60 patients of them, giving an overall prevalence of 30% , Table 1.

Table 1. Distribution of findings with prevalence of incidental lesions among the studied group (N=200)

Variable	No.	%	Prevalence
No incidental findings	140/200	70.0	
Incidental findings	60/200	30.0	30.0%
Total	200	100.0	

Age and Gender distribution of the 60 patients:

Table 2 summarizes the demographic characteristics of the 60 patients with incidental findings, the mean age of those patients was 55.5 ± 10.2 (range 21 – 80) years, 15% of the patients aged≤ 40 years, 20% aged 41 – 50 years, 43.3% aged 51-60 years and 13 patients aged more than 60 years. Males were 26 (43.3%) while females were more frequent, 34 (56.7%) with a female to male ratio of 1.3:1.

Table 2. Demographic characteristics of the studied group

Variable		No.	%
Total number		60	100.0
Age (year)	≤ 40	9	15.0
	41 – 50	12	20.0
	51 – 60	26	43.3
	> 60	13	21.7
	mean ± SD	55.5 ± 10.2	-
	Range	21 - 80	
Gender	Male	26	43.3
	Female	34	56.7
	F/M ratio	1.3	-

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As it shown in table 3 and figure 19, the lung parenchyma was the dominant structure with incidental findings where 26 lesions (43.3%) were reported in this structure followed by mediastinal lymph nodes 11/60 (18.3%), liver and pericardium, with 4 lesion for each (6.7%), then aorta with 3 lesions (5%).Only 2 lesions (3.4%) were found in each of aortic valve, breasts, diaphragm and Vertebral body. Other findings were reported in pleura, pulmonary artery, Latismusdorsi muscle and miscellaneous with only one lesion in each, (1.7%).

Table 3. Incidental findings according to structures involved.

Structure	No	%
Lung Parenchyma	26	43.3
Mediastinal Lymph nodes	11	18.3
Liver	4	6.7
Pericardium	4	6.7
Aorta	3	5.0
Aortic valve	2	3.4
Breast	2	3.4
Diaphragm	2	3.4
Vertebral body	2	3.4
pleura	1	1.7
Pulmonary artery	1	1.7
Latismusdorsi muscle	1	1.7
Miscellaneous	1	1.7
Total	60	100.0

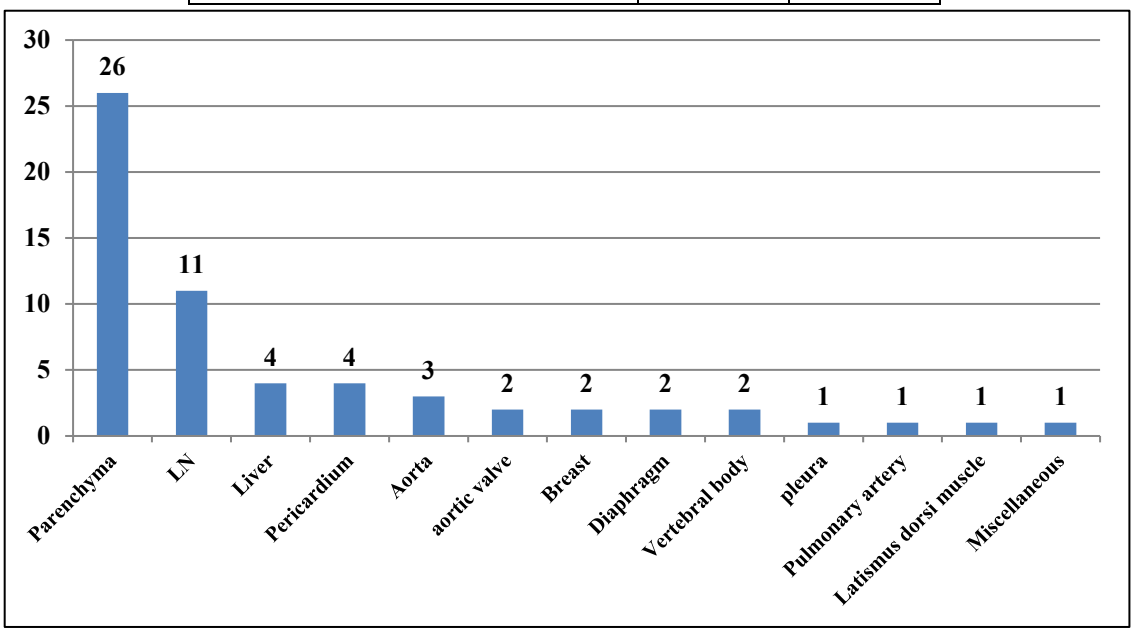

Figure 1. Distribution of incidental lesions according to structures.

