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Echocardiographic Assessment of Pulmonary and Right Chamber Parameters in Healthy Individuals Who Live More Than 8200 Feet Above the Sea Level: A Colombian Experience

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Background: In the Andean Mountains, more than 35 million people live over 8200 feet above the sea level (fasl), where hypobaric hypoxia is known to induce pulmonary vasoconstriction, leading to pulmonary hypertension. Nevertheless, the actual prevalence of high-altitude pulmonary hypertension is unknown, and the implications of the adaptive mechanisms on the Right Ventricle (RV) and clinical outcomes are yet to be elucidated. **Methods:** We performed a cross-sectional study in two Colombian cohorts to assess the Systolic Pulmonary Artery Pressure (sPAP) and RV function by Doppler echocardiography in healthy adults who lived >8200 fasl. The first cohort was evaluated in Bogota at 8612 fasl. The second cohort was evaluated in Aquitana at 9941 fasl. **Results:** We screened 144 individuals; 16 were excluded due to current medications or past medical history. Of 128 individuals analyzed, 18% were women; the median age was 65 years old; mean diastolic and systolic arterial blood pressure was 123±15 mmHg and 93±10 mmHg, respectively; 40% of patients had a body mass index >30 kg/m2; 30% of men had a waist circumference > 110 cm, and 15% of women had values >95 cm. In Aquitana cohort, 16% were classified as having elevated blood pressure, 21% as stage 1 hypertension, and 57% as stage 2 hypertension in which 25% of patients had concentric remodeling with an average RWT(Relative Wall Thickness) of 0.40. Baseline characteristics and echocardiographic parameters are described in Table 1. From the total cohort, average sPAP was 23 mmHg, 25 patients had sPAP> 30mmHg of which 5 had TAPSE (Tricuspid Annular Plane Systolic Excursion) <18mm, and only 1 had a RVS' (Right Ventricular Annular Systolic Velocity) <9.5 cm/s with a decreased systolic right ventricular function. Overall, 10 patients had a dilated RV, with only 1 having a basal right ventricle to left ventricle ratio >1.0. 14% of patients had ≥2.8m/s of systolic peak tricuspid regurgitation velocity, 6% had TAPSE < 18 mm and 6% had RVS' < 9.5 cm/s. **Conclusions:** In the overall cohort, individuals who lived over 8200 fasl did not have higher estimated sPAP, with no significant differences in RV dimensions and function. Nonetheless, the significant percentage of stage 2 hypertension and sPAP difference in the Aquitania cohort might imply the need for further investigation into the long-term adaptative mechanisms in adults living at high altitudes, leading to adverse cardiovascular outcomes.

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Precise Left Ventricular Regional Wall Thickness Quantification and Visualization: A Showcase of 3D Echocardiography and Deep Learning

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Background: Echocardiography provides valuable information on LV geometry and function. Numerous diseases can affect the thickness of the myocardium, such as cardiomyopathy or infarction. Current guidelines recommend that LV wall thickness is measured at the blood-tissue interface in the parasternal long axis view, using the 2D linear method. However, this is sensitive to plane-positioning and tends to overestimate wall thickness. Three-dimensional echocardiography (3DE) enables full-volume imaging, thus eliminating the need for geometric assumptions. This study aims to show the feasibility and utility of modeling LV wall thickness using 3DE and deep learning. **Methods:** Single-beat, full-volume 3D transthoracic echocardiograms of the LV, and cine cardiac magnetic resonance (CMR) studies (<1 hour apart), were acquired in 116 subjects (57 healthy controls and 59 patients). A novel deep learning algorithm for 3DE segmentation (trained using a multi-modality approach) enabled wall thickness to be automatically quantified across the entire LV, using CMR as a reference. Four studies, highlighting distinct myocardial disease processes (apical hypertrophic cardiomyopathy, dilated cardiomyopathy; infarction, and amyloidosis), plus a healthy control, were selected for visual inspection and quantitative wall thickness assessment with respect to the 17 AHA segments. **Results:** The feasibility of automated wall thickness assessment with 3DE was 91 % (10 patients had poor images) in the study population. The analysis time for each image was <3 seconds using a computer with a graphics processing unit. Compared to CMR-derived measurements, the error in the 3DE-derived regional wall thickness was 0 ± 2 mm (mean ± SD). Figure 1 compares wall thickness maps for the healthy control and the four pathological cases. **Conclusions:** Deep learning, coupled with 3DE, allows for the precise quantification of regional LV wall thickness with the accuracy of CMR. This can be rapidly visualized as a heat map across a bullseye plot, in line with regional LV strain and myocardial work assessment. This has the potential to be a new tool in the echo lab to aid in differentiating between normal and hypertrophied hearts, identifying regional wall motion abnormalities, and detecting different patterns of hypertrophic cardiomyopathy.

