Original article

Incidental extra-cardiac pathologies on cardiac computed tomography

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ABSTRACT

Background: Extracardiac pathologies are frequently present in cardiac CT but are not routinely commented upon, and sometimes may have serious medical concern. This study aims to identify extracardiac pathologies present in patients undergoing cardiac computed tomography (CT) for some cardiac reasons.

Patients and Methods: This six months cross sectional study was conducted in the Department of Diagnostic Radiology in collaboration with Department of Cardiology, Punjab Institute of Cardiology Lahore. Total 200 patients from Jan to June 2017 referred to Radiology department for Cardiac CT were evaluated for extracardiac manifestations, including insignificant incidental findings and normal variants. The data was entered into SPSS version 20 and simple percentages were calculated.

Results: In this study, out of total 200 patients, 61% of the patients had extra cardiac pathologies. Most common extra cardiac findings included lung pathologies (63%), hepatic diseases (11%), mediastianal pathologies (9%), pulmonary embolism (4%), aortic dissection (4%), bone abnormalities (3%), breast diseases (2%), adrenal diseases (2%) and normal anatomical variants (2%).

Conclusion: On the basis of findings of this study, it is concluded that there is a high percentage of non-cardiac pathologies in patients undergoing CT for cardiac assessment. It is therefore suggested that the radiologists should routinely report and emphasize any significant incidental extracardiac pathology and cardiologists should consider these findings for an optimal patient outcome.

Keywords:
Cardiac CT; multidetector computed tomography; extra-cardiac pathologies; incidental pathologies; normal variants.

INTRODUCTION

Cardiac computed tomography (CCT) has been developed as a non-invasive test almost as reliable as invasive conventional digital subtraction angiography (DSA).[1] The modality is also superior over later because of its added ability of simultaneous imaging of several extra-cardiac structures such as chest wall including bones and muscles, mediastinum, lung parenchyma, breasts, upper abdominal organs and spaces in addition to heart, coronary arteries and pericardium.[1–4] Multi detector computed tomography (MDCT) allows gated CT imaging of the heart and high temporal and spatial resolution imaging has been made possible with superior quality imaging of both cardiac and extracardiac structures.[5] Cross sectional nature of CT imaging allows the radiologists and cardiologists to see the structures surrounding the heart although these might not be the intended target of imaging.[6]

Competing interest: The authors have declared no competing interests exist.
Citation: Malik A, Khan B. Incidental extra-cardiac pathologies on cardiac computed tomography. J Fatima Jinnah Med Univ 2018; 12(1): 21-24.

Chest pain is major symptom associated with coronary heart disease (CHD) but might also be indicative of many extracardiac, sometimes potentially life-threatening conditions such as aortic dissection**,** pulmonary embolism, primary and secondary malignancies of lungs and bones and interstitial lung disease etc. Clinical differentiation of these with CHD is not always possible.[7-8] It is where CCT proves itself to be superior over other cardiac investigations such as echocardiography, conventional coronary angiography and radionuclide imaging providing supplementary information about the surrounding extracardiac structures due to its cross-sectional nature of imaging.[1,9,10]

Although there have been studies describing the prevalence of extracardiac findings but these report a very wide range from 10–60%.[6] This study is planned due to scarcity of such data from this part of the world as findings might influence patient management and outcome by improving the image evaluation strategies both by radiologist and cardiologist.

PATIENTS AND METHODS

This cross-sectional study was conducted in the Department of Diagnostic Radiology, Punjab Institute of Cardiology Lahore, from January to June 2017. A total of 200 patients, undergoing CCT presenting with chest pain as major symptom were randomly selected for the study. Patients with calcium score >100, those with previous history of stenting/CABG and known cases of lung diseases were excluded from the study. The age of these patients ranged between 45-65 years. Male to female ratio of the patients was 2.3:1.

CCT was done on 64-MDCT (GE Health care®) scanner. Patients with CT and anxiety related tachycardia were premeditated with oral β-blockers, as well as with sublingual nitroglycerin. Intravenous 100–150 ml of nonionic contrast medium, depending on body weight, was injected at a rate of 4–6 ml/s, with the use of automatic bolus trigger software. For appropriate imaging, heart rate of 50-60 beats /min was maintained and KV 120, effective mAS of 600-850 were used to minimize motion artifact. Scanning was done from arch of aorta to the level of hemidiaphragm. To image heart and coronary arteries, smallest possible field of view (FOV) was used to achieve best resolution. Besides images for cardiac analysis, images were made with a large FOV to evaluate the chest. This method is not universal, but it could be beneficial to evaluate all organs in the scan. Data was entered and analyzed in SPSS version 20 and simple percentages were calculated.