Figure 19. Distribution of incidental lesions according to structures.

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The reported changes at each structure demonstrated in table 4, in parenchymal lesions, Emphysematous changes were the more frequent, represented (13.3%) followed by ground glass opacification (10%), Bronchiectasis (6.7%), Lung Collapse (6.7%), Lung fibrosis (3.4%) , Pulmonary venous HT (1.7%) and Bilateral pulmonary nodule (1.7%). Lymphadenopathy reported in lymph nodes (18.3%) of the patients , liver cyst in 4 patients (6.7%), pericardial calcification in 2 patients (3.4%), pericardial effusion in and pericardial thickening in 1.7% for each. ascending aneurysm reported in 3 patients (5%). Each of Aortic valve calcification, breast mass, hiatus hernia, vertebral body hemangiomachanges were found in 3.4% . Other changes included Pleural thickening, Pulmonary artery hypertension, ElastifibromaDorsi and Situsinversus were found in 1.7% for each. From other point of view, table 5 and figure 20, demonstrate more details of these findings where cross-tabulation of these findings was made, showing the distribution by structure and organ involved. Lung was the dominant organ with incidental lesions, where 27 lesions (45%) in this organ, followed by Mediastinum,15/60), (25%), heart 6/60 (10.2%)and liver 4/60 (6.7%), other organs are less frequent (1.7%-3.4%).

Table 4. Changes reported among 60 patients with incidental lesions distributed according to structures

Structure	Change	No	%
Parenchyma	Emphysematous changes	8	13.3
	Ground glass opacification	6	10.0
	Bronchiectasis	4	6.7
	Lung Collapse	4	6.7
	Lung fibrosis	2	3.3
	Pulmonary venous HT	1	1.7
	Bilateral pulmonary nodule	1	1.7
LN	LAP	11	18.3
liver	Cyst	4	6.7
Pericardium	Calcification	2	3.4
	Pericardial effusion	1	1.7
	Pericardial thickening	1	1.7
Aorta	Ascending Aneurysm	3	5.0
Aortic valve	Calcification	2	3.4
Breast	Breast mass	2	3.4
Diaphragm	Hiatus hernia	2	3.4
Vertebral body	Vertebral body Hemangioma	2	3.4
pleura	Pleural thickening	1	1.7
Pulmonary artery	Pulmonary artery hypertension	1	1.7
Latismusdorsi muscle	ElastifibromaDorsi	1	1.7
Miscellaneous	Situsinversus	1	1.7

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Table 5. Distribution of changes according to structures and organs among 60 patients with incidental lesions

Organ	Structure	Change	No	%
Lung	**Parenchyma**	Emphysematous changes	8	13.3
		Ground glass opacification	6	10
		Bronchiectasis	4	6.7
		Lung Collapse	4	6.7
		Lung fibrosis	2	3.4
		Pulmonary venous HT	1	1.7
		Bilateral pulmonary nodule	1	1.7
	Pleura	Pleural thickening	1	1.7
Total			**27**	**45.0**
Mediastinum	**LN**	LAP	11	18.3
	Aorta	Ascending Aneurysm	3	5
	Pulmonary artery	Pulmonary A. hypertension	1	1.7
Total			**15**	**25.0**
Liver	**liver**	Cyst	4	6.7
Heart	**Pericardium**	Calcification	2	3.3
		Pericardial effusion	1	1.7
		Pericardial thickening	1	1.7
	Aortic valve	Calcification	2	3.4
Total			**6**	**10.0**
Breast	**Breast**	Breast mass	2	3.4
Diaphragm	**Diaphragm**	Hiatus hernia	2	3.4
Spinal cord	**Vertebral body**	Vertebral body Hemangioma	2	3.4
Miscellaneous	**Latismusdorsi muscle**	ElastifibromaDorsi	1	1.7
	Miscellaneous	Situsinversus	1	1.7
Total			**2**	**3.4**

