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Short Communication

Coronary CT angiography: A retrospective study of 220 cases

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ABSTRACT

Background: Coronary artery disease (CAD) is a common cause of morbidity and mortality worldwide. Although catheter coronary angiography (CCA) is the gold standard in the diagnosis and management of CAD, coronary CT angiography (CCTA) has shown promising results for the same.

Methods: CCTA was done using 40 slice multi-detector CT (Somatom Sensation, Siemens, Germany) machine in 220 patients of suspected CAD. Patients were classified as (a) normal (no calcific or soft plaque), (b) non-obstructive coronary disease ($<$50% stenosis), (c) obstructive coronary disease ($>$50% stenosis), or (d) a non-diagnostic study.

Results: 96 (43.6%) cases were found to have normal coronary arteries on CCTA, 41 (18.6%) patients were classified as having non-obstructive disease, 67 (30.5%) patients were defined to have obstructive CAD, and 16 cases (7.3%) were inconclusive. Significantly obstructive triple vessel disease was noted in 4 (6%) cases. Double vessel disease was seen in 25 (37.3%) cases and single vessel disease was seen in 38 (56.7%). Single most common vessel with obstructive CAD was left anterior descending artery and was noted in 30 (44.7%) out of 67 such cases. The least affected vessel was left circumflex in 15 cases (22.3%). Median calcium score for non-obstructive CAD was 60 (range 30–95), and for obstructive CAD 300 (range 120–780).

Conclusion: Key benefits of CCTA lie in the avoidance of CCA since it has a high negative predictive value. CCTA has a definite role in post-stent and post-coronary artery bypass graft patients.

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Introduction

Coronary artery disease (CAD) is caused by buildup of atheromatous plaque inside the walls of the coronary arteries leading to narrowing of lumen. These plaques can be soft, calcific, or mixed depending upon the amount of calcium in them. Most of the individuals having CAD remain asymptomatic till the disease progresses and leads to cardiac ischemia, which often presents as acute myocardial infarction. Most common cause of death is considered to be ischemic heart disease in the world[1] and it is also a leading cause for admissions to hospital.[2] The routine tests used for diagnosis of cardiac ischemia are electrocardiogram (ECG), blood tests (troponin test), cardiac stress testing by treadmill test (TMT), or nuclear stress testing. However, these tests only provide indirect evidence of CAD. Catheter coronary angiography (CCA) provides direct evidence of stenosis and is considered to be the gold standard. However, CCA is invasive in nature. Coronary CT angiography (CCTA) is a non-invasive technique to image coronary arteries by multidetector CT (MDCT). Imaging of coronary arteries has been made possible by MDCT due to faster craniocaudal coverage and ECG gating. It provides direct evidence of CAD by not only demonstrating the soft or calcific plaques but also the degree of stenosis. Initial attempts at CCTA by 16 slice scanner were not encouraging, as it was only after the appearance of 40 and especially 64 slice scanners the CCTA became a worthy challenger of CCA. With the advent of advanced MDCT such as 256 and 320 slice scanners and improved software it was thought that CCTA would possibly obviate the need of CCA for diagnostic purposes. Despite tremendous technological advances in terms of shorter scan time and reduced radiation exposure[3] and overall improved image quality, CCTA has still not gained much acceptance in the medical fraternity. This article aims at describing the role of CCTA in the workup of CAD and examines the pros and cons including its current status.

Materials and methods

Study design

Retrospective descriptive.

Setting

600 bedded multispeciality zonal hospital.

Study period

January to October 2009.

Cases

All cases of suspected CAD who underwent CCTA study were included in the study group. All patients who underwent CCTA were referred by the concerned cardiologist. The patients who gave history of allergy to contrast or had earlier contrast reaction, patients with deranged renal function test (eGFR < 60), uncooperative patients who were unable to hold breath for 15–18 s, patients with heart rate of more than 66 bpm after administration of beta blocker or with irregular heart rate, and patients with high calcium score (>1000) were excluded from the study.

Study technique

CCTA was done using 40 slice MDCT (Somatom Sensation, Siemens, Germany) machine. Patients were adequately prepared before CCTA study by proper briefing of the procedure, use of beta blockers (Tab Metoprolol 50 mg was given at night prior to the day of scan and one tablet was given 1 h before taking up the patient for scanning), and practice of breath-hold for holding breath for 15–18 s was ensured as per standard protocol. ECG gating was done in each case and images were acquired with retrospective gating. Prospective and retrospective gating are two different techniques of acquiring data in CCTA with their own pros and cons. Calcium scoring tool was used to evaluate the calcium load of coronary arteries. Calcium score >1000 was taken as a relative contraindication for CCTA. Imaging parameters used were slice thickness 3 mm with recon with 1 mm slice and recon increment of 0.5 mm, FOV 170–180 mm, and care dose 4D was used to reduce the radiation exposure. The average radiation exposure (effective dose) was 14–16 mSv (range 10–18 mSv) as calculated from computed tomography dose index $CTDI_{vol}$ (38–40 mGy) and dose length product of (600–650 mGy cm) estimates. Nonionic water soluble iodinated contrast (Iohexol 350 mg/mL) was injected intravenously through 18 G cannula @ 05 ml per sec with a pressure injector. A total quantity of 80–100 mL iohexol was used depending on the body weight. Curved multiplanar reconstructions, maximum intensity projection (MIP), and volume rendering technique (VRT) were used to produce diagnostic quality images for interpretation. Patients were classified as (a) normal (no calcific or soft plaque), (b) non-obstructive coronary disease (<50% stenosis), (c) obstructive coronary disease (>50% stenosis), or (d) a non-diagnostic study. Findings of CCTA were recorded and analyzed.

Results

During the study period, a total of 220 cases underwent CCTA study. 140 cases were male and 80 cases were females with M:F ratio 1.7:1. Average age of patients was 54 years with youngest patient of 38 years, and oldest being of 72 years. 12 patients were post-coronary artery bypass graft (CABG) who had presented with symptoms of angina. 15 cases of post-percutaneous transluminal coronary angioplasty with stenting had undergone CCTA for evaluating stent patency. 96 (43.6%) cases were found to have normal coronary arteries on CCTA, 41 (18.6%) patients were classified as having non-obstructive disease, 67 (30.5%) patients were defined to have obstructive CAD, and 16 cases (7.3%) were inconclusive. Significantly obstructive triple vessel disease was noted in 4 (6%) cases. Double vessel disease was seen in 25 (37.3%) cases and single vessel disease was seen in 38 (56.7%). Single most common vessel with obstructive CAD was left anterior descending artery (LAD) and was noted in 30 (44.7%) out of 67 such cases. The least affected vessel was left circumflex (LCX) in 15 cases (22.3%). Median calcium score for