Conversion of Left Atrial Volume to Diameter for Automated Estimation of Sudden Cardiac Death Risk in Hypertrophic Cardiomyopathy

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Background

A subset of patients with hypertrophic cardiomyopathy (HCM) is at high risk for sudden cardiac death (SCD). Practice guidelines endorse use of a risk calculator which requires entry of left atrial (LA) diameter. However, American Society of Echocardiography (ASE) guidelines recommend use of LA volume index (LAVI) for routine quantification of LA size.
Aims of this study were to: a) develop a model to estimate LA diameter from LAVI for entry to automated calculators and b) evaluate whether substitution of measured LA diameter by estimated LA diameter derived from LAVI re-classifies HCM-SCD risk.

Methods

The study cohort was comprised of 500 consecutive HCM patients who underwent transthoracic echocardiography (TTE) from 2003 to 2012 at Mayo Clinic Rochester, Minnesota. LA diameter and LAVI were measured off-line using digital clips from TTE by an experienced sonographer. Linear regression models were developed to estimate LA diameter from LAVI. A European Society of Cardiology endorsed equation estimated SCD risk. Calculated risk using measured LA diameter was compared to risk using estimated LA diameter derived from LAVI.

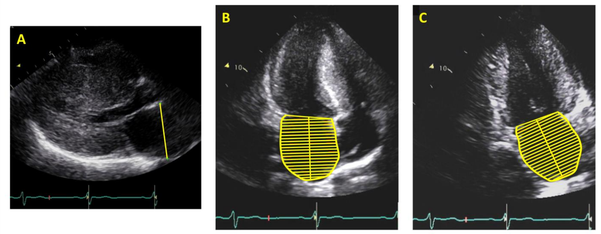

Figure 1: Left atrial measurements

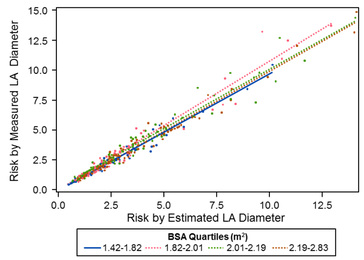

Figure 2: Correlation between risk estimated by the HCM-SCD risk equation comparing measured and estimated LA diameter by BSA quartiles of HCM patients.

Results

For 500 subjects (mean age 53 years, 54% male) the mean LAVI was 48.5 ± 18.8 mL/m 2 . The derived LA diameter was 45.1 mm (SD: 5.5 mm), similar to the measured LA diameter (45.1 mm, SD: 7.1 mm). Median SCD risk at 5 years estimated by measured LA diameter was 2.22% (interquartile range ((IQR): 1.39, 3.56) while median risk calculated by estimated LA diameter was 2.18% (IQR: 1.44, 3.52). Lin's concordance correlation coefficient for SCD risk calculated by measured LA diameter compared to estimated diameter was 0.983 (0.980, 0.986). The majority of patients (476/500 (95%)) maintained the same risk classification regardless of whether the measured or estimated LA diameter was used. Kappa correlation coefficient for group classification was 0.90 (0.86, 0.94).

Discussion

- ASE practice guidelines recommend LA dimension quantification by volumetric methods. Hence, most echocardiography laboratories in the United States have adopted LAVI in clinical practice.
- However, available risk calculators for HCM-SCD require entry of LA diameter which is no longer measured during routine echocardiography.
- LA volume provides the closest agreement to conventional tri-dimensional reconstruction of the left atrium and a more accurate and reproducible estimate of LA size. [1, 2] LA volume is also a robust marker of cardiovascular events. [3] Furthermore LAVI has been used to predict adverse outcomes in patients with HCM. [4, 5]
- The study herein demonstrated that estimated LA diameter can be used for HCM-SCD risk calculation.

Conclusions

Substitution of measured LA diameter by estimated LA diameter in the HCM. SCD calculator did not reclassify risk, justifying automated calculation of HCM-SCD risk for cohort studies and generation of input for clinical decision support systems using LAVI.

Limitations

The present study included data of 500 HCM patients from a single center. In the future, independent validation in other centers may also assess risk using estimated LA diameter in the HCM-SCD risk equation. We had limited number of outcomes at follow-up. Future studies with larger samples could further evaluate outcomes of HCM patients classified using the estimated LA diameter. Patients younger than 18 years old were excluded in our study, and the use of estimated LA diameter in the pediatric population also requires future investigation.

References

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