Computed tomography (CT) has already become a powerful diagnostic tool and cardiac CT is increasingly used as a noninvasive modality for the diagnosis of coronary artery disease in the clinical routine. Recent development in cardiac CT technology includes coronary plaque characterization, dual-energy spectral imaging, myocardial CT perfusion, CT-derived fractional flow reserve (CT-FFR), ultra-low dose CT imaging, and so on. Detailed analysis of coronary plaque characteristics and components not only provides complimentary information to coronary artery stenosis evaluation, but also reveals the risk of plaque instability and rupture. Dual-energy spectral imaging has expanded the role of conventional CT by providing more comprehensive and accurate assessment, such as beam hardening artifacts reduction, in-stent stenosis visualization and improvement of contrast to noise ratio, analysis of myocardial iodine map. Myocardial CT perfusion combined with CT-FFR is an emerging method for the assessment of functionally significant stenosis, which enables one-stop shop of morphological and functional evaluation. The idea of low radiation dose, as the permanent focus of cardiac CT, has accompanied all along with the technical progresses. All these aforementioned advancements have been promoting to mutual penetration and integration, which paving the way for multi-parameter imaging as a “low-dose one-stop cardiac CT”. Beyond that, along with the burgeoning of artificial intelligence, we can predict that in the upcoming future, the clinical demands-based big data analysis radiomics will highly likely to be the perspective of cardiac CT, which is conducive to preoperative assessment, treatment plan, risk stratification of major adverse cardiac events and prognostic analysis.
The application of dual-energy CT in cardiac imaging is targeted to decomposition and quantification of different materials and minimizing image artifacts.

Myocardial perfusion imaging with dual-energy CT has been studied most and a promising imaging method to identify anatomically or hemodynamically significant stenosis of coronary arteries at once. However visual assessment is still the most common approach to evaluate myocardial perfusion defects although iodine concentration of a specific region could be quantified with dual-energy CT. The advantage of dual-energy CT compared to single-energy CT regarding visual assessment includes minimizing beam hardening artifacts which is common and problematic sometimes in the lateral wall of left ventricle and providing color-coded maps to effectively represent iodine distribution as a marker of perfusion.

Myocardial viability imaging could be performed with dual-energy CT. It has basically same advantage as those in perfusion imaging including minimizing artifacts and providing regional iodine distribution map. However, the diagnostic perfusion of dual-energy CT was quite low compared to late-gadolinium enhancement of MRI. Furthermore, Myocardial viability imaging itself in cardiac CT does not provide additional benefit over myocardial perfusion imaging.

Recently, Hong et al. reported that myocardial extracellular volume fraction could be measured with dual-energy CT. Its advantage includes not only less beam hardening artifacts but also volume acquisition of whole left ventricular myocardium which enables volumetric quantification of myocardial fibrosis, no need to use pre-contrast images, and less chance of misregistration which is from using two image acquisitions in convention MRI to get extracellular volume fraction. In addition, coronary artery disease could be assessed together with myocardial extracellular volume fraction at one CT examination which could be helpful to exclude ischemic etiology in patients with suspicious cardiomyopathy.

Coronary atherosclerotic plaque can be assessed with the decomposition capability of dual-energy CT. One practical application is generating virtual non-contrast images from conventional enhanced cardiac CT to measure coronary artery calcium score. Some reports have supported that two scores from real and virtual calcium scan have good agreement and a substantial radiation dose reduction reaches 20% when using virtual calcium images which substitutes for real unenhanced imaging, thus reducing time and radiation exposure. Otherwise, there has been some tries to remove calcium from coronary CT angiography to facilitate and improve the diagnostic performance in case of heavy calcification. Plaque characterization is another expectation for dual-energy CT owing to its capability of tissue decomposition. However, dual-energy CT showed a similar accuracy as single-energy CT for the attenuation-base characterization of non-calcified plaques.

The presence or absence of enhancement, enhancement degree in tumors or thrombi are able to be assessed with dual-energy material decomposition. Differentiation a tumor from thrombus by presence of enhancement is critical in patient management in clinical practice. In stroke patient, presence of thrombus in left atrial appendage is a major cardioembolic source. However, usual coronary CT angiography protocol does not allow to easily and accurately differentiate thrombus from blood stasis, which all are presented with no enhancement. Dual-energy CT in delayed phase with dual phase administration of contrast agent is a robust method to screen cardioembolic source including thrombus in left atrial appendage.

Dual energy imaging can be performed with three major systems: 1) dual source system with different tube potentials, 2) single source system with a rapid tube potential switching between projection views, 3) dual-layer detector system. First two methods have difficulties
and unresolved needs regarding patient selection, radiation dose, and temporal and spatial resolution. Dual-layer detector system performs as routine CT scan without need patient selection and is beneficial to reduce radiation exposure to patients. Scan protocol, image acquisition, analysis, and interpretation should be standardized and more evidence of clinical utility of dual energy CT is necessary.

Spectral CT is a multi-energy CT with a photon counting detector in concept. To fully utilize the potential capability of multiple material decomposition, contrast materials with new material and different distribution from that of iodine are needed not only for clinical imaging but also for molecular imaging in the future.

References

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Magnetic resonance imaging (MRI) is a sophisticated imaging technique that has evolved as a clinical modality over the past 30 years. Cardiovascular studies using MRI began with the advent of MRI in the 1980s and are widely used in clinical and research fields. MRI provides not only valuable data about the metabolic status of tissues and organs but also morphological information. MRI also does not involve potentially dangerous ionizing radiation, unlike other imaging techniques such as computed tomography (CT) or nuclear medicine. Cardiac MRI provides complementary information on left ventricular function, local perfusion, myocardial viability, metabolic changes and direction of origin. Current cardiac MRI has dramatically reduced scan times and improved overall image quality with advances in hardware and reconstruction algorithms.

Cine MRI provides a dynamic image of cardiac wall motion, allowing more accurate assessment of the wall motion. Left ventricular function and mass, measured with cine MRI, are used in clinical practice as an endpoint in clinical trials (1). While MRI has become accepted as the “gold standard” method for assessment of global function, there exists the substantial potential for it to provide much more detailed and quantitative information on cardiac function. However, many common cardiac diseases initially affect the myocardium on a regional, rather than global basis. Regional myocardial wall motion can be quantified using myocardial strain analysis (2). Strain reflects myocardial deformation and is more closely linked with myocyte metabolism and contractility than LVEF (3). Tagging and DANTE method are used as a gold standard in analyzing these strains. Recently, however, features such as feature tracking and deformation tracking which can analyze strains in Cine image by the image processing method have been actively studied (3-5).

