(43.0%) patients; radiologists reported CAC only in 32/215 (14.9%) patients and in none of them the coronary arteries involved were indicated.
Conclusion: Non-gated chest CT is a valid tool for the evaluation of CAC. Nowadays radiologists are not confident in reporting this incidental finding. When the coronaries are not the aim of CT study, the reporting rate of CAC is very low. A systematic evaluation of CAC could be proposed in all chest CT studies to offer additional clinical information concerning heart disease risk.

B-0998 14:09

Progression of coronary artery calcifications during the first year after renal transplantation

L.V. Forzenigo, D. Cresseri, C. Alfieri, L. Longhi, M.G. Raciti, M. Garavaglia; *Milan/IT (laura.v.f@libero.it)*

Purpose: Cardio-vascular disease (CVD) is the most common complication after kidney transplant (KTx) and coronary artery calcifications (CAC) are claimed to play a key role. Scanty and contradictory results have been produced on this topic. In the present study, we looked at the CAC progression, evaluated according to Sevrukov's criteria, during the first year after KTx.
Methods and Materials: 86 consecutive KTx patients were evaluated within 3 months after KTx for CAC evaluation with CT. In 79 patients we repeated the CAC evaluation after 1 year. In 8 patients who did not perform the second control because of any clinical reason. The Agatstone score (AS) values and changes were put into relationship with the main biochemical and clinical variables, using univariate (UA) and multivariate analysis (MA).
Results: At basal evaluation 48/86 (56%) had significant AS values. The basal AS values were related only to the age of the patient, at either UA or MA ($p < 0.0001$). After 1 year, 8/79 (10.1%) patients significantly worsen their AS values, while the remaining 71 did not. No significant relationship was found between any clinical, instrumental or laboratory data and worsening of AS, nor there was any relationship of worsening in AS with any change in renal function.
Conclusion: The presence of CACs is a frequent finding at time of KTx. A worsening of CAC is also observed. However, the clinical meaning of this finding is equivocal and we need larger studies before deciding whether the CAC assessment is worth-doing on a routine basis.

B-0999 14:18

Sport category is an important determinant of cardiac adaptation: an MRI study

T. Luijkx, M.J. Cramer, N.H.J. Prakken, C.F. Buckens, F.J.G. Backx, W.P.T.M. Mali, B.K. Velthuis; *Utrecht/NL (tluijkx@gmail.com)*

Purpose: Physiologic cardiac adaptation in athletes is influenced by body surface area, gender, age, training intensity and sport type. This study assesses the influence of sport category and provides a reference framework for physiologic limits by sport category and gender.
Methods and Materials: 381 subjects (mean age 25±5 years, range 18-39, 61% men) underwent a cardiac MRI (CMR) investigation: 114 healthy non-athletes (≤3 hours weekly exercise) and 267 healthy elite athletes (mean 17±6.6 hours weekly exercise). Athletes performed either low dynamic-high static (LD-HS, n=42), high dynamic-low static (HD-LS, n=144) or high dynamic-high static sports (HD-HS, n=81).
Results: The left ventricular (LV) end-diastolic volume (EDV) (ml/m2) for non-athletes/LD-HS/HD-LS/HD-HS, respectively, was 101/107/122/129 in males and 90/103/106/111 in females. The LV end-diastolic mass (EDM) (g/m2) for non-athletes/LD-HS/HD-LS/HD-HS was 47/49/57/69 for males and 34/38/42/51 for females. Athletes' LV EDV/EDM ratios were not larger than in non-athletes, disproving selective ventricular wall thickening. LV/RV EDV ratios were similar in all groups (males/females range 0.90-0.92/0.90-1.01). Multivariate linear regression demonstrated a highly significant contribution of sport category with coefficients larger than that of training hours, gender and age ($p < 0.01$, LV EDV/EDM coefficients for sport category LD-HS 6/0.75, HD-LS 16/7, HD-HS 21/17).
Conclusion: This study demonstrates balanced cardiac adaptation for all sport categories, with preserved ratios of LV volume/LV wall mass and LV/RV volume. Sport category has a large impact on cardiac adaptation. HD-HS sports show the largest changes, whereas LD-HS sports show dimensions similar to non-athletes. This study's results can serve as a reference in clinical practice.

