Online-only content for “Cardiotoxicity and Breast Cancer as Late Effects of Pediatric and Adolescent Hodgkin Lymphoma Treatment” by Candela in the American Journal of Nursing, April 2016, p. 32.

### CHEMOTHERAPY

<table>
<thead>
<tr>
<th>Sec #</th>
<th>Therapeutic Agent(s)</th>
<th>Potential Late Effects</th>
<th>Risk Factors</th>
<th>Highest Risk Factors</th>
<th>Periodic Risk Factors</th>
<th>Health Counseling/Further Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>34</td>
<td>ANTHRACYCLINE ANTIBIOTICS</td>
<td>Cardiac toxicity</td>
<td>Treatment Factors Combined with radiation involving the heart</td>
<td>Host Factors Female sex</td>
<td>Periodic Evaluation SOB</td>
<td>Health Links Heart Health Cardiovascular Risk Factors</td>
</tr>
<tr>
<td></td>
<td>Daunorubicin</td>
<td>Cardiomyopathy</td>
<td>Combined with other cardiotoxic chemotherapy</td>
<td>Black/African descent</td>
<td>OFE</td>
<td>Counseling Counsel patients with prolonged QTc interval about use of medications that may further prolong the QTc interval (e.g., tri cyclic anti depressants, antifungals, macrolide antibiotics, melonitazone). Counsel regarding maintaining appropriate weight, blood pressure and heart-healthy diet. Counsel regarding appropriate exercise. Aerobic exercise is generally safe and should be encouraged for most patients. Intensive isometric activities (e.g., heavy weight lifting, wrestling) should generally be avoided. High repetition weight lifting involving lighter weights is more likely to be safe. The number of repetitions should be limited to that which the survivor can perform with ease. Patients who choose to engage in strenuous or varsity team sports should discuss appropriate guidelines and a plan for ongoing monitoring with a cardiologist.</td>
</tr>
<tr>
<td></td>
<td>Doxorubicin</td>
<td>Arrhythmias</td>
<td>- Cyclophosphamide conditioning for HCT</td>
<td>Younger than age 5 years at time of treatment</td>
<td>Orthopnea</td>
<td>Considerations for Further Testing and Intervention Cardiology consultation in patients with subclinical abnormalities on screening evaluations, left ventricular dysfunction, dysesthesia, or prolonged QTc interval. Consider excess risk of intensive isometric exercise program in any high risk patient (defined as needing screening every 1 or 2 years). Additional cardiology evaluation in patients who received &gt; 300 mg/m2 or &lt; 300 mg/m2 plus chest radiation who are pregnant or planning pregnancy. Evaluation to include an echocardiogram before and periodically during pregnancy (especially during third trimester) and monitoring during labor and delivery due to risk of cardiac failure.</td>
</tr>
<tr>
<td></td>
<td>Epirubicin</td>
<td>Subclinical left ventricular dysfunction</td>
<td>- Anthracycline - Amicarne</td>
<td>Treatment Factors Higher cumulative anthracycline doses:</td>
<td>Chest pain</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Idarubicin</td>
<td></td>
<td>- ≥ 550 mg/m2 in patients 18 years or older at time of treatment</td>
<td>Palpitations</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mitoxantrone</td>
<td></td>
<td>- ≥ 300 mg/m2 in patients younger than 18 years at time of treatment</td>
<td>If under 25 yrs: abdominal symptoms (nausea, vomiting)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Info Link**
- Childhood cancer patients exhibit clinical and subclinica
toxicity at lower levels.
- Certain conditions (such as isometric exercise, pregnan
acy, and viral infections) have been anecdotally reported
to precipitate cardiac decompensation.
- Prospective studies are needed to better define the contribution of these factors to cardiac disease risk.

**Info Link (Dose Conversion):**
- Pediatric studies of anthra
cycline cardiotoxicity typi
cally describe risks based on combined cumulative
doses of doxorubicin. There is a paucity of literature
to support isotoxic dose conversion.
- To gauge the frequency of
cardiotoxicity, use the following formulas to convert to
doxorubicin isotoxic equivalents prior to calculating
total cumulative anthracycline dose.

- **Doxorubicin:** Multiply total dose x 1
- **Daunorubicin:** Multiply total dose x 1
- **Epirubicin:** Multiply total dose x 0.67
- **Idarubicin:** Multiply total dose x 5
- **Mitoxantrone:** Multiply total dose x 4

*Clinical judgment should ultimately be used to deter
mine indicated screening for individual patients.*

### ANTHRACYCLINE ANTIBIOTICS (cont)

**HISTORY**
- **SOB**
- **DOE**
- **Orthopnea**
- **Chest pain**
- **Palpitations**
- **If under 25 yrs: abdominal symptoms (nausea, vomiting)**

**Info Link**
- Exertional intolerance is uncommon in patients younger than 25 yrs old.
- Abdominal symptoms (nausea, emesis) may be observed more frequently than exertional dyspnea or chest pain in younger patients.

**PHYSICAL**
- **Cardiac murmur**
- **S3, S4**
- **Increased P2 sound**
- **Pericardial rub**
- **Rales**
- **Wheezes**
- **Jugular venous distension**
- **Peripheral edema**

**SCREENING**

- **ECHO (or comparable imaging to evaluate cardiac function)**
- Baseline at entry into long-term follow-up, then periodically based on age at treatment, radiation dose, and cumulative anthracycline dose.
- **EKG (include evaluation of QTc interval)**
- Baseline at entry into long-term follow-up, repeat as clinically indicated

SYSTEM = Cardiovascular

SCORE = 1
Figure 3. Guidelines for patients with a history of treatment for Hodgkin lymphoma who are at risk for the potential late adverse effects of cardiotoxicity and breast cancer. From the Children’s Oncology Group’s Long-Term Follow-Up Guidelines for Survivors of Childhood, Adolescent, and Young Adult Cancers, Version 4.0, October 2013. Used with permission.