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Background

- Measurement of LVEF by 2D contrast echo (2DCE) is widely used to monitor cardiotoxicity resulting from chemotherapy
- Recently, an automated 3D echocardiography (A3DE) software program has become available that automatically determines LV volumes and EF *without the need for manual corrections*
- A3DE has potential to improve laboratory efficiency by reducing reporting times and avoiding the time and cost associated with routine contrast administration

Methods

- Population: 71 consecutive cancer patients with acceptable acoustic windows
- All 71 assessed with 2DCE and A3DE (Heart Model, Philips) with 3 different A3DE settings
- LVEDVi, LVESVi and LVEF recorded for each
- 2DCE used standard biplane method of disks
- All 2DCE recordings checked by an echocardiographer for accuracy of LV length/area tracings
- A3DE used volumetric measurement based on automatically detected endocardial borders at end-diastole and end-systole – *no manual corrections were made*
- For 2DCE, reproducibility was assessed by comparing differences between 4- and 2-chamber LV lengths. The difference was 2.1 +/- 2.5% (Majority had <3mm difference).
- For A3DE, reproducibility was assessed by calculating the '% difference' for LVEF, which equals the difference in LVEF measurements between 2 datasets divided by the average LVEF



Figure 1: Display of recordings with each A3DE HM setting

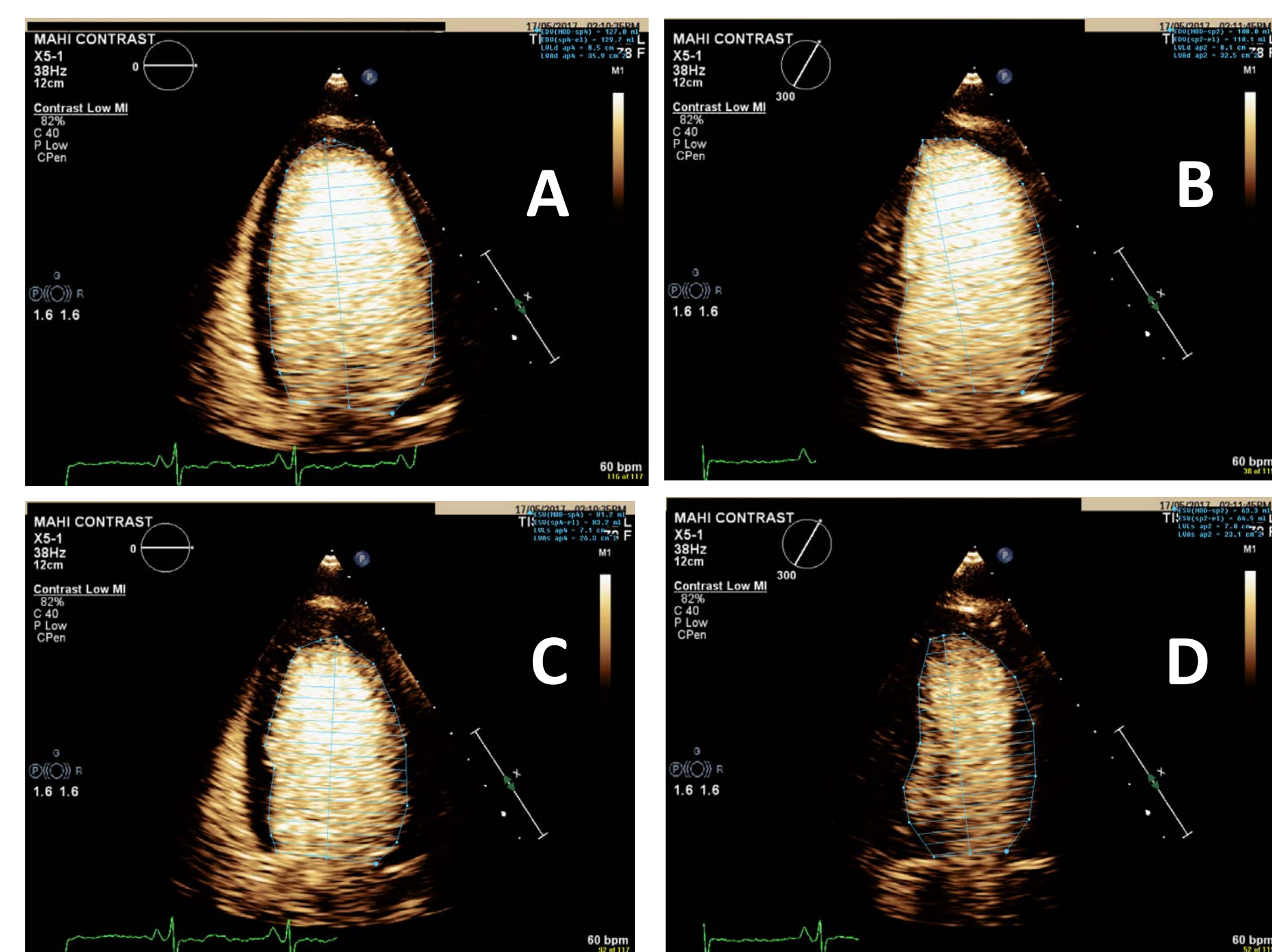


Figure 2: Display of 2DCE biplane method of disks
 A – LVEDV in apical 4-chamber
 B – LVEDV in apical 2-chamber
 C – LVESV in apical 4-chamber
