SE 03 CV-01
Possibility to diagnose unstable coronary plaques on coronary CT angiography
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**PURPOSE:** To evaluate signs of atherosclerotic unstable coronary plaques on coronary CT angiography.

**MATERIALS AND METHODS:** This single institute based retrospective study has enrolled 47 patients who had diagnosed with unstable coronary plaques, underwent coronary CT angiography (64 MD-CT) from 2016 to 2018. The results of the study were used to determine the average statistical significance and the indicator error, and the probability of the stable criteria.

**RESULTS:** To consider signs of unstable coronary plaques, coronary artery diameter dilatation is 16 (34.0% ± 6.9), low density part (< +30 HU) in the plaque is 14 (28.8% ± 6.7), punctate calcification in the plaque is 36 (74.5% ± 6.4), peripheral high attenuation up to +130 HU (napkin ring sign) is 9 (19.2% ± 5.8), irregular margin seems to ulcer of plaque is 18 (38.3% ± 7.1) and intimal dissection is 8 (17.0% ± 5.5) respectively. The most reliable finding, punctate calcification is identified 74.5% during the unstable coronary plaque, which shows statistical significance (p < 0.01).

**CONCLUSION:** In summary, we concluded that following signs including coronary artery diameter dilatation, low density part in the plaque, irregular margins or ulceration, napkin ring sign and intimal dissection were significant to diagnose unstable coronary plaque by coronary CT angiography.

SE 03 CV-02
On the results of the detection of aortic aneurysm though the use of CT aortography
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**PURPOSE:** The objective of the study aortic aneurysms age, sex and location with CT aortography.

**MATERIALS AND METHODS:** From 2014 to 2018 the research team conducted a study on 30 patients with aortic aneurysm from 187 patients by doing a CT aortography using a Philips Ingenuity 64 slice scanner at the CT cabinet Department of Radiology of the State 3rd Central Hospital. We determined the aortic aneurysm lie by De Bakey’s classification (type I: involves ascending and descending aorta, type II: involves ascending aorta only, type III: involves descending aorta only, commencing after the origin of the left subclavian artery) and also determined age and sex correlation of the patients.

**RESULTS:** In all 30 occur 21 (70.0% ± 2.7) was male, 9 (30.0% ± 2.7) was female, the ratio of male and female 2.3:1. Regarding age half of the participants were 31-40 age - 7 (23.3% ± 7.9), 41-50 age - 5 (16.7% ± 6.0), 51-60 age - 7 (23.3% ± 7.9), 61-70 age - 7 (16.7% ± 6.0), 71-80 age - 5 (16.7% ± 6.0), 81-90 age - 1 (3.3% ± 3.3). The average life expectancy was (65.5 ± 5.3). The classification of De Bakey of the patients I type - 5 (16.7% ± 6.0), II type - 23 (76.7% ± 7.9), III type - 2 (6.7% ± 3.0).

**CONCLUSION:** 1. The aortic aneurysm occur mostly in people of age 31-60, sex-relate for male and female 2:3:1.2. Most commonly located II type 76.7% of the De Bakey’s classification.

SE 03 CV-03
Correlation between the carotid arterial calcium score and silent cerebrovascular lesions on the obstructive sleep apnea patient: By using the upper airway CT and brain MRI
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**PURPOSE:** To investigate the relationships of carotid arterial calcium score on upper airway computed tomography (CT) and silent cerebrovascular disease (CVD) in patients with obstructive sleep apnea (OSA).

**MATERIALS AND METHODS:** This study retrospectively included 61 consecutive OSA patients who underwent both upper airway CT and brain magnetic resonance image (MRI). The carotid arterial calcium score (CarACS) on each upper airway CT were quantified using the modified Agatstone scoring method. The severity of OSA was divided into four groups (normal, mild, moderate and severe) using the respiratory disturbance index (RDI) as the results of polysomnography (PSG). The silent cerebrovascular lesion was evaluated by T2-weighted and fluid-attenuated inversion recovery (FLAIR) images on brain MRI using the grading of periventricular hyperintensity (PVH): PVH grade 0 to 4. Various clinical characteristics including age, gender, body mass index, comorbid disease (e.g., hypertension, diabetes mellitus, and smoking), blood pressure, and total cholesterol were analyzed in each patient; we also investigated the
history of cerebral infarction.

RESULTS: Among the 61 patients, 12 patients (19%) had a history of cerebral infarction and 5 patients (8%) showed cardiovascular disease. The numbers of patient of each PVH grade were as followed: 26 patients (42%) for PVH 0; 14 patients (23%) for PVH 1; 15 patients (25%) for PVH 2; 4 patients (7%) for PVH 3; and 2 patients (3%) for PVH 4, respectively. The carotid arterial calcification (CarAC) was found in 14 patients (23%), and mean carotid arterial calcium score (CarACS) was 45.74±112.3. In univariate analysis, the presence of CarAC (standardized coefficient [β] = 0.483, p < 0.001), CarACS (β = 0.482, p < 0.001), and the age (β = 0.36, p = 0.010) showed significant association with PVH grade. The apnea index (β = 0.267, p = 0.070) and lowest oxygen saturation (%; β = -0.219, p = 0.139) showed week association with PVH grade. The severity of OSA (RDI index) was not showed any association with PVH grade. In multivariate analysis, the CarACS (β = 0.399, p = 0.008) was the only affecting factor for PVH grade.

