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Original article:

Study of role of ultrafast MDCT coronary angiography in patients with risk factors

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Abstract:

Introduction: Coronary artery disease (CAD) remains the leading cause of death in western countries with increasing prevalence in developing countries. The standard reference for diagnosis of CAD is coronary catheter angiography.

Material & methods: This study was conducted at a tertiary care hospital, for the period of one year . Data was collected from patients referred to the CT scan department.

Results : Of 99 patients referred for CT coronary angiography, there were 57 patients (57.57%) were symptomatic , 42 patients (42.42%) were asymptomatic with or without risk factors for CAS (diabetes, hypertension, smoking, alcohol, family history of CAS) or referred from the health check up department.

Conclusion: MDCT coronary angiography was found to be of benefit in with or without risk factors to exclude significant coronary artery stenosis.

INTRODUCTION

Coronary artery disease (CAD) remains the leading cause of death in western countries with increasing prevalence in developing countries. The standard reference for diagnosis of CAD is coronary catheter angiography. The greatest advantage of catheter angiography is its high spatial resolution and option of directly performing intervention , such as balloon dilatation or coronary stenting. Only 1/3rd of all coronary catheter examinations in the United States were performed in conjunction with an interventional procedure (Percutaneous Transluminal Coronary Angioplasty-PTCA), however , whereas the rest were performed for mere diagnostic purposes (i.e. for verifying the presence and degree of CAD only).[1]The scenario is similar in developing countries. Accordingly, a reliable , non-invasive tool for imaging of the coronary arteries and for early diagnosis of CAD is highly desirable.Imaging of the heart has always been technically challenging because of the heart's continuous motion. CT imaging of the heart moved into the diagnostic realm by the introduction of multidetectorrow CT (MDCT)[2,3] and development of ECG-Synchronized scanning and reconstruction techniques.[4] These modalities allow for faster volume coverage and high spatial and temporal resolution. The introduction of MDCT especially has greatly benefitted cardiovascular CT applications as the speed of image acquisition shortens breath hold and examination time for the patient and

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reduces the amount of contrast media needed for high and consistent vascular enhancement.[4-5]With the advent of 64-slice MDCT scanner sub millimeter resolution (0.4mm) of substantial anatomic volumes is routinely achieved.

Material & methods:

This study was conducted at a tertiary care hospital, for the period of one year.Data was collected from patients referred to the CT scan department.

Inclusion criteria

1.Symptomatic or asymptomatic patients with cardiac symptoms.

2.Symptomatic or asymptomatic patients with high risk factors for coronary artery stenosis.

3.Patients having heart rate of <65bpm

4.Patients with good breath holding capacity

5.Patients with post stent insertion and post CABG patients

Exclusion criteria

1.Patients with renal dysfunction

2.Allergy to contrast media

3.Unable to breath hold

4.Heart rate of >65bpm inspite of use of beta-blockers.

5.Very obese patients

6.Patients having an irregular ECG rhythm

The study was conducted in accordance with the approval and recommendations of our institutional ethical board. Initially, written informed consent was obtained from all patients. Thereafter the individual details, clinical history, past history, vitals wererecorded.Atopogram was performed followed by a calcium score. Thereafter contrast enhanced CT coronary angiography was carried out.

CT scanner in our institution is a SIEMENS 128 Slice Scanner.

99 patients were referred for CT coronary angiography. Of these, 57 patients were symptomatic and 42 patients were asymptomatic (patients with risk factors like DM, HTN, etc.). Of these, 14 patients had prior intervention, 12 were post CABG and 2 were post stenting patients.

The patients were in varied age groups, ranging from 25 yrs to 82 yrs. There were 71 male and 28 female patients.

TECHNIQUE

Scan protocol and image reconstruction

All patients were scanned with a SIEMENS 128-slice CT scanner equipped with a new feature in multislice CT technology, so called z-axis flying focus technology.[14] Due to higher oversampling rate in the z axis,reduces the artifacts related to the spiral acquisition and improving spatial resolution down to 0.4 mm.[3(14)]

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OBSERVATION AND RESULTS

99 patients were referred for CT coronary angiography. Of these, 57 patients were symptomatic and 42 patients were asymptomatic (patients with risk factors – Diabetes, Hypertension, Smoking, Alcohol, Family history of IHD).

