Evaluation of Late Bypass Graft Patency by Multi Row Detector Computed Tomography

In the 25 patients, of the heart were acquired with 1.5 mm slice thickness, 0.5 mm overlap, ECG trigger at 250 ms following the R wave. Intravenous contrast agent (160 ml) was injected at a rate of CK of 630 +/- 380 ui/l. All the patients had coronary angiography that demonstrated significant coronary lesions in 5 (2 pts with multivessel disease) that were revascularized by angioplasty. SPECT showed regional perfusion defect and wall motion abnormality in all the territories of myocardium. Delayed acquisition demonstrated subepicardial hyperenhancement in the distal coronary arteries and in small secondary branches. By EBT, 50 axial cross-sections were obtained from 14 subjects who died within 24 hours. These casts were scanned with Toshiba multislice helical CT (Anion) using a scanning protocol similar to clinical practice. A series of left ventricular short-axis MPR images were reconstructed later with slice thickness of 2 mm, 5 mm, 5 mm, 7 mm, and 10 mm. Multislice Simpson's method was used to calculate the actual left ventricular volume in each patient. Results: Torsos of the left ventricle were accurately measured by EBT (sensitivity 100%). In three of these patients, pronounced left atrial appendage spontaneous echocardiographic contrast was seen in TEE.

Assessment of Myocardial Damage in Non-ST Elevation Acute Myocardial Infarction Using ECG-Gated Multislice Computed Tomography: A Preliminary Study

Stephan Achenbach, Theresa Menendez, Karsten Pohle, Dieter Ropers, Dagmar Sacher, Christian Schlundt, Frank A. Flachskampf, Uwe Nixdoff, Werner G. Daniel, Ohanessian, Claude Angel, Bernard Lancelin, Marie Lannelongue Hospital, Le Plessis University of Erlangen, Germany.

Background: Multislice detector computed tomography (MSCT) demonstrated various contrast enhancement patterns in left ventricular myocardium after reperfused Q wave myocardial infarction (MI). We compared accuracy of MSCT to diagnose small Q wave MI, defined by ECG analysis and creatine kinase muscle blood level>1500 u/l, to the ECG gated rest myocardial perfusion imaging study.

Methods: Ten consecutive patients (mean age 62 years) admitted for a non-ST elevation MI with TIMI flow >2 and TIMI flow <7 days after MI. Topography of the infarcted area was determined by ECG and echocardiographic studies. During MSCT evaluation, a first enhanced image acquisition was followed by delayed acquisition 5 minutes later. For each area, subendocardial and subepicardial myocardium were analysed separately and classified as normal, hypoenhanced or hyperenhanced compared to remote non infarcted myocardium. ECG analysis (T wave 0.10 mm in 6 pts and Thalium 201 in 2 pts) was used to assess myocardial perfusion and regional wall motion at rest.

Results: Topography of the infarcted area was (3): Inferior (4) or lateral (2) with a mean elevation of 1.07 mm in all the patients. All the patients had significant coronary artery stenosis that demonstrated significant coronary lesions in 5 pts (2 pts with multivessel disease). All the patients had hypoenhancement of subendocardial myocardium. Delayed acquisition demonstrated subepicardial hyperenhancement in all the patients, and its topography correlated with ECG and echocardiographic findings enabling correlation with ECG-gated MSCT image.

Conclusions: ECG-gated multislice computed tomography showed constant regional delayed subepicardial hyperenhancement early after mild non-ST elevation myocardial infarction. MSCT might be a useful tool for evaluation of myocardial damage in non ST elevation MI and needs larger studies to be evaluated.

Electron-Beam Tomography for the Detection of Left Atrial Thrombi in Patients With Atrial Fibrillation

Stephan Achenbach, Theresa Menendez, Karsten Pohle, Dieter Ropers, Dagmar Gaecker, Chalmin Schlundt, Frank A. Flachskampf, Uwe Nixdoff, Werner G. Daniel, University of Erlangen, Erlangen, Germany. Massachusetts General Hospital, Boston, MA.