Myocardial perfusion imaging is used for detecting myocardial viability and critical coronary stenosis (6). First-pass perfusion imaging uses a gadolinium-based contrast agent to capture a strong T1-weighted image with high temporal resolution. It is possible to monitor the contrast as it disseminates throughout the myocardium (1). Arterial-spin-labeling MRI is the perfusion imaging using blood flow sensitivity as endogenous contrast. ASL can obtain perfusion images without contrast agents, but low sensitivity is a problem to overcome (7, 8).

Delay enhanced MRI (DE-MRI) is also a way to measure myocardial viability with high spatial resolution. After 10-15 minutes of injecting the contrast agent, the inversion recovery pulse nullifies the signal of the normal myocardium so that the infarcted myocardium can be contrasted. There is an absence of the viable myocardium with increased extracellular space that results in increased contrast concentration and enhancement on DE-MRI. This is good for observing focal scars, but it is better to use T1 mapping to observe diffuse fibrosis. T1 mapping is a measure of T1 relaxation time in the myocardium. Modified look-locker inversion recovery (MOLLI) and saturation recovery single shot (SASHA) methods are representative. Gadolinium contrast agents (0.1-0.2 mmol/kg) were injected, and the difference of T1 between normal and infarct myocardium was differentially decreased due to gadolinium washout. Therefore, myocardial T1 values are indicative of abnormal accumulation of gadolinium in the myocardium. Extracellular volume can also be measured using the difference in myocardium and blood T1 before and after contrast (1).

Detection of myocardial edema has previously been shown to allow early detection of acute coronary syndromes. A quantitative T2 mapping is superior to T2-weighted images in identifying tissues with interstitial edema (1). Previous T2 mapping was taken with black-blood TSE, but it is not well used for problems such as respiration, heart movement, and slow-flow artifact. Recently, T2 mapping using a T2-preparation pulse in the fashion of a Driven equilibrium is used.

Diffusion MRI provides information regarding
microscopic tissue structure through encoding random motion of water molecule (1). The information includes apparent diffusion coefficient (ADC), mean diffusivity (MD), fractional anisotropy (FA), Helix angle (HA) and fiber tracking of the LV wall. However, Myocardial microstructure has been challenging to probe in vivo. Spin echo-based diffusion-weighted sequences allow for single-shot acquisitions but are highly sensitive to cardiac motion (9). An approach to overcome signal attenuation caused by changes in cardiac motion is to design higher-order motion compensated diffusion gradient waveforms. The higher motion compensated diffusion encoding reduces the effect of strain and bulk motion on imaging in vivo myocardial fiber architecture as well as scalar diffusion parameters.

References

Cardiovascular magnetic resonance (CMR) is a non-invasive imaging technique, which allows accurate evaluation of biventricular function and precise myocardial tissue characterization in a one-stop-shop technique, free from ionizing radiations. This presentation will illustrate the clinical application of CMR in patients with myocardial infarction, nonischemic cardiomyopathy and congenital heart disease focusing on the T1 mapping sequence and myocardial strain.

T1 mapping is a novel technique to diagnose myocardial inflammation, fibrosis, hypertrophy and infiltration by measurement of T1 values, which directly correspond to variation in intrinsic myocardial tissue properties. Also, T1-mapping measurements also can estimate extracellular space by calculation of extracellular volume fraction. Therefore, T1 mapping can detect diffuse myocardial disease in early disease stages and complement late gadolinium enhancement in visualization of the regional changes in common advanced myocardial disease. It may allow grading of disease activity, monitoring progress, and guiding treatment, potentially as a fast contrast-free clinical application.

The assessment of left ventricular (LV) function is the important component of a cardiac imaging study. However, global measures, such as left ventricular ejection fraction (EF), may not be sensitive enough to detect subtle changes in LV function. Cardiac strain is a sensitive measure of deformation and measurements of strain are becoming increasingly popular in both clinical and research environments. LV myocardial systolic strain and deformation parameters are altered during early-stage disease pathogenesis and can be measured using CMR. Tagged-CMR, in which magnetization saturation bands arranged in a grid format are placed onto the myocardium, is now an established method for the assessment of regional LV function. However, myocardial tagging has not been widely adopted due to the necessity for additional scans and complex, time-consuming post-processing. Recently developed feature tracking software allows for the measurement of myocardial strain using CMR cine images. The software tracks endocardial and epicardial borders across frames to quantify the LV wall motion during the cardiac cycle. CMR-derived feature tracking methods are vendor-independent and thus do not require additional sequences. Furthermore, feature tracking-derived measurements of circumference exhibit acceptable inter-observer reproducibility and feature tracking-derived myocardial strain can predict acute myocarditis with high sensitivity and specificity. Their value in the early detection of LV systolic dysfunction has been demonstrated in several settings, such as coronary artery disease, post myocardial infarction, aortic stenosis and myocarditis.
SS 25 CV-01  16:00
Detection of occult myocardial scar with cardiovascular MR imaging in patients with asymptomatic type 2 diabetes mellitus: the accredit study
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PURPOSE: The main objective was to determine the prevalence of occult myocardial scar (OMS) on contrast-enhanced cardiovascular magnetic resonance imaging (CMR) in patients with type 2 diabetes mellitus. The relationship between the occurrence of OMS detected with CMR and coronary atherosclerosis observed with contrast-enhanced multiple detector computed tomography (MDCT) was also evaluated.

MATERIALS AND METHODS: This prospective, open-label study included asymptomatic patients with type 2 Diabetes Mellitus and at least two identified cardiac risk factors, scheduled to undergo a CMR and a MDCT procedures. CMR and MDCT were performed with gadoterate meglumine (Dotarem®, Guerbet) and iobitridol (Xenetix®, Guerbet), respectively. The prevalence of OMS was calculated on CMR. For each main coronary artery, stenosis degree and plaque characteristics were assessed on MDCT. For each patient, the infarct-related artery (IRA) was identified based on myocardial infarction location, and the association between coronary artery distribution and myocardial segments were analyzed on the basis of the AHA (American Heart Association) recommendations. If an OMS was detected, the corresponding coronary territory was defined as IRA. The characteristics of the coronary plaques located in IRA were compared to those located in non-IRA.

RESULTS: A total of 350 patients were included in the study (mean age [± SD], 60.2 ± 6.5 years [range, 35-75]; male, 60.9%; mean BMI, 25.4 ± 3.1 kg/m² [range, 18.6-36.4]) and 322 patients completed both CMR and MDCT procedures. At least one OMS was observed in 23 patients (7.1%) on CMR. Among them, 13 (56.5%) had a significant stenosis (> 50%) or occlusion on MDCT. At segment level, among the 4830 AHA segments assessed with MDCT, 510 (10.6%) were calcified plaque (> 50% calcium), 161 (3.3%) mixed (< 50% calcium) and 198 (4.1%) non-calcified (0% calcium). In patients with at least one OMS, MDCT identified 62 plaques in IRA and 52 in non IRA. In IRA, 10 of the plaques were non calcified, 14 mixed and 38 calcified. In the non-IRA, 16 plaques were non calcified, 9 mixed and 27 calcified.

