Undetected Health Problems and Surveillance Needs in Long-Term Cancer Survivors

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- Survivors who participated in this research
- All contributors
Background

- Late medical effects widely, as documented in cross-sectional surveys of cancer survivors after systemic treatment

- Little research has investigated the characteristics, consequences, or risk factors for late effects using standardized, objective testing rather than patient report
Objectives

• Characterize specific medical late effects in hematopoietic stem cell transplantation (HSCT) survivors who report that they have no major health problems

• Determine levels of undetected health problems in otherwise ‘healthy’ survivors

• Examine whether objective tests of health risks are elevated in these ‘healthy’ survivors relative to population norms
Method: Participants

- All locally residing HSCT survivors who met eligibility criteria for screening were approached and screened by phone.
- Survivors were compared to a cohort from the National Health and Nutrition Examination Survey (NHANES) matched for age, gender, and race.
Participants

• **Inclusion criteria**
  – 5-20 years post-transplant for hematologic malignancy
  – Current age 18-49
  – Able to travel to the Hutchinson Center
  – Able to walk without assistance or aids

• **Exclusion criteria**
  – Relapse of cancer post-transplant or second cancer
  – Hepatitis C, HIV or AIDS
  – Pulmonary disease or emphysema
  – Arthritis, muscle, joint, or nerve disease
  – Autoimmune disease
  – On immunosuppressive medications
  – Diabetes requiring insulin
  – Uncontrolled cardiovascular disease or cardiac problems
  – Thyroid or electrolyte imbalance not controlled with medication
  – Smoking, alcohol >2/day, or recreational drug use
  – Physician advice not to exercise
  – Unable to read and understand English
Flow Diagram

222 Met core inclusion criteria

179 Contacted

43 Unable to contact

179 Contacted

17 Refused

162 Completed Screening

17 Ineligible

57 Enrolled in onsite testing and patient reported outcomes (PRO)

88 Ineligible for onsite testing, enrolled in PRO only
Method: Procedure

• **Patient-reported outcomes** included the Medical Outcomes Study Short Form 36 (SF-36)

• **Objective tests** included:
  – DXA scan for body fat percent
  – Body mass index (BMI)
  – Blood pressure
  – Blood glucose level, lipid panel
  – Treadmill testing for VO$_2$max

• Participants paid $100
### Demographic Characteristics of Survivors (N=57)

<table>
<thead>
<tr>
<th>Category</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age, M ± SD</strong></td>
<td>39.6 ± 9.2</td>
</tr>
<tr>
<td><strong>Gender, n (%)</strong></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>31 (54%)</td>
</tr>
<tr>
<td><strong>Ethnicity, n (%)</strong></td>
<td></td>
</tr>
<tr>
<td>Not Hispanic or Latino</td>
<td>53 (93%)</td>
</tr>
<tr>
<td><strong>Race, n (%)</strong></td>
<td></td>
</tr>
<tr>
<td>Caucasian</td>
<td>49 (85%)</td>
</tr>
<tr>
<td><strong>Educational status, n (%)</strong></td>
<td></td>
</tr>
<tr>
<td>High school degree/GED only</td>
<td>7 (9%)</td>
</tr>
<tr>
<td><strong>Family income, n (%)</strong></td>
<td></td>
</tr>
<tr>
<td>&lt;$40,000</td>
<td>13 (23%)</td>
</tr>
<tr>
<td>&gt;$80,000</td>
<td>31 (54%)</td>
</tr>
<tr>
<td><strong>Marital status, n (%)</strong></td>
<td></td>
</tr>
<tr>
<td>Married/living with a partner</td>
<td>38 (67%)</td>
</tr>
</tbody>
</table>
Clinical Characteristics of Survivors (N=57)

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chronic Myeloid Leukemia</td>
<td>19 (33%)</td>
</tr>
<tr>
<td>Acute Lymphocytic Leukemia</td>
<td>7 (12%)</td>
</tr>
<tr>
<td>Acute Myeloid Leukemia</td>
<td>6 (11%)</td>
</tr>
<tr>
<td>Hodgkin Disease</td>
<td>6 (11%)</td>
</tr>
<tr>
<td>Non-Hodgkin Lymphoma</td>
<td>5 (9%)</td>
</tr>
<tr>
<td>Myelodysplastic Syndrome</td>
<td>5 (9%)</td>
</tr>
<tr>
<td>Other</td>
<td>9 (15%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Type of transplant, n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allogeneic</td>
</tr>
<tr>
<td>Autologous</td>
</tr>
</tbody>
</table>

| Age at transplant, M ± SD             | 28.1 ± 10.7|
| Years since transplant, M ± SD        | 11.5 ± 4.2 |
Patient report of physical function (SF-36)