Purpose: As endocardial echocardiography (TEE) is the gold standard for detection of left atrial thrombi but requires high operator experience. We investigated whether electron beam tomography (EBT) constitutes a reliable alternative to TEE for the detection of atrial thrombi in patients with atrial fibrillation (AF).

Methods: 40 patients with atrial fibrillation scheduled for external DC cardioversion were studied by EBT and TEE (27 male, mean age: 64 years). By EBT, 50 atrial cross-sections of the heart were acquired with 1.5 mm slice thickness, 0.5 mm overlap, ECG trigger at 250 ms following the R wave. Intravenous contrast agent (160 ml) was injected at a rate of 4 ml/s. An investigator blinded to all clinical data evaluated the EBT images concerning presence of left atrial thrombi and results were compared to TEE which was performed immediately following EBT.

Results: In 3 patients, EBT images were uninterpretable due to artifacts caused by a very high heart rate (150/min). In the remaining 39 patients, 8 patients with left atrial thrombi were correctly detected by EBT (sensitivity 100%, see figure). In 25 patients, EBT correctly predicted the absence of atrial thrombus, while in 8 patients, EBT was false-positive (specificity 81%). In three of these patients, pronounced left atrial appendage spontaneous echocardiographic contrast was seen in TEE.

The Optimal Slice Thickness for Left Ventricular Volume Calculation

Wei Cui, Takeshi Kondo, Takahisa Satoh, Hirofumi Anno, Iyo Yoshida, Masayoshi Sato, Hisashi Shinsaki, Satoshi Kikuzawa, Kouji Sugura, Keita Oshima, Kazuhito Katada, Makoto Nakano, Takeshi Kudo, Daisuke Hayashi, Tohoku University, Sendai, Japan.

Background: Recent advances in medical technologies have made accurate measurement of left ventricular (LV) volume more realistic by technologic improvements in Simpson's method. However, there is no universally accepted slice thickness for LV volume measurement, and no report has been published about the accuracy of LV volume measured by multislice computed tomography (MSCT). In this in vitro study, we try to determine the optimal slice thickness for measuring LV volume and evaluate the accuracy of MSCT for measuring LV volume.

Materials and methods: Fourteen human left ventricular casts were obtained from 14 subjects who died within 24 hours. These casts were scanned with Toshiba multislice helical CT (Aquilion) using a scanning protocol similar to clinical practice. A series of left ventricular short-axis MPR images were reconstructed later with slice thickness of 2 mm, 5 mm, 5 mm, 7 mm, and 10 mm. Multislice Simpson's method was used to calculate the actual left ventricular volumes in these slices. The actual left ventricular casts' volumes were determined by water displacement method.

Results: The actual left ventricular volume was 55.57±28.91 ml. The calculated volumes were 64.78±28.93 ml from 5.0 mm slice thickness, 64.35±26.74 ml from 3.5 mm slice thickness, 61.77±30.45 ml from 5.0 mm slice thickness, 64.18±31.70 ml from 7.0 mm slice thickness, and 68.15±32.57 ml from 10.0 mm slice thickness, respectively. All these calculated LV volumes correlated closely with the true volume (all r>0.96, P<0.001), but all overestimated the true LV volume (all P<0.01). Linear regression analysis showed that there was a close correlation between the overestimation and the selected slice thickness (r2=0.96, P<0.001) with a regression equation of overestimation=1.17x(slice thickness) + 0.98. However, ANCOVA analysis showed that slice thickness decreased to 5.0 mm, the overestimation became nonsignificant for slice thickness through 2.0 mm to 5.0 mm (P>0.05). Conclusion: LV volume can be calculated accurately with MSCT. The thinner the slice thickness is, the more accurate the calculated volumes are. However, 5 mm slice thickness is enough for accurate measurement of LV volume.
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1067-42 Correlation Between Atherosclerotic Risk Factors and Coronary Calcium by Electron-Bomb Tomography: A Multivariate Analysis in 1,875 Patients

Rogers, Karsten Pohle, Ralph Maßfert, Gerod Muschiol, Imgrund Bickel, Theresa Monnénder, Mtraf Kraut, Matthias Rapp, Werner G. Daniel, Matthias Hach. Address: University of Magdeburg, Erfangen, Germany.

