Echocardiography in Ischemic Heart Disease

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Clinically, echocardiography (Echo) is the most practical and commonly used imaging technique to evaluate chest pain patients with and without previously known coronary artery disease, or in patients with a diagnosis of acute myocardial infarction (AMI). The myocardial regional wall motion abnormality (RWMA) usually occurs immediately after a significant decrease of myocardial perfusion, the regional and global myocardial structure and functional abnormalities can readily be detected by echocardiography, as well as the global diastolic function which can be measured by Doppler echo application.

In patients with acute and chronic myocardial ischemia/infarction, 2-Dimensional (2D) and 3D Echo can detect structural and functional abnormalities, such as RWMA, left ventricular failure and remodeling, ischemia-related mitral regurgitation, true and pseudo-aneurysm and thrombus formation, free-wall rupture, pericardial effusion and tamponade, papillary muscle rupture, right ventricular infarction, in making early diagnosis, assisting treatment strategy decision making (for example, to early surgical intervention), predicting patient prognosis-risk stratification.

Low-dose and medium-to-high dose dobutamine Stress echo can help the detection of myocardial viability and ischemia in patients before and after coronary intervention (PCI). Stress echo findings have been reported to be important prognostic indicators in predicting cardiac death and cardiac event rates.

Ischemia-related hemodynamic abnormalities can be detected by Doppler echo. Intravascular echo provides excellent visualization of plaque morphology, characterization, and can measure coronary vascular lumen, help guiding optimal PCI and intracoronary Doppler echo can assess coronary flow reserve.

Tissue Doppler and Myocardial Deformation (strain, strain rate) measurements acquired by Echo, have been used to identify acute or chronic myocardial ischemia in recent 20 years.
**Stress Echo and Contrast Echo**

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Resting echocardiography is a convenient tool to evaluate cardiac function and provides the mechanism for patients’ symptom and sign. However, cardiovascular symptom could be induced by increasing workload or stress because increase in oxygen demand cannot be adequately met by the underlying disease. Therefore, echocardiography performed with stress is able to disclose additional abnormality which might not be seen at rest.

Stress echocardiography is usually performed with exercise, the administration of a pharmacologic agent or atrial pacing. The most common indication of stress echocardiography is evaluation of coronary artery disease. However, stress echocardiography is also helpful in evaluation of hemodynamic status, such as in valvular heart disease, pulmonary hypertension, exertional dyspnea and left ventricular filling pressure. In addition, stress echo has advantage of assessment of myocardial viability and prognosis as well.

With the use of the regional wall motion abnormality criteria, the sensitivity and specificity of stress echocardiography are comparable to stress thallium. However, the diagnostic accuracy depends on the patient population, the expertise of the interpreter, and the quality of the images.

We will primarily discuss the use of stress echocardiography using 2D, 3D and strain echocardiography in daily practice.

Contrast echocardiography is now used to identify intracardiac and intrapulmonary shunts, to augment Doppler velocity signals, to enhance the endocardial border, and to assess myocardial perfusion.

The most frequent shunt lesion evaluated in an echocardiography lab is an atrial shunt through a patent foramen ovale. Bubbles created by agitated saline do not appear in the left side of the heart unless there is a communication between the right and left chambers. Bubbles created by agitated saline strengthen Doppler velocity signals from the right heart chambers.
Integrated Use of IVUS & FFR

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In patients with coronary artery disease who are undergoing percutaneous coronary intervention (PCI), coronary angiography is the standard method for guiding the placement of the stent. However, in patients with coronary artery disease, determining which lesions cause ischemia and warrant stenting can be difficult. Noninvasive stress imaging studies are limited in their ability to accurately localize ischemia-producing lesions in these patients.

Fractional flow reserve (FFR) is an index of the physiological significance of a coronary stenosis and is defined as the ratio of maximal blood flow in a stenotic artery to normal maximal flow. It can be easily measured during coronary angiography by calculating the ratio of distal coronary pressure measured with a coronary pressure guidewire to aortic pressure measured simultaneously with the guiding catheter. FFR in a normal coronary artery equals 1.0. An FFR value of 0.80 or less identifies ischemia-causing coronary stenoses with an accuracy of more than 90%.