Table 1 Patients having risk factors with coronary artery disease

The patients with risk factors included diabetes, hypertension, smoking, alcohol and patients with family history of ischemic heart disease.

Factors	No. of cases	Coronary artery stenosis
Diabetes	42	26 (61.9%)
Hypertension	53	28 (52.8%)
Smoking	12	7 (58.3%)
Alcohol	8	5 (62.5%)
Family history of IHD	8	5 (62.5%)

Table no 2 :Distribution of coronary artery stenosis in patients with risk factors

	Patients with Coronary Artery Stenosis	Patients with no Coronary Artery Stenosis
Patients with risk factors (n = 80)	57(71.25%)	23(28.75%)
Patients with no risk factors(n = 19)	6(31.57%)	13(68.42%)

Total calcium score of all patients were calculated with dedicated software and expressed as Agatston scores. In our institute, we used the following charts.

DISCUSSION

Of 99 patients referred for CT coronary angiography, there were 57 patients (57.57%) were symptomatic , 42 patients (42.42%) were asymptomatic with or without risk factors for CAS (diabetes, hypertension, smoking, alcohol, family history of CAS) or referred from the health check up department.

There were 71 male (71.71%) patients 28 female (28.28%) patients,Out of 71 male patients, 42 were in symptomatic group and 29 patients in asymptomatic group. Out of 28 female patients, 15 patients were symptomatic and 13 patients wereasymptomatic.The patients were from a varied age group, ranging from 25 yrs to 82 yrs, with maximum patients in 41-50 and 51-60 yrs age group and less in 71-80 yrs age group.

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Of the 57 patients who were symptomatic, 43(75.43%) patients had evidence of CAS, while 14(24.56%) had no evidence of CAS. Of the 42 asymptomatic patients, 19(45.23%) patients had evidence of CAS, while 23(54.76%) had no evidence of CAS. Thus of the study population of 99 patients, 62(62.62%) had evidence of CAS, while 37(37.37%) had no evidence of CAS.These findings are in concordance with the reviewed literature.[6]

Cademartiri et al (2010)[7] compared the coronary artery calcium score (CACS) and CTCA for the assessment of non-obstructive/obstructive CAD in high-risk asymptomatic subjects. A total of 213 consecutive asymptomatic subjects (113 males; mean age of 53.6 +/- 12.4 years) with more than one risk factor and an inconclusive or unfeasible non-invasive stress test result underwent CACS and CTCA in an out-patient setting. All patients underwent conventional coronary angiography (CAG). Data from CACS (threshold for positive image: Agatston score 1/100/1,000) and CTCA were compared with CAG regarding the degree of CAD (non-obstructive/obstructive; less than/greater than or = 50 % lumen reduction). The mean calcium score was 151 +/- 403 and the prevalence of obstructive CAD was 17 % (8 % 1-vessel and 10 % 2-vessel disease). Per-patient sensitivity, specificity, positive and negative predictive values of CACS were: 97 %, 75 %, 45 %, and 100 %, respectively (Agatston greater than or equal to 1); 73 %, 90 %, 60 %, and 94 %, respectively (Agatston greater than or equal to 100); 30 %, 98 %, 79 %, and 87 %, respectively (Agatston greater than or equal to 1,000). Per-patient values for CTCA were 100 %, 98 %, 97 %, and 100 %, respectively ($p < 0.05$). Computed tomography coronary angiography detected 65 % prevalence of all CAD (48 % non-obstructive), while CACS detected 37 % prevalence of all CAD (21 % non-obstructive) ($p < 0.05$). The authors concluded that CACS proved inadequate for the detection of obstructive and non-obstructive CAD compared with CTCA. Computed tomography coronary angiography has a high diagnostic accuracy for the detection of non-obstructive and obstructive CAD in high-risk asymptomatic patients with inconclusive or unfeasible stress test results.

The procedure of coronary angiography was well tolerated by all the 99 patients. There were no episodes of contrast extravasation or adverse contrast reactions. Good intra-arterial contrast density was achieved in all the subjects, resulting in diagnostic images.

CONCLUSION

MDCT coronary angiography was found to be of benefit in with or without risk factors to exclude significant coronary artery stenosis.

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