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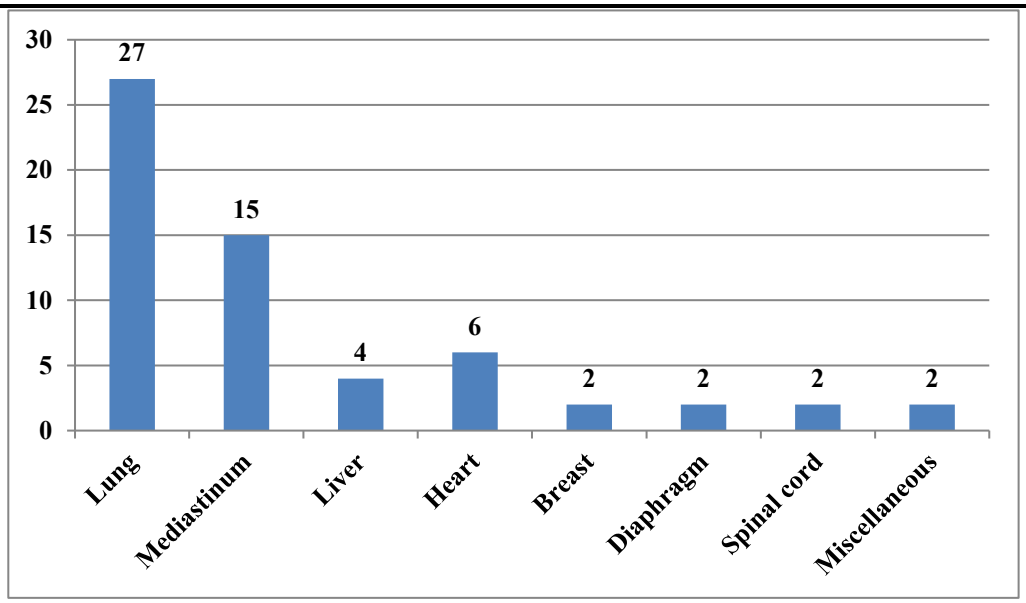

Figure 20. Frequency distribution of organs with incidental lesions

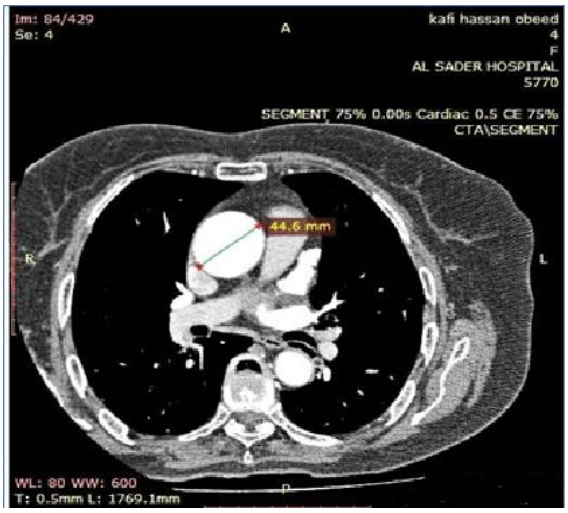

Figure 21. Aneurysm of ascending aorta incidentally found in 57-year-old man who was referred for coronary CT angiography for evaluation of coronary arteries .

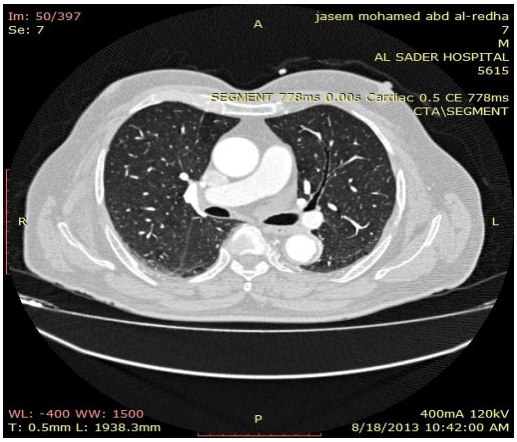

Figure 22. Bronchiectatic changes incidentally found in 50 years old woman who was referred for coronary CT angiography for evaluation of chest pain and dyspnea .

