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EDITORIAL

The WASE normative data on right ventricular motion components: where uniformity meets diversity!

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This editorial refers to 'Three-Dimensional Echocardiographic Evaluation of Longitudinal and Non-Longitudinal Components of Right Ventricular Contraction Results from the World Alliance of Societies of Echocardiography Study', **by J. I. Cotella *et al*. https://doi.org/10.1093/ehjci/jead213**.

The right ventricle (RV) has complex anatomy and contractile patterns. The RV myofibre architecture comprises of the superficial circumferential fibres that run parallel to the atrioventricular groove, and the subendocardial fibres that run longitudinally. The RV contraction can be divided into three main components as follows: longitudinal motion that draws the tricuspid annulus towards the apex, radial or inward motion of the RV free wall, and anteroposterior motion following left ventricular contraction.[1] Each motion component contributes differentially to the global RV ejection fraction (EF) in various health and disease states. Study in healthy volunteers has shown that the relative contribution of radial and anteroposterior components to the global RVEF was comparable to the longitudinal component.[2] In elite athletes, the RV longitudinal deformation predominates and the circumferential deformation is reduced. This functional shift was associated with better exercise capacity.[3] In post-cardiac surgery patients, the radial function is increased, while the longitudinal function is reduced.[1] In chronic compensated pulmonary hypertension patients, the longitudinal function is increased, while the radial function is reduced, resulting in preserved RVEF.[1] Changes in these motion components often precede changes in global RVEF, making them sensitive markers of subclinical RV remodelling.

Normative data lay the foundation for a common language, upon which abnormality is defined. Quality normative data, exemplified by its generalizability to different populations and uniform data acquisition, are scarce in the literature. Problems plaguing these studies include small sample size, lack of diversity in the study population, and technical variability in data collection or analysis. The World Alliance Societies of Echocardiography (WASE) study is well-positioned to bridge this knowledge gap. It is an inter-continental collaboration with participating countries from North America, Europe, Asia, South America, Africa, and Australia. With the diverse representation, the WASE study has the capacity to not only establish quality normal ranges but also delve into the similarities and differences in normal reference values across different sexes, races, and age groups.

In this issue of the journal, Cotella *et al.*[4] presented the normative data for the individual RV motion components, namely the longitudinal (LEF), radial (REF), and anteroposterior (AEF) ejection fractions, as well as each component's relative contribution to the global RVEF. The data are further categorized into sexes, age tertiles (18–40, 41–65, >65), and races (White, Black, Asian). Normative data for strains, i.e. global longitudinal strain (GLS), global circumferential strain, and global area strain (GAS), were also presented. A total of 1043 healthy subjects from the WASE study contributed to the normative data. It is the largest normative study of novel RV functional parameters published to date.

The notable findings are as follows: (i) longitudinal contraction, depicted by LEF, LEF/RVEF, and RV GLS decreased with age; (ii) Black subjects had lower RVEF and GAS compared with White and Asian subjects; and (iii) in Black men, the radial contribution to the global RVEF (REF/RVEF) was higher, while the longitudinal contribution (LEF/RVEF) was lower compared with White and Asian men. While intriguing, no explanation for these differences has been widely acknowledged so far. In addition, although these intergroup differences did achieve statistical significance, their clinical relevance awaits to be seen. For example, the absolute decrease in mean RV GLS amongst age groups was <2%. Despite having a P value of <0.001, such differences might not be clinically meaningful.

Previous study by the same group reported that the radial contribution to RVEF increased with age.[2] This study clarified the relationship further by demonstrating that the increase in radial contribution with age was statistically significant in women only. Another study by the same group reported that the RVEF was higher in women than men.[5] This study added that other RV functional parameters, e.g. REF, AEF, LEF, GLS, and GAS, were all higher in women compared with men.

Decreased RV functional parameters have been associated with adverse cardiovascular outcomes. A recent meta-analysis has shown that 3D RVEF was significantly associated with all-cause mortality and adverse cardiopulmonary outcomes compared with traditional 2D-derived RV functional parameters, e.g. tricuspid annular plane systolic excursion, fractional area change, and free-wall longitudinal strain.[6] A single-centre study of cardiac patients has shown that decreased 3D RVEF and 3D RV strains were associated with cardiac death, heart failure hospitalization, and ventricular arrhythmias.[7] Further studies are required to clarify the clinical utility of measuring 3D RV motion components, i.e. REF, AEF, and LVE in terms of outcome prediction and their incremental value beyond 3D RVEF.

The wider adoption of 3D RV motion component analysis beyond the realm of research is largely contingent upon two factors as follows:

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expertise in 3D data collection or analysis and software availability. In practice, 3D RV acquisition is challenging with high attrition rate. The European Association of Cardiovascular Imaging (EACVI) survey of 96 European echocardiography laboratories across 22 countries, mostly tertiary centres or university hospitals, showed that only 10% of the centres measured 3D RV volumes, while only 12% reported 3D RVEF.[8] These figures could be even lower in low-volume centres that might have lesser experience with 3D RV acquisition and analysis. In the WASE study, slightly more than half (52%) of the acquired 3D RV datasets were of sufficient image quality for analysis. There is a learning curve to 3D RV imaging. 3D RV acquisition should be incorporated into imaging routine whenever clinically indicated.

In the WASE study, proprietary software, i.e. ReVISION, was used for the analysis of the RV motion components. At present, it is the only commercial software that quantitates RV motion components and provides segmental analysis. While advancements in analysis software are laudable, one should be mindful that many resources are concentrated in the hands of a privileged few. Equal effort and enthusiasm should be put into democratizing these advancements, empowering the global community to translate research into clinical practice. Lowering the barriers to access, e.g. having gratis or open-source software, would genuinely be diversity, equity, and inclusion epitomized.

Normative data provide universal definitions of normal and abnormal. Having this common understanding allows harmony in the design and conduct of future studies. Analogous to the Tower of Babel parable, speaking the same language is paramount when working towards a shared vision. Quality normative data start with uniform data input, i.e. standardized imaging protocols and analysis, as previously emphasized by the EACVI research committee.[9] The Normal Reference Ranges for Echocardiography (NORRE) study is the first and the largest prospective European registry that provides normal echocardiographic reference values. Healthy subjects were recruited from 22 EACVI-accredited echocardiography laboratories. Data were acquired according to the ASE/EACVI recommendations, and quantitative analysis was performed by the EACVI Central Core Laboratory.

The contribution of the WASE study runs deeper than the normal reference ranges. It is the exemplar normative study: large numbers, study population of different ages, genders, nationalities, and ethnicities, with standardized image acquisition and analysis. The principles that it embodies set new benchmarks for normative research in the future.

The authors should be commended for establishing a global collaborative network that champions diversity and representation, providing normative data that are applicable to the worldwide community. There are still much to learn about the interplay between the various RV motion components in different health and disease states. In the words of Laozi, 'a journey of a thousand miles begins with a single step'. This normative paper is the first step that paves the way for many discoveries to come.

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Data availability

No new data were generated or analysed in support of this editorial comment.

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