The introduction of grey-scale IVUS in the 1980s was accompanied by validation studies that produced highly reproducible volumetric measurements of plaque and vessel dimensions. An equally important contribution of IVUS has been the in vivo confirmation of the concept of expansive arterial remodeling. Positive vascular remodeling is now an accepted feature of high-risk coronary plaques. The insights about the dynamic nature of coronary lumen dimensions have also found a following among interventional cardiologists, and they have extended the use of IVUS to obtain accurate vessel dimensions for stent sizing and often to accurately define lesion significance.

FFR and IVUS had proved to get the better outcome of PCI than angiogram by many trials, but the function and superior of both tools are some different. To determine performance of PCI by FFR, and survey the result of PCI by IVUS should be the best way in the future.
Because of beat-to-beat variation, it has traditionally been difficult to estimate left ventricular function in atrial fibrillation (AF). However, many previous studies including ours have found use of the index beat to measure many echocardiographic parameters in patients with AF is as accurate as the time-consuming method of averaging multiple cardiac cycles. Therefore, using the index beat method, we can easily obtain many reliable echocardiographic parameters in AF patients, such as myocardial performance index (MPI), global longitudinal systolic strain (GLS) and global early diastolic strain rate (E’sr). Although these new echocardiographic parameters are highly associated with left ventricular systolic and diastolic function and can predict cardiovascular outcomes in non-AF patients, their relationship with left ventricular structure and function and cardiovascular events in AF has not been evaluated. I will present whether these new parameters measured from index beat method can be served as useful indicators in evaluation of left ventricular systolic and diastolic function and as powerful parameters in prediction of adverse cardiovascular events in patients with AF.

In addition, the appearance of the mitral L wave is reported to be more common in AF than in sinus rhythm, and its presence also indicates advanced diastolic dysfunction in patients with AF. Because of highly variable cycle length, quantitative assessment of left ventricular diastolic function in AF patients frequently needs to average multiple consecutive heart beats, which is time-consuming, awkward and uneasy to apply in busy clinical scenarios. In contrast, qualitative identification of mitral L wave in AF patients is easy, rapid and reliable. I will also present the prognostic role of mitral L wave in AF patients.
Echo in Critically-ill Patients

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Echography has been employed in medical fields since decades ago. Being safe, non-invasive, readily assessable and relatively inexpensive, echography is increasingly used in clinical practice and can be regarded as an extension of traditional history taking, physical examinations and roentgenograms in the initial diagnosis and treatment of diseases. In the latest years, the application of echography in emergency medicine and critical care medicine plays an important role in the differential diagnosis of a variety of critical conditions and guidance of therapeutic interventions. For example, in patients with severe shock or hemodynamic instability, bedside echography offers the first line physicians a quick and thorough screening for fluid status and potential life-threatening etiologies such as internal bleeding, cardiac tamponade, tension pneumothorax or pulmonary embolism. In patients with acute respiratory distress, echocardiography can be employed in evaluating structural or functional abnormalities of the heart, pericardial diseases, and abnormal intra-cardiac or extra-cardiac shunt. Lung sonography differentiates pleural effusion, pneumothorax, alveolar consolidation or interstitial edema. In patients with suspected acute abdomen, echography is most useful in the diagnosis of intra-abdominal pathologies such as cholecystitis, liver abscess, appendicitis, pancreatitis, ischemic bowel diseases, etc. In most critical conditions such as cardiac arrest or per-cardiac arrest, echography plays an even more critical role in timely diagnosis of important etiologies such as cardiac tamponade, tension pneumothorax, pulmonary embolism, massive myocardial infarction, or hypovolemia. In the immediate post-cardiac arrest phase, echography also offers indicators of prognostic implications such as post-resuscitation myocardial dysfunction or hepatic portal venous gas. More recently, echography has also been applied in confirming the position of endotracheal tube during intubation of the critically ill patients. Other applications include trans-cranial Doppler evaluation of the cerebral blood flow in traumatic brain injury or cerebral vascular accidents such as stroke or subarachnoid hemorrhage, duplex sonar for detecting carotid dissection, peripheral arterial occlusion or deep vein thrombosis, etc. In summary, echography can be applied from head to heel at bedside in the critically ill patients. With proper education and training, the emergency and critical care physicians can make the most of echography in a more comprehensive way in their daily care of the critically ill patients, based on which the diagnosis and treatment can be accomplished more efficiently.
Cardiac resynchronization therapy (CRT), by correcting mechanical dyssynchrony as the predominant mechanism of response, is demonstrated to be effective in patients with advanced heart failure. Achieving optimum left ventricular lead position, at the site of maximal mechanical dyssynchrony but away from transmural scar, is identified as one of the main determinants of both symptomatic and prognostic benefit. Strategies employing multimodality cardiac imaging techniques have been used to identify this optimal pacing site, in addition to any potential anatomical limitations to successful implantation. Echocardiography plays an important role in the diagnosis and management of heart failure and is often the first and only imaging modality used to assess patients referred for CRT. Speckle tracking echocardiography (STE) derived strain imaging is a relatively new technique that offers a comprehensive approach to evaluate the pathophysiological mechanisms underlying CRT response through detailed characterization of LV function. In addition to providing indices of mechanical dyssynchrony and assessment of segmental wall motion timings, STE systolic strain has been used to identify areas of scar. In order to maximize CRT response rate and gain a survival advantage, optimal LV lead position must be achieved. Further understanding of CRT pathophysiology suggests that segments of the left ventricle that contract after aortic valve closure do not contribute to effective ventricular ejection, and that resynchronization of these delayed myocardial segments is one of the major mechanisms of benefit. STE enables a patient-specific approach to define optimum LV lead position and inform procedural planning in order to maximize CRT response.

