



MACHINE LEARNING APPLIED TO ENERGY WAVEFORM ECG FOR PREDICTION OF STAGE B HEART FAILURE IN THE COMMUNITY

Poster Contributions
Posters Hall_Hall A
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Background: Energy waveform (ew) ECG uses continuous wavelet transforms (CWT) to create time-frequency energy characterizations. Although ewECG changes reflect myocardial disease, optimal features for prediction of subclinical left ventricular dysfunction (Stage B heart failure [SBHF]) are unclear. Using machine learning (ML), we investigated whether ewECG could predict SBHF in at-risk community subjects to establish its potential role in screening.

Methods: Asymptomatic subjects (n=319) aged ≥ 65 yrs. with ≥ 1 non-ischemic risk factor for HF underwent clinical evaluation, MyoVista (HeartSciences, Southlake, TX) ewECG and echocardiographic evaluation. SBHF was defined as systolic (GLS $\leq 16\%$) or diastolic (E/e' ≥ 15 , E/e' > 10 with left atrial enlargement or impaired relaxation with other changes). A random forest classifier created the ML model using 33 of 643 CWT features.

Results: In the training dataset of Australian subjects (n=254), 135 (53%) had SBHF. In an external test dataset (n=65), 27 (42%) had SBHF. The ML model had a sensitivity and specificity of 81% and 74% respectively (AUC 0.72). Applied to the test dataset, sensitivity was 93%, specificity 61% and AUC 0.76. Based on this performance echocardiograms in at-risk individuals would be reduced by 38%, albeit missing 7% of SBHF cases.

Conclusion: Using ML algorithms ewECG shows suitable performance, based on sensitivity and ability to significantly reduce unnecessary echocardiography, for application as a screening test for SBHF.

Clinical and echocardiographic characteristics of the training and test dataset

	Training data	Test data	p-value
Age, yrs. (IQR)	71 (68-74)	70 (67-74)	0.15
Gender, male (%)	107 (42)	22 (34)	0.22
Type II diabetes (%)	80 (32)	21 (32)	0.93
SBP, mmHg (SD)	142 (15)	139 (17)	0.09
BMI, kg/m ² (IQR)	31 (28-35)	31 (27-34)	0.37
ACE/ARB (%)	193 (76)	43 (66)	0.1
NT-proBNP, pg/ml (IQR)	59 (30-108)	Incomplete data	NA
LVEF, % (SD)	62 (7)	63 (6)	0.41
GLS, % (IQR)	18 (17-20)	20 (18-21)	<0.001
e', cm/s (SD)	7.6 (1.8)	7 (2)	0.08
E/e', (IQR)	8 (7-11)	8 (7-10)	0.15
LAVI, ml/m ² (IQR)	34 (30-41)	35 (26-41)	0.48
SBHF (%)	135 (53)	27 (42)	0.1