CONCLUSION: In our study, OMS were identified with CMR in 7.1% of asymptomatic patients with type 2 diabetes mellitus and at least two identified cardiac risk factors. Further investigations are still required to determine whether the occurrence of OMS is related to atherosclerosis detected with MDCT.

SS 25 CV-02  16:10
Identification of coronary artery anatomy on dual-source cardiac CT before arterial switch operation in newborns and young infants: comparison with transthoracic echocardiography
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PURPOSE: To compare diagnostic accuracy between cardiac CT using a dual-source scanner and transthoracic echocardiography in identifying coronary artery anatomy before arterial switch operation in newborns and young infants.

MATERIALS AND METHODS: Between July 2011 and December 2016, 101 patients (median age, 4 days; range, 0 day-10 months; M:F = 78:23) underwent ECG-synchronized cardiac dual-source CT and transthoracic echocardiography before arterial switch operation. Coronary artery anatomy on cardiac CT and transthoracic echocardiography was evaluated and classified. With the surgical findings as the reference standard, the diagnostic accuracy for identifying coronary artery anatomy was compared between cardiac CT and transthoracic echocardiography.

RESULTS: The most common coronary artery pattern was the usual pattern (64.4%, 65/101), followed by a single coronary artery from the sinus 2 and a conal branch from the sinus 1 (7.9%, 8/101), the inverted pattern (5.9%, 6/101), the right coronary artery and left anterior descending artery from the sinus 1 and the left circumflex artery from the sinus 2 (5.9%, 6/101), and others. In 96 patients with surgically proven coronary
artery anatomy, the diagnostic accuracy of cardiac CT was significantly higher than that of transthoracic echocardiography (91.7%, 88/96 vs. 54.2%, 52/96; \( p < 0.0001 \)).

**CONCLUSION:** Cardiac CT may be used for identifying coronary artery anatomy before arterial switch operation with high diagnostic accuracy in newborns and young infants.

**SS 25 CV-03  16:20**

**Coronary to pulmonary artery fistula in the adult: natural history and management strategies**

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**PURPOSE:** To evaluate the natural history of coronary-to-pulmonary artery fistula (CPAF) detected on coronary CT angiography (CCTA) and to propose potential treatment strategies.

**MATERIALS AND METHODS:** The Institutional Review Board approved this retrospective study and informed consent was waived. 12,436 CCTA scans were performed in our institute between March 2009 and June 2016, and 74 patients were diagnosed as CPAF. Among them, patients with a follow-up of at least 2 years were retrospectively reviewed. Demographics, clinical history, prior cardiac testing, and reasons for CCTA were collected by a review of electronic medical records. The morphologic features of CPAF were analyzed, including vessel of origin site and number, size, and the presence of an aneurysmal sac. All patients were examined to what treatment they received after the diagnosis of CPAF. We investigated whether there were major adverse cardiac events (MACE), which was defined as the presence of death, myocardial infarction, and the need for revascularization or percutaneous intervention during the follow-up period.

**RESULTS:** 48 patients had a follow-up period of more than 2 years. The mean age of the study population was 62 years (range, 43-84; 39% male), and average follow-up period was 5.1 years. Common causes of CCTA were chest pain, palpitation, asymptomatic in order. Underlying diseases were hypertension, coronary artery disease, hyperlipidemia, and diabetes. The origin of CPAF was the left coronary artery in 22, the right coronary artery in one and both coronary arteries in 23 cases. More than half of the fistula sizes were less than 2 mm (26 cases, 62%). 12 cases were associated with an aneurysm (mean, 12 ± 7.5 mm). 4 cases underwent surgical ligation due to continued chest pain or having a larger aneurysm (range, 12-19 mm). After the operation, they were free of a symptom. Another 44 patients were observed with optical medical treatments (OMT) and their symptom was controlled well. All patients treated either surgery or OMT did not experience MACE during the follow-up period.

**CONCLUSION:** The natural course of CPAF detected by CCTA is usually benign. Optimal medical treatment is sufficient in most of the cases. Continued symptom and aneurysmal size are determinant for surgical ligation.

**CLINICAL RELEVANCE:** As a treatment strategy for CPAF, OMT and observation are first and in most cases that are enough.

**SS 25 CV-04  16:30**

**Head-to-head comparison between coronary CT angiography and optical coherence tomography for in-stent restenosis after drug-eluting stent implantation**

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**PURPOSE:** To evaluate characteristics of coronary computed tomography angiography (CCTA) findings of neointimal hyperplasia in patients diagnosed coronary stent failure and compare the quantitative measurements of CCTA with optical coherence tomography (OCT) defined in-stent neatherosclerosis in section-to-section-level.

**MATERIALS AND METHODS:** Total number of 370 CCTA and OCT cross-sections (18 coronary stent lesions in 18 consecutive patients who diagnosed stent failure from August 2008 to December 2013 and underwent both pre-procedural OCT and CCTA) were included. Stent area, lumen area, in-stent intimal hyperplasia (IH) area, IH% (IH area/lumen area), lipid quadrant, and presence of thin-cap fibroatheroma (TCFA), rupture and thrombus were evaluated using OCT. CT measurements (stent area, lumen area,
IH area and IH%) were compared with OCT-derived parameters. Lumen and IH attenuation were measured on CT. CT parameters were analyzed according to lipid quadrant (sections with ≤ 2 lipid quadrants [n = 146] vs. 3 or 4 quadrants [n = 117]) or presence of TCFA (n = 39).

**RESULTS:** Stent area (r = 0.66, p < 0.001) and lumen area (r = 0.43, p < 0.001) showed moderate correlation, however, IH area (r = 0.34, p < 0.001) and IH% (r = 0.19, p < 0.001) showed mild or weak correlation between CT and OCT. Sections with high lipid quadrant (3 or 4) showed low IH attenuation (395 Hounsfield unit [HU]) on CT compared to those with ≤ 2 lipid quadrant (p < 0.001). Neointimal rupture (n = 15) or thrombi (n = 17) were noted only in sections with high lipid quadrant (each, p < 0.001). In multivariable logistic analysis, high lipid quadrant was significantly associated with lumen attenuation (OR, 0.994; 95% CI 0.989-1.00; p = 0.04), IH% (OR, 1.046; 95% CI 1.004-1.090; p = 0.03) and IH attenuation (OR, 0.996; 95% CI 0.992-0.999; p = 0.01) measured on CT. Sections with TCFA presented larger IH area (3.7 mm$^2$) and smaller lumen area (1.8 mm$^2$) than those without TCFA (3.2 mm$^2$ and 2.1 mm$^2$). Presence of TCFA was associated with IH% (OR, 1.057; 95% CI 1.006-1.111; p = 0.03) on CT.

