H-S01 Application of Ultrasound in Carotid Artery Disease

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The ability to reliably identify stenosis in the carotid artery is important for clinicians. Identification of potentially treatable carotid stenosis enables selection of appropriate candidates for aggressive intervention. The goal of this talk is to present the clinical applications and interpretation of carotid sonographic examinations in screening patients with carotid stenosis and post -treat follow up. With the characters of non-invasive, accurate and cost-effective, carotid duplex examination is the first and often the sole imaging study. Advantages and limitations of the method will be discussed. Besides, current consensus for the ultrasound criteria in identifying significant re-stenosis after carotid stenting will also be mentioned.

H-S02

Application of Ultrasound in Renal Artery Disease

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Renovascular disease is a complex disorder, most commonly caused by fibromuscular dysplasia and atherosclerotic diseases. It can be found in one of three forms: asymptomatic renal artery stenosis (RAS), renovascular hypertension, and ischemic nephropathy. Particularly, the atherosclerotic form is a progressive disease that may lead to gradual and silent loss of renal function. Thus, early diagnosis of RAS is an important clinical objective since interventional therapy may improve or cure hypertension and preserve renal function. Screening for RAS is indicated in suspected renovascular hypertension or ischemic nephropathy, in order to identify patients in whom an endoluminal or surgical revascularization is advisable. Screening tests for RAS have improved considerably over the last decade. While captopril renography was widely used in the past, Doppler ultrasound (US) of the renal arteries (RAs), angio-CT, or magnetic resonance angiography (MRA) have replaced other modalities and they are now considered the screening tests of choice. An arteriogram is rarely needed for diagnostic purposes only. Color-Doppler US (CDUS) is a noninvasive, repeatable, relatively inexpensive diagnostic procedure which can accurately screen for renovascular diseases if performed by an expert. Moreover, the evaluation of the resistive index (RI) at Doppler US may be very useful in RAS affected patients for predicting the response to revascularization. However, when a discrepancy exists between clinical data and the results of Doppler US, additional tests are mandatory.

H-S03 Application of Ultrasound in Other Peripheral Artery Disease

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Duplex Doppler imaging of the lower limb arteries is a very effective tool, and it is cheaper and more readily available than CT and MRI. Besides, duplex ultrasound can provide clinicians with detailed information on the location, extent, and severity of disease from the visceral aorta to the tibial arteries. Duplex scanning is interpreted in conjunction with limb-pressure measurements to categorize arterial hemodynamics and functional impairment accurately. Understanding the features of duplex-acquired velocity spectra recordings is fundamental to accurate diagnostic testing, including the characteristic spectral features of "normal" versus "abnormal" lower-limb arterial flow, hemodynamic changes associated with stenosis or occlusion, and the status of distal limb or foot perfusion. The Recent advance in techniques and devices enable endovascular therapy (EVT) as the first-line treatment in patients with LEAD.

Duplex scanning can provide an arterial map of occlusive or aneurysm lesions analogous to an angiogram. Testing is accurate before and after intervention for the detection of stenosis. The detection of high-grade stenosis in an arterial segment allows for pre-emptive treatment before thrombosis occurs and improves long-term patency. In this talk, we will give a brief review of the role of a duplex in the era of EVT for LEAD and other vascular beds.

H-S04

Applications of Ultrasound in Iliocaval Vein Disease

Tien-Yu Wu Center of Peripheral Vascular, Department of Peripheral Vascular

Iliocaval venous disease aries from thrombotic and non-thrombotic etiology such as May-Thurner Syndrome, IVC occlusion, etc. Its clinical presentations include asymptomatic, edema, stasis ulcer and claudication. Sometimes, it is lethal when associated pulmonary embolism occurred.

However, the diagnosed of iliocaval diseased was sometimes difficult to identify. CT image is useful but remain not functional study and the information supported remain limited. Ultrasound though couldn't view the vessel directed but may provide us useful functional status. We may know the relative increasing pressure, occluded or non-occluded, situation. Combine other methodology, we may have a full view of the venous condition and help us to establish a better pre-interventional strategy.