B-1000 14:27

Fully automated assessment of right ventricular functional parameters from ECG-gated coronary CT angiography data: evaluation of prototype software

R.W. Bauer[1], A. Wrzesniak[1], D. Bernhardt[2], T. Lehnert[1], F. Vega-Higuera[2], T.J. Vogl[1], J.M. Kerl[1]; [1]*Frankfurt a. Main/DE*, [2]*Forchheim/DE (ralfwbauer@aol.com)*

Purpose: Enlargement of the right ventricle is a sign of RV dysfunction, pressure or volume overload, or arrhythmogenic RV dysplasia and also a survival predictor in chronic pulmonary disease and pulmonary embolism. We evaluated the performance of prototype software for fully automated segmentation and volumetry of the right ventricle.
Methods and Materials: In 50 retrospectively ECG-gated coronary CT angiography scans the endsystolic (RVVmin) and enddiastolic (RVVmax) volume of the right ventricle was calculated fully automatically by prototype software. Manual slice segmentation by two independent radiologists served as the reference standard. Measurement periods were compared for these methods.
Results: Right ventricular volumes calculated with the prototype software were in excellent agreement with the results from manual slice segmentation (Bland-Altman $r = 0.95$-0.98; $p < 0.001$; Lin's correlation Rho = 0.87-0.96, $p < 0.001$) for RVVmax and RVVmin with excellent interobserver agreement between both radiologists ($r = 0.97$; $p < 0.001$). There was no need for manual correction of the RV borders as segmented by the software in a single case. Measurement period was significantly shorter with the software (153±9 s) than with manual slice segmentation (658±211 s).
Conclusion: The prototype software was able to demonstrate excellent performance in comparison to the reference standard. It promises not only to minimise postprocessing time but also to eliminate subjective selection of slices and cardiac phases.

B-1001 14:36

True real-time cardiac MRI in free breathing without ECG-synchronisation using radial k-space sampling: initial results

R.W. Bauer[1], I. Radtke[1], S. Zhang[2], T. Block[1], J.M. Kerl[1], M.G. Mack[1], T.G. Graf[1], T.J. Vogl[1], M.C. Larson[1]; [1]*Frankfurt/DE*, [2]*Göttingen/DE (ralfwbauer@aol.com)*

Purpose: We investigated a novel TrueFISP sequence based on radial k-space sampling (rTrueFISP) that does not require ECG-synchronisation or breathhold for cine cardiac MRI.
Methods and Materials: 12 healthy volunteers (heart rate 78±12 bpm, range 57-100 bpm) underwent 1.5 T cardiac MRI. Single-shot short axis views were acquired with a) retrospectively ECG-gated segmented breathhold cine balanced steady-state free-precision (bSSFP) and b) with rTrueFISP sequences with sliding-window acquisition (5 subframes) with a temporal resolution of 15 fr/s and 40 fr/s. rTrueFISP were acquired during free breathing without ECG-synchronisation. Left ventricular functional parameters (EDV, ESV, EF) were determined according to the Simpson's rule with bSSFP representing the reference standard. Contrast-to-noise ratio (CNR) of myocardium/blood pool was calculated. Quality of wall motion depiction was assessed by two radiologists (1 = good, 2 = fair, 3 = non-diagnostic).
Results: EF showed strong correlation ($r=0.91$; $p < 0.001$) between bSSFP (65±5%) and 40 fr/s rTrueFISP (62±6%) but only moderate correlation ($r=0.67$) with 15 fr/s rTrueFISP (52±6%). The reason for that was that ESV was significantly ($p=0.003$) overestimated with 15 fr/s rTrueFISP (15 fr/s: 43.9 ml; 40 fr/s: 36.2 ml; bSSFP: 33.9 ml). Mean CNR was significantly lower ($p = 0.002$) with 40 fr/s rTrueFISP compared to 15 fr/s rTrueFISP and bSSFP (7.5 vs. 12.6 vs. 14.2). However, due to the faster temporal resolution image quality for wall motion assessment was rated significantly better for 40 fr/s.
Conclusion: Left ventricular functional analysis with real-time non-ECG-synchronised free-breathing rTrueFISP is in good agreement with standard ECG-gated breathhold cine bSSFP sequences.

B-1002 14:45

Evidence of continuous helical structure of the cardiac ventricular anatomy assessed by diffusion tensor imaging magnetic resonance multi-resolution tractography

A. Hidalgo[1], F. Poveda[1], E. Marti[1], D. Gil[1], A. Andaluz[1], F. Carreras[1], M. Ballester[2]; [1]*Barcelona/ES*, [2]*Lleida/ES (alhidalgop@gmail.com)*