**CONCLUSION:** Stent area and lumen area were moderately correlated between CT and OCT. High lipid quadrant in OCT is associated with lumen attenuation, IH attenuation and IH% on CT. TFCA is associated with IH% measured on CT. Quantitative parameters for in-stent restenosis measured on CCTA may be helpful to assess the presence of high lipid quadrant or TCFA.

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**Who are the patients whose coronary artery calcification progresses rapidly? According to serial CT measurements of coronary artery calcium**

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**PURPOSE:** Coronary artery calcium (CAC) is an established surrogate marker for cardiovascular disease, but little is known about risk factors for the progression of calcium burden. This study assessed the pattern of CAC increment and risk factors for rapid CAC progression.

**MATERIALS AND METHODS:** 515 asymptomatic adults who underwent serial CAC at least 3 times from 2004 to 2016 were included. The patients were categorized into three groups: zero CAC on all serial scans (group 1), eventual CAC formation with initial zero CAC (group 2), and increasing CAC with initial presence of CAC (group 3). Group 3 was subdivided into four groups according to the degree of slope and pattern (linear or exponential slope) of the CAC increment (Fig. 1). Variable risk factors and blood chemistry were analyzed for each group.

**RESULTS:** Group 1 (n = 310, 60.2%), group 2 (n = 59, 11.5%) and group 3 (n = 146, 28.3%) were followed up for the mean period of 2760 days. Age, prevalence of male, hypertension, hyperlipidemia, diabetes medication, family history of ischemic heart disease, smoker, systolic and diastolic blood pressure, glucose and triglyceride were higher in the group 3 compared to the group 1 (all ps < 0.05). There was no significant difference in any of the risk factor in between the groups with linear (n = 63, 43.6%) and exponential slope (n = 83, 56.8%). However, there were some risk factors that differed in between the high and low grade slopes, for both linear and exponential groups. In the linear slope group, prevalence of previous ischemic heart disease, hyperlipidemia, triglyceride, glucose and HbA1c were higher in the group 3 compared to the group 1 (all ps < 0.05). There was no significant difference in any of the risk factor in between the groups with linear (n = 63, 43.6%) and exponential slope (n = 83, 56.8%). However, there were some risk factors that differed in between the high and low grade slopes, for both linear and exponential groups. In the linear slope group, prevalence of previous ischemic heart disease, hyperlipidemia, triglyceride, glucose, and HbA1c were higher in the group with high grade slope compared to the group with low grade slope (all ps < 0.05). On the other hand, in the exponential slope group, initial CACS was higher for the group with high grade slope compared to the group with low grade slope (p = 0.03).

**CONCLUSION:** Patients showed varying CAC progression with differing slope pattern and degree. Although there was no significant relationship of risk factors to the slope pattern (linear vs. exponential), some risk factors and initial CACS were related to the higher degree of slope of CAC progression.
Asian consortium on radiation dose of pediatric cardiac CT (ASCI-REDCARD)

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PURPOSE: To evaluate current radiation dose levels and influencing factors in cardiac CT in children with congenital heart disease in Asia by conducting a retrospective multi-center, multi-vendor study.

MATERIALS AND METHODS: We included 1043 pediatric cardiac CT examinations performed in 8 centers between January 2014 and December 2014 to evaluate congenital heart disease. In five weight groups, we calculated radiation dose metrics including volume CT dose index, size-specific dose estimate, dose-length product and effective dose. Age at CT exam, gender, tube voltage, scan mode and cardiac function assessment significantly influenced CT radiation dose.

CONCLUSION: This multi-center, multi-vendor study demonstrated variations in radiation dose metrics of pediatric cardiac CT reflecting current practice in Asia. Gender, tube voltage, scan mode and cardiac function assessment should be considered as essential radiation dose-influencing factors in developing optimal pediatric cardiac CT protocols.
mortality (p < 0.05), and subsolid lesion characteristics had decreased hazard ratio (HR 0.279, 95% CI 0.125-0.624). Smoking history (≥ 30 pack-years), presence of symptom, high calcium score, and presence of obstructive CAD did not increase hazard ratio for mortality.

CONCLUSION: Among patients with the lung cancer detected on CAC scoring CT, concerns for detection and interpretation errors may prevent delayed diagnosis. Older age and larger lesion size may have poor survival, in contrast, subsolid lesion characteristics may have better survival.

SS 25 CV-08 17:10
Evaluation of left ventricular myocardial extracellular volume fraction by cardiac MR imaging in patients with atrial fibrillation
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PURPOSE: To evaluate left ventricular myocardial extracellular volume fraction (LV-ECV) by using cardiac magnetic resonance (CMR) imaging in patients with atrial fibrillation (AF).

MATERIALS AND METHODS: 137 patients with AF (mean age, 55.4 ± 10.6 years; 108 men) underwent CMR imaging on a magnetic resonance scanner (Magnetom Skyra, Siemens Healthineers). The LV-ECV (in %) was calculated from mid ventricular myocardial and blood T1 relaxation times (in ms) on CMR image. Maximum and minimum left atrial volumes (LAVs) were also evaluated by CMR imaging. Depending on the chronicity of AF, all patients were divided into two groups: 1) paroxysmal AF (PAF) and 2) persistent AF (PeAF).

RESULTS: Of all 137 patients, 107 (78.1%) and 30 (21.9%) were assigned into the PAF and PeAF, respectively. Native myocardial T1 relaxation time was significantly greater in the PeAF than in the PAF (1415 ± 109 ms vs. 1256 ± 58 ms, p < 0.001). LV-ECV was significantly greater in the PeAF than in the PAF (29.5 ± 3.4% vs. 24.9 ± 3.7%, p < 0.001). Furthermore, LV-ECV showed a significant positive relationship with minimum LAV (R = 0.40, p < 0.001) and maximum LAV (R = 0.32, p < 0.001), respectively. In multivariate analysis, the odds ratio of high LV-ECV (> 30%) was independently associated (95% CI = 2.75-48.3, p = 0.001) with the presence of PeAF.

CONCLUSION: High LV-ECV determined with CMR imaging may be associated with the increase of LAV, and act as an independent risk factor of PeAF.

