

Predicting Exercise Induced Left Ventricular Outflow Tract Obstruction in Hypertrophic Cardiomyopathy Patients from their Resting Transthoracic Echocardiogram.



L. Malcolmson^{1,2}, Dr S. Page¹, Dr A. Sengupta¹, G. Bassindale¹ and Dr N. Hadgraft².

¹The Leeds Teaching Hospitals NHS Trust, Leeds, UK.
²Manchester Metropolitan University, Manchester, UK.



Email: leanne.malcolmson@nhs.net

Introduction

Hypertrophic cardiomyopathy (HCM) is one of the most common genetic cardiovascular diseases. Around one third of patients develop latent left ventricular outflow tract obstruction (LVOTO).

LVOTO is dynamic and can be challenging to unmask. Exercise stress echocardiography is considered the gold standard test for diagnosing latent LVOTO, however variables which affect preload and afterload can prevent its detection. Identification of LVOTO aids risk stratification and guides treatment and therapies for symptomatic HOCM.

The Inherited Cardiac Conditions clinic at the Leeds Teaching Hospital NHS Trust (LTHT) would benefit from a model which uses a patient's resting echocardiogram to determine likelihood of LVOTO, despite a previous negative stress echocardiogram.

Aims

- Investigate whether resting echocardiographic parameters can predict exercise induced LVOTO.
- Formulate a model which could predict the outcome of a stress echocardiogram.

Methodology

Search for HCM patients with both a resting TTE and stress TTE over 8 year period (n=101)

Inclusion: PPG <30mmHg at rest

Exclusion: aortic stenosis, hypertension, myocardial infarction, or an LVOT gradient (≥30mmHg) at rest. Dobutamine stress TTE.

Resting and stress TTE's analysed

Resting parameters recorded : i.e. aorta-septal angulation (Fig. 1), SAM and AMVL length and AV velocity.

Maximum LVOT velocity and PPG from stress TTE. Positive stress test = PPG ≥30mmHg. Negative = PPG <30mmHg.

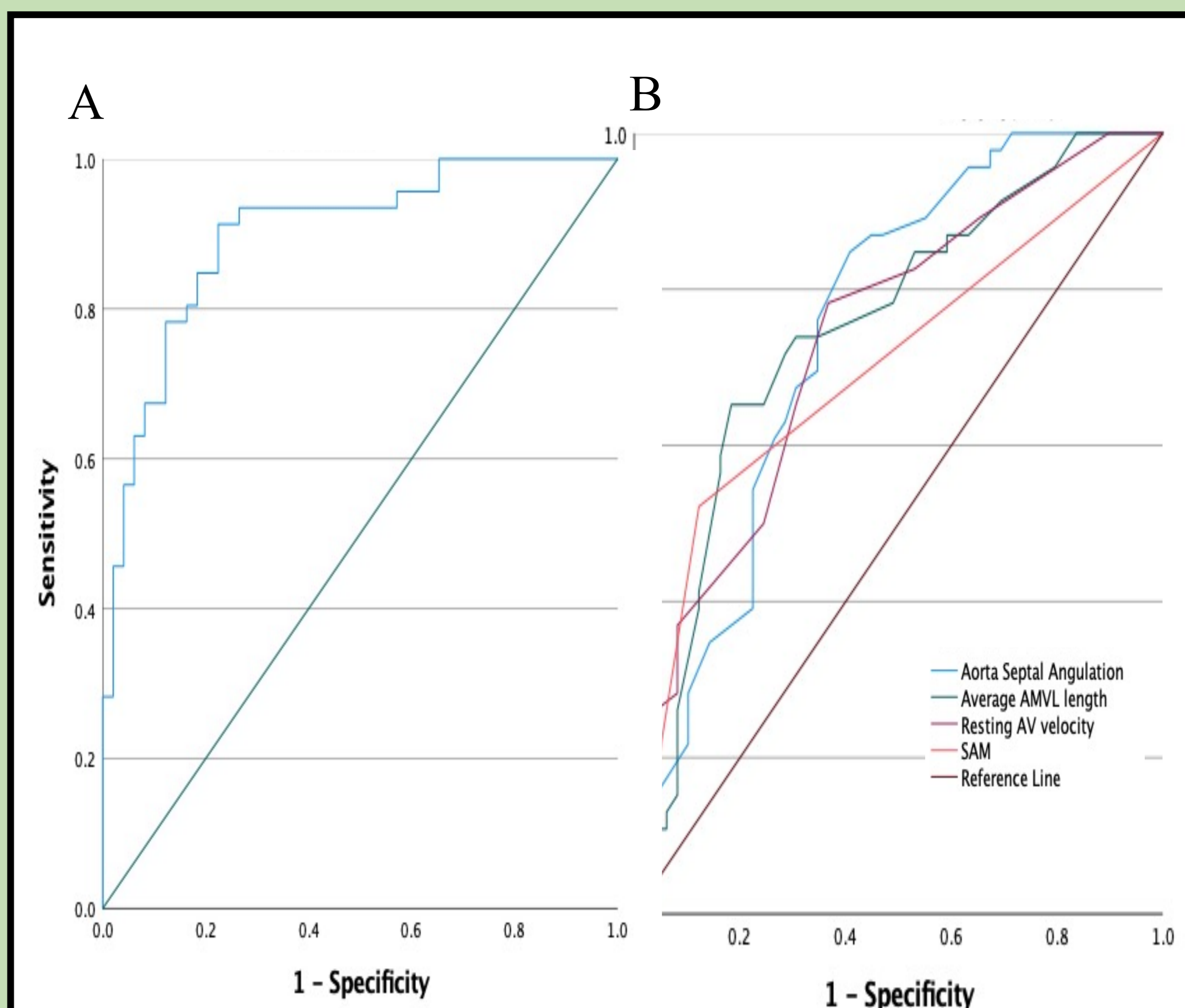


Figure 2 – ROC analysis of logistic regression model. A) Complete model AUC = 0.898 (95% CI, 0.836 to 0.961). B) Each individual element of the model shows an acceptable level of discrimination.

