POSTER SESSION II
Friday, September 12, 2008, 9:30 a.m. – 11:00 a.m.
Comparison with Other Modalities

4.01

BETA BLOCKER UTILIZATION AND SAFETY IN AN OUTPATIENT CARDIAC COMPUTED TOMOGRAPHIC ANGIOGRAPHY ENVIRONMENT

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Background: An optimal heart rate control is mandatory with the current 64-slice scanners to prevent motion artifacts during cardiac computed tomographic angiography (CTA). Depending on the practitioner's comfort level, beta blocker (BB) administration is done either exclusively by the aggressive rapid intravenous (IV) administration while on the table (IV metoprolol 5 mg every 1 minute up to a maximum dose of 50 mg) or by the conservative oral outpatient 3-day preparation with metoprolol or atenolol. Concerns regarding their safety have resulted in some practices considering the purchase of more expensive scanners with increased temporal resolution to eliminate the use of such heart rate slowing medications during CTA. This study was done to evaluate the feasibility and safety of heart rate slowing medications in an outpatient CTA setting.

Methods: Fifty-one consecutive patients (age 56 + 13 years, 71% males) with an intermediate likelihood of coronary artery disease who underwent CTA were studied. The heart rate was initially assessed 3 days before the procedure and the patients were started on BB, either metoprolol or atenolol once a day. On the day of testing, the heart rate was measured again and if the HR was > 65, IV metoprolol was used at doses of 5-10 mg every 3 minutes up to a dose of 40 mg. As needed, IV verapamil up to 10 mg was also used to assist the BB.

Results: Seventy-one percent of the individuals received a daily outpatient BB based on the initial heart rate assessment. Twenty-nine percent required IV BB on the day of CTA and only one required additional IV verapamil. Receiving outpatient BB reduced the use of IV BB on the day of CTA to slow the heart rate by 69%. In those who already received outpatient BB, only 31% required IV medications to further assist versus 27% with optimal initial heart rate who did not receive prior oral BB ($P > 0.9$). Heart rate at the time of acquisition was 59.7 + 5.4 bpm. The images were acquired with a 64-slice scanner and were of good quality without significant motion artifacts. There were no adverse affects while the patients were in the lab or after going home, and these medications were well tolerated.

Conclusion: Medications like BB and calcium channel blockers can be safely used in an outpatient setting and significantly reduce the IV BB to slow heart rate on the day of CTA. During CTA, contrast-related reactions are more likely to happen than those caused by such heart rate slowing medications.

4.02

AN ANALYSIS OF HUMAN GRAYSCALE ESTIMATION IN COMPARISON TO THE ACTUAL CONTRAST ENHANCEMENT IN CARDIAC CT ANGIOGRAPHY

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Background: Given the limitations of human eye for grayscales, only myocardial lesions that are infarcted or those areas replaced by calcium or fat will be promptly recognized from normal grayscale analysis in cardiac computed tomographic angiography (CTA). On the other hand, subtle changes in the "normal" grayscale may be overlooked. We sought to analyze the pattern of contrast enhancement of the walls of the left ventricular (LV) chamber in a normally appearing LV chamber.

Methods: CTA images from 75 individuals (age 63 ± 13 years, 73% males) were analyzed by an experienced reader using a GE Advantage Workstation (AW 4.3). The maximum, mean, and the SD (standard deviation or the noise) Hounsfield Units (HU) were measured using the ROI (region of interest) tool in these LV chambers of relatively normal appearing gray-scale-contrast enhancement.

Results: There were differences in the pattern of contrast enhancement of the LV chamber walls that was close to a 30% difference between the septum and the apex in normal eye analysis of grayscale. The interventricular septum enhanced the most followed by the lateral wall, posterior wall, inferior wall, anterior wall, and the apex (as a reference, the CT number for a non-enhanced tissue: 40 HU). In 25 individuals, the HU of dark areas in the myocardium by eye analysis was very low (6.5 ± 35.4 mean HU) showing a wide range of hypoenhancement.

Conclusion: "Normal" grayscale analysis by the human eye appeared to correctly identify the normally enhanced myocardium with wide spectrum of contrast enhancement differences from apex to septum. Additionally, the dark areas based on eye analysis clearly reflected significantly lower HU consistent with an infarct.

Difference in myocardium enhancement (HU) from Septum to Apex in Normal Subjects

Variable	Mean	SE	95% Confidence Interval
Apex			
Maximum HU	141.9	3.6	134.7 - 149
Average HU	81.9	3.2	75.4 – 88.3
SD (HU)	23.3	0.9	21.5 – 25.1
Septal			
Maximum HU	185.8	3.7	178.3 – 193.2
Average HU	116.5	3.5	109.5 – 123.4
SD (HU)	27.8	1.0	25.8 – 29.7
Anterior			
Maximum HU	148.6	3.6	141.4 – 155.9
Average HU	88.5	3.3	81.8 – 95.1
SD (HU)	24.2	0.7	22.8 – 25.6
Lateral			
Maximum HU	160.9	3.4	154.0 – 167.8
Average HU	101.4	3.3	94.9 – 107.9
SD (HU)	22.3	0.9	20.8 – 24.5
Posterior			
Maximum HU	156.0	3.6	148.7 – 163.3
Average HU	98.8	3.1	92.6 – 105.0
SD (HU)	22.3	0.8	20.8 – 23.8
Inferior			
Maximum HU	158.8	3.9	151.0 – 166.6
Average HU	93.4	4.0	85.2 – 101.5
SD (HU)	24.8	1.0	22.9 – 26.8