SS 25 CV-09 17:20
Arrhythmogenic right ventricular dysplasia/ cardiomyopathy (ARVD/C) in the south Asian population - prevalence of biventricular involvement
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PURPOSE: Biventricular involvement in arrhythmogenic right ventricular dysplasia/ cardiomyopathy (ARVD/C) indicates a more advanced disease state and worse prognosis. The prevalence of biventricular involvement varies as much as 16% (USA) to > 80% (UK), however, biventricular involvement in a south Asian population is unknown. The objective of our study was to define the cardiac MRI (CMR) characteristics of ARVD/C in an ethnically diverse group of Indians.

MATERIALS AND METHODS: We performed a retrospective study at two centers of all subjects referred for contrast enhanced CMR for suspected ARVD/C from September 2014 to March 2017. Subjects were scanned on a 1.5T MRI, 48 channel Aera and 32 channel Avanto, Siemens, Erhlangen. Analysis was performed on an MRI workstation with cardiac analysis software. The diagnosis of ARVD/C was made according to modified Task Force Criteria (TFC - 2010). Left ventricular (LV) involvement was defined as the presence of non ischemic distribution of late gadolinium enhancement (LGE) in the patients who met TFC 2010 for ARVD. Wall motion was assessed in all patients.

RESULTS: CMR was performed on 47 patients for suspected ARVD/C. Of these 16 (34%) were diagnosed with ARVD/C and had a mean age of 40.3 years ± 11; 94% were males. Out of a total 16 clinically diagnosed cases of ARVD, 1 study was of poor diagnostic quality and was excluded. 15 patients who did not meet any TFC-2010 for ARVD and had diagnostic quality CMR were considered as controls. In the ARVD/C group, the mean RV end diastolic index was 135.4 ± 35.1 ml/m² (control: 54.6 ± 8 ml/m², p < 0.001) and the mean RV EF was 20.8 ± 10.2% (control: 51.3 ± 7%, p < 0.001). LV involvement was noted in 9/15 (60%) patients with ARVD. LGE was noted involving the interventricular septum in 2/9 (22.2%) and diffuse patchy involvement in 7/9 (77.7%). Mean LVEF was 45.3 ± 8.6% (61.1 ± 3%, p < 0.001). 1/9 (11%) patients with ARVD with positive LGE had borderline normal LVEF. Additional MRI findings were dyskinetic right ventricular aneurysms in 7/15 (46.7%) and prominent RV trabeculations in 8/15 (53.3%).

CONCLUSION: Biventricular involvement is common in the Indian population with ARVD/C, occurring in
60%. LV involvement results in moderate dysfunction in the majority of patients. This is the first study to describe CMR imaging findings in ARVD/C in the Indian population.

**SS 25 CV-10  17:30**

Three-dimensional hemodynamic evaluation of patients with Fontan circulation: 2D PC MRI to 4D flow MRI

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**PURPOSE:** To investigate the reproducibility of hemodynamic information obtained with 4D flow MRI by comparing it with 2D PC through-plane velocity mapping results. In addition, hemodynamic features only accessible by 4D flow MRI are newly suggested.

**MATERIALS AND METHODS:** A total of 7 patients (age, 3.7±0.48, 2 female) who underwent 2D PC MRI and 4D flow MRI at the Fontan circulation were collected. All measurements were performed using 1.5-T (Achieva, Philips) and 3-T MRI scanner (Ingenia, Philips). 2D PC MRI was taken at the ascending aorta (AAO), descending aorta (DAO), superior vena cava (SVC), left pulmonary artery (LPA), right pulmonary artery (RPA) and conduit (CON). Velocity encoding (VENC) value was ranged from 80-150, according to the flow condition. 4D flow MRI was taken at a fixed VENC of 80 around the Fontan circulation, covering SVC, LPA, RPA and CON. Image resolution for 2D PC MRI was 1.4 by 1.4 mm with 22 phase, while isovoxel of 2 mm with 24 phase was used in 4D flow MRI.

**RESULTS:** A through plane 2D PC image of SVC, CON, LPA and RPA shows good correlation in the shape and area with the phase contrast image reconstructed by 4D flow MRI at the same location of each vessels (Fig. 1). A net flow rate according to the phase of each vessel was compared for quantitative comparison of 2D and 4D MRI (Fig. 2). Here, difference in patients was displaced as a standard deviation. Difference in mean peak flow rate as well as phase averaged flow rate obtained by 2D and 4D MRI were not statistically significant (p = 0.87 and 0.341 for peak and averaged flow rate, respectively). Time dependent particle tracking results from 4D flow MRI suggests new insight in classifying the Fontan circulation. Blood flow supplied from SVC and CON can equally divided into LPA and RPA (Fig. 3A), while in some cases, blood flow is significantly imbalanced (Fig. 3B).

**CONCLUSION:** Volumetric flow analysis in Fontan circulation using 4D flow MRI is comparable with the results from 2D PC MRI. One advantage of 4D flow MRI is an arbitrary segmentation after examination, which will minimize examination error caused by an abnormal vessel geometry. In addition, temporal variation of 3D velocity information obtained from 4D flow MRI can suggest new hemodynamic features in Fontan circulation such as flow imbalance. More number of patients are required for further validation.
SS 25 CV-11 17:40
Additional value of airway CT in obstructive sleep apnea: quantitative analysis of carotid arterial calcification for predictor of cardiovascular disease
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PURPOSE: Many studies have demonstrated that the patient with OSA showed relatively high prevalence of atherosclerotic neurovascular and cardiovascular disease. The purpose of our study is to evaluate the additional value of upper airway CT in patient with obstructive sleep apnea (OSA) for predictor of cardiovascular disease by quantitative analysis of carotid arterial calcification.

MATERIALS AND METHODS: This study included 180 consecutive patients aged 45-80 years who underwent polysomnography and upper airway CT between March 2014 and October 2016. The subjects were divided into three groups based on the results of respiratory disturbance index (RDI): mild (RDI < 15, n = 29), moderate (RDI 15-30, n = 50), and severe (RDI ≥ 30, n = 101). The carotid arterial calcifications on each upper airway CT were quantified using the modified Agatstone scoring method. The differences of clinical characteristics including age, sex, BMI, comorbid disease (hypertension, diabetes, smoking, dyslipidemia, etc.), SpO2, ESS, and carotid arterial calcium score between the 3 groups were analyzed.

RESULTS: The mean CarACS showed significant different between the 3 RDI group (p = 0.011, mild RDI: 4.3 ± 13.4, moderate RDI: 7.4 ± 28.8, severe RDI: 48.6 ± 121.6, respectively). Log-transformed CarACS showed significant positive correlation with RDI (r = 0.172 p = 0.021). Severe RDI group (RDI ≥ 30) showed larger number of subject with severe carotid arterial calcification than that of mild or moderate group.

