

Meeting abstract

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## 2040 CMR measurement of cardiac cycle dependent left atrial dynamics in atrial fibrillation: is it the gold standard?

Amit R Pate\*, Omid Fatemi, Patrick T Norton, John D Ferguson and Christopher M Kramer

Address: University of Virginia, Charlottesville, VA, USA

\* Corresponding author

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### Background

Left atrial volume (LAV) provides important prognostic information and can guide therapeutic decision-making in atrial fibrillation patients. Left atrial time-volume curves generated using CMR may provide a unique opportunity to simultaneously study left atrial size and function. We sought to determine the relationship between changes in LAV over the cardiac cycle and standard left atrial volume measurements. We additionally sought to determine the contribution of the pumping portion (PEF) of the overall left atrial ejection fraction (LAEF).

### Methods

While in sinus rhythm, 30 patients with paroxysmal atrial fibrillation underwent CMR on a 1.5 Tesla Avanto MRI scanner (Siemens Medical Solutions, Erlangen, Germany). Using SSFP (TR/TE 3 ms/1.1–1.3 ms), retrospectively gated, 6 mm thick axial cines with 25–40 frames per cardiac cycle, without gap between slices were obtained spanning the entire left atrium. A non-gated contrast-enhanced MRA in the coronal plane was obtained (slice thickness 2 mm, matrix size 108–156 × 192, FOV 400, TR/TE 2.6/0.9, flip angle = 15°). Time-volume curves were manually generated from the stacked SSFP images using Simpson's method of disks. The time-volume curves for all 30 patients are shown in the figure below. Using the time-volume curves, the overall LAEF, PEF, maximum LAV (LAMAX or  $\alpha$ ), and pre-atrial contraction volume (PACV or  $\beta$ ) were measured. LAV was also estimated from the end-systolic frame of the 2 and 4 chamber SSFP views

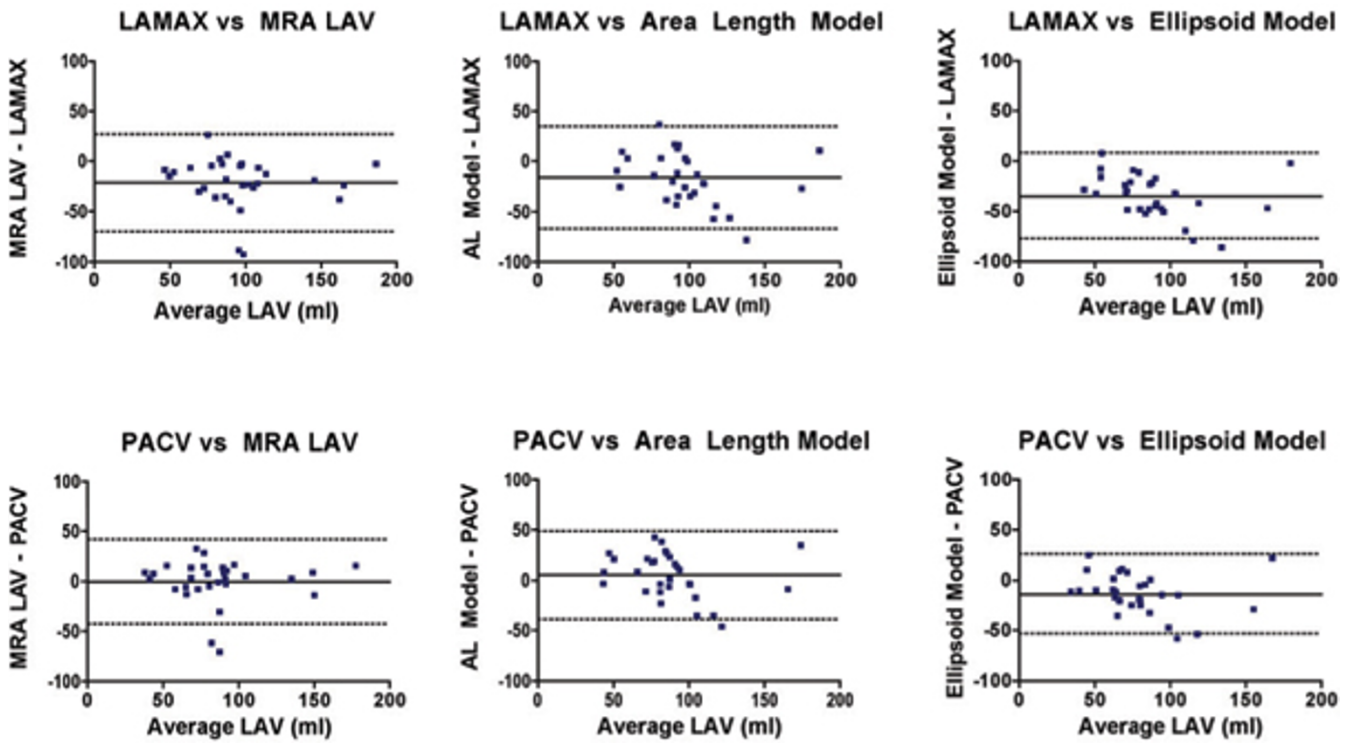
using the area-length (AL) and ellipsoid models. Aquarius software (Tera Recon, San Mateo, CA) was used to measure LAV from the MRA. Bland-Altman plots and linear regression analysis defined the relationship between the LAV measurements, LAMAX, and PACV.

