Tissue Doppler Imaging combined with advanced 12-lead ECG analysis might improve early diagnosis of hypertrophic cardiomyopathy in childhood

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Introduction:
Optimizing the early diagnosis of childhood hypertrophic cardiomyopathy (HCM) is essential for lowering the risk of HCM-related complications. However, use of standard echocardiography (ECHO) for diagnosis of HCM has been shown to be less sensitive in children than adults, and conventional resting 12-lead ECG is also usually normal in the early stages of HCM. Newer advanced electrocardiograms (A-ECGs) might therefore aid the earlier diagnosis of HCM, especially through their assessment of the spatial QRS-T angle, a parameter that has been suggested to be highly sensitive for HCM in adults and that can be derived from 12-to-Frank-lead transformations in software. Recent studies for example have shown that spatial QRS-T angles derived from standard 12-lead ECG recordings by using Kors´ regression coefficients are statistically equivalent to those derived from simultaneous true Frank XYZ -lead recordings.

In this study, we sought to assess whether spatial QRS-T angle and myocardial Tissue Doppler Imaging (TDI) could aid the early diagnosis of HCM in childhood.

Study population:
HCM: Children and adolescents with familial HCM (n=10, median age 16, range 5-27 years, phenotype positive by ECHO and ECG, heredity for HCM; genopositive for HCM n=8/10),

HCM-Risk: Children and adolescents at risk for HCM, without obvious hypertrophy but combined with heredity for HCM (n=12, median age 16, range 4-25 years, HCM or sudden death autopsy-verified HCM in ≥1 first-degree relative)

Controls: Healthy age-matched volunteers (n=21, no cardiac symptoms and no history of cardiac disease)

Methods:
All participants responded to a questionnaire and underwent routine physical examination. They were also investigated by routine ECHO (Philips iE33) TDI and 5-minute ECG sampling for advanced 12-lead ECG (A-ECG) analysis. The latter was done by using Cardiax® (IMED Co Ltd, Budapest, Hungary) and CardioSoft® (Houston, Texas, USA).
Spatial mean QRS-T angle (SA) was derived from the 12-lead ECG by using Kors´ regression transformation.

Cardiax® (IMED Co Ltd, Budapest, Hungary)

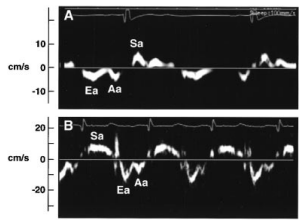
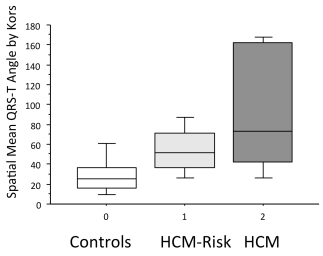


Illustration of Tissue Doppler Imaging, TDI. HCM vs normal control. From McMahnon et al *Circulation* 2004

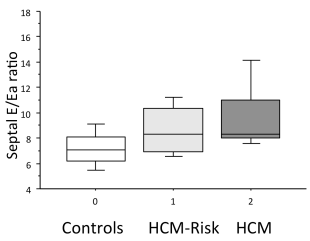
Results:
Spatial mean QRS-T angle by Kors´ regression transformation (Figure/ Panel A) and septal E/Ea ratio (Figure/Panel B) were most increased in HCM group as compared to the HCM-risk and control groups ($p<0.05$). Of note, these 2 variables showed a trend toward higher levels in the HCM-risk group than in control group ($p=0.05$ for E/Ea and 0.06 for QRS/T by ANOVA).

In a logistic regression model, increased SA and septal E/Ea ratio appeared to significantly predict both the disease (Chi-square in HCM group: 9 and 5, respectively, $p<0.05$ for both) and the state of being at risk for the disease (Chi-square in HCM-risk group: 5 and 4 respectively, $p<0.05$ for both), with further increased predictability level when these 2 variables were combined (Chi-square 10 in HCM group, and 7 in HCM-risk group, $p<0.01$ for both).

Panel A



Panel B



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Conclusions:
In this small pilot study, Tissue Doppler Imaging and spatial mean QRS-T angle, particularly when combined, appear to be sensitive in predicting both HCM and HCM-risk in children. Large-scale prospective studies are needed to confirm these initial findings.

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