In this talk, we'll showed the application of ultrasound to iliocaval disease. We'll also showed cased which combine both duplex and angiography to the audience to have a comparable view of the ultrasound. One may benefit from the lecture to know the application of the ultrasound and tips and tricks of performing it.

In summary, the ultrasound to the peripheral venous disease is very beneficial in functional and

morphological issue. Its' advantages are low risk, less invasive and effective. We hope the audience could be beneficial from the lecture and use it in daily practice.

H-S05 Applications of Ultrasound in Other Peripheral Vein Disease

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In the field of deep venous thrombosis ultrasound is nowadays the sole diagnostic modality in most centers and has contributed extensively in our understanding of the natural history and the pathophysiology of the disease. Duplex ultrasound is also used as a follow-up tool to detect venous reflux up to six months after treatment and to investigate conditions such as thrombus neovascularization.

Patients undergoing varicose vein stripping and venous ablative surgery routinely undergo preoperative ultrasound scanning to assure that the deep venous system is clot-free and to identify the location of perforators and accessory veins as well as the presence of lesser saphenous reflux. Intraoperatively, the use of ultrasound allows for placement of a catheter under direct guidance close to the sapheno-femoral junction, and then the anesthesia agent is injected. Successful ablation is then established by monitoring venous occlusion by means of ultrasonography.

Today, we use the duplex of ultrasound as the guidance of access site. Because of the antegrade approach makes higher success rate and less procedure time, the echo-guided puncture from tibial vein, popliteal vein or thrombosed femoral vein is an important technique of endovascular treatment. Under intravascular ultrasound, the thrombus aspiration process can be understanded clearly by sonography imaging, whether catheter directed thrombus suction or ultrasound-assisted thrombolysis.

H-S06

Application of AI Echo in Heart Failure with Preserved Ejection Fraction

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Patients with HF with preserved ejection fraction (HFpEF) may present with diastolic dysfunction and demonstrate distinct clinical and morphometric characteristics yet manifesting preserved global systolic function defined by LVEF>50%. EF as a percentage chamber-based measurement of the amount of blood pumped out of the heart during systole. By contrast, HFpEF cannot be determined alone clinically from the LVEF. The clinical judgement and diagnosis of HFpEF is not an easy task, as the diagnostic criteria need to follow the 2016 guidelines of the American College of Cardiologists and the American Heart Association, meanwhile also taking the diagnostic algorithm of the European Society of Cardiology from multiple diastolic properties and natriuretic peptide levels into account.

Herein, we developed an AI-based HFpEF prescreening algorithm capable of detecting intrabeat dynamics from LA-LV chamber kinetics, which rendered automatic recognition of abnormal mechanical features from a large scale HFpEF patient population with high diagnostic performance. Totally 1041 HFpEF patients and 1263 asymptomatic individuals were included. The patients' four-chamber view images were extracted from the echocardiography files and randomly separated into the training, validation and internal testing dataset. The model was further validated with an external testing dataset, the accuracy, sensitivity, and specificity became 0.85, 0.79, and 0.89, respectively, with the highest AUCs in both the internal testing dataset and external testing dataset as 0.95. We concluded that the clinical application of such prescreening program may be implemented in clinical setting, with novel perspectives in identifying multiple dimensions from structural abnormalities with prognostic values.

H-S07 Telemedicine for Echocardiography in the Era of COVID 19

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Cardiac point-of-care ultrasound (POCUS) has been rapidly developed around the world. The primary goals of POCUS are rapid integrated several basic views of ultrasound at bedside into a quit diagnosis and treatment plan. The focus has primary been to assess left and right ventricular size, function, valvular leaflet motion, pericardial effusion and diameter of inferior vena cava. Cardiac POCUS is intended replace comprehensive not to echocardiography exam, but enhances diagnostic accuracy for cardiac conditions in different scenario, such as COVID-19-related critical illness patients at emergency room or intensive care unit. Transthoracic echocardiography may be performed in a minority of patients with COVID-19.Focused studies could be performed quickly, and the majority were diagnostic. Patients with elevated cardiac biomarkers more often had reduced LV function.

