

NON CORONARY FINDINGS ON CONTRAST ENHANCED CARDIAC MDCT

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ABSTRACT

Introduction : Cardiac Computed Tomography angiography (CTA) is commonly performed for suspected coronary artery disease. Obtained images also show lungs and upper abdomen besides cardiac and coronary sections. The purpose of our study was to evaluate the incidence of non coronary findings on contrast-enhanced cardiac multi-detector computed tomography (MDCT). **Patients and Method :** CTA was performed in 92 patients, most of them were suspected to have coronary artery disease and in some patients with known co-morbid and high risk factors, CTA was performed as a screening method for detection of coronary artery disease. Cardiac CTA was performed on a 64-MDCT scanner with ECG-gating and bolus timing. Two radiologists assessed each examination in consensus. The findings were judged and categorized in two groups according to their clinical significance. Those findings which require therapeutic intervention or radiologic follow-up were judged potentially significant. **Results :** In this study, 10 patients (11%) had at least one unsuspected non coronary, potentially significant finding including pulmonary edema, pneumonia and mesenteric inflammation, gallstones, renal calculi and solitary pulmonary nodule. 28 patients (30%) had one or more insignificant non coronary findings detected on these scan. **Conclusion :** Clinically significant non coronary, non cardiac findings can be seen in cardiac MDCT if adequate chest coverage was obtained during cardiac scan, either by using large field of view or repeating low dose CT chest following cardiac CT, but latter carries risk associated with high radiation exposure which has to be justified against clinical benefit. **KEY WORDS:** MDCT, CTA, lung disease.

Introduction

Coronary artery imaging with contrast-enhanced computed tomography (CT) can play an important role in the management of patients with suspected or known coronary artery disease.¹

Multidetector cardiac CT is now being commonly performed for the evaluation of coronary arteries and to provide an assessment of graft patency after coronary artery bypass grafting surgery (CABG). Studies have revealed mean sensitivities, specificities, positive and negative predictive values of 87%, 89%, and 77% and 97%, respectively, for the detection of coronary artery stenoses.^{2 3 4}

New multi-detector CT scanner is a multipurpose imaging tool for which applications are well established.

Raw CT data with high spatial resolution is reconstructed which is synchronized to the cardiac cycle.

Although coronary CTA examinations are usually reconstructed in a small field of view focused on the heart, but raw data usually contain information regarding adjacent lungs, pleura, other mediastinal structures, bones and upper part of abdomen.⁵ Therefore, it is expected to incidentally come across some unexpected non coronary findings that might be clinically significant that would require either prompt intervention or at least follow up.

We retrospectively assessed the frequency and types of these incidental non coronary findings in patients who underwent cardiac CTA as no such data from our part of the world is available.

Patients and Methods

This is a retrospective study conducted in the

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Department of Radiology, Aga Khan University Hospital, Karachi. All patients referred for CTA for coronary artery disease were included. Study was carried out from July 2007 to June 2008. Patients were identified through our radiology information system. A total 92 patients were included in this study in which 67 were male and 25 were female with an age range of 38 years to 77 years (mean age 52 year). The patients had a defined indication for undergoing coronary CTA. These included patients with atypical chest pain with low pre test probability of having coronary artery disease to patients requiring evaluation of graft patency. Patients below 15 years of age and those with inadequate chest imaging e.g. due to breathing artifacts, were excluded.

Image Acquisition

CT data were acquired on a 64-MDCT scanner (Aquilion 64, Toshiba Medical Systems Corporation). All patients were pre treated with oral beta blockers. (Metoprolol) 100 mg reduce the heart rate to below 60 beats/minute and to minimize beat to beat variability induced by breath holding. Non ionic low osmolar Iodinated contrast material, (80-100ml) was injected with a power injector through an 18- to 20-gauge cannula into a peripheral vein preferably the antecubital vein at 4-4.8 ml/s. This was followed by a bolus of saline. Automated bolus timing was Images were obtained during single breath hold from the inferior margins of the heart up to the carina. For each patient, retrospective ECG gated images were obtained. The scanning protocol included collimation of 0.5 mm × 64 with slice thickness of 0.5 mm. The exposure factors were 120 kVp and 300 mAs. The typical field of view was 200 mm with a matrix of 512 × 512. A pitch of 0.2–0.3 was used with a scanner rotation time of 0.40 second. All images were reconstructed with a small field of view centered on the heart. Images were reconstructed with the multi segment algorithm provided by the manufacturer with retrospective ECG gating starting 400, 450, or 500 mSec before the gating signal. In each patient, a phase obtained at 75%, 80% and 85% of the R-R interval was reconstructed along with the best phase calculated by the dedicated computer system and used for primary analysis. Low dose CT chest was also performed after cardiac imaging from lung apices to the carina to cover that part of chest

missed on cardiac imaging to minimize the chances of missing any extra coronary incidental findings.