CONCLUSION: The severity of silent cerebrovascular lesion was associated with CarACS and age, whereas the severity of OSA did not contribute. Therefore, additional analysis of CarACS on OSA patients may provide more information for cerebrovascular status.

SE 03 CV-04
Morphological evaluation of the thoracic aorta and major branches in Turner syndrome on chest CT: Compared with normal control group
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PURPOSE: To evaluate the morphology and vascular anomalies of thoracic aorta and aortic arch branches using contrast enhanced chest computed tomography (CT) in patients with Turner syndrome (TS) compared with normal control group. MATERIALS AND METHODS: A total number of 23 consecutive TS patients (15.17 ± 6.41 years) who underwent contrast enhanced chest CT from May 2012 to March 2018 for clinical evaluation were retrospectively enrolled. Twenty-four females (15.30 ± 4.35 years) who underwent contrast enhanced chest CT with various clinical needs were retrospectively enrolled as control group. We measured the length of aortic arch using the curved multiplanar reconstruction (MPR) method with each CT images; the aortic arch was divided by the left common carotid artery (LCCA) into “proximal (proA)” and “distal arch (disA)”. We also measured each average cross sectional areas (cm²) and average diameters (cm) of major three branch vessels (right brachiocephalic artery [RBCA], LCCA and left subclavian artery [LSCA]), on en face images of MPR. We compared the lengths of proA, disA, the ratio of proA to disA (proA/disA), and the size of three vessels, between TS patients and normal control group. The other vascular anomalies including elongation of transverse aortic arch (ETA), coarctation of aorta (CoA), and aberrant or anomalous origin of subclavian or vertebral arteries were also recorded.

RESULTS: There was no statistically significant difference between TS group and control group in age and weight, however with TS group showed lower height (p < 0.001) and higher BMI (p = 0.015) than control group. The lengths of aortic arch (both proA and disA) and proA/disA were statistically significant higher in TS patients than control group (p < 0.05). The cross sectional areas of RBCA and LSCA were significantly larger in TS patients (p < 0.05), however that of LCCA was not different between two groups. Among all subjects enrolled in this study, several vascular anomalies were noted: ETA (n = 21), anomalous origin of left vertebral artery (n = 8), bovine arch (n = 4), CoA (n = 2), aberrant RSCA (n = 1). The ETA, CoA and aberrant RSCA were only seen in TS patients.

CONCLUSION: The TS patients showed relatively longer aortic arch, especially distal arch, and larger size of major branching vessels (RBCA, LSCA), except LCCA, than control group. Various vascular anomalies could found on TS patient, and the ETA was characteristic finding of TS with 52% incidence.

SE 03 CV-05
CT angiographic evaluation of congenital anastomoses between femoropopliteal vein and deep femoral vein: Types and Incidence
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PURPOSES: To evaluate congenital anastomotic channels between femoropopliteal vein and deep femoral vein by using CT venography. MATERIALS AND METHODS: We retrospectively evaluated CT venography of 488 limbs in 244 patients. The presence or absence of anastomotic channels (larger than 3-mm in a diameter) connecting femoropopliteal vein to deep femoral vein was determined and the observed channels were classified according to their location and courses.

RESULTS: There were two types of anastomotic channels in 32 patients (13%), they were persistent sciatic veins in 24 limbs of 15 patients (6%) and
The persistent sciatic veins anastomosed with the popliteal vein in popliteal fossa and coursed posterior to the adductor magnus muscle. The retrofemoral channels anastomosed with femoral vein at the level of adductor hiatus and located posterior to the femoral shaft. The size of persistent sciatic veins was similar to or larger than femoropopliteal veins in 50% (12/24 limbs) and retrofemoral channels in 22% (4/22 limbs).

CONCLUSION: The anastomotic channels connecting femoropopliteal vein to deep femoral vein was not rare variation and they may have an important role in collateral venous drainage of lower extremity.

SE 03 CV-06
Correlation of aortic arch calcification grading on chest radiograph and severity of coronary artery disease on conventional coronary angiography among patients with acute coronary syndrome
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BACKGROUND: The most frequent underlying cause of coronary artery disease is atherosclerosis. Aortic calcification (AC) is a marker of atherosclerotic disease. A number of studies have demonstrated an association between coronary and aortic atherosclerosis. Aortic arch calcification (AAC) grading may provide supportive information for atherosclerotic risk stratification.

OBJECTIVE: To determine the correlation between AAC grade on chest radiograph and severity of coronary artery disease (CAD) on coronary angiogram among patients with acute coronary syndrome (ACS).