In appropriately selected patients, echocardiography can guide COVID-19clinical management. Recently, hand-held cardiac ultrasound screening is widely used in critical care unit, can be applied in remote settings without routine access to complete echocardiogram examination. Primary care physician may take cardiac exam rapidly than transfer echo images by Wi-Fi to consult cardiologist for quit consultation and get immediate accurate diagnosis.

H-S08 The Role of Echocardiographic in Cardio-oncology

Wei-Ting Chang

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Advances in cancer detection and treatment have resulted in a growing number of cancer survivors. However, anti-cancer therapies can affect the cardiovascular system resulting in hypertension, heart failure, arrhythmias and thrombosis which are responsible for substantial morbidity and mortality in this population. Early detection of minor LV myocardial dysfunction is thus important for predicting LV dysfunction. Cardio-oncology is a relatively new subspecialty that aims to prevent, detect, monitor and treat the cardiac complications of cancer therapy. The goal of the cardio-oncologist is to provide optimal cardiovascular care for patients with cancer in a multidisciplinary setting involving oncologists, cardiologists, surgeons, cardiac physiologists/scientists, specialist nurses. pharmacists, and allied health professionals. The subspecialty of cardio-oncology aims to reduce cardiovascular morbidity and mortality in patients with cancer or following cancer treatment. Echocardiography is a key diagnostic imaging tool in the diagnosis and surveillance for many of these complications. In Chi-Mei Hospital, we started Cardio-Oncology Program focusing on patients with breast cancer and lymphoma since 2014. Till now, we enrolled more than 300 patients and performed comprehensive monitoring the not only echocardiography but speckle tracking imaging and functional capacity evaluations. Strikingly, the management of cardiovascular risks including patient education truly makes differences in the clinical outcomes. In this talk, I will share our experience of Cardio-Oncology program and the updated methodology for acquisition of images. Also, the frequently observed cardiovascular comorbidities in cancer patients will also be represented.

H-F01

Effects of Global Area Strain Derived from 3D Speckle Tracking Echocardiography on Exercise Capacity in Subjects Undergoing

Treadmill Exercise Test

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Background: Exercise capacity is a powerful predictor for mortality among patients with various diseases. However, determinants of exercise capacity by echocardiography are still not well elucidated. Global area strain (GAS) is a new index derived from 3D speckle tracking echocardiography (STE) and its clinical significance has rarely been studied. Our study was to validate the role of GAS for exercise capacity in health check-up population.

Methods: We prospectively recruited 94 symptom-free subjects (52.2 ± 11.7 years, 62.8% male) from a routine health examination. Significant structure heart diseases and angiographic documented coronary heart diseases were excluded. All of them received echocardiography and symptom-limited treadmill exercise test by Bruce protocol. Full volume 3D images were acquired from apical 4 chamber view and analyzed by 3D STE software. Four strain parameters were obtained from the analysis included GAS, global longitudinal strain (GLS), global circumferential strain (GCS), and global radial strain (GRS).

Results: Exercise time was significantly correlated with age (r = -0.469, p < 0.001), early mitral filling velocity to average mitral annulus velocity ratio (E/e'; r = -0.403, p < 0.001), GRS (r =0.208, p = 0.044), GAS (r = -0.662, p < 0.001), systolic blood pressure (r = -0.258, p = 0.012) but not left ventricular ejection fraction (LVEF) by M-mode (r = 0.158, p = 0.128), 2D (r = 0.104, p = (r = 0.104)0.317) or 3D echocardiography (r = 0.047, p = 0.655). Some risk factors, including gender (p = 0.005), hypertension (p=0.030), and smoking (p <0.001), were also correlated with exercise time. After multivariate analysis for determinants of exercise time, it still showed significant correlation in GAS (p < 0.001). We further divided subjects into three groups according to median level of GAS (-25.9%) and E/e' (7.30). Subjects with both poor

data (high E/e' and low GAS) had the lowest exercise capacity than subjects with low E/e' and high GAS (353 ± 135 vs. 571 ± 111 sec, p <0.001). There were 18 subjects with impaired exercise capacity (METs <8). Only GAS (OR 1.232, 95% CI 1.097-1.384, p < 0.001) was predictor for impaired exercise capacity after multivariate analysis.