Background: The purpose of this study was to assess the relationship between presence and extent of coronary artery calcification (CAC) by electron beam tomography (EBT) and standard atherosclerotic risk factors using a multivariate analysis.

Methods: EBT was performed in 1975 consecutive patients (1433 men and 442 women, mean age: 58 ± 11 years). 587 patients with a history of coronary artery disease (CAD) were identified. CAC was assessed in all 1525 patients using a standardized protocol (ECG-triggered, 40 axial slices, slice thickness 3 mm, no overlap).

Results: CAC was detected in 1525 patients (85% of men, 63% of women). Calcium scores ranged from 0 to 65,311 (mean 413 ± 555, median 0). History of diabetes (p < 0.001), age and gender were included as independent variables and compared with the presence and extent of CAC using multivariate regression analysis. Results: CAC was detected in 1525 patients (85% of men, 63% of women). Calcium scores ranged from 0 to 65,311 (mean 413 ± 555, median 0). History of diabetes (p < 0.001), age and gender were included as independent variables and compared with the presence and extent of CAC using multivariate regression analysis.

Conclusion: In a large group of patients, age, male gender, diabetes, hypertension and smoking were independently associated with the presence of CAC (p < 0.001).

1067-43 Calcium Scores From Thin and Thick Image Slice Computed Tomography Scanning Provide Equivalent Predictions of Future Coronary Events

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Image slices of between 2.5 and 3.0 mm are commonly used for coronary calcium CT scanning. Use of fewer but thicker image slices (5 to 6 mm) decreases processing and reading time and electronic storage space. To be acceptable, calcium scores (CS) from different image slice thicknesses must rank patients similarly and must discriminate future incident disease similarly in the same patients. We scanned 319 subjects hearts with 2.5 mm (n=284) and 6 mm (n=35) image slice thicknesses. Percentile distributions and percentiles were compared across slice thicknesses.

Background: The advantages of spiral imaging in magnetic resonance coronary angiography (MRA) are known. Recent implementation of MRA at a higher magnetic field strength demonstrated enhanced signal-to-noise ratio (SNR) enabling higher spatial resolution. Therefore, a pilot study was conducted to investigate spiral imaging at high field strength by assessing anatomic coverage and image quality.

Methods: Real-time and high-resolution spiral imaging sequences installed on GE Signa 3.0 Tesla (T) whole body system (GE, Milwaukee, WI) equipped with a gradient system capable of 40 mT/m peak amplitude and 150 mT/msec slew rate were implemented with a 5-inch receiver surface coil. The study consisted of 5 subjects (3 volunteers and 2 patients). The imaging protocol consisted of rapid real-time localization of the coronary arteries followed by high-resolution imaging. The real-time sequence consisted of gradient recalled echo sequence (31-ts TR, 5.5-ms TE, and 30° flip-angle) utilizing 10-ms spectral spatial pulse and 16-ms (4096 points and 4 interlaces) spiral read-out. A frame rate of 5 complete frames/generated a spatial resolution of 2.25mm with a FOV of 24 cm.

Results: Image quality was graded based on contiguity of the vessel border and artifact present in each segment. The scale ranged from 1-4 (4 excellent, 3 good, 2 fair, 1 poor) and 4 non-diagnostic). Results: Coronal segments were visualized in 80% (36/45) of all segments. Excellent or good image quality was achieved in 76% of all segments. These segments were LM, proximal-LAD, mid-LAD, proximal-LCX, mid-LCX, and proximal-LCX. Longitudinal spiral imaging at 3T holds promise to enhance MRA.

1075-44 Echocardiographic Assessment of Left Atrial Size: Simultaneous Validation by Electron-Beam Computed Tomography

David Mosekia-Zelouf, Michael Belamy, Andrea Rossi, Christian Eusmann, Jerome F. Breen, Thomas Behrenboue, Maurice Enriquez-Sarano, Mayo Clinic, Rochester, MN.

