Longitudinal analysis of myocardial function using strain in patients receiving cardiotoxic chemotherapy

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Longitudinal myocardial function assessment for chemotherapy-related cardiotoxicity and possible association with genetic polymorphism in pediatric population

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INTRODUCTION

• Chemotherapy-related cardiotoxicity (CTRC) can result in significant morbidity and mortality in long term cancer survivors.
• Our goal was to assess longitudinal myocardial function using left ventricular ejection fraction (LV-EF) and left ventricular global longitudinal strain (LV-GLS).
• Our secondary objective was to identify cardiovascular genetic polymorphism that may influence CRTC.

METHODS

• 50 Subjects ≥10 years of age who survived >2 years after completion of cancer treatment.
• 29 Subjects consented for genetic analysis and longitudinal evaluation with echocardiography.
• LV-EF: Measures using area-length bullet method.
• LV-GLS: Measured by using speckle tracing with 2D STE offline analysis software developed by TomTec Imaging Systems.
• Whole exome sequencing for genetic polymorphism was performed.
• GLS ≤-18% was considered normal.
• Data was analyzed with chi-square and paired T-test for categorical and continuous variables, respectively.

RESULTS

• 59% had longitudinal echocardiographic data for serial LV-EF and LV-GLS measurements.
• Baseline EF: 60.1% ± 5.4%; Baseline GLS: -21.71% ± 2.36%
• Mean follow-up duration was 4.1 years [range 2.2-6.5 years].
• All were clinically asymptomatic, NYHA Class I.
• Follow-up evaluation:
  • Mean reduction of LV GLS: 1.4% ± 2.1% [p=0.015]
  • Mean Reduction of EF: 1% ± 5.6% [p=0.45]
• Longitudinal data:
  • Decrease in GLS by > 2% in 47% of patients
  • Decrease in EF by ≥ 5% in 11.7% of patients

Table 1. Baseline characteristics at cumulative anthracycline dose <200 and ≥200 mg m^-2

<table>
<thead>
<tr>
<th>Category</th>
<th>All Patients</th>
<th>Cumulative anthracyline dose (mg m^-2)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&lt; 200</td>
<td>≥ 200</td>
</tr>
<tr>
<td>N (%)</td>
<td>29</td>
<td>16</td>
</tr>
<tr>
<td>Age (years)</td>
<td>17 ± 4</td>
<td>16.7 ± 3.7</td>
</tr>
<tr>
<td>Female (%)</td>
<td>14 (48.3)</td>
<td>7 (43.8)</td>
</tr>
<tr>
<td>Type of Cancer (%)</td>
<td></td>
<td>7 (53.8)</td>
</tr>
<tr>
<td>Solid</td>
<td>18 (62.1)</td>
<td>9 (56.2)</td>
</tr>
<tr>
<td>Leukemia</td>
<td>11 (37.9)</td>
<td>7 (43.8)</td>
</tr>
<tr>
<td>Radiation Exposure (Gy)</td>
<td>9.5 ± 15.9</td>
<td>12.5 ± 19.6</td>
</tr>
<tr>
<td>Bone marrow transplant</td>
<td>5 (17)</td>
<td>1 (6.2)</td>
</tr>
<tr>
<td>Follow up duration (years)</td>
<td>4.1 ± 1.5</td>
<td>3.4 ± 1</td>
</tr>
</tbody>
</table>

Table 2. Genetic polymorphism associated with changes in LV-GLS

CONCLUSION

• LV-GLS is a more sensitive marker for longitudinal analysis of cardiac function than LV-EF.
• Certain polymorphisms may influence CRTC and can be a valuable tool in risk-stratification of these patients.