Reference:
**Echo in Aortic Valve Disease**

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Echocardiography is a well-established technique for the evaluation of the morphologic features and quantification the severity of aortic valve disease. Low gradient of aortic valve stenosis needs to be further clarified by the low dose dobutamine stress test. TEE/3D echo could be applied for better defining the morphologic features and quantifying the severity of aortic valve disease. The severity of aortic regurgitation could be determined by measuring the width of vena contracta in the LVOT or from the area of vena contracta using 3D color flow dataset.

Recently, the transcatheter aortic valve implantation (TAVI) has been applied in the high-risk aged patients. Echocardiography played an important role for selection of patient, determination the aortic annulus size and monitoring during the peri-operative procedure for immediate detection of serious complications after TAVI, such as cardiac tamponade, paravalvular leak or other life-threatening conditions.

Echo also provides an important parameters such as LVEDD and LV mass and EF for determining when to selection of patients for valve replacements.

The appropriate criteria for choosing echo as a primary tool in assessing the aortic valve disease will be discussed in this meeting.

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**Single Beat, Full Volume Real-Time Three Dimensional Echocardiography in Congenital Heart Diseases**

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Echocardiography has been used in clinical cardiac diagnosis for more than 50 years. Its importance for non-invasive cardiac diagnosis can not be over-emphasized. The mode of display of echocardiography also emerged from line of M-mode to two-dimensional sector images.

Three-dimensional echocardiography (3DE) was introduced into clinical practice more than a decade ago. Originating from two-dimensional echocardiography (2D Echo), 3D Echo has stepped from off line reconstruction from 2D Echo as static images to real-time off line reconstruction and then further to on-line near real-time reconstruction to display the so called real-time (RT) 3D Echo. Usually only the narrow angle (30º) display is true RT3D. For full volume wide angle display of the black and white 3D Echo, it take 4 beats to display the full volume; for the color RT 3D Echo display of about 30º fan arc; it takes 8 beats to reconstruct. The other choice is to make narrow angle color reconstruction through less scanning plans with interpolation methods for RT3D Echo display sacrificing the quality of the RT3D Echo images. The latter is seldom adopted.

Recent advances in computer and technology has allowed better image acquision and processing. Thus the RT3D display of wide angle full volume Echo is made possible in a single beat in both black and white and color flow mapping display mode. The new single beat full volume RT3D Echo acquision and display mode is the superior evaluation tool than convention (near) RT3D Echo. The new single beat RT3D Echo makes realization of dream for the ER3D Echo. The wide angle of display and the fast acquision is re-revolutionary for RT3D Echo!

Our pilot experience in the new RT3D single beat Echo revealed that it is a much convinient Echo mode with many add-on digital image capability. It is not only good for pediatric patients with various congenital and acquired heart diseases, but also for adult patients. The impact of single beat RT3D Echo will thus not be over-emphasized and its further application in non-invasive cardiology will be highly expected.
Effects of Left Atrial Strain on Functional Capacity in Chronic Severe Mitral Regurgitation

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Objectives: We studied the effects of left atrial (LA) deformation on heart failure (HF) symptoms in patients with chronic severe primary mitral regurgitation (MR).