Conclusions: GAS by 3D STE is significantly associated with exercise capacity and there is a synergistic effect with E/e' on exercise time undergoing treadmill exercise test. In conclusion, GAS can be a useful parameter for exercise capacity in the health check-up subjects.

H-F02

Significance of Strictly Defined Idiopathic Tricuspid Regurgitation

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Background: Moderate to severe tricuspid regurgitation (TR) was found to cause right ventricular (RV) dilatation and dysfunction as the disease progresses, eventually leaded to RV failure and even death. Majority of TR is secondary, but the definition and classification are not uniform. A new class of TR, idiopathic TR, arose recently. However, its definition was different among current studies. The purpose of this study was to strictly define idiopathic TR from echocardiographic images based on a new systemic approach, and to study the characteristics of idiopathic TR.

Methods: We retrospectively collected 8711 patients from patient cohort of National Cheng Kung University Hospital echocardiography laboratory from January to June 2018. There were 670 patients (7.7%) with moderate to severe TR included in this study. Idiopathic TR was diagnosed strictly by a systemic approach after a step-by-step exclusion of primary TR, secondary TR related to pacemaker or RV instrumentation, left heart disease, congenital

heart disease, RV myopathy, and pulmonary hypertension.

Results: Among 670 patients with significant TR, there were 473 (70.6%) moderate TR and 197 (29.4%) severe TR. The distribution of significant TR included 74 (11.0%) primary TR and 596 (89.0%) secondary TR. In secondary TR, there were 48 (7.2%) patients with pacemaker related TR, 267 (39.9%) with left heart diseases, 24 (3.6%) with congenital heart disease, 6 (0.9%) with RV myopathy, 105 (15.7%)with pulmonary hypertension (PH), and 146 (21.8%) with idiopathic TR. We used idiopathic TR as a new category of TR, compared to primary, and functional (the remaining 5 secondary TR) TR, the results showed that the mean age in primary and idiopathic TR groups were older (p = 0.004), lower estimated pulmonary pressure (p <0.001) and right atrial (RA) pressure (p <0.001), thinner RV wall (p <0.001) and less RA area (p <0.001), higher RV fraction area change (FAC, p <0.001) and tricuspid annulus systolic velocity (S', p = 0.004), compared with functional TR group. Multivariate analysis showed idiopathic TR (p = 0.002) and primary TR (p = 0.008) had better RV FAC than functional TR after controlling age, atrial fibrillation, severity of TR, TR maximal velocity, RV area, and RA area. There was no significance when comparing the primary and idiopathic groups.

Conclusions: There were 21.8% of strictly defined idiopathic TR among significant TR. Idiopathic TR had better RV function than the other secondary TR and its characteristics were more similar with primary TR. Idiopathic TR should be strictly defined and regarded as a distinct type of TR.

H-F03

Automated Global Longitudinal Strain Exhibits Robust Association with Death in Hemodynamically Significant Chronic Aortic Regurgitation

Hao-Yun Chang, Wen-Jone Chen, Li-Tan Yang Department of Internal Medicine, National Taiwan University Hospital, Taipei, Taiwan Keywords: Aortic regurgitation, global longitudinal strain, survival

Background: Left ventricular global longitudinal strain(LVGLS) proved to be more sensitive and could detect subclinical systolic dysfunction than other LV parameters. However its implication in hemodynamically significant aortic regurgitation (AR) is not well established.

Objective: This study aims to examine the prognostic utility of automated LVGLS in chronic AR and compare it with other LV parameters.

Methods: LVGLS (presented as absolute value) was measured using a novel fully-automated two-dimensional strain software (Tomtec Imaging Systems) in consecutive patients with isolated chronic moderate-severe and severe AR between 2004 and 2020. Impact of LVGLS on survival was analyzed.