Design: Cross-sectional retrospective study.
Population: A total of 169 patients were included in the study. The patients underwent chest radiography and coronary angiogram at Chong Hua Hospital.
Methodology: Chest radiograph AAC grading was done on patients with ACS, who underwent coronary angiogram. The age, sex and cardiovascular risk factors were also noted.

Statistical Analysis: ANOVA and Chi-square test.

RESULTS: A total of 45 (26.6%) patients had 1-vessel disease, 51 (30.2%) with 2-vessel disease and 73 (43.2%) with 3-vessel disease. Ages of patients ranged from 20 to 84 years with a mean age of 60.67 years. There was a significant difference on the age of subjects according to CAD (p < 0.001). The higher the age, the higher the number of vessels with disease. Higher proportion of patients with higher number of vessels affected were found among those with DM (p = 0.03). Significantly higher proportion of patients with higher AAC grade had higher number of stenotic vessels (p = 0.007).

CONCLUSION: AAC grading on chest radiograph is correlated with the severity of CAD in patients with ACS. The higher the AAC grade, the more severe the ACS is.

SE 03 CV-07
Cardiac conduction devices in imaging: Simple but easily overlooked
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1. Types of CCD
   - Clinical indication, component of CCD, and ideal location of each type
     1) Temporary pacemaker (PM)
     2) Permanent PM
     - Single/dual chamber PM
     - Cardiac resynchronization therapy (CRT) device
     - Epicardial PM
     3) Implantable cardioverter defibrillator (ICD)
     4) Implantable cardiac monitor

2. Complications associated with CCD
   1) Cardiac rupture
   2) Disruption of lead integrity: fracture, kinking, pinching
   3) Superior vena cava (SVC) syndrome
   4) Lead dislodgement
   5) Pneumothorax

3. Check list for interpretation

4. Diagnostic pitfalls

Fig. 1. Left ventricular (LV) rupture by temporary PM lead.
Fig. 2. Right ventricular (RV) rupture by permanent PM lead.

Fig. 3. Lead crowding and SVC thrombosis inducing SVC syndrome.

Fig. 4. Too large heart chamber to diagnose exact location of the lead.

Fig. 5. Metal artifacts obscuring early finding of RV perforation.

SE 03 CV-08
Impact of epicardial adipose tissue in patients with acute coronary syndrome
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BACKGROUND: Epicardial adipose tissue has recently emerged as a new risk factor and active player in metabolic and cardiovascular diseases. Growing evidence suggests that epicardial adipose tissue (EAT) may contribute to the development of coronary artery disease (CAD). There is no any study to demonstrate the correlation between epicardial adipose tissue thickness and acute coronary syndrome in Mongolia.

PURPOSE: To investigate relation its impact of epicardial adipose tissue in acute coronary syndrome patients with the use transthoracic echocardiography in Mongolia.

MATERIALS AND METHODS: A total of 160 consecutive individuals (age, 55 ± 8.8 years; M:F = 135:25) who underwent coronary angiography and transthoracic echocardiography, including 80 CAD patients and 80 subjects without CAD, were enrolled in this study. EAT thickness was measured on the free wall of the right ventricle at the end of systole from parasternal long and short-axis views of three cardiac cycles. Coronary angiograms were analyzed for the presence, extend and severity of CAD. Subjects were divided into the CAD group and non-CAD group. All values were compared between groups.

RESULTS: The median EAT thickness was significantly increased in patients with CAD compared to this patients without CAD (5.46 ± 0.70 vs. 3.02 ± 0.68 mm, p = 0.001). Based on the angiographic findings, 47 (59%) patients had single-vessel disease and 33 (41%)
patients had multivessel disease. Multivariate logistic regression analysis demonstrated that EAT thickness was independently predictor in patients with CAD (p < 0.003). Predictors excluded were low density lipoprotein, cholesterol and fasting blood glucose.

CONCLUSION: Epicardial adipose tissue is independent predictor of patients with CAD. EAT thickness is associated with coronary artery disease.

SE 03 CV-09
CT and MR imaging of cardiac masses and pseudomasses: A case-based review
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Cardiac masses can have potentially devastating consequences for the patient if not diagnosed and treated appropriately. It is therefore important to be able to identify their imaging characteristics on both CT and MR imaging and differentiate cardiac tumors from tumor mimics.

OUTLINE:
- Intracavitary masses (myxomas, thrombi, and metastases)
- Valvular masses (papillary fibroelastomas and vegetations)
- Intramural masses, including malignant lesions (metastatic disease, primary cardiac sarcomas, and primary cardiac lymphomas) and benign lesions (lipomatous hypertrophy of the interatrial septum, lipomas, paragangliomas, rhabdomyomas, and fibromas)
- Epicardial/pericardial lesions (metastases, pericardial cysts, hemangiomas, and lymphangiomas)
- Tumor mimics and pseudomasses (hiatal hernias, the crista terminalis, and a prominent Chiari network)

Figs. 1-3. A hypointense intraluminal filling defect (red arrow) in the left ventricle seen on a cardiac MRI does not demonstrate enhancement (Fig. 2). An axial pre-contrast TruFISP image (Fig. 1) is included for comparison. Thinning (green arrows) and accentuated hypokinesis of the mid-to-distal anterior wall, apex, and inferior wall were also seen, compatible with prior MI and predisposition to forming a cardiac thrombus.

