Journal of Cardiovascular Magnetic Resonance

BioMed Central

Poster presentation

Accuracy and reproducibility of geometric models for assessment of left ventricular ejection faction using cardiovascular magnetic resonance

Peter Jordan*, Christopher A Miller, Tom Newton and Matthias Schmitt

Address: University Hospital of South Manchester, Manchester, UK

* Corresponding author

from 13th Annual SCMR Scientific Sessions
Phoenix, AZ, USA. 21-24 January 2010

Published: 21 January 2010

Journal of Cardiovascular Magnetic Resonance 2010, **12**(Suppl 1):P231 doi:10.1186/1532-429X-12-S1-P231

This abstract is available from: http://jcmr-online.com/content/12/S1/P231

Study objective

To assess the accuracy and reproducibility of geometric models for assessment of left ventricular ejection fraction.

Background

Cardiovascular magnetic resonance (CMR) is considered the clinical gold standard for accurate and reproducible assessment of left ventricular (LV) ejection fraction (EF). However, manual contouring of an entire LV short-axis stack can be time consuming. A number of geometric approximation models for assessment of ventricular volumes have previously been validated using angiography, echocardiography and single photon emission computed tomography. We aimed to assess the accuracy and reproducibility of these geometric models for LV EF assessment in unselected patients referred for clinically indicated CMR.

Methods

67 consecutive patients were recruited. SSFP cine images were obtained using a 1.5 T scanner (Siemens Avanto, Germany) equipped with a 32-channel surface coil. LV volumetric analysis was performed with the open source software package OSIRIX utilising the following geometric models - Triplane, Biplane, Monoplane, Hemi-ellipse, Modified Simpson's ellipse ("Mod Simps") and Teichholz. Analysis by manual endocardial border tracing of each short-axis slice in an LV 'stack' using Siemens Argus software was used as the reference standard. The images of 25 randomly selected patients were also independently analysed by a second observer to allow assessment of inter-observer reproducibility and then reanalysed by both observers to assess intra-observer reproducibility.

Results

The EF obtained by every geometric model was significantly different to the EF obtained by the reference standard with wide Bland-Altman levels of agreement (Table 1). The inter-observer and intra-observer reproducibility for each model was low, also with wide Bland-Altman ranges (Table 2).

Conclusion

The accuracy and reproducibility of geometric models for LV EF assessment are too low for clinical use.

Table 1: Comparison of EF calculated by each geometric model with the reference standard

	Triplane	Biplane	Monoplane	Hemiellipse	Mod Simps	Teichholz
Mean difference +SD (%)	-1.5 ± 6	-4.5 ± 6	-6 ± 7	3.5 ± 8	-0.5 ± 8	-3 ± 10
p-value	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Correlation coefficient (r)	0.94	0.93	0.90	0.91	0.88	0.84
Bland-Altman 95% limits of agreement (%)	-14 to 11	-17 to 8	-20 to 8	-12 to 19	-16 to 15	-23 to 17
Bland-Altman range (%)	25	25	28	31	31	40

Table 2: Inter- and intra-observer variability for measurement of EF with each technique

	Reference	Triplane	Biplane	Monoplane	Hemiellipse	Mod Simps	Teichholz
INTER-OBSERVER							
Mean difference +SD (%)	0.4 + 2	1.0 ± 7	-0.2 ± 7	-0.4 ± 7	3.4 ± 6	1.1 ± 6	4.2 ± 7
Correlation coefficient (r)	0.97	0.91	0.90	0.88	0.93	0.90	0.93
Bland-Altman 95% limits of agreement (%)	-4 to 4	-12 to 14	-15 to 14	-14 to 14	-9 to 16	-12 to 14	-9 to 18
Bland-Altman range (%)	8	26	29	28	25	26	27
INTRA-OBSERVER							
Mean difference +SD (%)	0.8 ± 2	-0.8 ± 4	-1.9 ± 4	-2.2 ± 6	0.2 ± 4.5	-0.7 ± 4	-1.5 ± 4
Correlation coefficient (r)	0.98	0.97	0.97	0.92	0.97	0.96	0.97
Bland-Altman 95% limits of agreement (%)	-3 to 4	-9 to 8	-11 to 7	-14 to 10	-9 to 9	-9 to 7	-10 to 7
Bland-Altman range (%)	7	17	18	24	18	16	17