THE ROLE OF THE ECHOCARDIOGRAPHY IN PREDICTING IMPLANTABLE CARDIOVERTEBRAL DEFIBRILLATOR (ICD) DISCHARGE

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BACKGROUND
Heart failure patients with low ejection fraction (EF) are susceptible to arrhythmias and sudden cardiac death. Implantable cardioverter-defibrillator (ICD) therapy is a recommended lifesaving intervention for patients with symptomatic heart failure (LVEF ≤30%) [40]. The benefit of ICD is that the device will terminate ventricular arrhythmias reducing mortality in this patient population. Once implanted, limited data exist on physiological markers to predict appropriate ICD discharge. Therefore, strategies to better define patients at high risk for arrhythmias requiring ICD therapy are needed.

OBJECTIVE
The purpose of this study is to identify the echocardiographic parameters that predict appropriate ICD discharge in patients with severe systolic heart failure using a propensity matched retrospective study design.

METHODS
This study is a retrospective single-institution investigation that enrolled a total of 1,445 patients who had an ICD implantation and follow-up clinic visits during Aug 2011-May 2014. Of these patients, 57 had appropriate ICD discharge while 1,388 had no ICD discharge. All included patients had 2-Doppler echocardiography within 90 days of either their clinic visit or ICD discharge.

Inclusion Criteria:
- Systolic heart failure with LVEF ≤ 35%
- ICD placed at ACH (with or without pacing systems)
- Interpretable 2-Doppler Echo cardiogram within 90 days of the ICD discharge (Case Cohort)
- Interpretable 2-Doppler Echo cardiogram within 90 days of a clinic visit [Control Visit].

A matched control group was identified from the 1,388 patients who had no ICD discharge with the below matching variables:
- Age
- Gender
- History of ischemic heart disease
- Amiodarone use
- Digoxin use
- ICD type
- Observation time (from the time of ICD implant to their ICD discharge or clinical visit)

RESULTS
The majority of the study population was Caucasian and male with an average age of 64.8 years. Echocardiographic parameters in the unmatched population associated with ICD shock vs. no shock included left ventricular (LV) systolic (5.0 ± 1.1 vs. 4.6 ± 1.1 cm, p<0.01) and diastolic (6.1 ± 0.9 vs. 5.6 ± 1.0 cm, p<0.01) diameters, and LVEDV-volume (190.3 ± 67.1 vs. 162.9 ± 63.3 mL, p<0.01). The two groups did not differ in measures of systolic function, expect for ejection fraction (31.1 ± 12.6 vs. 37.0 ± 14.8, p=0.01). For diastolic Doppler measures, shorter deceleration time (189.4 ± 72.4 vs. 215.7 ± 79.5 ms, p=0.04), greater mVTR ejection point velocity (101.2 ± 34.4 vs. 84.3 ±34.3 cm/s, p<0.01) and E/A ratio (1.6 ± 1.0 vs. 1.3 ± 0.9, p=0.05) as well as higher estimated pulmonary artery systolic pressure (44.7 ± 14.3 vs. 38.3 ± 13.9 mmHg, p<0.01) and tricuspid regurgitation (TR) peak velocity (289.6 ± 51.1 vs. 262.8 ± 54.8 cm/s, p<0.01) were significantly associated with ICD discharge. After matching, only mVTR ejection point velocity (101.2 ± 34.4 vs. 87.1 ± 26.0 cm/s, p<0.005) and TR peak velocity (289.6 ± 51.1 vs. 264.3 ± 55.9 cm/s, p=0.005) remained significant.

CONCLUSIONS
Echocardiographic measures of systolic function and LV remodeling were not associated with appropriate ICD shock. Echocardiographic parameters reflecting severe diastolic abnormalities are associated with appropriate ICD discharge.

Further studies are required to investigate the role of the echocardiographic parameters in predicting appropriate ICD discharges in heart failure patients.

REFERENCES

Table 1: Baseline Demographics of Study Population. COPD: Chronic Obstructive Pulmonary Disease; SCD: Sudden Cardiac Death; PPM: Permanent Pacemaker.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Overall (n=1445)</th>
<th>ICD Shock (n=57)</th>
<th>No ICD Shock (n=1388)</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (yr)</td>
<td>63.3 ± 10.7</td>
<td>63.5 ± 10.4</td>
<td>63.3 ± 10.7</td>
<td>0.71</td>
</tr>
<tr>
<td>Gender</td>
<td>71% M, 29% F</td>
<td>66% M, 34% F</td>
<td>71% M, 29% F</td>
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<tr>
<td>History of Ischemic Heart Disease</td>
<td>43%</td>
<td>46%</td>
<td>43%</td>
<td>0.41</td>
</tr>
<tr>
<td>Amiodarone use</td>
<td>16%</td>
<td>19%</td>
<td>16%</td>
<td>0.41</td>
</tr>
<tr>
<td>Digoxin use</td>
<td>13%</td>
<td>17%</td>
<td>13%</td>
<td>0.14</td>
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<tr>
<td>ICD type</td>
<td>Single Chamber</td>
<td>60%</td>
<td>60%</td>
<td>0.75</td>
</tr>
<tr>
<td>Observation time</td>
<td>from ICD implant to ICD discharge or clinical visit</td>
<td>252 ± 39 days</td>
<td>256 ± 39 days</td>
<td>0.41</td>
</tr>
</tbody>
</table>

Table 2: Echocardiography measurements between the study population based on appropriate ICD discharge vs no ICD discharge for a 1:1 matched cohort.

Table 3: Echocardiography measurements between the study population based on appropriate ICD discharge vs no ICD discharge for a 2:1 matched cohort.

Figure 1: Diastolic Measures by ICD Discharge versus no ICD Discharge. TR: Tricuspid Regurgitation.