Artificial Intelligence Predicts Atrial Fibrillation Development from the 12-lead Electrocardiogram in Heart Failure with Preserved Ejection Fraction

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Artificial Intelligence Predicts Atrial Fibrillation Development from the 12-lead Electrocardiogram in Heart Failure with Preserved Ejection Fraction
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Introduction: An artificial intelligence (AI) algorithm that utilizes data contained within a single 12-lead ECG during normal sinus rhythm has recently shown to identify patients with occult AF. Patients with HFpEF frequently display AF in association with left atrial (LA) dysfunction. Hypothesis: Patients with HFpEF and a higher probability of AF according to their AI-enabled ECG display more advanced LA remodeling and dysfunction, putting them at greater risk for AF development. Methods: This retrospective cohort study includes 613 patients with definite HFpEF. 184 ambulatory patients diagnosed through invasive hemodynamic testing and 429 inpatients admitted because of decompensated HFpEF. A previously validated AI algorithm that predicts current AF risk based on ECG analysis was applied to estimate future AF risk during long-term follow-up, with patients grouped into quartiles of AI-predicted AF risk. Cardiac structure and function, as well as incident AF rates were compared. Results: AI-predicted AF risk was 42% (14–69%) overall. Patients with higher risk were older, with more comorbidities, lower blood pressure, higher natriuretic peptide levels, greater conduction delays, a higher prevalence of pacing, and more frequent use of diuretics. In addition, underlying structural heart disease was more severe, with more pronounced left ventricular hypertrophy, larger LA volumes, lower LA reservoir and booster strain, higher cardiac filling pressures (confirmed through invasive measurements ambulatory patients), and more tricuspid regurgitation. Echocardiography images from a representative patient within each AF-risk quartile are presented in the Figure. Invasive hemodynamic measurements in the ambulatory cohort showed additionally that patients with higher AI-predicted AF risk had lower cardiac output (10.0± 2.85L/min and 6.94 ±2.49L/min in the lowest and highest risk quartile, respectively) and a higher pulmonary vascular resistance at peak effort (121± 102dynes/s/cm² and 220± 133 dynes/s/cm² in the lowest and highest risk quartile, respectively). Over a median follow-up of 41months (11-71months), AI-predicted AF risk was associated with new-onset AF [HR(95%CI) = 1.31(1.20-1.41); p < 0.0001] and all-cause death [HR(95%CI) = 1.20(1.08-1.37); p < 0.0001]. Conclusions: An AI-risk score based upon a single 12-lead ECG reflects the severity of underlying LA myopathy in HFpEF and predicts new-onset AF. These data suggest that application of an AI-enabled ECG may be useful to identify patients with the AFLA myopathy phenotype in HFpEF.

Clinical Characteristics and Outcomes of Temporary Trans-venous Pacing in Atrio-ventricular Block in Acute Myocarditis
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Background: Atrioventricular block (AVB) is known complication of acute myocarditis. Data is limited on the role of trans-venous pacing in acute mycarditis with atrioventricular block. Aim: We aimed to evaluate the clinical characteristics and outcomes of patients requiring temporary trans-venous pacing for AVB in acute myocarditis. Methods: We queried the national inpatient sample (NIS) from 2002 through 2015, unweighted, for patients older than 18 years old who carried a diagnosis of acute myocarditis using ICD-9 codes. Outcomes in patient who had trans-venous pacing were evaluated. Results: We identified 10,106 patients with acute myocarditis from 2002-2015. Of them, 5573 (55.1%) were idiopathic, 283 (2.8%) were septic, 103 (1.0%) were toxic, 89 (0.9%) were acute rheumatic, and 4058 (40.2%) were unspecified myocarditis. AVB occurred in 393 patients (3.9%) of which 134 (34.1%) patients needed trans-venous pacing (table 1 show distribution of trans-venous pacing according to the types of acute myocarditis). In patient who required trans-venous pacing; median age was 42 years (IQR 29-54), median length of stay was 6 days (IQR 4-9), median cost of hospital charger was $47,520 (IQR $28,265-$103,550), 64.9% were male, and 72.8% were White. In hospital death occurred in 5 patient (3.7%), 12 (9.0%) had septicemia, 2 (1.5%) had cardiac tamponade, 10 (7.5%) had ventricular arrhythmias, 18 (13.4%) needed permanent pacemaker, and 13 (9.7%) had cardiogenic shock. Conclusion: Heart block is not uncommon in acute myocarditis and one third of patients require temporary pacing, however AVB is transient in most patient with less than a fifth of patients requiring permanent pacemaker.

Table 1. Distribution of trans-venous pacing according to the type of acute myocarditis.

<table>
<thead>
<tr>
<th>Type Of Myocarditis</th>
<th>Total</th>
<th>Trans-venous pacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Idiopathic</td>
<td>5573 (55.1%)</td>
<td>37 (27.6%)</td>
</tr>
<tr>
<td>Septic</td>
<td>283 (2.8%)</td>
<td>4 (3.0)</td>
</tr>
<tr>
<td>Toxic</td>
<td>103 (1.0%)</td>
<td>0</td>
</tr>
<tr>
<td>Acute rheumatic</td>
<td>89 (0.9%)</td>
<td>0</td>
</tr>
<tr>
<td>Other</td>
<td>4058 (40.2%)</td>
<td>93 (69.4%)</td>
</tr>
</tbody>
</table>