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Utility of echocardiography for detecting of hypoxic myocardial injury in newborns

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Purpose to evaluate the utility of echocardiographic exam (echo) for diagnosis and follow up of perinatal posthypoxic myocardial injury.

Methods Patients: 78 newborns aged 0 to 14 days, normal birth weight, with perinatal hypoxia, receiving resuscitation (Apgar score 3-7), but without major congenital heart defects. In all cases were performed: clinical exam, ECG, chest X-ray (Rx.CT), Doppler echocardiography exam (Echo). Most of our patients were evaluated clinically and echo after 6 months.

Results The patients had mainly signs of neurological post hypoxic suffering, without signs of severe cardiac involvement. The cardiac exam revealed: systolic murmur (64) and signs of persistent pulmonary hypertension of newborn (PPHN). Chest X-ray: cardiomegaly (35 cases). ECG: severe left ventricle (LV) repolarization disturbances and low voltage of QRS complexes (37), without ischemic changes. Echo performed at 2-7 days of life revealed: the absence of other severe congenital cardiac anomaly; permeability of foramen oval (100% cases); myocardial hypertrophy (42 cases) mainly interventricular septal (29), signs of PPHN (6) with mild to severe tricuspid insufficiency and right atrium dilatation (28 cases); prolonged isovolumic relaxation period (35), increased myocardial performance index (44), the systolic function normal (all cases) and severe LV diastolic dysfunction (E/A<1) in 45 cases. All the cases received spironolactone 1-2mg/kg/day. Reevaluation at 6 months showed the reduction of the myocardial hypertrophy and of the tricuspid regurgitation, with a normal LV diastolic function.

Conclusions The perinatal hypoxia can induce the apparition of a true posthypoxic cardiomyopathy at more than 6% of patients, the signs of cardiovascular suffering missing often. Echo exam and especially Tei Index is the main method for diagnosis and follow up of perinatal hypoxic cardiomyopathy and is necessary from the first week of life.

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Assessment of systolic and diastolic features in light chain amyloidosis: an echocardiographic and cardiac magnetic resonance study

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Background Cardiac involvement in systemic light-chain amyloidosis (AL) is characterized by 2D-echocardiography (TTE) normal or slightly decreased left ventricular (LV) ejection fraction and typically a diastolic dysfunction with left atrial (LA) enlargement. To assess cardiac involvement, the Mayo Clinic staging (MC) using NTproBNP and troponin, has been validated and allows risk stratification of patients into 3 groups with different outcomes. Cardiac magnetic resonance (CMR) assesses accurately chambers size and function. We aimed to compare by TTE and by CMR respectively: features of LV systolic and diastolic function and by CMR, morphological functional parameters namely LV myocardial late gadolinium enhancement (LGE) and indexed LA volume (LAVi) and emptying fraction (LAEF).

Methods and results Forty-two consecutive patients (66±10 years, 57% males) with sinus rhythm with confirmed systemic AL, underwent simultaneously TTE and CMR within 24 hours. LAEF was calculated after assessing the maximal and minimal LAVi (by area/length formula) in CMR using 4 and 2 chambers views. Diastolic parameters and 2D-LV global longitudinal strain (GLS) obtained by TTE were stratified according to LAEF, to LAVi and to the presence or not of LGE. Patients in MC stage III had the worse TTE and CMR parameters. LV GLS (<10.1±3.1 vs. –17.3±3.7, p<0.001), mitral deceleration time, E/A ratio and lateral E/e’ ratio, were significantly altered in patients with low LAEF <17.5% (median value) vs. those with higher LAEF, whereas, they were not significantly different according to maximal LAVi. GLS was decreased in patients with LGE when compared to those without: –10.8 ±2.8% vs. –16.5±2.2%, p<0.0008.

Conclusion In systemic AL, reduced LV GLS is associated with presence of LGE while impaired LV filling pressures are rather related to decreased LA emptying fraction. Multimodality imaging in patients with AL may allow better and complementary assessment of LV hemodynamics.