4.03

PROSPECTIVE TRIGGERING WITH DUAL SOURCE CARDIAC CT: INITIAL CLINICAL EXPERIENCE

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Background: Prospectively triggered (PT) cardiac CT, whereby radiation is only administered at a predefined phase of the cardiac cycle, has been shown to substantially reduce patient radiation dose. Recent preliminary study showed the feasibility of this technique when a single source scanner was used and all patients were treated with beta-blocker medications. The aim of our study was to assess the use of this technique in a clinical patient population using the Dual Source Cardiac CT (DSCT; temporal resolution 83msec) when beta blockers were not routinely administered.

Methods: Among 200 consecutive patients (pts) referred for a clinical DSCT exam, prospective triggering was utilized in 20 pts. kV (range 100-140, average 116) and mAs (average 119) were chosen for each patient based on physician assessment of body habitus. Beta blockers were not administered (except for 1 pt). Effective radiation dose was calculated by multiplying the dose-length product (DLP) times a conversion factor ($k = 0.017$ mSv/mGy/cm). All data related to scan acquisition parameters was collected prospectively. Per-patient analysis of non-evaluable segments was determined based on clinical readings.

Results: Of the 20 PT scans performed, (mean age 42, mean BMI 29.3, 70% male), 13 pts were referred for coronary evaluation, 6 were referred for evaluation of coronary arteries and aortic disease (larger coverage), and 1 pt was referred for evaluation of a cardiac mass. The average heart rate was 66 bpm. All pts were in normal sinus rhythm, and 20% had either PACs or partial-

volume correction (PVC) during the acquisition. The average radiation dose for all 20 exams was 3.5 mSv (range 1.3 - 6.7) As expected, lower effective dose was achieved with lower kV and smaller coverage. When excluding the 6 studies which had a larger coverage, the average dose was 3.2 mSv. Of these, those which used 100kV resulted in an average dose of 1.5mSv. Twenty percent (4/20) of pts had at least one non-evaluable segment. The reasons for non-evaluable parts included ectopy resulting in slab artifacts (2 pts), calcium (1 pt) and presence of intra coronary stent (1pt).
Conclusions: Even in the absence of beta-blockers, use of prospective triggering DSCT is feasible and results in a significant reduction of radiation dose. Use of beta-blockers to decrease ectopy may reduce the number of non-evaluable segments.

4.04
ATHEROSCLEROTIC PLAQUE MORPHOLOGY ASSESSMENT ACCORDING TO BURDEN OF CORONARY ARTERY DISEASE IN PATIENTS WITH TYPE 2 DIABETES MELLITUS BY NON-INVASIVE CT ANGIOGRAPHY
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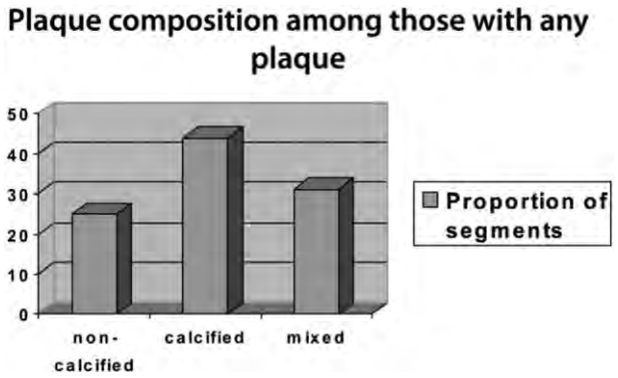
Background: Patients with diabetes mellitus (DM) have a higher risk of coronary artery disease (CAD) and are likely to have a higher underlying atherosclerotic burden. However the atherosclerotic plaque composition in these patients is not studied. In this study we evaluated the plaque burden, morphology, and distribution in type 2 DM patients using multi-detector computed tomography angiography (MDCTA).
Methods: The study population consisted of 40 symptomatic diabetic subjects (63 ± 10 years, 55% men), who underwent contrast-enhanced MDCTA. Enrolled patients had an intermediate pre-test probability of obstructive CAD.
Results: A majority of individuals (n = 33, 83%) had at least one segment with any plaque; 69% of diabetic had detectable coronary artery calcification (CAC) and 36% had CAC ≥ 400. Among individuals with any plaque the mean number of segments involved were 5.7 ± 3.0 segments; the respective mean number of segments with exclusively non-calcified, calcified and mixed plaques were 1 ± 1, 2.7 ± 2.4, and 2 ± 2 segments, respectively. Among those with any plaque, the overall proportion of segments that had noncalcified, calcified, and mixed atherosclerotic plaques were 25%, 44%, and 31%, respectively (Figure 1). In our study, 12 patients (30%) had at least one coronary segment with significant stenosis (luminal narrowing ≥ 50%). Type 2 DM patients in our study with significant stenosis were more likely to have plaque composition, that was mixed in nature (39% vs. 28%) and less likely to be exclusively noncalcified plaque alone (17% vs. 26%) when compared to those without significant stenosis. On the other hand, no difference was observed in the respective proportion of exclusively calcified plaque (44% vs. 46%).
Conclusions: Our study demonstrates a high burden of CAD in patients with diabetes. Majority of atherosclerotic plaque in these patients had calcification, however among patients with significant CAD, mixed plaque composition was more commonly observed. The prognostic value of these different atherosclerotic plaque morphologies on MDCT in high risk DM patients need to be assessed in larger prospective studies.
Figure 1.