Background: Decreased LA strain was noted in patients with chronic severe primary MR. However, effects of LA deformation on their functional capacity were not fully studied.

Methods: We recruited 110 patients with chronic severe MR and preserved left ventricular systolic function. Global peak LA longitudinal strain (LASp), peak strain rate in reservoir phase (LASRr), and in conduit phase (LASRe) were identified using the two-dimensional speckle tracking echocardiography. HF symptoms were evaluated by New York Heart Association (NYHA) functional classification.

Results: There were 35 (32%) patients in NYHA I, 62 (56%) in NYHA II, and 13 (12%) in NYHA III. LASp (29.9±8.9, 25.2±10.1, 18.8±6.4 %; p = 0.002), LASRr (2.5±0.5, 2.3±0.7, 2.0±0.8 s-1; p = 0.055), and LASRe (-2.4±0.7, -2.1±0.8, -1.7±0.5 s-1, p = 0.015) as well as age, presence of Atrial Fibrillation (AF), left ventricular mass index, and estimated pulmonary artery systolic pressure were relevant to stepwise decline in NYHA functional class (I to III). After multivariate analysis, only LASp (OR 0.891, 95%CI 0.796-0.997, p = 0.044) independently predicted severe HF symptoms (NYHA III). Age (OR 1.081, 95%CI 1.033-1.132, p = 0.001) and diabetes mellitus (OR 10.379, 95% CI 1.008-106.83, p = 0.049) significantly correlated with a decreased LASp.

Conclusions: In patients with chronic severe MR, LASp predicted severity of HF symptoms. Age and diabetes mellitus contributed to a decreased LASp.

Key words: mitral regurgitation, left atrium, strain, speckle tracking echocardiography
Cardiology

Prognostic Value of Left Atrial Volumes Assessed by Transthoracic 3D Echocardiography: Comparison with 2D Echocardiography

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Objectives: We hypothesized minimal left atrial volume index (LAVImin) by 3D echocardiography is the best predictor for future cardiovascular events.

Background: Although maximal left atrial volume index (LAVImax) by 2D echocardiography is a robust index for predicting prognosis, the prognostic value of LAVImin and the superiority of 3D over 2D echocardiographic measurements have not been determined in a large group of patients.

Methods: In protocol 1, we assessed age and gender dependency of LAVIs using 2D and 3D echocardiography in 124 normal subjects, and determined their cut-off values (mean + 2SD). In protocol 2, 2D and 3D LAVImax/LAVImin were measured in 556 patients with high prevalence of cardiovascular disease. After excluding patients with atrial fibrillation, mitral valve disease, and age < 18 years old, 439 subjects were followed up to record major adverse cardiovascular events (MACEs). Patients were divided into two groups by the cut-off criteria of LAVI in each method.

Results: In protocol 1, there was no significant age and gender dependency for each 2D and 3D LAVI. In protocol 2, during a mean of 2.5 years follow up, 88 patients developed MACEs, including 32 cardiac deaths. Kaplan-Meier survival analyses showed all 4 LAVI cut-off criteria had significant predictive power for MACEs. After variables were adjusted for clinical variables and left ventricular ejection fraction, all 4 methods were still independently and significantly associated with MACEs, but 3D derived LAVImin had a highest risk ratio. 3DLAVImin also had an incremental prognostic value over 3D LAVImax.

Conclusions: LAVIs by both 2D and 3D echocardiography are powerful predictors of future cardiac events. 3D LAVImin tended to carry a stronger and additive prognostic value over LAVImax.
Effect of Through Plane and Twisting Motion on Left Ventricular Strain Calculation: Direct Comparison between 2D and 3D Speckle Tracking Echocardiography

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Background: We aimed to investigate the effect of out-of-plane motion on discrepancy of strain measurements between 2D and 3D echocardiography.

Methods: 2D and 3D datasets were acquired in 54 patients. Using 2D/3D speckle tracking software, global circumferential and longitudinal strain (CS, LS) and CS/LS at 3 left ventricular (LV) levels was measured. The effect of through plane motion was assessed by mitral annular displacement (MAD).