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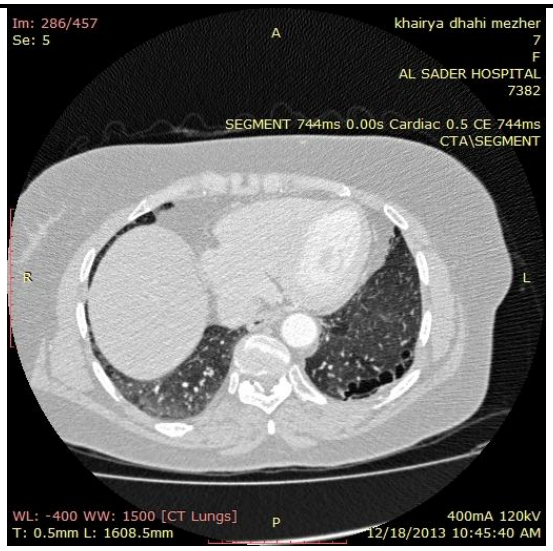

Figure 23. Emphysematous changes incidentally found in 48 years old weman who was referred for coronary CT angiography for evaluation of chest pain and dyspnea.

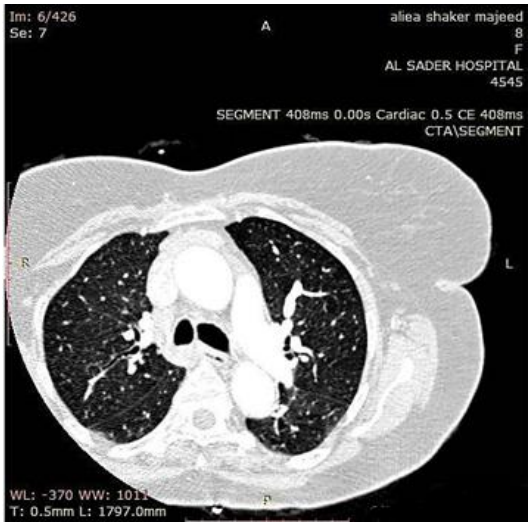

Figure 24. Ground glass opacification incidentally found in 45 years old woman who was referred for coronary CT angiography for evaluation of syncope, chest pain and dyspnea.

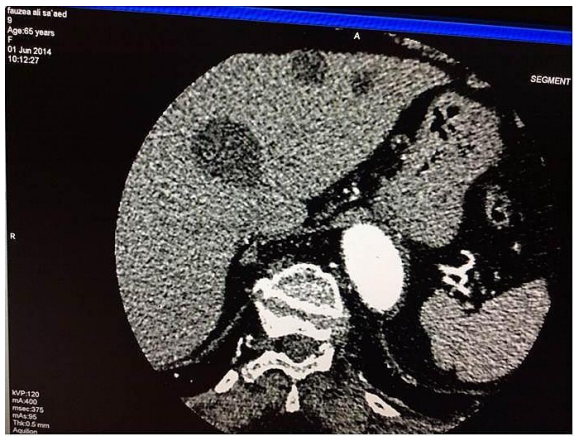

Figure 25. Liver cysts incidentally detected in 44 -year-old woman who was referred for coronary CT angiography for congestive heart failure.