Image Interpretation

Each cardiac examination was evaluated by Cardiologist or Radiologist who is particularly trained and accredited in coronary CTA. However same examinations were also evaluated for non coronary CT chest findings by two experienced Radiologist. All incidental findings were reviewed independently by two consultant radiologists and a final decision was based on consensus.

The non cardiac findings were divided into two groups, one clinically significant such as pulmonary edema, panniculitis, solitary pulmonary nodule and pneumonia, that would require either immediate treatment or follow up. The other clinically insignificant group comprising findings such as fibrotic old scarring in lungs, calcified granulomas, insignificant mediastinal lymph nodes, that were deemed not to have any current clinical significance.

Results

Non cardiac incidental findings were found in 32 patients (35%) out of 92. There were total 48 findings in 32 patients, out of those 13 were significant and 35 were insignificant.

Out of 32 patients, 10 patients (31%) had clinically significant non coronary findings and 28 patients (87%) had insignificant non coronary findings.

Out of 92, 11% patients had clinically significant non coronary findings and 30% patients had insignificant findings. Simultaneous significant and insignificant findings were seen in 6 patients.

More than one clinically significant finding was seen in 03 patients. More than one insignificant finding was seen in 08 patients.

Among significant findings, one had solitary pulmonary nodule that was sub centimeter in size, follow up CT chest or PET scan was advised. One patient showed inflamed mesentery, one with pulmonary edema and one with pneumonia.

Among insignificant findings, most common were fibrotic scarring in lungs in 07 patients, calcified granulomas in 06 patients, one patient had situs inversus.

Details of significant findings are given in (Table 1) and insignificant findings in (Table 2)

Table 1: Total number of significant findings(13) detected on cardiac CTA

Findings	Number of findings	Percentage
Pulmonary edema	01	01%
Cholelithiasis	03	3.2%
Pneumonia	01	01%
Chronic liver disease	01	01%
Mesenteric panniculitis	01	01%
Fracture of manubrium	01	01%
Renal stones	01	01%
Solitary pulmonary nodule	01	01%
Emphysema and apical bullae	01	01%
Bilateral pleural effusions	02	2.1%

Table 2: Total number of insignificant findings (35) detected on cardiac CTA

Findings	Number of findings	Percentage
Benign lymph nodes	06	6.5%
Adrenal cyst	01	01%
Fibrotic scarring	07	7.6%
Situs inversus	01	01%
Minimal bronchiectasis	02	2.1%
Double SVC	01	01%
Basal atelectasis	02	2.1%
Liver hemangioma	01	01%
Liver / renal cysts	05	5.4%
Calcified granulomas	06	6.5%
Enlarged Thyroid	01	01%
Minimal Emphysema	02	2.1%

Discussion

Incidental non coronary findings were seen in 35% of patients in our study, who underwent CTA for suspected coronary artery disease. However out of those, 11 % patients showed clinically significant non coronary findings, such as pulmonary edema, pneumonia, panniculitis, solitary pulmonary nodule and renal or gallstones, that might require immediate treatment or

at least follow up. Rest of the 30% patient showed clinically insignificant findings such as old pulmonary fibrosis, calcified granulomas and basal atelectasis that do not require immediate treatment. Mueller et al⁶ reported clinically significant findings in 20% of patients which is higher than our study. Those investigators reviewed CTA examination done on 16 multislice CT in 239 post CABG patients for assessment of graft patency; therefore it included both cardiac and non cardiac findings.

According to their study, clinically significant non cardiac findings were seen in 13.1% of patient which is comparable to our study. They found significant non coronary cardiac findings in 11.3% patients such as mediastinal hematoma, intraventricular thrombus and large pericardial effusion. However in our study no such findings were seen as our patient population was largely outpatient based with very low pretest probability for coronary or cardiac disease. In current study we found more incidental findings as compared to their study as they didn't record non significant non cardiac finding. We performed studies on a 64 multislice CT scanner.

Horton et al⁷ reported clinically significant non cardiac findings in 7.8% patients. They reviewed 1,326 screening electron beam unenhanced CT examinations done for calcium scoring. They had large cohort of patients but results are nearly comparable to our study although we did contrast enhanced as well as whole chest coverage.

Haller et al reviewed 166 patients undergoing contrast enhanced CTA examination and found non cardiac incidental findings in 24.7%, with minor or non significant findings in 19.9 % and major or significant findings in 4.8% patients only. These results are lower than in our study, which might be attributable to a small field of view they used which revealed only 35% of lungs and other chest structures. In comparison we included complete chest CT in our interpretation, which might be a reason for high number of incidental findings, but our cohort of patient is small which might be a reason of diagnosing less number of clinically significant findings that would require urgent treatment or had significant impact on patient such as carcinoma of lung and pulmonary embolism.

Conclusion

Clinically significant non coronary, non cardiac findings can be seen in cardiac MDCT if adequate chest

coverage was obtained during cardiac scan, either by using large field of view or repeating low dose CT chest following cardiac CT, but latter carries risk associated with high radiation exposure which has to be justified against clinical benefit.

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