Abstract: **P3431**

**Machine learning applied to energy waveform ECG for prediction of subclinical myocardial dysfunction**

**Authors:**
E Potter¹, Y Liu¹, S Teo¹, M Inouye¹, TH Marwick¹, ¹Baker IDI Heart and Diabetes Institute - Melbourne - Australia,

**Topic(s):**
Prevention – Cardiovascular Risk Assessment: Imaging

**Citation:**

Funding Acknowledgements:
Baker Heart and Diabetes Institute

Background: Energy waveform (ew) ECG used continuous wavelet transforms (CWT) to create time-frequency energy characterisations. Although ewECG changes reflect myocardial disease, the optimal measures for prediction of subclinical left ventricular dysfunction (sLVD) are unclear.

**Aim:** Using machine learning, we investigated whether ewECG could predict sLVD in community subjects at risk of heart failure (HF).

**Methods:** Asymptomatic community subjects aged ≥65 yrs. with ≥1 non-ischaemic risk factor for HF underwent clinical evaluation, MyoVista (HeartSciences, Southlake, TX) ewECG and echocardiographic evaluation. sLVD was defined as systolic (global longitudinal strain, GLS=16%) or diastolic (E/e' =15, E/e'>10 with left atrial enlargement, or impaired relaxation with other changes). A gradient boosting algorithm (supervised machine learning) with regularisation was implemented to predict sLVD using 362 ewECG features. The performance was assessed by precision, recall, F measure, precision-recall (PR) curve and receiver operating characteristic (ROC) curve. Feature importance was inspected by information gain node splitting.

**Results:** Of 97 subjects (age 71 (68-73) yrs., 53% female) 56 (58%) had sLVD. For prediction of sLVD, ewECG showed areas under PR and ROC curves of 0.86 and 0.8 respectively. The feature of greatest importance, with twice the importance of the second was a CWT frequency related to depolarisation.

**Conclusion:** ewECG shows good predictive performance for sLVD in elderly subjects at risk of HF. HF prevention strategies incorporating ewECG to select individuals for echocardiographic evaluation should be considered.

<table>
<thead>
<tr>
<th>Hypertension (%)</th>
<th>83 (86)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diabetes Mellitus (%)</td>
<td>34 (36)</td>
</tr>
<tr>
<td>Atrial Fibrillation (%)</td>
<td>8 (8)</td>
</tr>
<tr>
<td>BMI (IQR)</td>
<td>31 (27-34)</td>
</tr>
<tr>
<td>LVMi (SD)</td>
<td>73 (23)</td>
</tr>
<tr>
<td>Ejection fraction (SD)</td>
<td>60 (6)</td>
</tr>
<tr>
<td>GLS (SD)</td>
<td>18 (3)</td>
</tr>
<tr>
<td>E/e' (IQR)</td>
<td>8 (7-10)</td>
</tr>
<tr>
<td>LAVi (IQR)</td>
<td>33 (28-40)</td>
</tr>
</tbody>
</table>

IQR - Interquartile range, BMI - body mass index, LVMi - left ventricular mass index, GLS - global longitudinal strain, LAVi - left atrial volume index.
Abstract: P3431
Machine learning applied to energy waveform ECG for prediction of subclinical myocardial dysfunction

Authors: E Potter 1, Y Liu 1, S Teo 1, M Inouye 1, TH Marwick 1, 1 Baker IDI Heart and Diabetes Institute - Melbourne - Australia,

Topic(s): Prevention – Cardiovascular Risk Assessment: Imaging

Citation: Funding Acknowledgements: Baker Heart and Diabetes Institute

Background: Energy waveform (ew) ECG used continuous wavelet transforms (CWT) to create time-frequency energy characterisations. Although ewECG changes reflect myocardial disease, the optimal measures for prediction of subclinical left ventricular dysfunction (sLVD) are unclear.

Aim: Using machine learning, we investigated whether ewECG could predict sLVD in community subjects at risk of heart failure (HF).

Methods: Asymptomatic community subjects aged ≥65 yrs. with ≥1 non-ischaemic risk factor for HF underwent clinical evaluation, MyoVista (HeartSciences, Southlake, TX) ewECG and echocardiographic evaluation. sLVD was defined as systolic (global longitudinal strain, GLS = 16%) or diastolic (E/e' = 15, E/e'>10 with left atrial enlargement, or impaired relaxation with other changes). A gradient boosting algorithm (supervised machine learning) with regularisation was implemented to predict sLVD using 362 ewECG features. The performance was assessed by precision, recall, F measure, precision-recall (PR) curve and receiver operating characteristic (ROC) curve. Feature importance was inspected by information gain node splitting.

Results: Of 97 subjects (age 71 (68­73) yrs., 53% female) 56 (58%) had sLVD. For prediction of sLVD, ewECG showed areas under PR and ROC curves of 0.86 and 0.8 respectively. The feature of greatest importance, with twice the importance of the second was a CWT frequency related to depolarisation.

Conclusion: ewECG shows good predictive performance for sLVD in elderly subjects at risk of HF. HF prevention strategies incorporating ewECG to select individuals for echocardiographic evaluation should be considered.

Hypertension (%): 83 (86)  
Diabetes Mellitus (%): 34 (36)  
Atrial Fibrillation (%): 8 (8)  
BMI (IQR): 31 (27­34)  
LVMi (SD): 73 (23)  
Ejection fraction (SD): 60 (6)  
GLS (SD): 18 (3)  
E/e' (IQR): 8 (7­10)  
LAVi (IQR): 33 (28­40)

IQR - Interquartile range, BMI - body mass index, LVMi - left ventricular mass index, GLS - global longitudinal strain, LAVi - left atrial volume index