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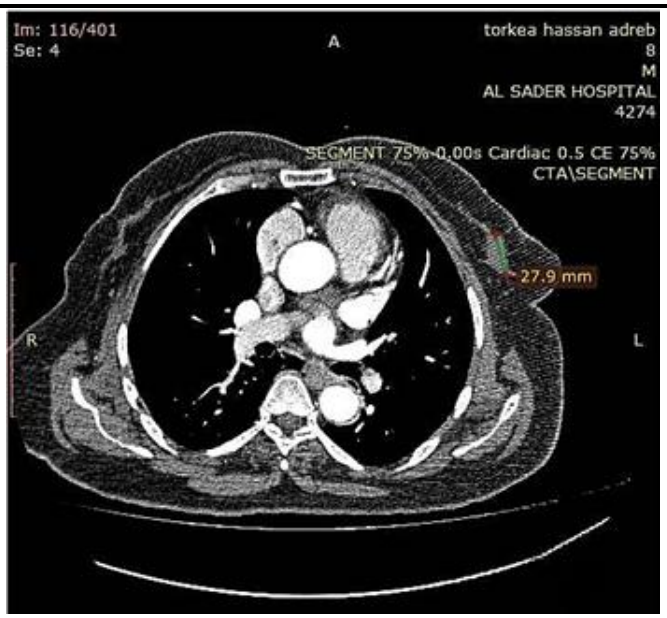

Figure 26. Breast mass incidentally detected in 40 -year-old woman who was referred for coronary CT angiography for chest pain.

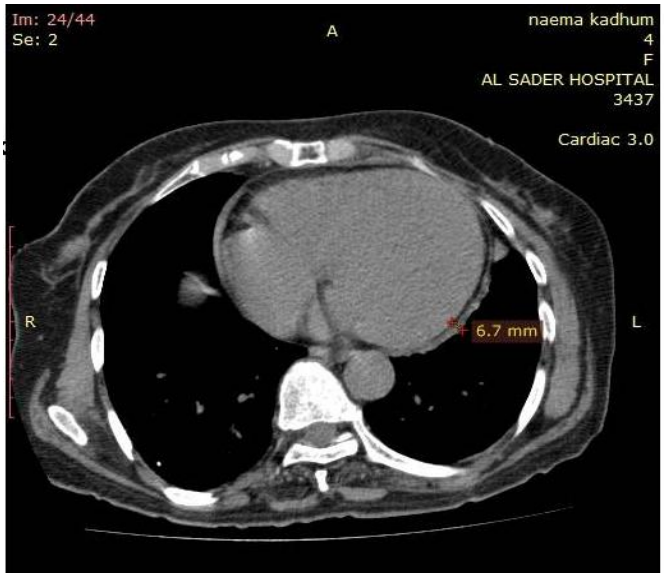

Figure 27 .pericardial thickeningincidentally detected in 49 -year-old woman who was referred for coronary CT angiography for chest pain and dyspnea .

Discussion

The use of coronary artery calcium scans (CCTAs) to detect atherosclerosis in the heart is becoming more common (7). In CCTA exams, the heart is scanned from the point where the pulmonary arteries branch off to the point where the left ventricle is at its most advanced, This leads to the reconstruction of pictures that center on the heart during the diastolic phase. The method allows us to freely modify the field of view (FOV) without exposing ourselves to any more radiation, as all content inside the gantry's bounds is scanned and made available. Fields of view (FOV) for cardiac imaging were limited to 16–25 cm^2 to attain optimal resolution. Even though all of the organs in the chest were irradiated, these pictures barely showed any of the lungs or any of the other organs. We

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also created a collection of wide-field-of-view (FOV) images to assess the periphery of the chest, in addition to the images used for cardiac analysis. Our hypothesis is that this approach has the potential to be positive to assess all organs exposed to radiation during the scan. The same scan might differentiate between pleural and aortic illnesses in patients exhibiting chest symptoms (8). Thirty percent of the patients (60 out of 200) in this study had INCFs. The most common site of incidental findings was the lung parenchyma, with twenty-six lesions (43.3%) reported there. The next most common site was the mediastinal lymph nodes, with eleven out of sixty patients (18.3%) reporting them. The liver and pericardium each had four lesions (6.7%), followed by the aorta with three (5%). The aortic valve, the breasts, the diaphragm, and the vertebral body each had two lesions (3.4%). In addition, one lesion was identified in the pleura, pulmonary artery, latissimus dorsi muscle, and other areas, accounting for 1.7% of the total. Furthermore, the majority of these discoveries necessitate further investigation due to their clinical significance.