### Results

LAMAX was  $107 \pm 36$  ml and occurred at  $42 \pm 5\%$  (range 29% to 51%) of the RR interval. PACV was  $86 \pm 34$  ml and occurred at  $81 \pm 4\%$  (range 71% to 90%) of the RR interval. LAEF was  $45 \pm 10\%$  (range 15% to 61%) and PEF was  $31 \pm 10\%$  (range 6% to 48%). LAV measured using the MRA, area-length and ellipsoid model correlated well with both LA MAX ( $r^2 = 0.57, 0.49, \text{ and } 0.65$ , respectively,  $p < 0.0001$ ) and PACV ( $r^2 = 0.62, 0.56, \text{ and } 0.65$ , respectively,  $p < 0.0001$ ). Bland-Altman analysis (See Figures 1 and 2) demonstrated that the LA MAX was underestimated by all 3 methods when compared to SSFP 3D volume measurements. The average measurement bias for MRA, area-length model, and ellipsoid model was  $-21 \pm 25$  ml,  $-16 \pm 26$  ml, and  $-35 \pm 22$  ml, respectively. The bias and limits of agreement were reduced when LAV measurements were compared to PACV rather than LA MAX.

### Conclusion

Left atrial volume changes significantly during the cardiac cycle, and the left atrial pump function contributes substantially to the overall LAEF. Left atrial volumes measured by MRA, the area-length model, and the ellipsoid model underestimate the LAMAX when compared to the



**Figure 1**

gold standard measure of 3D volumetrics by stacked SSFP images. CMR generated time-volume curves provide novel insight into cardiac cycle dependent left atrial dynamics. Further studies will determine if accurate measurements of LAMAX, overall LAEF, or PEF provide prognostic information and better guide therapy for atrial fibrillation and other disorders affecting the left atrium.

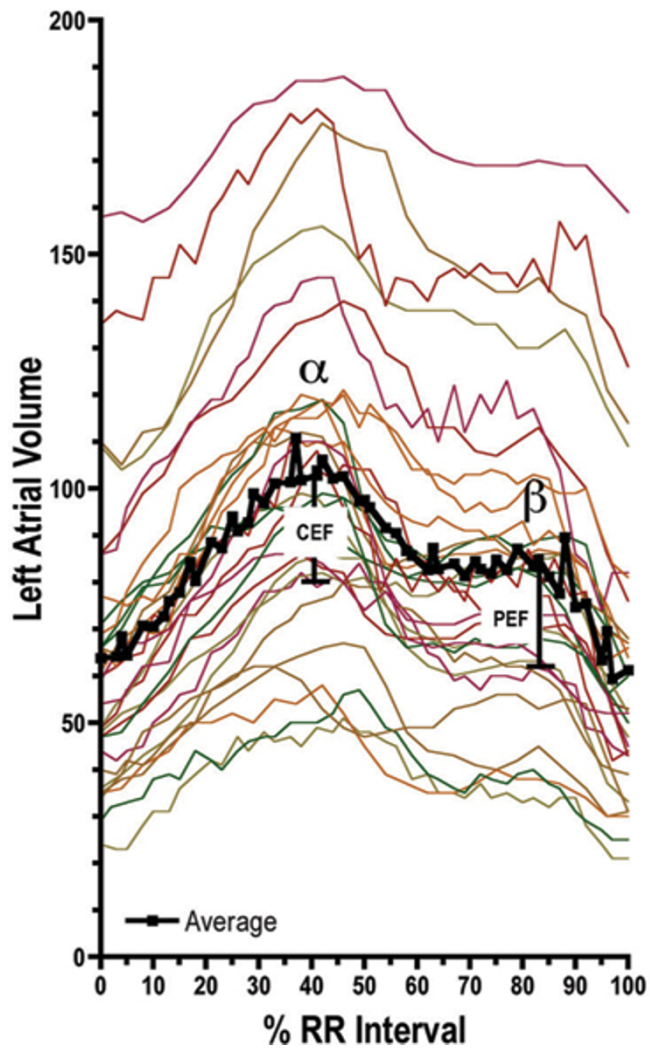


Figure 2