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Validation of stress thallium-201/rest technetium-99m sequential dual isotope high-speed myocardial perfusion imaging against fractional flow reserve for the detection of the extent of ischemia


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Objectives The aim of this study was to determine the diagnostic accuracy of stress thallium-201/rest technetium-99m sequential dual-isotope high-speed myocardial perfusion imaging (DH-HS-MPI) against invasively determined fractional flow reserve (FFR) and to establish the correlation between myocardial ischemia at risk defined by using the invasive BARI-score and DI-HS-MPI.

Methods Fifty-four patients referred for angiography underwent DI-HS-MPI. Perfusion was scored visually by summed stress score (SSS) on a patient and coronary territory basis, and ischemic burden was calculated by quantitative segmentation of the extent of ischemia. Significant coronary artery disease (CAD) was defined by the presence of ≥90% stenosis/occlusion or fractional flow reserve ≤0.80 in vessels >2mm. The relation between FFR and...
perfusion was determined for each vascular zone. The BARI-score was calculated from the coronary angiograms to quantify the myocardial risk. Results FFR was measured in 70 of 162 coronary vessels; Vessels FFR measured per patient was 1.3±0.57. Sensitivity, specificity, and diagnostic accuracy of MPI for the detection of significant CAD were 92%, 88%, and 90% by coronary territory and 87%, 93%, and 92%, on a patient basis. The area under the summary receiver-operating characteristic at the patient level was 0.94 (95% CI: 0.88 to 1) and 0.90 (95% CI: 0.83 to 0.97) at the artery and territory levels, respectively. The mean ischemic burden for MPI and BARI-score showed a strong correlation between techniques (r=0.71, P<0.0001).

Conclusions Stress thallium-201/rest technetium-99m sequential DI-HS-MPI accurately detects functionally significant CAD as defined by using FFR and provides an assessment of ischemic burden in agreement with the invasive BARI-score.

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Comparison of cardiac magnetic resonance imaging and echocardiography for the assessment of aortic valve area

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Background Aortic valve area (AVA) calculated by the continuity equation by echocardiography (CE-TTE) is the method of reference to assess aortic valve stenosis severity (AS). The Hakki’s formula (simplified Gorlin formula) is another method, sometimes used during cardiac catheterization to calculate AVA. It can also be adapted to magnetic resonance imaging (CMR) to assess the AVA as previously demonstrated. The aim of our study is to investigate, using a large number of patients with AS, the accuracy of the « hakki-cmr » method to determine the severity of AS compared to C-TTE.

Methods and results Between 2007 and 2014, 390 consecutive patients with AS (mean age 81±10 years, men 55%, mean LVEF=60±13%, underwent clinically indicated TTE (IE 33, philips) and CMR (philips ACHIEVA 1.5 tesla) within 30 days. The mean pressure aortic gradient was 44±18mmHg; the AVA was respectively 0.67±0.25cm2 by CE-TTE, 0.74±0.30cm2 using Hakki-cmr. Hakki’s formula and AVA from CE-TTE were almost interchangeable, with a mean difference of 0.07cm2 (95% limits of agreement 0.15 to 0.21cm2, p=0.0001). The intraobserver reproducibility of the AVA measurements with Hakki-CMR was excellent, with an average of 2 measurements of 0.67±0.18 and 0.67±0.13cm2 (intraclass correlation coefficient 0.77, estimated within-subject SD 0.10cm2).

Conclusion In a large cohort of patients with AS, assessment of AVA using Hakki’s formula by CMR, yielded more reliable results than those obtained using planimetry by CMR, and similar to those obtained using the CE-TTE. Despite the potential time and cost issue of CMR, the Hakki formula used during flow quantification, is a valuable method that is reliable, easy, and fast to apply. It may be highly useful especially in cases of echogenicity issues by TTE and regardless of the valve degree of calcification.