RESULTS

In this study, 200 patients were assessed for extracardiac manifestations over a 6 months period. Out of the total, 61% (N=122) of the patients showed incidental extracardiac findings on Coronary MDCT angiography which included lung abnormalities in 63% (77 patients), hepatic disease in 11% (13 patients), mediastinal pathologies in 9% (11 patients) out of which more than 50% are minor pathologies with no active management needed, pulmonary embolism in 4% (5 patients); 3 patients having right artery embolism,1 patient having main trunk and 1 patient with left main pulmonary embolism and aortic dissection in 5 (4%) more cases. Bone abnormalities were found in additional 3% (4 patients), breast masses in 2.5% (3 patients) and adrenal masses in another 1% (2 patients). Moreover, normal anatomical variants were also found in 2.5% of the patients which included Azygous fissure, anomalous origin of right Subclavian artery from arch of aorta distal to left subclavian artery and Bifid ribs.

Lung abnormalities included pulmonary nodules 20% (25 cases), out of which 3% (4 patients) proved to be malignant. The rest however showed no interval change on follow up CT scan and so were considered as benign. Pulmonary infiltrates and consolidation were seen in 18% (22 cases), emphysema in 15% (18 patients), bronchiectasis in 5% (6 patients), multiple cysts in 3% (4 cases) and effusions were identified in 2% (2 patients).

Among the hepatic pathologies most common was chronic liver disease in 6% (7 cases). Hepatic carcinoma was identified in 3% (4 patients) and hepatic cysts in another 2% (2 patients) cases. Most prevalent mediastianal finding was lymphadenopathy seen in 5% (6 patients) of cases. Diaphragmatic hernias were seen in 2.5% (3 cases) and paravertebral masses in 1.5% (2 patients) cases. Table 1 summarizes various extracardiac pathologies observed in 122 patients.

DISCUSSION

Reports of extracardiac findings on cardiac CT differ widely in prevalence rates, Greenberg-Wolff and coauthors even reported it to be up to 76.8%.[3] They however classified the extracardiac abnormalities in two groups according to clinically significance. Clinically significant lesions were seen in only 39% case. Reports using electron beam CT show lower detection rates of extracardiac abnormalities (7.8–20.5%).[11–13] Electron beam CT uses the smaller field of view and thicker image sections, both of these are the reason for this lower detection capability. This study found the overall detection frequency of about 63% and did not categorize patients into clinically significant or insignificant lesions, this prevalence is in accordance with already reported figures.[1–8,10]

Table 1. Frequency of extra cardiac pathologies (N=122)

Extra Cardiac Pathologies	Frequency (%)
Lung	**77 (63)**
Pulmonary nodules	25 (32.5)*
Pulmonary infiltrates /consolidation	22 (28.5)*
Emphysema	18 (23.4)*
Bronchiectasis	6 (7.8*)
Pulmonary cysts	4 (5.2)*
Effusions	2 (2.6)*
Hepatic	**13 (11)**
Chronic liver disease	7 (53.8)*
Hepatic carcinoma	4 (30.8)*
Hepatic cysts	2 (15.4)*
Mediastinal	**11 (9)**
Lymphadenopathy	6 (54.5)*
Diaphragmatic hernias	3 (27.3)*
Paravertebral masses	2 (18.2)*
Pulmonary embolism	5 (4)
Aortic dissection	5 (4)
Bone abnormalities	4 (3)
Breast masses	3 (2.5)
Adrenal masses	1 (1)
Normal variants	3 (2.5)

*Percentages calculated against total number of patients in each group

One previous study reported that the most common extracardiac abnormality was pulmonary nodule in 13% of the patient as compared to 20% in our study.[3] The authors however reported hepatic lesions to be just 2% in contrast to 11% in this study. The difference might be due to high incidence rate of chronic liver disease in Pakistani population mostly due to Hepatitis C and B infections. Lehman and group also reported pulmonary lesions in highest percentage, pulmonary nodules being most numerous. In their study they also found hepatic lesions in a substantial number, the majority of which however were hepatic cysts.[8]

Horton and associates, using electron beam CT, included 1326 patients and reported lung lesions in highest number as incidental extracardiac abnormalities. However, they reported just 7.8% detection rate of extracardiac abnormalities in his patients.[12]

This wide range of incidence among various studies obviously might be due to difference of study population but size of field of view also plays an important role in the

capability of cardiac CT to detect the lesions outside the heart.[3]

Earl and colleagues[10] reviewed previous studies on the incidental extracardiac findings detected on cardiac CT.[4,5,9-21] They calculated that detection of unknown pulmonary malignancy was between 0–1.2% with a mean of 2.7%. This percentage was slightly high in this study (3%). The reason might be due to difference in study population as well as our strategy of reconstructing images with a wider field of vision.

The results of the study showed detection of significant percentage of extracardiac abnormalities in patients undergoing cardiac CT, keeping in view the already reported results. The reason for higher detection rate in this study might be due to the reconstruction performed in the images with larger field of vision to properly visualize the surrounding structures thus improving detection percentage of the extracardiac pathologies.[6]

CONCLUSION

It is concluded that there is a high percentage of non-cardiac pathologies in patients undergoing CT for cardiac assessment. It is therefore suggested that the radiologists should routinely report and emphasize any significant incidental extracardiac pathology and cardiologists should consider these findings for an optimal patient outcome. Radiologists and cardiologists should have a complete knowledge of the possible extracardiac findings detectable on cardiac CT.

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