4.05
DETECTION OF CORONARY ARTERY DISEASE BY FREE-BREATHING, WHOLE HEART CORONARY MAGNETIC RESONANCE ANGIOGRAPHY: OUR INITIAL EXPERIENCE
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Background: Free-breathing, whole heart coronary magnetic resonance angiography (MRA) has gained a great attention as a totally noninvasive diagnostic modality for the detection of coronary artery disease. We examined the accuracy of coronary MRA to identify the presence or absence of coronary artery stenosis in comparison with conventional coronary angiography.
Methods: Free-breathing, whole heart coronary MRA with diaphragm drift correction software was performed in 39 consecutive patients undergoing conventional coronary angiography. A total of 156 coronary arteries and 312 coronary artery segments were analyzed.
Results: In the vessel-based analysis, the sensitivity to detect coronary stenosis ≥ 50% was 80% and the specificity to define luminal narrowing < 50% was 97%. The accuracy, positive predictive value, and the negative predictive value were 92%, 93%, and 92%, respectively.
Conclusions: Free-breathing, whole heart coronary MRA that provides diaphragm drift correction software yields excellent diagnostic accuracy to detect significant coronary artery disease and has potential to become the routine diagnostic modality for patients with suspected coronary artery disease.

4.06
EVALUATION OF ISCHEMIC MYOCARDIAL STUNNING FOLLOWING ADENOSINE VASODILATOR STRESS USING CARDIAC MAGNETIC RESONANCE IMAGING
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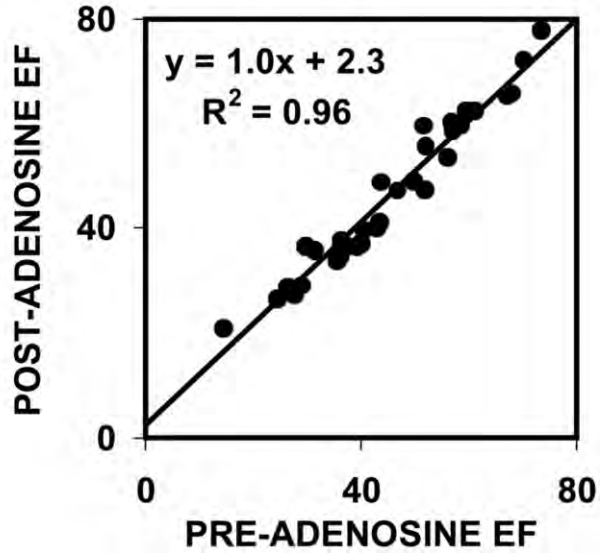
Background: Several studies have reported myocardial stunning in up to 30% of patients undergoing adenosine SPECT imaging. However, in patients with significant perfusion defects, the edge-detection algorithm that gated SPECT relies on may fail to properly assess wall motion. Therefore, the purpose of this study was to evaluate the incidence of myocardial stunning following adenosine stress by cardiac magnetic resonance imaging (CMR), a modality in which functional analysis is independent of perfusion.
Methods: Thirty-three patients undergoing adenosine vasodilated CMR perfusion imaging were retrospectively identified. Basal, mid, and apical short axis cines were acquired before and immediately after adenosine infusion. Ejection fraction (EF) was measured blindly using CAAS-MRV

FIGURE 1



(PieMedical, Maastricht, The Netherlands). First-pass perfusion imaging was performed at matched slice positions and blindly analyzed visually (0-normal to 3-severe defect) on a 16-segment model. Sum difference score (SDS) was the stress defect score minus rest defect score (maximum 48).
Results: The mean EF prior to adenosine infusion was 44.8%. The mean EF following adenosine infusion was 46.0%. As seen in Figure 1, pre- and post-adenosine EF are highly correlated with a slope of 1.0 (95% confidence interval 0.90 - 1.05). Severe reversible perfusion defects (SDS $\geq$ 5) were seen in 15/32 (47%) of patients. In these patients, mean pre- and post-adenosine EF were 44.7% and 46.8% respectively.
Conclusion: Myocardial stunning was not seen in patients undergoing adenosine vasodilated CMR perfusion imaging, even in the presence of significant reversible perfusion defects. The apparent fall in EF reported in nuclear single-photon emission computed tomography studies may be due to suboptimal edge detection rather than myocardial stunning due to adenosine.

