

**Society of Thoracic Radiology
Oral Presentations
Scientific Session I
Monday, March 3, 2008**

Moderators: Drs. C. Meyer and S. Desai

- 1 7:00 AM University of Maryland, **Coronary Bypass Graft Occlusion: Appearance on Cardiac CTA**, BARRY-LANE PA, Sherwood JM, Jeudy J, Poston RS, White CS
Patricia A. Barry-Lane, MD, PhD
- 2 7:08 AM University of California, San Francisco, **Assessment of Coronary Calcium in Patients with HIV at Increased Risk for Coronary Artery Disease**, CHEN JS, Ordovas KG, Lee TJ, Hsue PY, Elicker BM, Higgins CB, Reddy GP
JS Chen, MD, PhD
- 3 7:16 AM Weill Medical College of Cornell University, **Doubling Times of Clinically Detected Lung Cancer: A Critique of the ACCP**, YANKELEVITZ D,
David Yankelevitz, MD
- 4 7:24 AM University of Michigan, **Aortic Valve Area by Planimetry on 64-Detector Computed Tomography Strongly Correlates with Transesophageal Echocardiography in Patients with Aortic Stenosis**, SUNDARAM B, LaBounty T, Agarwal P, Armstrong W, Kazerooni EA, Yamada E
Baskaran Sundaram, MD MBBS MRCP FRCR
- 5 7:32 AM New York University, **Single Acquisition Dual Energy CT: Analysis of Vascular Enhancement and Post-processing Techniques for Evaluation of the Thoracic Aorta**, GODOY MCB, Leidecker C, Schmidt B, Assadourian B, Naidich DP, Vlahos I
MCB Godoy, MD
- 6 7:40 AM University of California, Los Angeles, **Non Contrast MRA of Thoracic Aorta by ECG Gated Free Breathing 3D SSFP Technique**, Singhal A, Tomasian A, Malik S, Laub G, Finn JP, Ruehm SG, KRISHNAM M
Mayil Krishnam, MD
- 7 7:48 AM University Hospital, Heidelberg, **Treatment Monitoring in Patients with Pulmonary Arterial Hypertension (PAH) Using Quantitative 3D MR Pulmonary Perfusion and Phase-contrast Flow Measurements**, LEY S, Gruenig E, Risse F, Ehlken N, Ley-Zaporozhan J, Mereles D, Kauczor HU
Sebastian Ley, MD

Coronary Bypass Graft Occlusion: Appearance on Cardiac CTA

BARRY-LANE PA, Sherwood JM, Jeudy J, Poston RS and White CS

Purpose: To determine the most common CT imaging characteristics of coronary bypass graft occlusion.

Methods: From 2003-2006, 275 patients underwent cardiac CTA after bypass grafting. The patients included immediate post operatively with follow up imaging ranging from months to years and patients with remote history of bypass who presented with chest pain for evaluation of graft patency. ECG-gated CTA was performed on 4- to 64-detector MDCT. Images were evaluated by two radiologists for patency, site of occlusion, appearance of occlusion and type of graft involved.

Results: 770 grafts in 275 patients were evaluated, 90 of whom underwent follow up imaging. (M:F 213:59, avg 63 yo).

Initially, 60 graft occlusions were identified. Common findings of graft occlusion included a “nubbin” sign consisting of a small outpouching of contrast from the aorta (22/60), the vanished graft sign (only a marker of prior graft placement identified) (18/60) and complete vessel thrombosis (16/60). Other imaging findings included focal thrombosis (n=4), mural calcification (n=6), diffuse narrowing (n=22) and distal loss of the graft, where the distal graft and anastomosis were not evident (n=4). Initial studies revealed an 8% occlusion rate; 12% on follow up imaging. The most commonly occluded grafts were saphenous vein grafts to posterior descending artery. Similar to catheterization studies, saphenous venous graft occlusion (55/302 or 18%) was more common than internal mammary or radial artery occlusion (5/368 or 1.3%).