Results: Total 1019 patients were identified (age 60±17 years, 18% woman, 36% bicuspid aortic valve), and 34% was symptomatic. The average LVGLS was 16.5±3.7%. In this cohort, mean Charlson comorbidity index(CCI), LVEF, LVESD, LVESDi, and LVEDD were 1.30±1.86, 59±9%, 40±7 mm, 20.3±3.8 mm/m2, and 60±7 mm, respectively. Separate multivariate models adjusted for age, sex, CCI, AR severity, and symptoms demonstrated that LVEF (hazard ratio[HR] per 1%: 0.97 [95% CI 0.95-0.98], p=0.001), LVESDi (HR per 1mm/m2: 1.03[95% CI 1.00-1.07], p=0.043), LVESVi (HR per 5ml/m2: 1.07 [95% CI 1.03-1.11], p=0.0002), and LVGLS (HR per unit: 0.91[0.87-0.96], p=0.0003) were independently associated with death. However head-to-head comparison showed that LVGLS had stronger correlation with mortality than LVEF, LVESDi, and **LVESVi** (all P≦0.025). Patients with LVGLS<16.5% (average) (HR 1.51[95% CI 1.05-2.17], p=0.023) had worse survival as compared to those with LVGLS \geq 16.5% after adjustment for age, sex, CCI, symptoms, AR severity and symptoms.

Conclusion: In this large cohort of patients with moderate-severe and severe AR, LVGLS was independently associated with death, statistically superior than conventional LV indexes and showed incremental value in prognosis prediction. Those with LVGLS<16.5% had significant worse survival and this cutoff may be integrated in clinical decision-making for early intervention.

H-F04

Left Atrial-Booster-Pump Function as a Predictive Parameter for Atrial Fibrillation in Patients with Severely Dilated Left Atrium

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Introduction: The Cardiovascular Health Study showed patients with left atrial (LA) dimension (LAD) larger than 50mm had approximately four times the risk of developing atrial fibrillation (AF). However, some patients with LAD \geq 50 mm are free from AF. The aim of this study was to investigate whether the application of clinical and echocardiographic parameters could differentiate between the patients having severely dilated left atrium with and without AF.

Methods: We retrospectively enrolled 160 consecutive patients with LAD \geq 50 mm between September 2014 and October 2019 at Taoyuan and Linkou Chang Gung memorial hospitals. On the basis of AF duration, we divided patients into three groups: no AF (n=80), paroxysmal AF (n=53) and non-paroxysmal AF groups (n=27). For paroxysmal AF and non-paroxysmal AF groups, all enrolled patients had undergone radiofrequency catheter ablation and the echocardiographic parameters were obtained in sinus rhythm on the next day after ablation. LA peak ventricular systolic longitudinal strain (LASr), the systolic component of LA strain rate mostly reflects LA reservoir function (LASRr),

and the early diastolic and late diastolic components mostly reflect LA conduit function (LASRe) and LA contractile function (LASRa) were obtained by averaging values obtained in the apical 4-chamber and 2-chamber views. A proportional odds logistic regression model using a backward stepwise method was used to identify the independent predictors.

Results: Comparisons of the conventional echocardiographic parameters and speckle-tracking echocardiography-derived LA function parameters showed the non-AF group had significantly smaller LA minimal volume, higher LA emptying fraction, LASr, LASRr, and LASRa ($-1.75\pm0.54s-1$, -1.12 ± 0.46 s-1, and $-0.70\pm0.28s-1$, p<0.001) than the AF groups. The multivariate analysis showed that LASRa was the only independent predictor of freedom of AF in this study cohort.

Conclusion: In this retrospective study, the multivariate analysis revealed that LASRa was the only independent predictor.

H-F05

Risk Stratification in Patients with Hypertrophic Cardiomyopathy: Looking Beyond the Left-sided Chambers

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⁷College of Medicine, National Yang Ming Chiao Tung University, Taipei, Taiwan Background: Patients with hypertrophic cardiomyopathy (HCM) present heterogeneous outcomes. As risk stratification mostly focused on left-sided chambers, this study sought to investigate the prognostic value of right ventricular (RV) function in patients with HCM.

Methods: We prospectively enrolled patients with HCM, defined as an end-diastolic wall thickness \geq 15mm in the absence of secondary causes. Conventional ventricular functional parameters, including left ventricular ejection fraction (LVEF), tricuspid annular plane systolic excursion (TAPSE), and fractional area change, were obtained. Longitudinal strain (LS) was analyzed using speckle tracking method. The primary endpoint was defined as a composite of hospitalization for heart failure, ventricular arrhythmia, or all-cause death.