Results

The final model consisted of 4 statistically significant predictors of stress echocardiography outcome: aorta-septal angle, anterior mitral valve leaflet length, resting velocity and the presence of SAM ($\chi^2(4) = 56.874, P < 0.05$). The model correctly classified 83.2% of cases (sensitivity 84.8%, specificity 81.6%). These same parameters could also be used to predict peak pressure gradient via linear regression.

Conclusion

In agreement with previous research, aorta-septal angle, anterior mitral valve leaflet length, resting AV velocity and the presence of SAM were all predictors of exercise induced LVOTO. A model has been created for trial use in the Inherited Cardiac Conditions clinic at LTHT to help determine a patient's predicted peak pressure gradient and their likelihood of having provokable LVOTO.

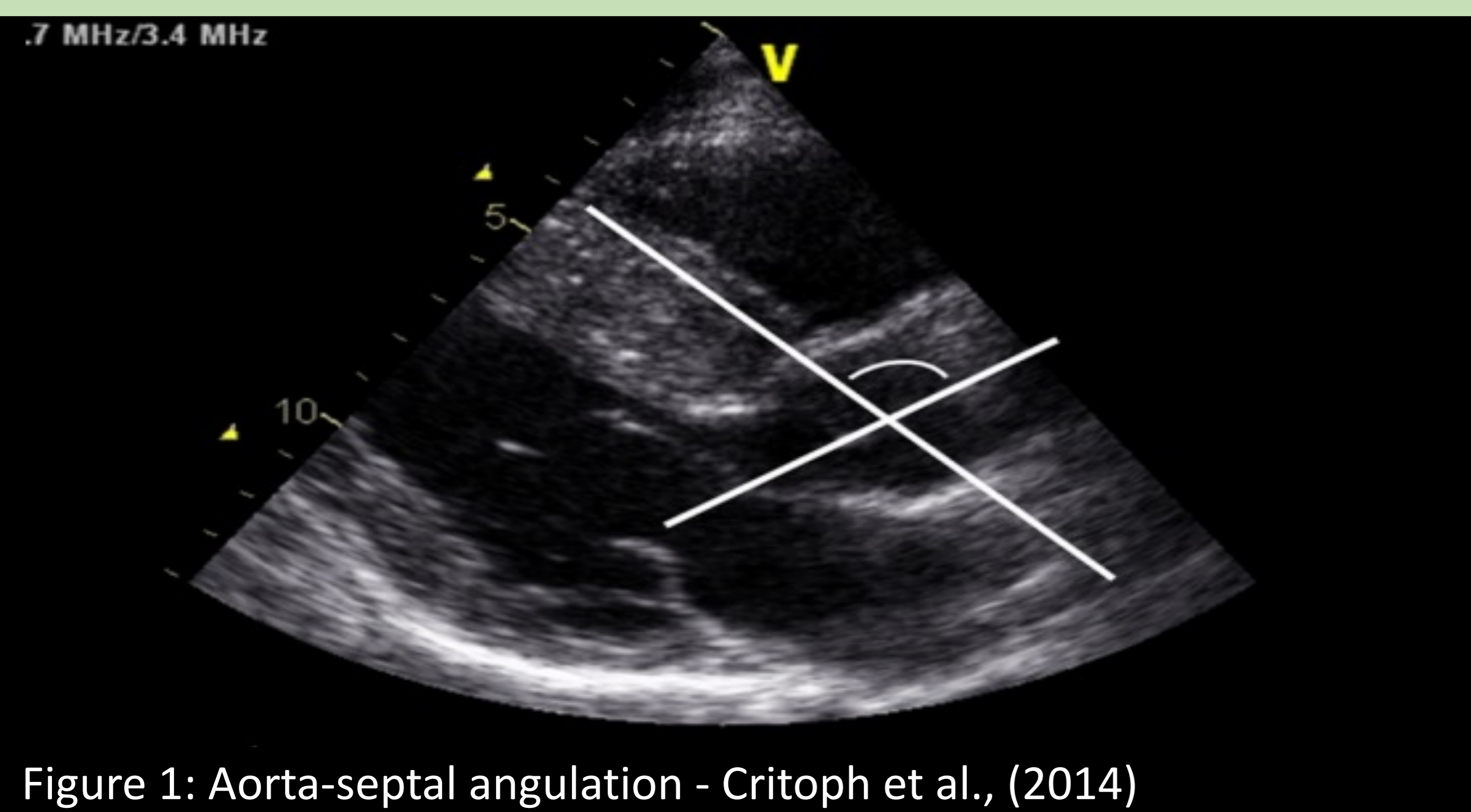


Figure 1: Aorta-septal angulation - Critoph et al., (2014)