 D – LVESV in apical 2-chamber

	LVEDVi (mL/m ²)	LVESVi (mL/m ²)	Mean LVEF +/- Standard Deviation	LVEF Difference: Δ A3DE - 2DCE < 5% Number of Patients, (%)
HM A3DE Setting 1 (80-60)	70 ± 14	33 ± 11	53 ± 9%	19/61, 31%
HM A3DE Setting 2 (80-40)	70 ± 14	28 ± 9	59 ± 7%	39/61, 64%
HM A3DE Setting 3 (70-30)	66 ± 14	26 ± 9	61 ± 7%	39/61, 64%
2DCE	65 ± 13	25 ± 7	61 ± 7%	N/A

Table 1: Left Ventricular Volumes and Ejection Fraction as Determined by HM A3DE settings and 2DCE

Results

- 10/71 subjects excluded: major discrepancy between endocardial border visualized by operator vs that automatically detected by A3DE software
- Data for remaining 61 subjects seen in table 1
- 2DCE reproducibility: the difference in lengths was 2.1 +/- 2.5% (majority had <3mm difference).
- A3DE reproducibility: the % difference in LVEF between 2 datasets was 5.5 +/- 3.8% (mean +/- standard deviation)

Limitations

- The vast majority of subjects had a normal LVEF
- 2DCE used as a reference standard – known problem with foreshortening causing underestimation of LV volumes
- Heart Model is not currently widely available for clinical use

Conclusions

- **In a population with adequate image quality there is a large group in whom a fully automated non-contrast 3D echocardiographic method provides very similar results to 2D contrast echocardiography**
- **In subjects with good initial agreement between 2DCE and A3DE it may be reasonable to undergo further surveillance of LVEF with A3DE alone**

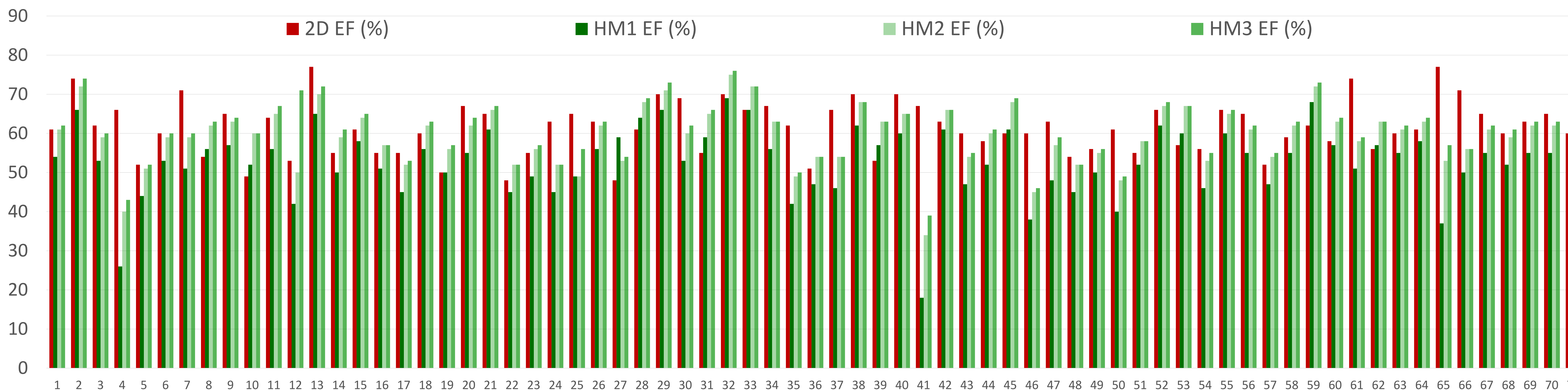


Figure 3: Ejection Fraction in Individual Subjects by 2D Contrast and A3DE Using Three Different Heart Model Settings