Using a 16-row MDCT, Gil et al. (9) found extra-cardiac abnormalities in 56% of the individuals studied, adding to the few studies that have revealed the prevalence of INCFs using MDCT. With a 16-MCDT scanner, 56 out of 295 patients (19%) required clinical or radiological follow-up due to substantial extra-coronary findings on CCTAs, according to the study by Law et al. (10). Among 503 patients referred for CCTA using 16-slice and 64-slice MDCT scanners, research by Onuma et al. (8) found that 58% of the patients had INCFs. They discovered four cases (1% of the total) of cancer and 23 individuals (23%) with clinically significant no cardiac pathology necessitating further testing.

The detection rate of clinically relevant discoveries was greater when employing a full "thoracic" FOV (26% versus 15%) in a study by Aglan et al. (37) that evaluated the prevalence of extra-coronary findings using both a full and a short "cardiac" FOV. In a study comparing the detection rates of pulmonary nodules on CCTA with a limited and full field of view (FOV), Northam et al. (38) found that when using a limited FOV for CCTA, over 67% of nodules larger than 1 cm and over 80% of nodules smaller than 1 cm can be missed. According to Haller et al. (6), who assessed the volumes of the shown body parts, a specialized CCTA that focused on the heart only showed 36% of the whole chest volume, but when the raw data from the CCTA were reconstructed with the maximum field of view, 70% of the chest was visible. It is possible that the discrepancy in the percentage of INCF between our study and the aforementioned studies is due to the different numbers of patients examined; in our case, a small field of view (FOV) limited to the heart was utilized for coronary artery evaluation, and supplementary image reconstruction with a large FOV was carried out to assess the entire thorax. The value of CCT for incidental detection of non-cardiac disease is debatable, according to Yiginer et al. (39), since it may necessitate more expensive diagnostic treatments. However, they recommend that smokers over the age of 50 get a full thoracic calcium score imaging scan for the detection of potentially cancerous pulmonary nodules; this is due to the fact that lung cancer is the most prevalent cancer killer. Incorporating full thorax low-dose CT into the CCTA procedure would be advantageous, according to Kim et al. (40), since it allows high-risk patients to get screened for lung cancer and coronary artery disease at the same time with tolerable radiation exposure.The choice of how to assess incidental results and how to consult with patients will likely remain a topic of discussion and controversy as long as medical imaging (including CCTA) exists. Despite the lack of scientific validation for the benefits of

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examining INCFs, we believe that the best course of action is to review the data from each CCTA study, describe any non-cardiac findings with an estimate of their clinical relevance, and discuss with each patient as needed. Our study included two cases of lung cancer, highlighting the critical need for improved methods of early diagnosis. Therefore, it is imperative that CCTA interpreters possess the necessary skills to identify and assess non-cardiac diseases. The absence of patient follow-up is one of the study's weaknesses. For instance, thorough follow-up won't be available for a long time because following lung nodules is challenging and needs demonstrating stability over 2 years. The purpose of the study was not, however, to track how the anomalies were treated. The main objective of this investigation was to ascertain the frequency of INCFs, which, as per current radiological standards, necessitate further clinical or radiological monitoring.

Conclusions:

1. The CCTA, together with cardiac imaging, can reveal crucial information regarding extra-coronary pathology that necessitates further investigation.
2. In cardiac MDCT, a large number of results were found that did not pertain to the heart.
3. Malignant INCFs, particularly in the chest, are common.

Recommendations:

1. Looking at the INCFs that are accessible from the CCTA data is a good idea. A wide field of view (FOV) that encompasses the whole thorax is necessary for a thorough evaluation of the lungs, mediastinum, bones, and upper abdomen.
2. It is important for the radiologist or cardiologist analyzing the cardiac CT to thoroughly examine all organs in the scanned region.
3.If a patient has an accidental abnormality in an organ other than their coronary arteries, they should see a clinician.
4. A specialized CCTA questionnaire should be created and filled out by the physician who requests the test. This doctor is most suited to assess the patient's health and determine if further testing of the lungs, mediastinum, bones, etc. is necessary.

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