4.07

RELATIONSHIP BETWEEN CORONARY STENOSIS BY MULTI-SLICE CT ANGIOGRAPHY AND ISCHEMIA BY TC-99M PERFUSION SPECT

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Background: Multislice computed tomography (MSCT) shows great promise for the detection of coronary artery disease (CAD), but there is limited data comparing its accuracy with established methods such as Tc-99m perfusion (single-photon emission computed tomography (SPECT).
Methods: We compared the results of 16-Slice MSCT angiography using a Siemens scanner with stress-rest Tc-99m Sestamibi Gated SPECT (dual head gamma camera, Philips) in 59 patients who underwent both procedures within 6 months at our hospital with no intervening revascularization or cardiac events. SPECT was performed with symptom-limited exercise in 52 patients and vasodilator stress in 7 patients for the diagnosis of CAD or detection of ischemia. Results were defined as normal or abnormal based on the presence or absence of ischemia. CAD detected by MSCT was graded as absent, mild (0-40% diameter stenosis), moderate (40-70%), severe (70-99%), or occluded.
Results: All patients with total occlusions had ischemic SPECT studies, compared to 15/20 (75%) patients with severe or total occlusions, 17/28 (61%) patients with moderate or worse stenosis, 19/60 (32%) patients with any grade of CAD and 4/19 (21%) patients with no detectable CAD by MSCT ($p = 0.008$). Of 36 patients with normal SPECT studies, 21 (58%) had evidence of atherosclerosis by CTA, though only 5/36 (14%) had severe disease. Of 23 patients with abnormal SPECT studies, 19/23 (83%) had evidence of CAD, with 15/23 (65%) assessed as severe or occluded by CTA. One-quarter of patients with stenosis assessed as severe by CTA had normal SPECT studies.
Conclusions: There is a stepwise relationship between SPECT findings and MSCT, with an increasing prevalence of ischemia as the degree of stenosis increases. However, 25% of patients with stenosis assessed as severe by CTA had normal SPECT studies, suggesting the absence of ischemia despite anatomic disease.

4.08

COMPARISON OF EBT AND 64 MDCT TO DETECT SMALL OR LOW-DENSITY CALCIUM FOCI: AN IN-VIVO AND IN-VITRO STUDY

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Background: The aim of this study was to estimate the sensitivity to detect small or low density calcium foci with Electron Beam Tomography (EBT) and 64 multidetector computed tomography (MDCT) (GE 64).
Methods: The in-vivo group included 66 single coronary arteries with solid calcium foci of <10 Agatston score (AS), selected from 93 patients who underwent coronary calcium scanning (CAC) with both EBT and MDCT on the same day. All foci can be scored by either scanner or both EBT or MDCT. The in-vitro study included a cork chest phantom with dog heart, 57 small (<6.6-18.9 mm^3 with 200 mg/cc) or low density foci (14.8-157.8 mm^3, 150mg/cc) were inserted into a coronary artery and sealed with wax. The technique parameters of EBT (GE Imatron) were 100 ms, 130kVp, 630 mA, and 3 mm slice thickness. The parameter of MDCT was 140 kVp, 430 MA, 350 ms/per rotation and 2.5 mm in thickness. The calcium score were measured with the Aquarius workstation (Terarecon, Inc). Each calcific foci was measured. The Chi-square test (X^2) was completed to test the difference in sensitivity to detect small and low density calcium foci.
Results: The foci number that can be detected and scored was 58/66 and 40/66 in the in-vivo group and 46/57 and 35/57 in the in-vitro study using GE64 and EBT respectively ($P<0.05$).
Conclusions: There was a significant increase in the sensitivity to detect small or low density calcium foci with 64-MDCT in both patients and phantoms.

4.09

ROLE OF CORONARY FLOW RESERVE DURING HIGH RESOLUTION B-MODE ULTRASOUND IN THE FUNCTIONAL ASSESSMENT OF CORONARY ARTERY STENOSIS: COMPARISON WITH GATED SPECT

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Background: To estimate the value of coronary flow reserve (CFR), as measured by transthoracic Doppler echocardiography, for functional assessment of stenosis severity in comparison with exercise gated single-photon emission computed tomography (SPECT).
Methods: We studied 142 patients suspected of having coronary artery disease. The flow rate in the distal left anterior descending (LAD) coronary artery was measured by echocardiography both at rest and during intravenous infusion of dipyridamole. CFR was calculated as the ratio of hyperemic to basal peak diastolic flow velocities. The CFR measurements by ultrasonography were compared with the results of gated-SPECT. All patients underwent coronary angiography as control.
Results: Complete Doppler ultrasound data were acquired for 136 of 142 study patients. Of these 136 patients, SPECT confirmed reversible perfusion defects in the LAD territories in 82 patients (group A). Fifty-four patients had normal perfusion in the LAD territories (group B). Peak CFR (mean value $\pm$ SD) were 1.6 ± 0.5 in group A and 2.4 ± 0.7, respectively ($p < 0.001$). CFR < 2.0 predicted reversible perfusion defects, with a sensitivity and specificity of 88% and 84%, respectively.
Conclusions: Noninvasive measurement of CFR by transthoracic Doppler ultrasonography provides a functional estimation of LAD stenosis severity comparable to gated-SPECT.