Conclusion: Cardiac CT is an excellent noninvasive diagnostic imaging tool to evaluate coronary bypass graft occlusion. Common signs in our study included a small proximal outpouching of contrast and complete absence of the vessel.

Assessment of Coronary Calcium in Patients with HIV at Increased Risk for Coronary Artery Disease: Extracardiac Findings

CHEN JS, Ordovas KG, Lee TJ, Hsue PY, Elicker BM, Higgins CB, Reddy GP

PURPOSE: To retrospectively assess the frequency and significance of non-cardiac findings noted incidentally in patients with HIV during calcium screening coronary CT.

METHODS: Non-contrast calcium scoring coronary CTs acquired on 16-slice MDCT scanners from 2004 to 2007 on 267 patients referred from an HIV cardiology clinic, who were asymptomatic with respect to their cardiac status, were retrospectively reviewed. Patients were referred from a cardiologist as part of a separate clinical trial assessing coronary artery disease and HIV infection. Studies were reviewed for extracardiac findings and tabulated by type. Descriptive statistics were used to evaluate the data. Significant findings were defined as those that necessitated immediate attention or follow-up imaging.

RESULTS: In 267 patients (231 M; 36 F; mean age 48.9), 33% had extra-cardiac findings, of which 26% were considered clinically relevant (overall, 8% of all exams had significant extra-cardiac findings). Significant findings included pulmonary nodules, active bronchopneumonia, lymphadenopathy, an indeterminate adrenal lesion, and multiple bone lesions. Incidental findings included hepatic cysts and calcified lymph nodes. No appreciable difference in extra-cardiac findings were found between men and women (33% vs. 27%).

CONCLUSION: The high prevalence of clinically significant non-cardiac findings in calcium scoring CTs from our series of asymptomatic patients with HIV supports careful review of all extra-cardiac tissues, especially given interest in using CT to assess HIV-positive patients for development of accelerated coronary artery disease. All such screening calcium scoring CT's require radiologist evaluation as a significant percentage will have additional extracardiac findings.

Doubling Times of Clinically Detected Lung Cancer: A Critique of the ACCP

YANKELEVITZ D

Purpose: Based on their analysis of the SEER database, the ACCP recently estimated that doubling times of clinically detected lung cancers were in the range of 45-60 days. This estimate of a rapid doubling time, in contrast to a much longer estimate for screen diagnosed cancers was in large part the basis for their recent recommendations regarding screening for lung cancer. We reviewed their analysis to see if it was credible.

Methods: The ACCP estimated doubling times used an “epidemiologic approach” based on a well described model of tumor doubling times. To fit the model they used information from the SEER database to determine the average size of tumors, the typical length of time till death from those tumors and then assumed 6 doubling times would occur in that interval. We reviewed the basis for each of these assumptions. They did not apply the same model to estimate doubling times of typical screen detected cancers.

Results: We found that the typical size of tumors found in SEER that would correspond to symptom prompted detection was in the range of 4.7 cm not 3.2 cm as suggested by ACCP. The typical number of doubling times based on size at detection till size at death was 3-4 not 6 as reported. Using these estimates, along with the ACCP initial assumption of 1 year till death, these results translate to a typical doubling time approaching 120 days for clinically detected cancers. In addition, using the ACCP estimates of the size of tumors when they are not visible by CT (22 doublings) and the size when they are typically detected (28 doublings), typical doubling times for screen detected tumors are 60 days.

Conclusions: We found that the assumptions used by the ACCP in making their estimates were unjustifiable and that using the same database, our estimates of doubling times accord with the vast amount of available literature regarding doubling times of clinically detected lung cancer. We also found that using the ACCP approach there was no reason to assume a difference in doubling times between screen detected cancers and those found clinically.

Aortic Valve Area by Planimetry on 64-Detector Computed Tomography Strongly Correlates with Transesophageal Echocardiography in Patients with Aortic Stenosis

SUNDARAM B, Troy LaBounty, Prachi Agarwal, William Armstrong, Ella A. Kazerooni, Elina Yamada

Objectives: Compare aortic valve area (AVA) and calcification with 64-detector computed tomography (MDCT) to transesophageal (TEE) and transthoracic echocardiography (TTE) in aortic stenosis (AS) patients.