Results: Although a good correlation of global CS was noted between the two methods (r=0.80, p<0.01), mean values of global CS were significantly higher in 3D compared to 2D echocardiography. Correlation of CS and their mean differences were 0.65/-4.61 at the basal level, 0.76/-4.17 at the mid-ventricular level and 0.60/-2.23 at the apical level, respectively. Correlation of global CS between the two methods was higher in patients who showed MAD<9.4mm (r=0.81) compared to those with MAD≥9.4mm (r=0.61). A good correlation of global LS (r=0.89, p<0.01) was noted with no significant bias. Correlation of LS and their mean differences were 0.52/1.59 at the basal level, 0.89/-1.17 at the mid-ventricular level and 0.73/1.46 at the apical level, respectively. Correlation of LS between the two methods was higher in patients who showed LV twist <12.2° (r=0.94) compared to patients with LV twist ≥12.2° (r=0.68).

Conclusions: Through plane motion produced discrepancy of CS measurements, especially at LV basal level. Larger bias of LS at the basal and apical LV level compared to the mid-ventricular level between the two methods suggests LV twisting also affects the calculation of 2D LS.
Significant Correlation between Brachial Pulse Pressure Index and Renal Resistive Index

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**Background:** The renal resistive index (RI) calculated as (peak systolic velocity – minimum diastolic velocity)/peak systolic velocity is significantly associated with renal function. The formula used to calculate pulse pressure index (PPI) is similar to that used to calculate renal RI, i.e., (systolic blood pressure – diastolic blood pressure)/systolic blood pressure. Therefore, this study investigated whether brachial PPI significantly correlated with renal RI and could be used to identify impaired renal function.

**Methods and results:** This study enrolled 255 consecutive patients referred for echocardiographic examination. Renal RI was measured by Doppler ultrasonography and blood pressures were automatically measured with an ankle brachial index-from device. Patients with a mean brachial PPI ≥ 0.428 had a lower estimated glomerular filtration rate (eGFR) compared to those with brachial PPI <0.428 (P <0.001). Multivariate analysis showed that brachial PPI significantly correlated with renal RI (β = 0.458, P <0.001). The areas under the curve for brachial PPI and renal RI in prediction of estimated glomerular filtration rate (eGFR) <60 mL/min/1.73 m² and eGFR <45 mL/min/1.73 m² were 0.604 and 0.734 (P ≤ 0.005) and 0.682 and 0.893 (both P <0.001), respectively.

**Conclusions:** Patients with high brachial PPI had depressed renal function. Brachial PPI significantly correlated with renal RI obtained by Doppler ultrasonography. This index was also useful in identifying patients with decreased eGFR. Since brachial PPI is easily obtained in clinical practice, it has potential use for identifying impaired renal function in large-scale screenings.

**Key words:** Resistive index, pulse pressure index, blood pressure, chronic kidney disease.
Bedside Sonographic Diagnosis of Pneumothorax in Pediatric Patients

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Background: Pneumothorax used to be diagnosed with chest radiography. Significant advances in sonography have made it a useful tool for the diagnosis of pulmonary pathology. Therefore we employed portable ultrasonography as a non-invasive method and an alternative tool for the bedside diagnosis of pneumothorax.

Method: We enrolled 21 inpatients that were found to have pneumothorax. Their age ranged between newborn to 18 years old. All of them had chest radiography for the confirmation of diagnosis. Also we employed bedside sonography to monitor the patients before and after treatment during October 2010 to December 2012. Sonographic signs of patients with pneumothorax were compared with controls (n=30).

Results: A total of 51 children, 21 with pneumothorax and 30 without pneumothorax as control group were examined. From the sonographic images, we specifically noted 3 sonographic signs: abolished lung sliding sign, curtain sign and lost of B line sign whereas abolished lung sliding sign had specificity and sensitivity of 100%, positive predictive value of 100% and negative predictive value of 100%. Curtain sign had specificity and sensitivity of 100%, positive predictive value of 100% and negative predictive value of 100%. Lost of B line sign had a sensitivity of 86% and specificity of 47%, positive predictive value of 62% and negative predictive value of 77%.

Conclusion: Our results demonstrated that there are several sonographic signs useful for the diagnosis of pneumothorax, namely abolished sliding sign and curtain sign. In experienced hands, sonography may be considered a tool of choice for the diagnosis of patients with pneumothorax and may be a convenient monitoring and management guide for patients with pneumothorax.