Purpose: Deep understanding of myocardial structure linking morphology and function of the heart would unravel crucial knowledge for medical and surgical clinical procedures and studies. Diffusion tensor MRI provides a discrete measurement of the 3D arrangement of myocardial fibres by the observation of local anisotropic

diffusion of water molecules in biological tissues. In this work, we present a multi-scale visualisation technique based on DT-MRI streamlining capable of uncovering additional properties of the architectural organisation of the heart.
Methods and Materials: We selected the John Hopkins University (JHU) Canine Heart Dataset, where the long axis cardiac plane is aligned with the scanner's Z-axis. Their equipment included a 4-element passed array coil emitting a 1.5 T. For DTI acquisition, a 3D-FSE sequence is apply. We used 200 seeds for full-scale tractography, while we applied a MIP mapping technique for simplified tractographic reconstruction. In this case, we reduced each DTI 3D volume dimensions by order-two magnitude before streamlining.
Results: Our simplified tractographic reconstruction method keeps the main geometric features of fibres, allowing for an easier identification of their global morphological disposition, including the ventricular basal ring. Moreover, we noticed a clearly visible helical disposition of the myocardial fibres, in line with the helical myocardial band ventricular structure described by Torrent-Guasp. Finally, our simplified visualisation with single tracts identifies the main segments of the helical ventricular architecture.
Conclusion: DT-MRI makes possible the identification of a continuous helical architecture of the myocardial fibres, which validates Torrent-Guasp's helical myocardial band ventricular anatomical model.

B-1003 14:54

Inaccuracies in cine SSFP MR LV volumetric measurements in patients with LV hypertrophy: correction applying the mass conservation principle

K.U. Bauner, M. Durand, A. Crean, E. Nguyen, S. Ley, R. Wald, H. Rakowski, N. Paul, B. Wintersperger; *Toronto, ON/CA (Kerstin.Bauner@med.uni-muenchen.de)*

Purpose: The study aim was to evaluate differences of LV mass and ESV assessment in patients with LV hypertrophy by comparing standard contouring methods with a total LV volume approach which includes application of the "conservation of mass" principle for myocardial volume.
Methods and Materials: 47 patients diagnosed with HCM/DCM (n=24/23) undergoing cardiac MR at 1.5 T/3 T were included. All patients underwent standard cine SSFP in short-axis orientation for LV volumetrics (6x1.3x1.3 mm3, TR30-35 ms). For the total LV volume approach, datasets were evaluated using semi-automated post-processing with epi- and endocardial contouring at end-diastole (ED) and epicardial contouring only at end-systole (ES). Calculation of ESV was based on total LV volume and the myocardial volume as assessed at ED applying the mass conservation principle (MCP). Analysis was performed for DCM and HCM patients and compared to standard LV volumetric assessment (STD) with epi-and endocardial contouring at ED/ES for EDV, ESV and myocardial mass.
Results: The HCM group showed smaller ESV using STD as compared to MCP (60.3±31.5 ml vs. 72.9±36.3 ml; p=0.0018) while no differences were found for the DCM group (175.7±79.9 ml vs.176.5±77.2 ml; p=0.62). Average HCM EF declined from 65% (STD) to 56% (MCP) (p=0.0003). LV mass using STD approach differed by 2.6 g (1.2%) (95%CI:0.4-4.8 g/-0.4-2.9%) between ED and ES in DCM patients (p=0.03) but by 18.2 g (10%) (95%CI: 12.3-24.0 g/7.1-12.9%) in the HCM group ($p < 0.001$).
Conclusion: ESV and end-systolic mass assessment is challenging in HCM, due to problematic endsystolic endocardial contouring and underestimation of true ESV. Utilisation of the LV mass conservation principle may increase accuracy.

B-1004 15:03

Cardiac MRI using a new trigger method: MR compatible Doppler-ultrasound device to trigger the heart frequency in comparison to ECG

B. Schoennagel, C. Much, J. Yamamura, K. Tornquist, G. Adam, U. Wedegärtner; *Hamburg/DE (wedegaer@uke.uni-hamburg.de)*

Purpose: The aim was to assess a MR compatible Doppler-ultrasound device as a new method to trigger the heart rate for cardiac MRI in comparison to ECG triggering.
Methods and Materials: MR imaging was performed on 6 sheep on a 1.5 T MR scanner. The Doppler-ultrasound sensor was placed on the chest above the heart and fixed gently with a belt. The recorded signal was transferred to the ECG trigger unit of the MRI scanner and used for cardiac triggering. Additionally, conventional ECG triggering was recorded. Cardiac MRI was performed using both triggering methods consecutively. For cardiac MRI gradient echo sequences in 2- and 4-chamber view and in short axis view with cine sequences (25 phases) to determine left ventricular volumes (LV) and ejection fraction (EF) were generated. MR images acquired with Doppler-ultrasound and conventional ECG triggering were evaluated separately by two radiologists concerning image quality and functional assessment.
Results: Cardiac MR imaging was possible in all 12 examinations, 6 using the Doppler-ultrasound device and 6 using ECG triggering. Using Doppler-ultrasound for triggering image quality was comparable to ECG. All anatomical structures could be clearly evaluated. For functional evaluation the LV and the EF were assessed. There was no significant difference between both methods: LV 128 ml and EF 48% for Doppler ultrasound and LV 130 and 46% for ECG.
Conclusion: The MR compatible Doppler-ultrasound device is a new triggering method for cardiac MRI. It might be faster and easier in the application compared to ECG.