4.10

SIGNIFICANT DIFFERENCES IN LEFT VENTRICULAR VOLUMES AND EF BETWEEN GSPECT AND ECHOCARDIOGRAPHY AND INTERRATER DIFFERENCES

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Background: Left ventricular ejection fraction (EF) is a powerful predictor of prognosis in coronary artery disease and is often estimated by echocardiography or nuclear imaging. The purpose of the current study was to measure end diastolic and end systolic volumes and hence EF for echocardiography compared with different gated single-photon emission computed tomography (GSPECT) software and to measure interrater differences using three GSPECT software programs.
Methods: Eighty-four patients scheduled for nuclear imaging due to known or suspected coronary artery disease underwent GSPECT (patients with atrial fibrillation or left bundle branch block were excluded). We used a 1-day protocol GSPECT with 99mTc-tetrofosmin, using 8 frames/cardiac cycle during rest images. GSPECT images were processed by two raters who estimated left ventricular volumes and EF using the Cedar-Sinai quantitative gated-SPECT (QGS), Emory Cardiac Toolbox (ECTB) and 4D-MSPECT of the University of Michigan. Echocardiographic volumes were measured by biplane Simpson's method. Measures are means $\pm$ SD. Differences were compared with t-tests. Interrater differences were calculated as mean difference (95% limits of agreement).
Results: The 84 patients were 62.1 years $\pm$ 8.9, 35% were women, and 26% previously had myocardial infarction. Echocardiographic end diastolic volume was 90.4 ml $\pm$ 28.1, end systolic volume 32.1 ml $\pm$ 18.7, and EF 65.8% $\pm$ 10.5. GSPECT volumes and EF are shown in Table 1.

Interrater mean difference in end diastolic volumes by QGS was 0.92 (-12.6-14.5), ECT -2.9 (-31.9-26.2), p=0.013 compared to QGS, 4D-MSPECT -0.52 (-10.6-9.6), p=0.041. Interrater difference in end systolic volumes by QGS was 1.5 (-5.7-8.7), ECT -0.45 (-9.1-8.1) p=0.004, 4D-MSPECT 0.32 (-7.5-8.2) p=0.046.The interrater mean difference in EF for QGS was 1.1(-5.3-7.5), mean difference for ECT was 0.05 and 95% (-9.4.9.5) ,p= 0.062 compared to QGS and mean interrater difference was 0.69 for 4D-MSPECT and 95% limits of agreement were -8.59-9.97 (p=0.458).

Conclusions: Ejection fraction and left ventricular volumes calculated by different software programs in gated SPECT differ significantly from those obtained by biplane echocardiography. There are significant interrater differences in end diastolic and end systolic volumes with different software. The discerning clinician should keep in mind that volumes and EF reported by a GSPECT study may differ between raters and from echocardiography.

Table 1. Volumes and EF, *p < 0.05, **p < 0.001 compared to echocardiography

Software	End diastolic volume, ml	End systolic volume, ml	EF, %
QGS	96.0 ± 30.3*	42.9 ± 21.8**	57.5 ± 9.8**
ECTB	106.6 ± 31**	41.0 ± 21.1**	63.4 ± 10.1*
4D-MSPECT	96.9 ± 28.8*	40.2 ± 21.0**	61.1 ± 10.6**

4.11

VALUE OF SAME-SESSION CORONARY ARTERY CALCIUM (CAC) SCORING IN THE SETTING OF STRESS MYOCARDIAL PERFUSION IMAGING (MPI) USING CT-BASED ATTENUATION CORRECTION (CTAC)

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Background: Findings of a zero or very low coronary artery calcium score (CAC) or a normal or low-risk myocardial perfusion single-photon emission computed tomography (SPECT) study using computed tomography-based attenuation correction (CTAC), have excellent negative predictive value for short- and intermediate-term hard and soft coronary events. CAC is sensitive for underlying coronary artery disease (CAD), but not specific for degree of luminal stenosis, whereas SPECT myocardial perfusion imaging (MPI) displays greater specificity for flow-limiting CAD and positive predictive value for short-term events. Data evaluating the potential synergism between these two techniques are limited. We examined the correlation between degree of CAC and MPI abnormalities using CTAC and assessed concordance in patients further evaluated with angiography.

Methods: A total of 250 subjects with no history of CAD referred for stress MPI were studied. Imaging was performed using Siemens SYMBIA-T6 SPECT-CT imaging systems (Siemens Medical Solutions, Hoffman Estates, IL) and a stress Tc-99 sestamibi protocol. Separate breathhold CT acquisitions were acquired for CTAC and CAC. SPECT images were reconstructed for attenuation correction (including scatter correction and resolution recovery) using manufacturers' software without modification. CAC was tabulated by vessel using a 13-segment coronary artery model and correlated with perfusion defects scored for severity, i.e. summed stress and difference scores (SSS, SDS), and extent in each coronary distribution using a standard 17-segment model. Results were analyzed for concordance and further correlated with subsequent angiography in those patients referred with a positive SPECT MPI study. Clinical outcome was based on review of medical notes.