Key words: pneumothorax, children, diagnosis
Strategic Approach for Isolated Secundum Atrial Septal Defects in Adults with Transthoracic Echocardiography

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Background: Transthoracic echocardiography (TTE) is the major tool for diagnosis of structural heart disease in children. And often is regarded as definitive diagnostic tool for many congenital heart diseases. However, the use of TTE in adults and older children may be limited by thoracic windows and dropout. The purpose of this study was to evaluate the accuracy of transthoracic echocardiography (TTE) in evaluation of ASD in for children and adults. We employed a systemic, integrated approach for the exclusion and inclusion of diagnosis of ASD. The approach includes 3 basic views for TTE: parasternal short-axis views, parasternal 4-chamber views and apical 4-chamber views. Besides, serial scanning for each basic view was also employed so that the full scale of atrial septum could be systemically integratedly evaluated. For those who with accessible subxyphoid views, short and long axis with systemic integrated dynamic scanning also were done.

Methods: Between Jan. 2002 and Dec. 2012, 106 adult patients, from our clinic or referred from other hospital, was evaluated as candidate for transcatheter closure of ASD. Their age ranged from 18 to 71 years with mean of 35.4±11.7 years. And their body weight ranged from 40 to 91 kg with mean 60.9±8.9kg. TTE was performed in all these patients. TEE was performed in 78 patients and CT scan was performed in 65 patients. For comparison, 60 young children and 30 infants with good transthoracic and subxyphoid windows are enrolled as control group.

Results: Among these patients, ASD was ruled out by TEE in 8 patients. TTE did not show any evidence of interatrial shunt in these 8 patients. For the remaining 98 patients with isolated ASD, CT scan show no atrial shunt in 2 patients but TEE and TTE showed presence of shunt. 4 patients were seen with large defects and insufficient rims seen by TTE, TEE and CT scan. For our control group, TTE with with subxyphoid views all showed no interatrial shunt.

Conclusions: Our experience showed that TTE is a reliable in pre-interventional evaluation of ASD for transcatheter closure in adults and older children, including its morphology, location and rim adequacy. Few exceptions included circumstance such as partial anomalous pulmonary returns and complex ASD morphology with suboptimal subcostal windows. We propose that for adults with clinical suspicion of ASD, a strategic approach should be done. TTE is the first line of Echo imaging using integrated dynamic approach to scan all parts of atrial septum. For borderline cases, TEE with or without CT scan is recommended. CT alone is not adequate nor appropriate for diagnosis of isolated ASD due to resolution limitation and irradiation.
Idiopathic Hypereosinophilic Syndrome with Löeffler’s Endocarditis

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**Introduction:** The hypereosinophilic syndromes (HES) are a heterogeneous group of disorders marked by the sustained overproduction of eosinophils. Cardiac involvement is common and is the major cause for morbidity and mortality. Herein we present a case with idiopathic HES and severe cardiac involvement, so-called Löeffler’s endocarditis.

**Case description:** A 39-year-old previously healthy man suffered from chronic watery diarrhea for 9 months and the symptoms worsened in recent two months accompanying with body weight loss of 20 kgs. Hypereosinophilia was noted, however, invasive and noninvasive studies (including stool tests, abdominal ultrasound, computed tomography, endoscopy, bone marrow aspiration) failed to delineate a cause. After an episode of acute pulmonary edema during admission, the transthoracic echocardiography (TTE) was arranged, which showed the severe mitral regurgitation, severe tricuspid regurgitation and the subendocardial thickening of the left ventricle, an unique pattern caused by hypereosinophilia with cardiac involvement. Combining the findings in TTE and cardiac magnetic resonance, the subendocardial thickening was a result of eosinophil related myocardium injury and was composed of necrotic tissue, myocardial fibrosis and thrombi. He underwent myocardial biopsy which showed eosinophil infiltration and thrombi deposition. Idiopathic HES with end organ damage, including Löeffler’s endocarditis and eosinophilic gastroenteritis was diagnosed herein. The patient had a remission after corticosteroid treatment and the follow up TTE showed resolution of the subendocardial thickening. HES can induce not only the subendocardial changes but also valvular heart disease due to restricted mobility of the leaflets.