B-1005 15:12

Non-invasive cardiac vein mapping: role of MDCT-CA

R. Malago, A. Pezzato, C. Barbiani, U. Alfonsi, G. Sala, R. Pozzi Mucelli; *Verona/IT (robertomalag@yahoo.it)*

Purpose: Coronary venous anatomy is of primary importance when implanting a pacemaker or a defibrillator device because coronary sinus can be enlarged or stenotic depending on chronic heart failure. The aim of this study is to evaluate the usefulness of MDCT-CA in describing the coronary venous tree and in particular the coronary sinus and detecting main venous system variants.
Methods and Materials: 301 consecutive patients (196, mean age 63.74 YO) studied for coronary artery disease with 64 slice MDCT-CA were retrospectively examined. The cardiac venous system was depicted using 3D, MPR, cMPR and MIP post-processing reconstructions on an off-line workstation. For each patient image quality, presence and calibre of the coronary sinus (CS), great cardiac vein (GCV), middle vein (MV), anterior interventricular vein (AIV), lateral cardiac vein (LCV), posterior cardiac vein (PCV), small cardiac vein (SCV) and presence of variant of the normal anatomy were recorded.
Results and **Conclusion:** CS, GCV, MV and AIV were visualised in 100% of the cases. The LCV was visualised in 255/301 (84%) patients, the PCV in 248/301 (83%) patients and the SCV in 69/301 (23%) patients. Mean diameter of the CS was 8.69 mm in 276/301 (91.7%) patients without chronic heart failure and 9.93 mm in 25/301 (8.3%) patients chronic heart failure.

B-1006 15:21

Accelerated cine imaging of the heart in mice at 9.4 T: comparison of retrospectively self-gated and prospectively triggered FLASH sequences

P. Fries, J. Stroeder, A. Mueller, A. Massmann, R. Seidel, G. Schneider, A. Buecker; *Homburg/DE (drpeterfries@googlemail.com)*

Purpose: To compare prospectively triggered FLASH (PT) with retrospectively self-gated (RSG) and accelerated retrospectively self-gated FLASH (accRSG) cine sequences for the assessment of cardiac function in mice at 9.4 T.
Methods and Materials: 10 C57/BL6 mice were examined on a 9.4T animal scanner (Bruker BioSpec, Germany). We acquired 6 consecutive 1 mm short axis slices covering the left ventricle (LV) using a PT (TR/TE=5.7/2.1, α=20°, FOV=2.5x2.5 cm, matrix=256x256, frames: 20, PI=1), a RSG (TR/TE=5.6/1.5, α=20°, FOV=2.5x2.5 cm, matrix=256x256, frames=20, PI=1), and an accRSG (TR/TE=5.6/1.6, α=20°, FOV=2.5x2.5 cm, matrix=160x160, cardiac frames=20, PI-GRAPPA=2). Two readers independently evaluated the different datasets in a blinded manner (twice, separated by 6 weeks) regarding LVEDV, LVESV, SV, EF, cardiac output (CO) and myocardial mass (MyoM). Total acquisition times (TA) for the complete examination of the heart were assessed for each sequence. Statistical analyses included a one-way ANOVA with Bonferroni multi-comparison test ($p < 0.05$) and Bland-Altman analyses for the assessment of intra- and inter-observer variability.
Results: There were no statistically significant differences between the different imaging approaches for all cardiac parameters (LVEDV (PT/RSG/accRSG (mean): 49.13/52.44/49.71μl, p=0.06), LVESV (18.18/18.13/16.88μl, p=0.26), SV (30.75/34.31/32.83μl, p=0.06), EF (63.1/66.9/66.0%, p=0.7), CO (12.9/14.2/14.3 ml/min, p=0.07) and MyoM (67.6/65.2/64.8 mg, p=0.08)). TA was significantly shorter for accRSG (8:00±0:05 min, p=0.001) compared to PT (mean/SD: 19:24±4:41 min) and RSG (16:45±0:10 min).
Conclusion: Cine MRI with accRSG allows for an assessment of cardiac function in mice within 8 min while providing the same quantitative data as conventional PT and RSG FLASH sequences. This approach allows an expedition of MR studies in cardiovascular disease models.