Fig. 4. Contrast-enhanced chest MRA demonstrates a left upper lobe pulmonary mass (red arrow) that infiltrated along the left hilum and through the left superior pulmonary vein (blue arrow), extending also into the left atrium (purple arrow). Pathology was consistent with metastatic renal cell carcinoma.

Figs. 5, 6. Contrast-enhanced cardiac CT demonstrates a pedunculated, supravalvular mass (blue arrow) originating from the posterior leaflet of the right coronary cusp via a thin stalk, compatible with a papillary fibroelastoma.

Figs. 7, 8. Cardiac MRI demonstrates a large left atrial multilobulated mass with heterogeneous enhancement on the early (Fig. 7) and late (Fig. 8) phases of contrast enhancement, consistent with undifferentiated pleomorphic sarcoma.
Figs. 9, 10. A PET/CT image demonstrates focally increased linear FDG uptake in the interatrial septum (blue arrow) correlating with an area of fat density on the CT images (red arrow). Findings are compatible with lipomatous hypertrophy of the interatrial septum.

SE 03 CV-10
Diagnostic key points of CT of double outlet of right ventricle guide to surgical scheme and timing
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PURPOSE: To investigate the effects of the diagnostic key points of CT of double outlet of right ventricle (DORV) for the choice of surgical scheme and timing.

MATERIALS AND METHODS: Surgical and imaging data of 21 DORV patients who were treated from January 2016 to April 2017 were retrospectively analyzed, including 14 boys and 7 girls, aged 11-day to 7-year old. All patients were confirmed by cardiac CT angiography (CTA) and echocardiography before surgery. The basis for diagnosing and typing DORV is as follows: 1. according to the relative ubiety of aorta-pulmonary arteries, it is divided into aortic-pulmonary arterial anteroposterior, aortic-pulmonary arterial lateral, aortic right oblique and aortic left oblique; 2. according to the relationship between the location of ventricular septal defect (VSD) and the aortic opening is divided into VSD subaortic (SubAO), subpulmonary artery (SubPA), under the doubly committed (DC) and non-committed aorta (NC); 3. according to the pulmonary artery (PA) development is divided into normal development of PA, pulmonary stenosis (PS), pulmonary trunk and left and right pulmonary arteries developed well, and poor development of left and right pulmonary arteries and pulmonary vascular bed; through the above three points for accurate diagnosis of DORV to select the best surgical plan and timing.

RESULTS: After classification of 21 patients with DORV, 10 cases were SubAO or DC, including 6 cases with PS and 4 cases with normal development of PA; 7 cases were SubPA, including 1 case with poor development of pulmonary vascular bed and 6 cases with normal development of PA; 4 cases were NC, including 3 cases with PS and 1 case with normal PA development. The choice of DORV surgical scheme is more accurate after classification. Among the 21 DORV patients, 11 cases without PS should complete the operation as soon as possible to avoid early pulmonary hypertension, for the other 10 patients with PS, the operation time can be appropriately delayed, and the palliative operation may be followed by radical surgery.

CONCLUSION: DORV is a complex cardiac malady with a high operative mortality rate. CTA can clearly show the connection of the great vessels of the heart and the location of the VSD, which is the most important factor in the choice of DORV surgical scheme, in addition, CTA can clearly show extracardiac vascular malformations, such as PA development, PS, etc., which is closely related to the timing of DORV surgery.

SE 03 CV-11
Valvular pathology on chest radiographs: With echocardiogram and cross-sectional imaging correlation
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The clinical presentations of cardiac valvular pathologies are usually nonspecific, and their cardiovascular- and pulmonary-related symptoms are often first imaged by chest radiographs. It is therefore crucial for the radiologist to be able to identify their radiographic manifestations in order to guide appropriate treatment and follow-up cardiac imaging of undiagnosed or newly diagnosed valvular disease.

OUTLINE: Review of normal cardiac valve anatomy on a chest radiograph. Case-based review of the clinical
and imaging manifestations of aortic valve (stenosis and regurgitation), mitral valve (prolapse, stenosis, regurgitation, and annular calcifications), pulmonic valve (stenosis and regurgitation), and tricuspid valve (regurgitation) pathologies, as well as endocarditis with septic pulmonary emboli.

Figs. 1, 2. Aortic stenosis. A chest radiograph (Fig. 1) demonstrates calcifications of the aortic valve, which are better demonstrated on a chest CTA (Fig. 2).

Figs. 3-5. Mitral regurgitation. A chest radiograph demonstrates asymmetric right upper lobe pulmonary edema (Fig. 3, red arrow), which resolved after initiation of diuretics. Lateral view demonstrates the “walking man sign” (Fig. 4) which results from an enlarged left atrium (orange line) causing posterior displacement of the left main bronchus (blue arrow), which no longer overlaps with the right bronchus (green arrow). An echocardiogram (Fig. 5) demonstrates the blue regurgitant jet.