Background: Left atrial (LA) size is an important measure of cardiac remodeling with serious outcome implications. It is routinely assessed by M-mode echocardiography, which measures only one dimension of an eccentric cavity. LA volume measurement globally assesses LA remodeling but has not been fully validated. Electron Beam Computed Tomography (EBCT) provides a reference to which echocardiography can be compared.

Methods: We analyzed two subsets of patients with mitral regurgitation and a wide range of LA volume overload (regurgitant volume 5 to 197 mL). First, in 33 patients (validation set) LA volume was measured by four different echographic methods (from cubed M-mode diameter, from two dimensional stenomass using an empiral equation, from bpline method of disks and from bpline area-length method) and compared to simultaneous (within one hour) EBCT. Second, in 251 patients (testing set, mean age 64±14, 57% females), we prospectively evaluated the relationship between M-mode diameter and LA volume, was measured by the previously defined method.

Results: In the validation set, the four echographic methods of LA volume measurement (respectively 62±32, 153±54, 135±56 and 145±57 mL) showed good correlations with EBCT (143±55 mL) all <r>0.80, p<0.0001) but the area-length method was the only one that did not underestimate LA volume (p=0.57). In the testing set, M-mode diameter (48±9 mm) also correlated to LA volume (bline area-length) (110±59mm, n=74, p<0.0001) but the relation was curvilinear. Hence, small diameter increases corresponded to variably larger LA volume increases and the 95% confidence interval of LA volume estimation increased widely with the diameter even for relatively normal LA sizes (32±140 m, for a diameter of 40 mm).

Conclusion: For echocardiographic determination of LA volume 1) methods based on LA diameter, M-mode or bpline area-length method underestimate LA volume (24%±23 mL) and are plagued by wide confidence intervals and scatter even for normal values, while 2) the area-length method is simple and shows high accuracy compared to EBCT. Therefore, to assess cardiac remodeling, LA size can be routinely and reliably assessed by the bpline area-length method.

Monday, March 31, 2003, 9:00 a.m.-10:00 a.m.
McCormick Place, Hall A

1075A-MP-203 Spiral Magnetic Resonance Coronary Angiography With Real-Time Localization at 3T


Background: The advantages of spiral imaging in magnetic resonance coronary angiography (MICA) are known. Recent implementation of MICA at a higher magnetic field strength demonstrated enhanced signal-to-noise ratio (SNR) enabling higher spatial resolution. Therefore, a pilot study was conducted to investigate spiral imaging at high field strength by assessing anatomic coverage and image quality.

Methods: Real-time and high-resolution spiral imaging sequences installed on GE Signa 3 Tesla (T) whole body system (GE, Milwaukee, WI) equipped with a gradient system capable of 40 mT/m peak amplitude and 150 mT/msec slew rate were implemented with a 5-inch receiver surface coil. The study consisted of 5 subjects (3 volunteers and 2 patients). The imaging protocol consisted of rapid real-time localization of the coronary arteries followed by high-resolution imaging. The real-time sequence consisted of gradient recalled echo sequence (31-ts TR, 5.5-ms TE, and 30° flip-angle) utilizing 10-ms spectral spatial pulse and 16-ms (4096 points and 4 interlaces) spiral read-out. A frame rate of 5 complete frames/generated a spatial resolution of 2.25mm with a FOV of 24 cm.

Results: Image quality was graded based on contiguity of the vessel border and artifact present in each segment. The scale ranged from 1-4 (4 excellent, 3 good, 2 fair, 1 poor) and 4 non-diagnostic). Results: Coronal segments were visualized in 80% (36/45) of all segments. Excellent or good image quality was achieved in 76% of all segments. These segments were LM, proximal-LAD, mid-LAD, proximal-LCX, mid-LCX, and proximal-LCX. Longitudinal spiral imaging at 3T holds promise to enhance MRA.