Background: AVA with ECG-gated MDCT is not well validated.

Methods: Retrospective evaluation of 80 consecutive AS patients with both 64-detector ECG-gated MDCT and TEE. AVA planimetry was possible in 80 patients with MDCT and 63 patients with TEE; AVA by Continuity Equation (CE) was available in 53 patients. Independent, blinded review was done by 1 cardiologist (TEE and TTE) and 2 cardiothoracic radiologists (MDCT). MDCT was compared to the reference standards of TEE and the CE.

Results: The median AVA on TEE was 0.7 +/- 0.9 cm². There was strong correlation in AVA between MDCT and TEE (n=63; r=0.84, p<0.001; mean difference=-0.1+/-0.5 cm²) and between MDCT and CE (n=53; r=0.81, p<0.001; mean difference=0.1+/-0.3 cm²). The sensitivity and specificity of MDCT to detect severe AS compared to TEE was 92.5% and 89.5%. AVA on MDCT had an excellent interobserver correlation (n=80; r=0.91, p<0.001; mean difference=0.1+/-0.3 cm²). Valve calcification grade had good interobserver agreement with MDCT (k=0.72), and fair agreement between MDCT readers and TEE (k=0.34, k=0.37). A higher calcification grade was associated with a smaller AVA (-0.37, p value =0.001; -0.51, p<0.001).

Conclusions: AVA on MDCT strongly correlates with echocardiography and has excellent sensitivity and specificity to detect severe AS when compared to TEE. AVA and valve calcification should be reported on MDCT of the heart and thoracic aorta, as they may have important and incremental clinical value.

Single Acquisition Dual Energy CT: Analysis of Vascular Enhancement and Post-Processing techniques for Evaluation of the Thoracic Aorta

GODOY MCB, Leidecker C, Schmidt B, Assadourian B, Naidich DP, Vlahos I

Purpose: The aim of this study is to demonstrate the potential advantages and limitations of Dual Energy CT (DECT) to evaluate the thoracic aorta.

Methods: CTA of the aorta was performed in 16 patients using a dual source MDCT (Somatom Definition, Siemens Medical Solutions, Germany): 64 x 0.6mm collimation, rotation time 0.5 sec, pitch 0.5-0.7, tube A (140kVp: 56-80 mAs) tube B (80kVp: 370-480 mAs). Intravenous contrast media (Ultravist 300mg/I/ml) was administered (40-120ml). HU values were measured in both groups at 80 and 140kVp in the ascending aorta, aortic arch and descending aorta.

Results: In a series of cases including aortic aneurysms, dissection, intramural hematoma, penetrating atherosclerotic ulcer and post-operative aortas (metallic endograft and inclusion grafts) we depicted markedly enhanced vascular opacification at 80kVp compared to 140 kVp images (mean 445 v 238 HU, $p < 0.001$). Image noise was higher at 80kVp (SD 25 v 16 HU, $p < 0.001$), but did not affect clinical interpretation. There was increased sensitivity to endoleaks detection and better characterization of aortic abnormalities at 80 kVp images. The ability to perform CTA with markedly reduced contrast volume or flow rates was demonstrated. At 80kVp high quality images were achieved with as little as 40ml of contrast at 4ml/s. The comparison of true pre-contrast and subtraction (virtual non-contrast) images showed potential to eliminate aortic pre-contrast imaging, reducing radiation dose. Misregistration free subtraction angiographic CT images demonstrating iodine distribution alone were demonstrated.

Conclusion: Single acquisition DECT is a new method that can increase the quality of CTA of the aorta, with the potential to reduce contrast volume and rate administration as well as radiation dose.