Figs. 6, 7. Tricuspid regurgitation. A chest radiograph demonstrates prominent convexity of the right heart border (Fig. 6, blue line), corresponding to right atrial enlargement. A lateral view demonstrates obliteration of the retrosternal space (Fig. 7, blue arrow) due to enlargement of the right ventricle, which forms the anterior heart border.

Figs 8, 9. Pulmonary stenosis. A chest radiograph (Fig. 8) demonstrates a dilated pulmonary artery (blue arrow) as well as a rounded left heart border (red arrow) suggestive of accompanying right ventricular enlargement. An axial chest CT angiogram image (Fig. 9) demonstrates the markedly dilated main pulmonary artery (blue arrow).
Fig. 10. Septic pulmonary emboli. A chest CT image demonstrates the predominantly peripheral nodular pulmonary opacities (blue arrows), some also demonstrating cavitation (*), and small bilateral pleural effusions (orange arrows).

SE 03 CV-12
Clinical impact of collateral circulation in patients with median arcuate ligament syndrome
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PURPOSE: To analyze the computed tomographic (CT) findings and medical records in patients diagnosed with median arcuate ligament syndrome (MALS), and to evaluate the risk factors associated with vascular complications developed in patients with MALS.

MATERIALS AND METHODS: This retrospective study was approved by the Institutional Review Board, and the requirement to obtain informed consent was waived. A total of 37 consecutive patients were diagnosed with MALS by both axial and sagittal CT reconstruction imaging in our single institution during 7 years. The dynamic contrast-enhanced CT, medical records, and angiography were reviewed.

RESULTS: Thirty two patients (86.5%) were asymptomatic and incidentally diagnosed with MALS at CT. Seventeen patients (45.9%) had significant arterial collateral circulations and 10 patients (27.0%) were found to have splanchnic artery aneurysms including one patient (2.7%) with acute bleeding secondary to aneurysm rupture. Peripancreatic vascular network including pancreaticoduodenal arcades and dorsal pancreatic artery was the most common site for development of both collateral circulations (15/21, 71.4%) and aneurysms (10/17, 58.8%). Splanchnic artery aneurysms were significantly more common in patients with collateral circulations (8/17, 47.1%) compared with those without collateral circulations (2/20, 10%) (p = 0.02).

CONCLUSION: Splanchnic artery aneurysms are not uncommon in asymptomatic patients with collateral circulation caused by significant celiac axis stenosis or obstruction due to MAL. Therefore, regular follow-up should be recommended for patients with peripancreatic collateral circulations associated with MALS regardless of symptoms and prophylactic endovascular treatment should be specifically performed in patients with pancreaticoduodenal arcade aneurysm to prevent life-threatening aneurysm rupture.

SE 03 CV-13
Clinical and imaging findings of vascular compression syndromes
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Vascular compression syndromes (VCS) are caused by the entrapment of vessels between rigid or semi-rigid surfaces in a confined anatomic space. VCS is a wide disease spectrum with various symptoms, signs, and clinical significance according to the location and underlying anatomical variations. Although in some cases, affected lesions without any specific symptoms can be found incidentally on the radiologic study, they may cause hemodynamically significant disease, including arterial ischemia and embolism, venous stasis and thrombosis, and hematuria. Therefore, we have to understand the possible location of vascular compression syndrome and underlying patients' anatomic variations. Also, it would be more helpful in the further management of VCS.

In this pictorial review, we will discuss the clinical and diagnostic features and pathophysiology of specific VCS from all over the human body via a case based approach. The characteristic imaging findings of each cases will be described in detail.
SE 03 CV-14

Metabolic imaging for heart with cardiac MRI
Hyo Lim Kim

Ischemic heart disease and heart failure are the most common symptoms of heart disease. Magnetic resonance spectroscopy (MRS) is a non-invasive diagnostic tool for biochemically characterizing the normal and abnormal tissues in the heart, which has advantages over other diagnostic methods in the quantification of myocardial metabolism without the use of contrast agents or invasive radiation. 1H MRS and 31P MRS are mainly used in both clinical and preclinical researches by monitoring the metabolic changes of myocardium, providing valuable information on the metabolite-based diagnostic and therapeutic outcomes. In this review, we discussed the potential diagnostic biomarkers for the ischemic heart disease and heart failure in multinuclear MRS and metabolic imaging. In addition, we briefly reviewed the future directions of the MRS, including hyperpolarized 13C MRS and high field strength MRS techniques, which are applicable to early diagnosis and prediction of therapeutic response in heart diseases.

SE 03 CV-15

Comparison of coronary CT angiography image quality with high- and low-concentration contrast agents (CONCENTRATE): A randomized controlled trial
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PURPOSE: To confirm that there is no difference in image quality with multicenter trial, when comparing CT images taken with low tube voltage to CT images taken using conventional high tube voltage, assuming that BMI-based tube potential selection and iterative image reconstruction were used.