**Conclusion:** Our case demonstrates the typical cardiac manifestations in HES. The role of TTE is important not only as a valuable diagnostic tool but also as the reflection of treatment response during follow up.
Multiple Proximal Pulmonary Artery Thrombi Detected by Transthoracic Echocardiography

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Category: case report We report a 58-year-old female who presented with shortness of breath and atypical chest pain. The transthoracic echocardiography (TTE) showed not only right ventricular failure signs, but multiple heterogeneous mass in pulmonary arteries as well. The chest-computed tomography scan revealed multiple thrombi-involved bilateral proximal pulmonary arteries. The case emphasized the images of multiple pulmonary thrombi as detected by TTE.

Infective Endocarditis with Mitral Valve Aneurysms: A Case Report

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A 32-year-old man with mild mental retardation denied other systemic disease. He was brought to our hospital due to progressive short of breath and bilateral leg edema for 1 month. He had no history of unknown fever or heart murmur. Transthoracic echocardiography showed moderate to severe mitral regurgitation and moderate aortic regurgitation. The vegetation (1.3*0.8 CM) was on aortic valve. A mobile lesion that appeared to be a cystic tumor (1.26*0.38CM) was on the anterior mitral leaflet. The lesion had no color Doppler signal inside. During the hospital course, the patient did not develop the sporadic febrile illness, and streptococci Viridans was cultured from the blood sample. Antibiotics were administered for 1 week, after which the aortic and mitral valves were replaced. At operation, the aneurysm was found on the anterior leaflet of the mitral valve. The mitral valve leaflets were redundant and prolapsed. Histopathological examination of the valve aneurysm showed inflammatory cells. Cultures of the native valves were negative for bacteria. The postoperative clinical course was uneventful. Mitral valve aneurysm is found in the anterior leaflet and associated with infective endocarditis. The probable mechanism of aneurysm formation is mycotic destruction of the leaflet structure or myxomatous degeneration. In addition, the existence of aortic regurgitation jet or eccentric mitral regurgitation jet striking the leaflet of the mitral valve could lead to infective endocarditis.
Huge Coronary Fistulae from RCA and LAD to PA with Echo Manifestation of Rupture of Pulmonary Artery Aneurysm

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Coronary artery fistulae are anomalous connections between a coronary artery and a cardiac chamber or great vessel. Coronary artery fistulae vary widely in morphologic appearance and presentation. We presented a case of huge coronary artery fistulae from RCA, LAD to PA with echo manifestation of rupture of pulmonary artery aneurysm. This 63 years old lady with underlining type 2 diabetes mellitus experienced progressive shortness of breath in recent 3 weeks. Aggravated cough with whitish sputum secretion, orthopnea and paroxysmal nocturnal dyspnea were also mentioned. Due to symptoms as above, she went to our OPD for further evaluation. Following CXR revealed cardiomegaly with enlargement of pulmonary arteries. EKG revealed sinus tachycardia. Furthermore, rupture of pulmonary artery aneurysm near the pulmonary valve was highly suspected through 2-D echocardiography. Color Doppler revealed abnormal small turbulent flow in the main pulmonary artery, and Doppler revealed diastolic-dominant flow. Patient was admitted immediately and the need of emergent surgical intervention was also well-explained. However, following MDCT revealed huge coronary fistulae between RCA, LAD to pulmonary artery with aneurysm formation. Cardiac catheterization also confirmed this diagnosis and some small feeding arteries from aorta were also found. Further surgical ligation of coronary artery fistulae was performed smoothly without complication. Then patient was discharged smoothly about one week after intervention without current symptoms or complications. Coronary artery fistulas can be diagnosed with coronary angiography, MDCT and echocardiography. A large fistula can be occasionally found as a mass lesion or rupture of vessels on echocardiography but cannot be easily confirmed. Carefully interpretation with 2D image and diastolic dominant Doppler flow are essentially important.