At or above population mean (T score 50 or higher) 82%
Below population mean (T score below 50) 18%
Comparison of Survivors to matched NHANES cohort

<table>
<thead>
<tr>
<th></th>
<th>Survivors (N=57)</th>
<th>NHANES (N=571)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M (SD)</td>
<td>M (SD)</td>
<td></td>
</tr>
<tr>
<td><strong>BMI (kg/m²)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Males</td>
<td>26.1 (4.2)</td>
<td>28.1 (4.9)</td>
<td>.03</td>
</tr>
<tr>
<td>Females</td>
<td>24.6 (5.5)</td>
<td>27.4 (6.9)</td>
<td>.01</td>
</tr>
<tr>
<td><strong>Blood Pressure</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Systolic</td>
<td>114.8 (13.3)</td>
<td>116.9 (13.2)</td>
<td>.25</td>
</tr>
<tr>
<td>Diastolic</td>
<td>76.5 (11.1)</td>
<td>73.3 (11.0)</td>
<td>.04</td>
</tr>
<tr>
<td><strong>Glucose, fasting</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>94.3 (20.9)</td>
<td>90.9 (20.9)</td>
<td>.22</td>
</tr>
<tr>
<td><strong>Cholesterol</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LDL</td>
<td>124.0 (38.2)</td>
<td>122.9 (22.8)</td>
<td>.83</td>
</tr>
<tr>
<td>Triglycerides</td>
<td>165.9 (107.7)</td>
<td>141.9 (173.3)</td>
<td>.09</td>
</tr>
<tr>
<td>Total Cholesterol</td>
<td>217.0 (41.1)</td>
<td>205.3 (40.5)</td>
<td>.01</td>
</tr>
</tbody>
</table>
Overweight and Obesity: Body Mass Index

- Healthy Weight (BMI < 25)
  - Survivors NHANES: 49%
- Overweight (BMI < 30)
  - Survivors NHANES: 36%
  - NHANES: 35%
- Obese (BMI ≥ 30)
  - Survivors NHANES: 16%
  - NHANES: 33%
- Survivors
  - NHANES: 31%
Overweight and Obesity in Survivors

- Healthy Weight: 18%
- Overweight: 49%
- Obese: 62%

Body Fat Percentage
- Healthy Weight: 18%
- Overweight: 20%
- Obese: 16%

Body Mass Index
- Healthy Weight: 18%
- Overweight: 49%
- Obese: 62%

Legend:
- Purple: Body Fat Percentage
- Blue: Body Mass Index
Elevated Blood Pressure

Overall % with high BP (systolic ≥ 140, diastolic ≥ 90):
- Survivors: 16%
- NHANES matched sample: 10%

% Undetected high BP (not taking meds or told have high BP):
- Survivors: 7%
- NHANES matched sample: 10%

P = .112
Elevated Fasting Glucose

Survivors NHANES matched sample

% with high fasting glucose (fasting glucose ≥100)

% undetected high fasting glucose (not taking meds or told high glucose)

P = .233
Hyperlipidemia

Triglycerides and LDL

- Survivors NHANES matched sample: 40% with high triglycerides (≥ 150), 28% with high LDL (≥ 130)
- Triglycerides: P = .030
- LDL: P = .059

Total Cholesterol

- Survivors NHANES matched sample: 26% with high TOTAL cholesterol (≥ 240), 12% undetected high cholesterol (not taking meds or told have high cholesterol)
- P = .076

Legend:
- % with high triglycerides (≥ 150)
- % with high LDL (≥ 130)
- % with high TOTAL cholesterol (≥ 240)
- % undetected high cholesterol (not taking meds or told have high cholesterol)
VO₂max (aerobic capacity)

- Very Poor: 22%
- Poor: 21%
- Fair: 23%
- Good: 17%
- Superior: 13%
- Excellent: 4%
Limitations and Strengths

• Limitations
  – Small sample
  – Cross sectional study
  – Does not provide fully representative population-based cohort for determining prevalence

• Strengths
  – New information in HSCT survivor cohort
  – Standardized objective test results
  – Results can be compared to population norms
Conclusions

• High percentages of health risks relative to population norms, many previously undetected:
  – Hyperlipidemia and high blood pressure
  – Elevated fasting glucose
  – Poor aerobic capacity

• Body fat percentage relative to BMI is concerning, indicating loss of muscle mass
  – 16% obese on BMI vs. 62% on body fat percentage

• These are underestimates of medical problems in HSCT survivor populations
Implications

• Low aerobic capacity and high body fat percentage increase risks for:
  – Metabolic syndrome
  – Cardiovascular events

• Surveillance guidelines are needed
  – Expand list of recommended tests
  – Mandate routine testing at younger ages

• Primary care providers need education

• Clinical trials need to target these complications