MATERIALS AND METHODS: The CONCENTRATE study was a prospective, multicenter, noninferiority, randomized trial. Eight clinical sites in South Korea participated in this study. A total of 312 patients were enrolled in 8 clinical sites. All patients randomly assigned 1:1:1 for each contrast medium of 270, 320, and 370 mg/ml and were taken coronary CT angiography. If patients received low-concentration contrast agent, CT scans were taken with lower kVp. We measured the Hounsfield unit of each segments of coronary arteries. The signal-to-noise ratio (SNR) and the contrast-to-noise ratio (CNR) were measured using the each HU and noise.

RESULTS: The mean HUs of the three groups showed significant differences. The mean HU of the 320 mg/ml group was the highest with 539.06 ± 179.40 and the mean HU of the 370 mg/ml group was the lowest with 459.60 ± 132.35. Noise was significantly higher in the low-concentration contrast group. SNR and CNR were significantly lower in the low-concentration contrast group, but there was no significant difference in the quality of the image among the three groups. The DLP of the 370 mg/ml group was significantly higher than that of the low-concentration contrast agents group.

CONCLUSION: Even with the low-concentration contrast, the quality of the image for reading is not reduced through low kVp and iterative reconstruction. Rather, it has the advantage of a low radiation dose.

SE 03 CV-16

Pictorial essay of left atrial appendage occlusion in Chinese population: Role of CT imaging in pre-operative planning and post-operative application
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PURPOSE: Left atrial appendage occlusion (LAAO) is an increasing performed procedure for patients with non-valvular atrial fibrillation with high risk of stroke and those in whom oral anti-coagulant is considered unfavorable due to high bleeding risk. Contrast enhanced computed tomography (CT) and trans-esophageal echocardiography are currently the two main methods for pre-operative assessment mainly for sizing of the left atrial appendage.

MATERIALS AND METHODS: We aimed to review the CT assessment for left atrial appendage anatomy and its imaging method. Local cases (n = 83) from April 2017 to April 2018 who had CT assessment for LAAO were also reviewed. Patient’s demographic data, left atrial morphology and size (diameter, area and perimeter),
correlation with the final device size were reviewed. We also reviewed example of use of CT imaging in postoperative complication in particular peri-device leakage.

SE 03 CV-17
Role of imaging in patients with ventricular assist device
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PURPOSE: To understand function and mechanism of ventricular assist devices (VAD). To study the role of pre and post-operative imaging, techniques and limitations in patients with VAD. To demonstrate local and systemic complications associated with these devices.

MATERIALS AND METHODS: We retrospectively reviewed imaging of 30 VAD patients between October 2017 and March 2018. Preoperative imaging was done only in certain cases - to assess retrosternal structures (if previous cardiac surgery), to estimate distance of cardiac apex from thoracic cage, to ascertain cardiac morphology and to assess for peripheral vascular access. Satisfactory placement of VAD on postoperative imaging was noted in all except 2 cases, one of which showed positional dynamic inflow tract obstruction (Fig. 1), and another which showed outflow tract-aorta anastomotic stenosis (Fig. 2). 1 patient was successfully transplanted while another developed right heart failure and was upgraded to biventricular VAD. The most common complication was hemorrhage, partly explained by anticoagulation. Postoperative hemorrhage were seen in the mediastinum (3 cases), pleural (6 cases) and pericardial spaces (2 cases). Non-traumatic hemorrhages were noted in the lung parenchyma, chest wall and retroperitoneum (1 case each). Retroperitoneal hematoma after complicated vascular access for surgery was noted in 1 case. Evidence of thrombosis in the outflow tract was seen in 1 patient (intentionally performed). Evidence of thrombo-embolic brain insult was noted in 3 patients. Other systemic complications were cholecystitis and cecal volvulus (1 case each). Ultrasound played a very important role in excluding driveline infection. 2 cases of collection around the driveline were seen.

CONCLUSION: It is vital to carefully assess the inflow and outflow tracts for evidence of any obstruction in VAD patients. Preoperative imaging is helpful for surgical planning and to assess baseline brain changes as thromboembolic phenomena are common. Hemorrhagic events were noted to be more common than thrombotic events and both should be excluded.

Fig. 1. Diastolic (a) and systolic (b) phase contrast CT images demonstrate abnormal inferior orientation of the VAD inflow tract. An in-plane image obtained in systole (c) shows partial occlusion of lumen by inferior papillary muscle

Fig. 2. Contrast enhanced CT images in three planes show well opacified anastomosis of outflow tract and ascending aorta, with evidence of stenosis at this site.

SE 03 CV-18
Demonstration of functional classification of aortic regurgitation and aortic leaflet repair using CT
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Demonstration of the cause of aortic regurgitation and anatomic assessment of the aortic root, including the aortic cusps, are very important to determine the repairability and surgical techniques of the aortic valve.
Cardiovascular repair. Functional classification of aortic regurgitation has been described and utilized for echocardiographic and CT evaluation.