Results: A total of 56 HCM patients (aged 58.0 ± 14.9 years, 64.3% male) were included. After a mean follow-up of 20.2 ± 7.4 months, primary endpoints developed in 14 (28%) patients on medical treatment. The eventful group had reduced LV LS of the thickest segment, TAPSE, and RV global LS. After adjusting for age, sex, and LVEF, TAPSE [hazard ratio (HR), 95% confidence intervals (CIs): 0.33, 0.13-0.83] and RV global LS (HR, 95% CIs: 1.07, 1.00-1.14) remained the independent prognostic predictors. Addition of either TAPSE or RV global LS significantly improved the prognostic value than assessing LV systolic function alone (net reclassification improvement by 29% and 31.7%, respectively, both P< 0.05).

Conclusion: RV function assessed by TAPSE or RV global LS is predictive of subsequent cardiac events, suggesting that comprehensive evaluation of RV function is useful for risk stratification in patients with HCM.

Keywords: Hypertrophic cardiomyopathy; Right ventricular function; Risk stratification; Speckle tracking echocardiography; Longitudinal strain.

H-F06

Malignant Neoplasm Mimicked Left Atrial Appendage Thrombi - A Rare Presentation of Recurrent Cardiac Sarcoma.

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Most of cardiac tumors are metastasis of extra-cardiac origins. Primary cardiac neoplasms are rare, and approximately 85% of them are benign. Intimal sarcoma is the most frequent kind of primary cardiac malignancy. Outcomes of patients with intimal sarcoma are unsatisfied. The reported mean survival rate is only 6-25 months despite treatment.

Because of the rare prevalence of primary cardiac sarcoma, we know little about its presentation. Here I present the clinical course of a 49-year-old female patient who suffered from recurrent cardiac sarcoma. Three-dimensional echocardiography plays an importance role in the diagnosis and the follow-up of this patient.

H-F07

Diagnosis of a Wild-type Transthyretin Cardiac Amyloidosis in the 6th Decade of Age: Role of Multi-modality Imaging

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Introduction: Wild type ATTR, also known as senile systemic amyloidosis, was previously described to be exclusive to older patients. This report explores a rare case of wild-type ATTR cardiac amyloidosis (ATTRwt-CA) occurring in a relatively young patient diagnosed with multi-modality imaging.

Case presentation: A 66-year-old man presented with progressive shortness of breath in recent eight months. His medical history was notable for type 2 diabetes mellitus, hypertension and dyslipidemia. Chest X-radiography revealed cardiomegaly and pulmonary congestion, а diagnosis of heart failure was made. Coronary artery angiography revealed 80% stenosis over the left anterior descending artery, and he received stent deployment. Nonetheless, progressive shortness of breath recurred in recent two months. Transthoracic echocardiography (TTE) revealed an increased left ventricular (LV) wall thickness. Two-dimensional speckle-tracking echocardiography (STE) revealed reduced global longitudinal strain (LS) of -13.4% sparing. Technetium-99m with apical pyrophosphate scintigraphy revealed a Perugini grade 3 myocardial uptake. Cardiac magnetic resonance (CMR) imaging demonstrated high native T1 value, increased extracellular volume fraction and diffused subendocardial late gadolinium enhancement. These findings were highly suggestive of cardiac amyloidosis. He received endomyocardial biopsy (EMB) and pathology revealed hypertrophic myocardial tissue and amyloid deposit, further genetic testing revealed no variant of the transthyretin (TTR) gene. A diagnosis of ATTRwt-CA was concluded.

Discussion: ATTRwt-CA was previously described to be exclusive to older patients. However, more cases in young patients are being identified as in our patient suggesting this condition may be underdiagnosed in this population. Early presentations of cardiac amyloidosis are nonspecific, frequently lead to delay in diagnosis and poor prognosis. Advanced multimodality cardiac imaging prompts the early and accurate diagnosis of cardiac amyloidosis, available non-invasive diagnostic modalities included echocardiography, STE, 99Tc-PYP nuclear imaging and CMR imaging.

Keywords: Wild-type transthyretin cardiac amyloidosis; speckle-tracking echocardiography; Technetium-99m pyrophosphate scintigraphy; cardiac magnetic resonance