CONCLUSION: Additional analysis of carotid arterial calcium scores on upper airway CT on OSA patients may be providing information of subclinical atherosclerosis as predictor of cardiovascular disease.

SS 25 CV-12 17:50
Spontaneous visceral artery dissection: clinical and radiologic characteristics, management strategies and patients’ outcome
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PURPOSE: To report CT findings of spontaneous visceral artery dissection (SVAD) with clinical circumstances. To evaluate treatment strategies correlated with patients' prognosis.

MATERIALS AND METHODS: For 4 years, 18 patients had been diagnosed as SVAD on enhanced abdominal CT scans. The clinical characteristics, comorbidities, risk factors and the treatment with prognosis were evaluated by data from the electronic medical records. Analysis of CT exams included location of SVAD, affected visceral organs, abnormalities of other abdominal arteries. If endovascular intervention was performed, angiographic findings were also reviewed.

RESULTS: Fifteen patients were men and average age was 49.9 years (range, 29-84). The location of SVAD was superior mesenteric artery (SMA) only in 9, celiac axis (CA) only in 5, both SMA and CA in 2, renal artery (RA) in 2 patients. In one patient, CA dissection developed 20 months after SMA dissection. Most common symptoms were acute abdominal pain in 10 patients, but all two patients with RA dissection complained acute flank pain with segmental infarct in corresponding renal parenchyma. There is no organic ischemia in SMA dissection and only one case of CA dissection resulted in segmental splenic infarct. Only 7 patients had hypertension, no patients had coronary arterial diseases while metabolic diseases were more common: diabetes mellitus (DM) in 5, impaired glucose tolerance (IGT) in 7, dyslipidemia in 8 patients. Smokers were 6 patients and CT findings of atherosclerosis were found in 3 patients. No patients underwent for surgical procedures and 4 patients underwent endovascular procedures, one stenting and 3 angioplasty. The others were managed by medical treatment.

CONCLUSION: Clinical manifestation of SVAD is very similar to other conditions of acute abdomen. Most affected persons are late thirties to early fifties males. SMA is most common site of SVAD. The major risk factors are metabolic disease such as DM, IGT and dyslipidemia, however smoking, hypertension or other cardiovascular diseases are not frequent in SVAD. Most SVAD do not result visceral ischemia and are treated by medical management. Although dissection in RA is rarer than in CA or SMA, renal infarct is serious problem and prompt management must be performed.
Factors affecting the difference in aortic valve area measured with cardiac CT and transthoracic echocardiography in patients with severe aortic stenosis

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The aortic valve area (AVA) measurement between cardiac computed tomography (CCT) and transthoracic echocardiography (TTE) can be different. The purpose of this study was to evaluate factors affecting the measurement of AVAs measured with CCT and TTE in patients with severe aortic stenosis. One hundred twenty-seven consecutive patients that underwent transcatheter aortic valve replacement (TAVR) were included. All patients had a pre-procedure TTE and CCT before TAVR. AVA was deduced from the continuity equation on TTE (AVATTE) and manual planimetry on CCT (AVACCT). Factors that related to difference between AVACCT and AVATTE were evaluated by linear regression analysis. AVACCT (0.92 ± 0.36 cm², p < 0.001) was significantly greater than AVATTE (0.69 ± 0.16 cm²). There was poor correlation between AVAs measured with CCT and TTE (r = 0.2, p = 0.03). There was significant difference between CCT (5.0 ± 0.92 cm², p < 0.001) and TTE (3.52 ± 0.77 cm²) measurements of left ventricular outflow tract (LVOT) area. Multiple linear regression showed that difference between AVACCT and AVATTE was significantly associated with log-transformed aortic valve calcium score (estimate -0.267, p = 0.00), LVOT area difference between CCT and TTE (estimate -0.082, p = 0.006), and age (estimate -0.006, p = 0.01). In case of LV ejection fraction < 50%, aortic valve calcium score ≥ 1.651, LVOT eccentricity ≥ 0.78, presence of atrial fibrillation, absence of significant calcification of aortic valve, or mean transaortic pressure gradient ≤ 40 mmHg, there was no significant correlation between AVACCT and AVATTE. Age, Agatston aortic valve score, and LVOT area difference between CCT and TTE might affect difference between AVACCT and AVATTE in patients with severe aortic stenosis.
New classification of coronary venous anatomy using coronary CT angiography for cardiac resynchronization therapy planning

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PURPOSE: Based on the venous anatomy analyzed using coronary CT angiography (CCTA), we propose a new coronary venous anatomy classification for the patients who have a plan to cardiac resynchronization therapy (CRT).

MATERIALS AND METHODS: 191 patients underwent 256 MDCT were retrospectively enrolled. CCTA protocol was used for CRT which has two phases scan (late arterial and venous phases) and split contrast agent injection technique. A volume rendering image and a curved multi-planar reconstruction image set by 3D reconstruction workstations were used for identifying and measuring coronary veins. Image quality is graded with 5-point-scale method (1; bad to 5; excellent) by two radiologists. For new simple venous anatomy classification for CRT (called as ‘LPM classification’), we categorized according to the presence of main 3 veins (left marginal vein [L, 1], posterior vein of left ventricle [P, 2] and middle cardiac vein [M, 3]) for CRT and order of their dominance (Table 1).

RESULTS: The venous anatomy can be evaluated from all patients using this protocol (135 excellent, 46 good and 8 fair). Depending on new “LPM Classification”, 142 out of 189 (74.3%) patients had all 3 main veins (termed as “LPM” group), 18 patients (9.4%) had P and M without L (termed as “PM” group), 23 patients (12.0%) were “LM” group, 2 patients (1%) were “LP” group. Only 6 out of 191 (3.1%) patients could not classified by this LPM classification. According to the second category of dominant vein order, LPM_3_1_2 (M > L > P) is highest frequency (29.8%), followed by LPM_3_2_1 (25.7%), LM_3_1 (11.5%) and LPM_3_1,2 (10.5%).

CONCLUSION: MDCT using two phase protocol can visualize the venous anatomy with good image quality. By using the new ‘LPM classification’, most venous anatomy were categorized.