1. Functional classification of aortic regurgitation
   - Type Ia (Sinotubular junction [STJ] enlargement and dilatation of the ascending aorta)
   - Type Ib (Dilatation of the sinuses of Valsalva and the STJ)
   - Type Ic (Dilatation of the ventriculoaortic junction)
   - Type Id (Cusp perforation)
   - Type II (Leaflet prolapse as a result of excessive cusp tissue or commissural disruption)
   - Type III (Leaflet restriction, possibly due to bicuspid, degenerative, or rheumatic valvular disease)

2. Aortic valve replacement
   - Mechanical
   - Bioprosthetic/biological (bovine, xenograft, homograft, allograft)

3. Aortic valve repair
   - Type Ia (Reduction of the circumference of the STJ, replacing the ascending aorta)
   - Type Ib (Valve sparing operation: remodeling (Yacoub) and reimplantation (David operation)
   - Type Ic (Commissural annuloplasty or circular annuloplasty)
   - Type Id (Patch closure)
   - Type II (Leaflet plication or triangular resection)
   - Type III (Shaving, decalcification and valve extension)

SE 03 CV-19
CT pulmonary angiography correlation with echocardiography to predict RV dysfunction in cases of pulmonary embolism and compare high-pitched and ECG gated versus non-ECG gated scans for radiation dose
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PURPOSE: Prediction of RV dysfunction on CT pulmonary angiography in suspected cases of pulmonary embolism and correlation with echocardiography. To study the benefits of high pitched ECG gating over standard non-ECG gated CTPA for patient radiation dose and overall image quality

MATERIALS AND METHODS: High pitched and ECG gated CTPA in 20 patients of case group was compared to standard non-ECG gated CTPA 20 patients of control group in suspected cases of PE with 50 ml Iohexol IV contrast on 64 slice scanner. Echocardiography was performed according to guidelines of American Society of Echocardiography. CTPA and Echocardiography were correlated for the prediction of RV dysfunction. Patients were also followed up for 30-day mortality rate and necessity of intensive care treatment.

RESULTS: ROC curve calculation revealed cut off for RV dysfunction on CTPA as ≥1.01 for RV/LV and ≥ 1.83 for PA/AO ratio with sensitivity of 85.7% and 100% and specificity of 65% and 85.3% respectively compared to sensitivity and specificity of echocardiography. One month follow up was completed for all patients in which 7 patients died mostly related to PE. Statistically significant relationship was noted between the RV/LV ratio and PE-related mortality, with a p value < 0.0351. Radiation dose parameters of ECG gated CTPA lead to a significant decrease in radiation dose compared to non-ECG gated CTPA (2.65 ± 0.45 mSv and 3.19 ± 0.57 mSv, respectively) (p = 0.0016).

CONCLUSION: RV dysfunction can be assessed with CTPA by using specific assessment parameters compared to gold standard of echocardiography. High pitched and ECG gated CTPA is better compared to standard non-ECG gated CTPA in terms of patient related radiation dose with marked reduction in total millisieverts.

CLINICAL RELEVANCE/APPLICATION: RV dysfunction is necessary to predict intensive care requirement, need for diuretics and to predict the prognosis of patients in suspected cases of pulmonary embolism. Echocardiography is currently the modality of choice for diagnosis of RV dysfunction but cannot be used for detection of pulmonary thromboembolism for which CT Pulmonary Angiography is necessary. In this study we have concluded that RV dysfunction can also be diagnosed on CT which is beneficial for the management of the patient and saves the cost of echocardiography. Using high pitch technique and ECG gating in CTPA a reduction in patient radiation dose of up to 0.5 Msv can be achieved which is compared to approximately 27 chest radiographs.

SE 03 CV-20
The feasibility of coronary calcium scoring on the non-enhanced chest CT with 16 cm axial volume scan technique: A prospective pilot study
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PURPOSE: To evaluate the feasibility of coronary artery calcium score (CACS) on the non-enhanced chest CT using 16cm axial volume scan technique

MATERIALS AND METHODS: Twenty subjects (M:F = 13:7; mean age, 67.7 ± 9.4 years) that clinically required non-chest CT scans were prospectively enrolled. All
CT scans were performed on a 256-slice CT scanner (Revolution, GE Healthcare, Waukesha, Wisconsin, USA). Non-enhanced chest CT scans were done with 16 cm-coverage axial volume scan technique and the following parameters: 120 kVp, noise index = 20, tube rotation time = 0.28 sec, and slice thickness = 0.625 mm, 1.25 mm, 2.5 mm. Then ECG-triggered cardiac calcium scoring CT was performed with 16 cm axial volume scan and the following parameters; 120 kVp, noise index = 20, tube rotation time = 0.28 sec, slice thickness = 2.5 mm. The CACS was calculated by conventional Agatston method using commercially available software (Aquarius iNtuition™ Ver.4.4.6; TeraRecon, Foster City, CA, USA). CACs calculated from the non-enhanced chest CT with various slice thicknesses were compared with those of the coronary calcium scoring CT. A p-value < 0.05 was considered statistically significant.