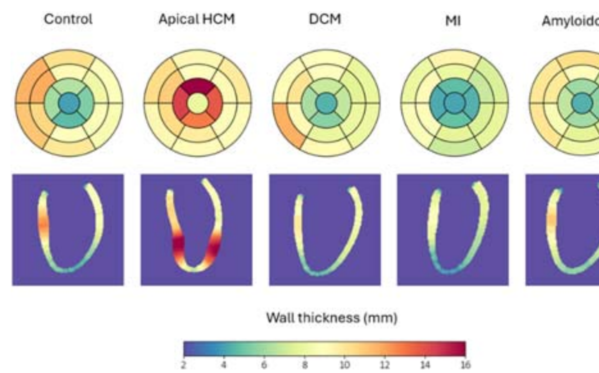

Figure 1. LV wall thickness heat maps derived from 3DE.

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Implementing Artificial Intelligence in Transthoracic Echocardiography for Left Ventricular Ejection Fraction: A Large-Scale, Real-World Clinical Integration with Collaborative Clinician-AI Workflow and Direct Echo - Cardiac Magnetic Resonance Imaging Comparison

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Background: Prerequisite to the adoption of artificial intelligence (AI) in cardiovascular imaging is the demonstration of accurate results that can be seamlessly integrated into an efficient reading and reporting workflow. The purpose of this study was to analyze the accuracy, adoption, and efficiency of an AI-based 2D-biplane assessment of left ventricular ejection fraction (EF) in echocardiography with a collaborative clinician-AI workflow. **Methods:** Auto EF is a novel, vendor agnostic software that is natively integrated into the reading and reporting environment of *syngo* Dynamics. The AI generated results are fully customizable. The Auto EF function in *syngo* Dynamics was assessed during an enterprise-wide AI adoption phase between March and December 2023 at a tertiary academic medical center. To assess accuracy, EF was obtained by standard 2D-biplane and by Auto EF assessment of the apical 4- and 2-chamber views in non-contrast echocardiography and compared to EF by cardiac magnetic resonance imaging (CMR) performed within 3 days. Adoption was determined by assessing the increase in use of Auto EF by sonographers during the study period. Lastly, to assess efficiency, the time saved using Auto EF versus standard methods was determined, as well as the frequency by which the Auto EF contours needed to be manually adjusted. **Results:** Of the 1,200 echocardiograms assessed for accuracy, with a mean EF of 59.9% +/- 9.3%, 279 studies used the Auto EF software. Compared to CMR, the mean EF difference was 0.5 +/- 5.9% for Auto EF versus 2.0 +/- 6.2% for traditional biplane imaging. The percentage of cases with EF within 10% EF units of MRI was 91% for Auto EF compared to 87% for traditional imaging. Adoption increased during the study period, with the monthly use of Auto EF increasing from 2,061 studies in June to 5,642 studies in December. Efficiency was assessed in 10 studies by 9 sonographers; implementation of the Auto EF software, including contour adjustments as needed, was performed 35 seconds faster (74%) than standard 2D-biplane measuring. **Conclusions:** The *syngo* Dynamics Auto EF function can accurately assess EF compared to the standard of care (2D-biplane imaging) and the gold-standard (CMR) with improved efficiency as