A Rare Yet Serious Complication Following Blunt Chest Trauma: Acute Aortic Regurgitation

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A 61 year-old male was involved in a motorcycle accident in March, 2012, and was then admitted to our surgical intensive unit for blunt chest trauma. He was intubated with mechanical ventilator support, and tube thoracostomy was done for left hemothorax. A transthoracic echocardiogram (TTE) was arranged for survey of cardiac trauma during hospitalization but neither anatomical nor physiological anomalies were identified in this study. Symptoms of heart failure developed after he was discharge from the chest surgery ward in April, 2012. Due to intolerable progressive dyspnea, he visited our Emergency Department (ED). On physical examination, a new grade IV/VI “to and fro” murmur could be heard over right upper sternal border. Chest X-ray showed pulmonary edema. An electrocardiogram demonstrated sinus tachycardia. A TTE revealed severe aortic regurgitation (AR), normal heart size, and adequate left ventricular performance. A tranesophageal echocardiogram disclosed flail of left coronary cusp with severe AR, and morerately-severe mitral regurgitation. Then, we referred this patient to the cardiovascular surgery department for prompt surgical treatment.
A Rare and Lift-Threatening Complication of Infective Endocarditis: Pseudoaneurysm of the Mitral–aortic Intervalvular Fibrosa

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This 59 years-old gentleman was admitted for intermittent fever and progressive shortness of breath for four days. There was no obvious focus of infection after the initial studies. However, the reports of blood culture yielded oxacillin-sensitive staphylococcus. Transthoracic echocardiography (TTE) disclosed moderate AR and MR. No vegetation was seen at first. Follow up transesophageal echocardiography (TEE) was arranged and it revealed a pseudoaneurysm of the mitral-aortic intervalvular fibrosa (P-MAIVF), with marked pulsatility with systolic expansion and diastolic collapse. Cardiovascular surgeon was consulted for aortic valve replacement and aorta reconstruction. P-MAIVF is a rare complication of infective endocarditis, but delay in diagnosis can lead to devastating outcome. Parasternal long axis view of TTE or longitudinal view of aorta of TEE image may easily identify the abnormal space between LA and aorta. Surgery is currently the recommended treatment due to the possible complications, such as fistula formation and coronary artery compression.

PTA for May-Thurner Syndrome? Evaluate by Ultrasound and Pressure Gradient Measurement

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Background: May-Thurner syndrome is classically a condition in which left common iliac vein compression by right common iliac artery results in left leg edema. PTA with stenting will be the main treatment strategy. Here we describe a case which PTA can be safely deferred by echo and pressure gradient measurement.

Case Report: A 35-year-old lady with a history of ovary cancer suffered from left leg edema for 3 months. Ultrasound showed flattened venous flow over LCFV suggesting higher level stenosis. CT scan and angiography revealed left common iliac vein compression by right common iliac artery with post-stenotic dilatation and focal left external iliac vein stenosis. Pressure gradient is zero mmHg across left common iliac vein and 40 mmHg across left external iliac vein. PTA with stenting of left external iliac vein was performed. No more pressure gradient was noted and ultrasound showed normal venous flow over LCFV hence PTA with stenting to left common iliac vein was deferred. Left leg edema resolved 2 days following the procedure and no more edema was noted during 3-month follow up.

Conclusion: For May-Thurner syndrome with significant stenosis found by angiography, it is necessary to measure pressure gradient and evaluate venous flow by ultrasound to determine necessity of PTA.
Significant Correlation between Pulse Pressure Index and Left Ventricular Filling Pressure and Diastolic Function in Patients with Chronic Kidney Disease


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Background: Abnormal left ventricular (LV) function and geometry are common among patients with chronic kidney disease (CKD). The formula derived from fluid-flow analogue of the Ohm law used to calculate pulse pressure index (PPI) is (systolic blood pressure – diastolic blood pressure)/systolic blood pressure. Therefore, this study investigated whether PPI significantly correlates with the ratio of transmitral E-wave velocity (E) to early diastole mitral velocity (Ea) and LV diastolic dysfunction (LVDD) in patients with CKD.

Methods and results: This study enrolled 511 patients with CKD from our Outpatient Department of Internal Medicine. The pulse pressure and PPI were significant difference in E/Ea subgroup (E/Ea $\geq$ 12, E/Ea < 12) (P< 0.001, both). Multivariate analysis showed that PPI significantly was the independent determinant of E/Ea (unstandardized coefficient $\beta = 17.328$, P< 0.001) and LVDD (Odds ratio = 1.487 per increased 0.064, P = 0.003) among study subjects.

Conclusions: This study found that PPI significantly correlated with E/Ea and LVDD in patients with CKD. PPI has potential use for identifying LV filling pressure and LVDD in the CKD population.

Key words: Pulse pressure index, pulse pressure, chronic kidney disease, left ventricular filling pressure, left ventricular diastolic dysfunction