RESULTS: The mean heart rate of 20 subjects was 75.6 ± 13.1 beats per minute. Mean CACS on the coronary calcium scoring CT was 346.4 ± 535.4. Mean CACS on the non-enhanced chest CT with 2.5 mm, 1.25 mm and 0.625 mm slice thickness were 243.7 ± 352.5, 299.8 ± 433.9 and 326.2 ± 437.7 respectively (p < 0.05). Correlation coefficients of CACS between coronary calcium score CT and non-enhanced chest CTS with 2.5 mm, 1.25 mm and 0.625 slice thickness were 0.895, 0.969 and 0.959 respectively. Root mean square errors (RMSE) of CACS on the non-enhanced chest CTs with 2.5 mm, 1.25 mm and 0.625 slice thickness were 0.895, 0.969 and 0.959 respectively. Inter-observer agreement for the calcium score measurement was 0.994.

CONCLUSION: CACS assessment is feasible on the non-enhanced chest CT with 16 cm axial volume scan technique. Among the various slice thicknesses, 1.25 mm slice thickness might be optimal with the highest correlation and the lowest RMSE for the CACS on the non-enhanced chest CT.

SE 03 CV-21
Secondary dissemination of hydatid disease to the retroperitoneum, aorta and bilateral common iliac arteries complicated by pseudo-aneurysm formation Rohit Bhoil1, Sanjeev Sharma2, Ashwani Kumar Tomar2, Suresh Sharma2, Neeti Aggarwal2
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Human echinococcosis is a zoonotic infection, caused by larval stage of Echinococcus, having a world-wide distribution with highest prevalence in live-stock raising countries. It may be seen in any part of body; liver is affected in more than two-third of cases followed by lungs, with less common sites being kidneys, brain, heart, muscles and bone. Aorta as a site of localization of hydatid disease is extremely rare with less than 10 such cases reported till now. We report an extremely rare case of a retroperitoneal hydatid cyst involving the abdominal aorta and its bifurcation resulting in a false aneurysm formation in a 37-year-old man presenting with mild low back-ache. He gave history of being operated three times earlier; at the age of 5, 17 and 33 years of age for hydatid disease in the liver, left lung and left retroperitoneum respectively. His histopathology report revealing it to be hydatid, at that time the result of an indirect hemagglutination test for E granulosus was positive in high (1/616) titers. Our case is probably the first reported case in the world in which a patient of aortic hydatid has been followed up for two years and is still asymptomatic.

SE 03 CV-22
Cardiac MRI T2* value for myocardial iron overload compared with transmitral flow on echocardiogram for early detection of diastolic dysfunction in thalassemia patients Husna Mohd Zaki, Hasyma Abu Hassan Hospital Serdang, Malaysia.
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PURPOSE: In thalassemia patients, cardiac failure due to myocardial iron overload is one of the commonest cause of death. Thus, early detection of myocardial overload and heart failure is important for optimization of chelation therapy. As compared with systolic function, the left ventricular diastolic function is considered a more sensitive early marker of heart failure. The aim of this study is to evaluate the relationship between the myocardial T2* value in cardiac MRI and the diastolic function on echocardiogram, using the method of transmitral flow velocity.

MATERIALS AND METHODS: Forty-five subjects (mean age, 27.8 ± 10.9) referred for evaluation of the Cardiac MR. It consisted of 29 thalassemia patients on regular transfusion and chelation therapy, as well as 16 normal controls. They also underwent echocardiogram on the same day. The patients’ myocardial iron overload was determined using T2* value on cardiac MRI, while the diastolic function was evaluated using by way of transmitral flow (using parameters E wave, A wave, E/A Ratio and deceleration time) on echocardiogram.

RESULTS: There is weak positive correlation between E/A ratio of transmital flow to assess the diastolic parameters on echocardiogram and the myocardial T2* value (r = 0.333*, p < 0.05). Meanwhile the E and A values, as well as the deceleration time on echocardiogram have no statistically significant correlation with that of the echocardiogram (r = 0.116, p = 0.447, r = 0.196, p = 0.296 and r = 0.057, p = 0.709
respectively). $T_2^*$ value demonstrates low positive predictive value of 20% but high negative predictive value of 97.1% in predicting diastolic function evaluation, with high specificity (81.0%) and relatively low sensitivity (66.7%). There are no statistical differences in the means of the diastolic parameters and the grading of the myocardial iron overload.

**CONCLUSION:** CMR evaluation of $T_2^*$ value for myocardial iron overload showed positive, albeit weak correlation, with the diastolic parameters using transmitral flow on echocardiogram. However, with high specificity and high negative predictive value, it may be a useful tool in predicting the diastolic function. Nevertheless, other methods in evaluation of diastolic function such as pulmonary venous flow was not examined in this study, which could be a potential parameter to be included in the future study.

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