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Left ventricular mechanics in mitral valve prolapse: a longitudinal study

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Background Valve apparatus alterations may influence left ventricular (LV) mechanics in mitral valve prolapse (MVP).

Objective To assess LV mechanics and ventriculo-valvular interaction in MVP.

Material and results A comprehensive echocardiography including 2D speckle tracking myocardial longitudinal strain assessment was carried out in 194 adult patients with MVP (leaflet displacement >2mm above the annulus) and 30 matched controls. In MVP group mitral regurgitation (MR) was not significant in 76 (39%) patients (NoMR-MVP, effective regurgitant orifice ≤0.1mm2), mild to moderate in 53 (27%) and severe in 65 (34%) patients. Posterior (PML) and/or anterior (AML) mitral leaflet prolapse were present in 188 (93%) and 85 (42%) patients, respectively. PML and AML positions averaged ~6.0±3.4mm and ~1.6±3.5mm, respectively. Ventriculo-atrial disjunction was found in 82 (41%) patients and averaged 5.7±1.6mm. Posterior wall thickening was clearly increased in MVP groups with frank wall bulging in 82 patients (41%). Despite the third left chamber (between mitral annulus and prolapsed leaflets) forward stroke volume was preserved in MVP groups, and even increased in NoMR-MVP (44±9mL/m2 vs 39±9mL/m2) in Controls (P<0.001). In addition LV EF was improved in NoMR-MVP. Global Longitudinal Strain (GLS) was also improved in NoMR-MVP (~21.5±2.8%) and in the overall MVP group (~21.7±3.0%) compared with Controls (~19.7±1.7%), both P<0.001. In multivariate analysis GLS improvement was associated with the magnitude of PML prolapse (β=0.14, P=0.04), posterior wall thickening (β=0.16, P=0.004), posterior papillary muscle displacement in systole (β=0.21, P=0.002) and posterior wall bulging (β=0.23, P=0.001).

Conclusion MVP and associated abnormalities have a significant impact on LV mechanics. LV systolic function is improved in MVP as assessed by EF and GLS and preserves forward stroke volume. These changes might have significant effect at long-term on LV myocardium.

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0038

Addressing the controversy of estimating right ventricular systolic pressure by echocardiography: insights from 307 patients with advanced lung disease or pulmonary arterial hypertension

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Background There is a controversy on the reliability of echocardiography in estimating right ventricular systolic pressure (RVSP) in advanced lung disease (ALD) and idiopathic pulmonary arterial hypertension (PAH) patients. This study aimed to develop a quality control method for echocardiographic RVSP assessment to provide guidance.

Methods We selected consecutive patients referred from 2001 to 2012 for ALD or PAH, in whom an echocardiogram and a right heart catheterization (RHC) were performed within five days. In order to assess reader level influence on echo interpretation, three levels of readers (multi-reader echo-lab, level 2 and 3) estimated RVSP (based on the tricuspid regurgitation TR maximal velocity). Invasive and non-invasive RVSPs were compared using Pearson’s coefficient and Bland-Altman analysis. PH classification performance was also assessed. Reasons for under- or overestimation were systematically analysed.

Results Among the 307 patients included (mean age 50±13, 41% male), two-thirds had pulmonary hypertension (PH). RVSP was measurable in 56% of patients. There was a strong correlation between echo and RHC (r=0.84 for echo-lab, 0.86 level 2 and 0.96 level 3). For PH classification, areas under the curve of level 2 and 3 RVSPs were excellent (0.94 and 0.97); >45mmHg was associated with 86% sensitivity and 100% specificity. No severe PH (mPAP ≥50mmHg) was missed. The main reason for underestimation was the absence of a well-defined TR envelope and for overestimation the inability to identify the complete envelope by decreasing the gain.

Conclusion Echocardiography’s reliability for RVSP estimation can be improved when careful attention is paid to simple practical signal quality parameters, clearly identified by the present study.

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