**Background**

- Despite promising cancer results from immune checkpoint inhibitors (ICI) several immune related adverse events (irAE) have been observed, including myocarditis.

- Though it has a low incidence, 0.5 to 1%, ICI myocarditis is the most fatal irAE with a reported mortality of 25 to 50%.

- ICI myocarditis diagnosis depends on a combination of clinical presentation: biomarkers, cardiac imaging, and endomyocardial biopsy.

- The clinical presentation of myocarditis is often equated with heart failure despite most patients presenting with normal left ventricular ejection fraction (LVEF).

- Current practice guidelines suggest to first rule coronary artery disease (CAD) prior to making a diagnosis of myocarditis.

**Objective**

To establish that the presentation of heart failure may not always indicate ICI myocarditis.

**Methods**

- A single center retrospective cohort study of all patients who had endomyocardial biopsy for suspected ICI myocarditis between January 2018 and January 2020 was performed.

- Manual electronic medical record review was performed to collect demographics, oncologic history, laboratory values, catheterization data, and cardiac imaging data.
  - Pulmonary capillary wedge pressure (PCWP) ≥12mmHg indicates heart failure and PCWP<12mmHg indicates no heart failure.

- Clinical parameters and right heart hemodynamics were compared using Chi-square test.

**Results**

- 52 patients had endomyocardial biopsy for suspicion of ICI myocarditis.
  - The mean age was 68 years and the majority were male (75%).
  - 42 (81%) patients had definite, probable, or possible myocarditis and the remaining were considered negative for myocarditis.

- Of those with myocarditis, LVEF <50% was observed in 47% of patients and pulmonary capillary wedge pressure (PCWP) >12mmHg was observed in 47% of patients.
  - Elevated PCWP and LVEF <50% were not correlated (p=0.78).

- 47% presented with dyspnea but presenting symptoms of dyspnea and elevated PCWP were not associated (p=0.09).

- Of the 8 patients presenting with dyspnea but with normal PCWP, 3 (38%) had concomitant myositis, myasthenia gravis, or guillian barre irAEs.

- Significant CAD was found on left heart cath in 26% of patients presenting with myocarditis but the presence of CAD was not associated with having elevated PCWP (p=0.14).

**Conclusions**

- ICI myocarditis has varied clinical presentations including heart failure.

- With patients presenting with dyspnea but have normal filling pressures on echocardiogram, concomitant muscular/neuromuscular junction irAEs should be considered.

- Cancer and CAD have shared risk factors and up to a quarter of patients presenting with myocarditis may have concomitant CAD.

- The presence of CAD should not rule out myocarditis.

**References**

Lili Zhang, Kerry L. Reynolds, Alexander R. Lyon, Nicolas Palaskas, Tomas G. Neelan,


**Table 1-Baseline Demographics**

<table>
<thead>
<tr>
<th>Demographics &amp; Clinical Parameters</th>
<th>Definite Myocarditis n=26</th>
<th>Probable Myocarditis n=7</th>
<th>Possible Myocarditis n=9</th>
<th>Negative for Myocarditis n=11</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, Median (IQR)</td>
<td>74 (66-77)</td>
<td>62 (58-73)</td>
<td>65 (63-69)</td>
<td>69 (66-76)</td>
<td>0.54</td>
</tr>
<tr>
<td>Gender % (M/F)</td>
<td>73/27</td>
<td>71/29</td>
<td>89/11</td>
<td>73/27</td>
<td>0.79</td>
</tr>
<tr>
<td>Race %</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>73</td>
<td>57</td>
<td>67</td>
<td>27</td>
<td>0.4</td>
</tr>
<tr>
<td>Black</td>
<td>8</td>
<td>14</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>21</td>
<td>28</td>
<td>32</td>
<td>37</td>
<td>0.78</td>
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</tbody>
</table>

**Table 2-Right and Left Heart Catheterization Data at Time of Biopsy**

<table>
<thead>
<tr>
<th>Right/Left Heart Catheterization Data</th>
<th>Definite Myocarditis n=26</th>
<th>Probable Myocarditis n=7</th>
<th>Possible Myocarditis n=9</th>
<th>Negative for Myocarditis n=11</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pulmonary capillary wedge pressure mean</td>
<td>12 (9-15)</td>
<td>11 (8-13)</td>
<td>16 (7-22)</td>
<td>13 (10-16)</td>
<td>0.79</td>
</tr>
<tr>
<td>Left ventricular end-diastolic pressure</td>
<td>20 (12-22)</td>
<td>17 (14-19)</td>
<td>22 (11-26)</td>
<td>18 (15-19)</td>
<td>0.75</td>
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<tr>
<td>Cardiac index- Fick L/min/m2</td>
<td>2.8±2.2±3.1</td>
<td>3.2±2.2±3.1</td>
<td>2.3±1.8±2.2</td>
<td>3.1±2.8±3.2</td>
<td>0.07</td>
</tr>
<tr>
<td>Arterial systolic blood pressure</td>
<td>128 (114-144)</td>
<td>132 (122-150)</td>
<td>114 (105-122)</td>
<td>128 (117-133)</td>
<td>0.37</td>
</tr>
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