Results: Of 250 subjects (51% male, 35% diabetic, 65% symptomatic), CAC of 0, 1-10, 11-99, 100-399, ≥ 400 were found in 100, 16, 52, 32 and 55 subjects, with CAC of >100 in 56% of normal MPI. Twenty-eight percent of all cases had CAC of <10 with normal MPI. Patients' age ranged from 36 to 84 years, with a mean age of 55 years. Forty-eight patients had subsequent coronary angiography. Higher SSS and SDS correlated with angiographic disease severity across all CAC score ranges. Discordant angiographic findings were present in 5 patients, 3 with typical angina symptoms, with CAC scores of 0, of whom 4 were under 50 years old. All patients classified as normal/low risk were alive per CareWeb at 7 to 17 months follow up.

Conclusions: In patients with normal MPI, potentially valuable additional information regarding underlying subclinical CAD was found in 58% with CAC imaging, however, the intermediate outcome in this group remains very good with no documented hard cardiac events to date. The findings of severely obstructive CAD in 5 patients with CAC of 0 preclude the use of CAC for excluding CAD, particularly in symptomatic younger patients.

4.12

A COMPARATIVE STUDY OF DOBUTAMINE STRESS MYOCARDIAL PERFUSION IMAGING AND DOBUTAMINE STRESS ECHOCARDIOGRAPHY IN THE DETECTION OF CORONARY ARTERY DISEASE IN HYPERTENSIVE PATIENTS

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Background: Simultaneous dobutamine stress myocardial perfusion imaging and dobutamine stress echocardiography for the evaluation of the presence and extent of coronary artery disease (CAD) are assessed for a head-to-head comparison regarding the diagnostic accuracy of the two tests in hypertensive group of patients. The aim of this study is to compare the sensitivity and specificity of these two imaging modalities, for the detection of coronary artery disease.

Methods: This prospective observational study was performed at the Institute of Nuclear Medicine & Ultrasound in collaboration with the cardiology department of BSM Medical University, Dhaka from January 2006 to July 2007. A total of 80 patients (male 82% and female 18%, mean age 55.0 ± 1.02 years, range 31-68 years) are included in this study and informed about the necessity, risk, and benefit of these two tests. Informed consent was obtained. All patients underwent simultaneous dobutamine stress echocardiography (DSE) followed by dobutamine stress myocardial perfusion imaging (MPI) in single day stress-rest protocol with Tc ^{99m} tetrofosmin. Coronary angiogram was performed in all patients within one month after imaging studies (significant stenosis was > 50%).

Results: The overall sensitivity, specificity, and predictive accuracy of dobutamine stress myocardial perfusion imaging for the detection of coronary artery disease were 97%, 62.5%, and 90%, respectively. Positive predictive values were 91.2% and negative predictive value was 83.3%. The overall sensitivity, specificity, and predictive accuracy of dobutamine stress echocardiography for the detection of coronary artery disease were 92%, 75%, and 88.7%, respectively. Positive predictive values were 93.7%, while negative predictive value was 70.6%. Dobutamine stress MPI showed higher sensitivity than DSE (p > 0.05), but specificity lower than DSE (P > 0.05), that does not rich the level significance.

Conclusions: In our study, both non-invasive methods for the detection of CAD showed a good diagnostic accuracy. Nevertheless the dobutamine stress myocardial perfusion imaging showed higher sensitivity in comparison with DSE in this specific group of patients.

4.13

NON-INVASIVE STRESS TESTING OF MYOCARDIAL PERFUSION DEFECTS: HEAD-TO-HEAD COMPARISON OF THALLIUM-201 SPECT TO MRI PERFUSION

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Background: To evaluate the diagnostic value of magnetic resonance perfusion imaging in the assessment of hemodynamically obstructive coronary artery disease (CAD) in a head-to-head comparison with thallium-201 (201TI) single-photon emission compute tomography (SPECT) as reference.

Methods: Eighteen patients (mean age 61 ± 5 years, 14 men, 4 women) with a history of angina pectoris were studied with 201TI-SPECT and fast gradient-echo (GRE) magnetic resonance imaging (MRI) of myocardial perfusion during dipyridamole-induced vasomotor stress. Within 5 days of 201TI-SPECT, GRE-MRI perfusion imaging was performed with the same protocol as 201TI-SPECT. Images for both scans were obtained in oblique horizontal, vertical long axis and short axis planes. Myocardial segments were assessed visually and myocardial perfusion was graded on a semi-quantitative 5-point scoring system (0 = normal, 1 = mildly reduced perfusion, 2 = moderately reduced perfusion, 3 = severely reduced perfusion, and 4 = nearly absent perfusion) to derive the summed stress score (SSS), summed rest score (SRS) and summed difference score (SDS).

In all patients coronary angiography was performed to evaluate CAD process.