Non Contrast MRA of Thoracic Aorta by ECG Gated Free Breathing 3D SSFP Technique

Singhal A, Tomasian A, Malik S, Laub G, Finn JP, Ruehm SG, [KRISHNAM M](#)

Purpose

To study the feasibility of non-contrast 3D SSFP MR Angiography for evaluation of thoracic aorta and to correlate the results with conventional contrast-enhanced MRA (CE-MRA).

Methods

29 consecutive patients with known or suspected aortic diseases underwent non-contrast SSFP MRA with non-selective radiofrequency excitation and conventional CEMRA of thorax at 1.5 T. Both datasets were evaluated for vessel visibility and border definition, artifacts, findings, and intra-vascular signal-to-noise ratio (SNR) in the aortic segments namely aortic annulus, sinus, sino-tubular junction, ascending thoracic aorta, aortic arch, descending thoracic aorta and origin of the supraaortic arteries. Statistical analysis was performed.

Results

Mean scan time for SSFP MRA was 7 ± 2 minutes. On SSFP MRA and CEMRA, 255 (98.84%) and 234 (90.7%) segments were graded as having diagnostic or excellent definition, respectively. On SSFP and CE-MRA, 17 (6.6%) and 92 (35.7%) segments were identified to have motion artifacts, respectively. Aortic pathologies demonstrated in both datasets included aortic root dilatation (n=13), ascending aortic aneurysm (n=10), aortic arch aneurysm (n=3) and descending thoracic aorta aneurysm (n=2), aortic coarctation (n=5), dissection (n=2), and mural thrombus (n=2). Segmental visibility was higher for aortic root on SSFP MRA ($P < 0.01$), and no significant difference existed for visibility scores of aorta (ascending, arch, and descending) or the arterial origins between the two datasets ($P > 0.05$ for all). SNR values were significantly higher on SSFP MRA for all segments ($P < 0.01$).

Conclusion

Non-contrast 3D SSFP MRA provides excellent vessel definition and SNR for confident evaluation of thoracic aortic pathologies.

Treatment Monitoring in Patients with Pulmonary Arterial Hypertension (PAH) using Quantitative 3D MR Pulmonary Perfusion and Phase-Contrast Flow Measurements

LEY S, E. Gruenig, F. Risse, N. Ehlken, J. Ley-Zaporozhan, D. Mereles, H.-U. Kauczor

Purpose

Pulmonary arterial hypertension (PAH) is a small vessel disease with reduced pulmonary perfusion and increased pulmonary arterial pressure. For treatment monitoring exercise tests like the 6-min walk distance (6MWD) are used. Using MRI it is possible to quantitatively assess disease severity with regards to pulmonary perfusion and central hemodynamics. The goal of our study was to assess treatment response using the 6MWD and MR-perfusion and flow measurements.

Material and Methods

20 PAH patients were included of whom 10 received no therapy (control), and 10 received therapy. 3 weeks after the initial examination patients were re-examined using 6MWD, 3D-MR-perfusion and phase-contrast flow measurements in the main pulmonary artery. Perfusion evaluation comprised pulmonary blood volume (PBV), pulmonary blood flow (PBF), mean transit time (MTT). Flow measurements revealed peak-velocity, time-to-peak-velocity.

Results

6MWD did not change in the control-group (difference 17m, $p=0.3$, sign-test) while it improved significantly after therapy (91m, $p=0.004$). PBV remained stable in the control-group ($p=0.3$) and changed significantly in the therapy-group ($p=0.02$). PBF showed no difference in the control-group ($p=0.8$) and in the therapy-group ($p=1$). The control-group showed a significantly prolonged MTT ($p=0.02$) indicative for disease progression. The MTT remained stable in the therapy-group ($p=0.3$). Peak-velocity showed no difference in the control group ($p=0.3$) while it decreased significantly following therapy ($p=0.02$). Time-to-peak-velocity remained showed no difference in both groups ($p=0.7$, $p=0.3$, respectively).

Conclusion

Therapeutic effects in PAH patients can be quantitatively monitored by MR pulmonary perfusion and by flow measurements in the main pulmonary artery.