Table 1. LPM classification

<table>
<thead>
<tr>
<th>According to presence of main 3 coronary veins</th>
<th>According to dominancy of coronary veins</th>
<th>Nomenclature</th>
<th>Prevalence (n=189)</th>
</tr>
</thead>
<tbody>
<tr>
<td>L = P = M</td>
<td>LPM-1,2,3</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>L&lt; P = M</td>
<td>LPM-2,3_1</td>
<td>8 (4.2%)</td>
<td></td>
</tr>
<tr>
<td>L&lt; P &lt; M</td>
<td>LPM-3_2_1</td>
<td>49 (25.7%)</td>
<td></td>
</tr>
<tr>
<td>L= P &lt; M</td>
<td>LPM-3_1,2</td>
<td>20 (10.5%)</td>
<td></td>
</tr>
<tr>
<td>P &lt; L &lt; M</td>
<td>LPM-3_1_2</td>
<td>57 (29.8%)</td>
<td></td>
</tr>
<tr>
<td>P &lt; L = M</td>
<td>LPM-1,3_2</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>L&lt; M &lt; P</td>
<td>LPM-2_3_1</td>
<td>6 (3.1%)</td>
<td></td>
</tr>
<tr>
<td>L = M &lt; P</td>
<td>LPM-2_1_3</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>P &lt; M &lt; L</td>
<td>LPM-1_3_2</td>
<td>2 (1.0%)</td>
<td></td>
</tr>
<tr>
<td>No left marginal vein,</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P = M</td>
<td>PM-2,3</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>P &gt; M</td>
<td>PM-2_3</td>
<td>1 (0.5%)</td>
<td></td>
</tr>
<tr>
<td>P &lt; M</td>
<td>PM-3_2</td>
<td>17 (8.9%)</td>
<td></td>
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<tr>
<td>No posterior vein of left ventricle</td>
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<td></td>
<td></td>
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<tr>
<td>L = M</td>
<td>LM-1,3</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>L &gt; M</td>
<td>LM-1_3</td>
<td>1 (0.5%)</td>
<td></td>
</tr>
<tr>
<td>L &lt; M</td>
<td>LM-3_1</td>
<td>22 (11.5%)</td>
<td></td>
</tr>
<tr>
<td>No middle cardiac vein</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>L = P</td>
<td>LP-1,2</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>L &gt; P</td>
<td>LP-1_2</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>L &lt; P</td>
<td>LP-2_1</td>
<td>2 (1.0%)</td>
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<tr>
<td>Non-classified</td>
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<td>6 (3.1%)</td>
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</tr>
</tbody>
</table>

Assessment of left ventricular function and volume by 3rd generation DSCT with patient specific radiation dose and advanced model based iterative reconstruction: a comparison with echocardiography

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PURPOSE: To compare 3rd generation dual source CT (DSCT, Somatom force, Siemens Medical Solution, Forchheim, Germany) using ECG-based maximum tube current modulation, patient specific kVp, mAs modulation and advanced modeled iterative reconstruction with echocardiography (ECHO) for the determination of left ventricular ejection fraction (LVEF), end-diastolic volume (EDV), end-systolic volume (ESV) as well as assessing coronary artery image quality and patient radiation dose.
**MATERIALS AND METHODS:** Thirty consecutive patients (M:F = 18:12; mean age, 58.3 ± 8.4 years) with chest pain were enrolled in this study. EF, EDV and ESV were measured by both DSCT and ECHO, and the correlation coefficients were assessed. In addition, subjective image quality of coronary artery segment (1, excellent; 4, poor) and radiation dose were recorded.

**RESULTS:** Comparison of LVEF, EDV, and ESV between DSCT and ECHO showed a significant correlation (p < 0.01) and the LVEFs measured by DSCT and ECHO were not statistically different. However, LV, EDV and ESV from DSCT were statistically higher than those from ECHO (p < 0.05). The average subjective image quality score of the coronary artery segment was 1.10 and the mean patient radiation dose was 2.36 ± 0.4 mSv.

**CONCLUSION:** DSCT with patient specific radiation dose and advanced model based iterative reconstruction offers comparable results to ECHO for LVEF and LVV with a low radiation dose.

**SS 27 CV-05 10:30**

Semiautomatic three-dimensional CT ventricular volumetry in patients with congenital heart disease: agreement between two methods with different user interaction

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**PURPOSE:** To assess agreement between two semi-automatic, three-dimensional (3D) computed tomography (CT) ventricular volumetry methods with different user interactions in patients with congenital heart disease.

**MATERIALS AND METHODS:** In 30 patients with congenital heart disease (median age, 8 years; range, 5 days-33 years; 20 men), dual-source, multi-section, electrocardiography-synchronized cardiac CT was obtained at the end-systolic (n = 22) and/or end-diastolic (n = 28) phase. Nineteen left ventricle end-systolic (LV ESV), 28 left ventricle end-diastolic (LV EDV), 22 right ventricle end-systolic (RV ESV), and 28 right ventricle end-diastolic volumes (RV EDV) were successfully calculated using two semi-automatic, 3D segmentation methods with different user interactions (high in method 1, low in method 2). The calculated ventricular volumes of the two methods were compared and correlated. A p value < 0.05 was considered statistically significant.

**RESULTS:** LV ESV (35.95 ± 23.49 ml), LV EDV (88.76 ± 61.83 ml), and RV ESV (46.87 ± 47.39 ml) measured by method 2 were slightly but significantly smaller than those measured by method 1 (41.25 ± 26.94 ml, 92.20 ± 62.69 ml, 53.61 ± 50.08 ml for LV ESV, LV EDV, and RV ESV, respectively; p ≤ 0.02). In contrast, no statistically significant difference in RV EDV (122.57 ± 88.57 ml in method 1, 123.83 ± 89.89 ml in method 2; p = 0.36) was found between the two methods. All ventricular volumes showed very high correlation (r = 0.978, 0.993, 0.985, 0.997 for LV ESV, LV EDV, RV ESV, and RV EDV, respectively; p < 0.001) between the two methods.

**CONCLUSION:** In patients with congenital heart disease, 3D CT ventricular volumetry shows good agreement and high correlation between the two methods, but method 2 tends to slightly underestimate LV ESV, LV EDV, and RV ESV.

**SS 27 CV-06 10:40**

Three-dimensional navigator-gated whole-heart MRI should not be used for ventricular volumetry using three-dimensional threshold-based segmentation in patients with congenital heart disease

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**PURPOSE:** To compare three-dimensional (3D) threshold-based segmentation using 3D whole-heart MRI with simplified contouring using short-axis cine MRI in quantifying ventricular volumes with great arterial flow volumes using phase contrast MRI as a reference.