Results: Seven out of 18 patients studied had a history of previous myocardial infarction. 201TI-SPECT determined myocardial ischemia (abnormal SSS > 4) during dipyridamole stimulation was found in the regional myocardial territories supplied by the LAD (n = 6), LCX (n = 5), and RCA (n = 7) with a SSS of 22 ± 11, SRS of 14 ± 10, and SDS of 8 ± 4. By 201TI-SPECT, the sensitivity to detect hypoperfused segments was 61% (11/18) with the GRE-MRI analysis. The difference in the detection of stress-induced perfusion defects (n = 7) between 201TI-SPECT and GRE-MRI reached statistical significance ($p<0.001$ by chi2-test). The sensitivity, specifity, negative predictive and positive predictive value, and accuracy for GRE-MRI analysis of myocardial perfusion in the detection of flow-limiting epicardial coronary artery lesions, as defined as diameter stenosis >50%, were 72%, 100%, 54%, 100%, and 73%, respectively.

Conclusions: These preliminary results indicate a moderate diagnostic accuracy of cardiac GRE-MRI perfusion imaging during dipyridamole-induced coronary flow increases in the detection of flow-limiting epicardial artery lesions. The concordance between 201TI-SPECT and cardiac GRE-MRI imaging in the detection of stress-induced perfusion defects was relatively low, and 39% of 201TI-SPECT-determined perfusion defects were not identified by cardiac GRE-MRI, which deserves further investigations.

4.14

COMPUTED TOMOGRAPHIC CORONARY ANGIOGRAPHY AND FRAMINGHAM RISK FACTOR SCORES: FURTHER SUPPORT FOR DIRECT SCREENING FOR ATHEROSCLEROSIS

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Background: Framingham risk scores (FRS) are routinely used to identify individuals who may benefit from aggressive risk factor modification but FRS does not account for genetic and environmental variables. Computed tomographic coronary angiography (CTA) can non-invasively assess coronary atherosclerosis and is an ideal modality for the identification of subclinical atherosclerosis. The objective of this study is to understand the relationship between FRS and coronary atherosclerosis as measured by CTA.

Methods: Consecutive patients who underwent CTA were prospectively enrolled and categorized according to FRS. Atherosclerotic calcific and non-calcific plaques were assessed.

Results: In this study, 447 patients without a history of MI, DM and not on statin therapy were categorized according to FRS. Coronary atherosclerosis was present in 60.6% of patients. Of the 258 patients with very low FRS (calculated 10-year risk ≤5%), atherosclerotic plaque was visually present in 113 (43.8%). Furthermore, 9.1% of patients with high FRS had no evidence of atherosclerotic plaque. Although mean atherosclerotic plaque burden increased with the 10-year Framingham risk the correlation between FRS and plaque was fair ($r = 0.50$; $p < 0.001$).

Conclusions: Although FRS and other established clinical variables are predictive of coronary artery disease events, CTA provides evidence of calcific and non-calcific coronary atherosclerosis in many patients with low- to intermediate-risk Framingham scores. Furthermore, a small minority of patients with high FRS have no evidence of atherosclerosis. Prospective studies are required to determine the value of identifying subclinical coronary atherosclerosis with CTA and modifying therapy based on these results are required.

4.15

DIAGNOSTIC ACCURACY AND IMPACT OF COMPUTED TOMOGRAPHIC CORONARY ANGIOGRAPHY ON UTILIZATION OF INVASIVE CORONARY ANGIOGRAPHY

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Background: Since computed tomographic coronary angiography (CTA) has a high negative predictive value, it is a potential gatekeeper for invasive coronary angiography (ICA). Before CTA can be further accepted into clinical practice, its clinical impact on health care resource utilization needs to be better understood. We sought to determine the clinical impact of CTA on ICA referrals, CTA accuracy, and CTA normalcy rate.

Methods: To determine the 'impact of CTA', 7,017 consecutive patients undergoing ICA prior to (n = 3,538) and after (n = 3,479) implementing a cardiac CT program were reviewed. For the CTA 'accuracy', we evaluated consecutive CTA patients who underwent ICA. For 'normalcy rate', we identified 201 patients with a low pre-test probability for obstructive CAD (≤ 5.5%).

Results: With the implementation of a cardiac CT program, the frequency of 'normal' ICA decreased from 31.5% (1,114/3,538 patients) to 26.8% (932/3,479 patients) ($p < 0.001$). Analysis of the 148 CTA patients that underwent ICA showed CTA had excellent "per patient" sensitivity (99%), positive predictive value (92%), and negative predictive value (95%) for obstructive CAD. The positive likelihood and negative likelihood ratios were 11.9 and 0.06, respectively. Using thresholds of ≥50% diameter stenoses, the 'normalcy rate' of CTA was 94%.

Interpretation: The clinical implementation of CTA appears to positively impact ICA by reducing the rate of normal ICA. As well, the high diagnostic accuracy of CTA supports its role as a clinically useful tool.

4.16

REPRODUCIBILITY OF EJECTION FRACTION ASSESSMENT BY CT-ANGIOGRAPHY

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Introduction: Cardiac computed tomography (CTA) has emerged as a new tool to assess left ventricular ejection fraction (LVEF). The accuracy of multiphase CTA in the measurement of LVEF has been demonstrated in comparison to other imaging modalities. However, the reproducibility of CTA assessment of LVEF has not well been demonstrated. The aim of this study is to assess the interobserver variability in the LVEF assessment by CTA.

