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2D and 3D assessment of the left ventricle volume and ejection fraction in a general population

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Introduction

In standard practice, LV volumes and EF are estimated by 2D technique. 3D echocardiographic assessment seems more reliable; however, this method has not yet been validated in the general population.

Purpose

To validate 3D echocardiography in a large population sample and investigate differences between 2D and 3D LVEF and volumes

Methods

In The Copenhagen City Heart Study, 4466 echocardiograms were available for analysis. The echocardiograms were obtained during four consecutive heartbeats in both 2D and 3D with GE Vivid E9. Offline analysis was performed on EchoPac v. 201. LVEF was calculated by the modified Simpsons Biplane Auto EF for 2D and by the 4LVQ method for 3D.

Results

The study included 2090 echocardiograms. The mean 2D LVEF was 57.3 ± 6.1% (IQR 54 - 61%) and 51.7 ± 7.9% (IQR 47 - 57%) by 3D. The mean end-diastolic volume (EDV) and end-systolic volume (ESV) by 2D and 3D techniques were: EDV 2D 106.1 ± 29.6 ml vs EDV 3D 128.2 ± 32.3 ml , ESV 2D 45.7 ± 15.6 ml vs. ESV 3D 45.7 ± 20.7 , $p < 0.05$ among all variables.

The average difference of means between 2D and 3D LVEF was 5.6 ± 11.2%, -22.1 ± 56.8 ml for EDV, and -16.9 ± 32.9 ml for ESV.

The correlation coefficient for LVEF was 0.42, EDV 0.76 and for ESV 0.70.

Conclusion: In our study, we found a significant difference in both LVEF and ventricular volumes when comparing 2D echocardiograms with 3D. 3DE had, in general, lower LVEF, higher EDV and ESV compared to 2D.

Table 1: Summary of results

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Variable	Min	Max	Mean	IQR (25-75)	p-value
LVEF, 2D (%)	18	76	57.3 ± 6.1	54-61	< 0.05
LVEF, 3d (%)	13	77	51.7 ± 7.9	47-57	< 0.05
EDV, 2D (ml)	13	275	106.1 ± 29.6	85-123.8	< 0.05
EDV, 3D (ml)	50	270	128.2 ± 32.3	106-148	< 0.05
ESV, 2D (ml)	15	150	45.7 ± 15.6	35-54	< 0.05
ESV, 3D (ml)	13	185	45.7 ± 20.7	48-74	< 0.05

LVEF: left ventricle ejection fraction, EDV: end-diastolic volume, ESV: end systolic volume, IQR: Inter-quartile range

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