**MATERIALS AND METHODS:** In 110 patients with congenital heart disease (median age, 18 years; age range, 4 months-35 years; M:F = 74:36), navigator-gated, 3D whole-heart MRI during end-systole (ES) and end-diastole (ED), short-axis cine MRI, and phase contrast MRI of the great arteries were acquired. Left ventricle (LV) and right ventricle (RV) ES and ED volumes were measured by using 3D threshold-based segmentation for 3D whole-heart MRI and by using simplified contouring for short-axis cine MRI. The trigger delays for both ES and ED phases were compared between the 2D short-axis cine imaging and the 3D whole-heart imaging. The stroke volumes calculated from the ventricular volumes were compared and correlated with the arterial flow volumes.

**RESULTS:** The ES and ED trigger delays of the 3D whole-heart imaging were significantly shorter than the 2D short-axis cine imaging for both the LV (270.2 ± 42.7 ms vs. 287.0 ± 38.3 ms; p < 0.001) and the RV (270.4 ± 42.2 ms vs. 287.0 ± 38.3 ms; 597.4 ± 88.9 ms vs. 692.7 ± 132.3 ms; p < 0.001). Aortic flow volumes were not significantly different (mean difference = 0.02 ml, p = 0.98) from LV stroke volumes by 3D threshold-based segmentation but significantly different (mean difference = -8.7 ml, p < 0.001) from those by simplified contouring.
Pulmonary arterial flow volumes were not significantly different (mean difference = 0.4 ml, p = 0.83) from RV stroke volumes by simplified contouring but significantly different (mean difference = 22.7 ml, p < 0.001) from those by 3D threshold-based segmentation. Higher correlations with arterial flow volumes were observed in simplified contouring than in 3D threshold-based segmentation for the LV (r = 0.90 vs. 0.85) and the RV (r = 0.90 vs. 0.77).

CONCLUSION: 3D navigator-gated whole-heart MRI should not be used for ventricular volumetry using 3D threshold-based segmentation in patients with congenital heart disease mainly due to incorrect timing of the ED phase, especially for the RV.

SS 27 CV-07 10:50
The feasibility of dual energy CT in cardiac contusion imaging
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PURPOSE: The purpose of this study was to evaluate the efficiency and feasibility of DECT used in the diagnosis of cardiac contusion with the mildest blunt cardiac injury (BCI)

MATERIALS AND METHODS: This study was performed between February 2014 -September 2015, a total of 17 consecutive patients (M:F = 10:7; median age, 51 years; range, 20-78 years) were enrolled in the study. DECT was performed within 48 hours of the trauma and a subsequent follow-up DECT was performed a little less than one year after the first examination. All examinations were analyzed on iodine map images by two experienced radiologists. Interobserver and intraobserver agreement was calculated. The correlation of initial troponin level, age and gender with number of contusion areas in the left ventricle and complete recovery of contusion were measured.

RESULTS: The contusion areas were amorphous, with considerable variation in their size, shape, and density. Contusions were primarily located in the left free wall of ventricle, the ventricular septum, and the apex, respectively. In 10 patients, contusion areas disappeared upon follow-up examination. In four patients, the contusion areas decreased but were still present in the follow-up examination. The interobserver agreements were almost perfect with respect to the presence of cardiac contusion, the anatomic location of contusions, and the contusion areas (kappa values of 1.0, 1.0, and 0.9 for intraobserver agreement and 1.0, 1.0 and 1.0 for intraobserver agreement, respectively). The correlation were found between age of patients and complete recovery of contusion (p = 0.01).

CONCLUSION: DECT can show cardiac contusion and could be useful and feasible for the diagnosis and follow-up of BCIs. DECT is a new, user-independent and valuable imaging technique.

SS 27 CV-08 11:00
Optimal monochromatic energy levels in spectral CT pulmonary angiogram for the detection: using detector based spectral CT
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PURPOSE: The aim of this study was to investigate the optimal monochromatic level, in spectral CT pulmonary angiography (sCTPA), for the detection of pulmonary thromboembolism, using detector-based spectral CT

MATERIALS AND METHODS: Eighty-two patients with pulmonary embolism were scanned with spectral CT mode in the arterial phase. Images of both conventional (120 kVp polychromatic) and multiple monochromatic energy level images (VME) from 40 KeV to 80 KeV at intervals of 10 KeV were generated using Spectral CT viewer in SpDS. Image noise, clot diameter and clot to artery contrast-to noise ratio (CNR) at selected monochromatic levels in sCTPA were measured and compared. Subjective image quality for these images were also assessed and compared. We analyzed data using paired t test and Wilcoxon rank sum test.

RESULTS: The lowest noise for the VME images were obtained at 40 keV. The CNR increased as energy
decreased. The diameter of clots correlated with the energy levels.

**CONCLUSION:** Virtual monochromatic images at 40 keV yielded the lowest image noise, high CNR and highest diagnostic confidence for the detection of pulmonary embolism.

**SS 27 CV-09 11:10**

**Evaluation of commissural malalignment of aortic-pulmonary sinus using cardiac CT for arterial switch operation: comparison with transthoracic echocardiography**

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ghw68@hanmail.net

**PURPOSE:** To compare diagnostic accuracy between cardiac CT and echocardiography for evaluating commissural malalignment of aortic-pulmonary sinus in children with complete transposition of the great arteries and to seek potential clinical implication of commissural malalignment on the arterial switch operation.

**MATERIALS AND METHODS:** In 37 patients (35 boys; median age, 8 days; range, 3-80 days) with complete transposition of the great arteries who had tricuspid semilunar valves and underwent an arterial switch operation, the degree of the commissural rotation of the aortic-pulmonary sinus was assessed on cardiac CT (n = 37) and echocardiography (n = 35). With surgical finding as a reference, cardiac CT was compared with echocardiography in identifying commissural malalignment in 35 patients. The influence of the height difference between the semilunar valves measured by cardiac CT on the identification of commissural malalignment with cardiac CT and echocardiography was evaluated. The impact of commissural malalignment on coronary transfer techniques was evaluated.

**RESULTS:** In operative findings, the commissures of the semilunar valves were aligned in 24 patients and malaligned in 13. With surgical findings as a reference, cardiac CT showed higher, but not statistically significant (p > 0.05), sensitivity (91.7% vs. 75.0%), specificity (87.0% vs. 78.3%) and accuracy (88.6% vs. 77.1%) for the diagnosis of the malalignment than echocardiography. The measured height difference between the semilunar valves did not affect the identification of the malalignment with cardiac CT and echocardiography. The surgical malalignment group showed a higher requirement of modified coronary transfer techniques than the surgical aligned group (11/13 vs. 11/24, p = 0.03).

**CONCLUSION:** Cardiac CT and echocardiography appear useful for evaluating commissural malalignment of the semilunar valves in patients with complete transposition of the great arteries frequently requiring modified coronary transfer techniques at during an arterial switch operation.