Methods: Multiphase CTA (20 phases, 2.5 mm slice thickness) of 45 patients were reprocessed for LVEF assessment by three investigators: an experienced computed tomography technologist with 3D imaging training, an inexperienced cardiology trainee, and a cardiologist with level-3 training in CTA. The investigators were blinded to each others interpretations. All processing was done using the Vitrea Workstation from Vital Images (Minneapolis, MN). Pearson's correlation coefficients were calculated.

Results: The mean age was 57.6 ± 10.4 years and 58% were males. There was excellent inter-observer correlation between the LVEF measurement by the experienced technologist and the level 3 cardiologist. ($r = .92$, $p < .001$). The median difference in the LVEF assessment was 3% (range 1-11). There was significant but less strong correlation between the LVEF assessment by the trainee and either the experienced technologist ($r=0.78$, $p<.001$) or the cardiologist ($r = 0.72$, $p < .001$).

Conclusion: Assessment of LVEF by CTA was highly reproducible by an experienced technologist and a level 3 cardiologist. Whether extensive training improves the precision of LVEF by inexperienced trainee is yet to be determined.

4.17

THE IMPACT OF VOLUME AND READER EXPERIENCE ON THE DIAGNOSTIC ACCURACY OF CORONARY CT ANGIOGRAPHY

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Background: Sixty-four-slice computed tomography angiography (CTA) has emerged as a powerful non-invasive tool to rule out coronary artery disease (CAD). Most of the diagnostic accuracy data comes from high-volume centers with highly experienced readers. The aim of this study is to establish the diagnostic accuracy of CTA in a community setting, and to determine the impact of the reader experience on the positive and negative predictive value (PPV, NPV) of CTA changes with reader experience.

Methods: We included 41 consecutive patients without known CAD who had coronary CTA and coronary angiography within 90 days. The CTA and angiograms were each evaluated using the standard American Heart Association 16-segment model. A "by segment" analysis was performed using diagnostic coronary angiography as a gold standard.

Results: A total of 655 segments were analyzed. The sensitivity, specificity, PPV, and NPV of CTA were 52%, 90%, 44% and 93% respectively.

Comparing the earlier cases to the later cases, there was an increase in the PPV (39% v. 50%) of CTA with no change in the NPV.

Conclusions: CTA retains a high NPV when performed outside of high volume centers, thus retaining its ability to significantly rule out coronary artery disease. Readers' experience results in improving the specificity and positive predictive value of the CTA.

Experience	Sensitivity	Specificity	PPV	NPV
1st Half	54%	88%	39%	93%
2nd Half	51%	93%	50%	93%

4.18

NORMAL LIMITS OF LEFT VENTRICULAR DIASTOLIC FILLING RATE BY GATED MYOCARDIAL PERFUSION SPECT: VALIDATION BY TISSUE DOPPLER IMAGING

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Background: Impaired diastolic function (DF) precedes systolic dysfunction in ischemic heart disease and is associated with systolic heart failure and hypertrophic heart disease. Consequently, assessment of DF is an important component of the evaluation of patients for cardiovascular disease. Gated single-photon emission computed tomography myocardial perfusion scintigraphy (GSPECT) can provide measurements of left ventricular systolic and diastolic function. However, normal diastolic filling parameters with this technique have not been fully validated. The objective of this study was to validate normal values for left ventricular peak filling rate (PFR) by GSPECT with traditional tissue Doppler imaging (TDI), a widely used load-independent measure of DF, in a population with low likelihood of cardiovascular disease.

Methods: This study evaluated 53 patients (55% male), mean age 57 years (± 14), who had both GSPECT and TDI within 1 month and no significant change in their clinical status between the two studies. Patients with coronary artery disease, hypertension, diabetes mellitus, atrial fibrillation, severe valvular disease, heart rate >100, or technically inadequate studies were excluded. All echocardiograms were required to have normal ejection fraction, normal wall motion, and no evidence of diastolic dysfunction by standard TDI criteria, defined as a lateral wall E' >10 cm/s for patients between 45 and 54 years, > 9 cm/s for patients between 55 and 65 years and > 8 cm/s for patients greater than 65 and an E/E' ratio < 10. All GSPECT studies were required to have normal ejection fraction, normal wall motion, and no evidence of perfusion defects. LV PFR (end diastolic volumes/second) by GSPECT was assessed using QGS software and adjusted for heart rate (calculated PFR (cPFR)).

Results:

Age	N	Avg cPFR (EDV/s) ± SD	Average E'' lateral	Average E/E''
< 55	22	2.63 ± 0.77	13.93	7.01
55-65	15	2.75 ± 0.68	12.11	7.12
> 65	16	2.36 ± 0.68	10.91	8.18
All ages	53	2.52 ± 0.68	12.31	7.41

Conclusion: This study establishes age-specific normal values for diastolic filling parameters by GSPECT validated with standard TDI parameters.