Childhood Cancer
Survivorship

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Overview:

1. Epidemiology of childhood cancer survivorship
2. Late effects
3. Palliative care of survivors
4. Examples
Pediatric Cancers:

- Diverse group of malignancies - aggressive and fast growing:
  - Leukemia and lymphomas
  - Brain tumors (e.g. medulloblastoma)
  - Neuroblastoma
  - Rhabdomyosarcoma
  - Hepatoblastoma
Improved survival due to:

- Advancement made through enrollment on clinical trials
- Aggressive treatment regimens
  - Chemotherapy
  - Radiation therapy
  - Surgery
  - Bone marrow transplantation
  - Bioimmunotherapies
Survival rates:

- Nearing the 80% survival rate for children diagnosed with cancer!!
- Is possible because
  - Rapidly growing cancers which respond to these multimodal treatment regimens
  - In general, no underlying chronic health problems
    - Often first time they have interacted with the healthcare system for other than WCC and acute infections
Epidemiology of Survivorship:

- Over 10 million survivors in the United States
- Approximately 300,000 are survivors of childhood cancer
- 1/810 individuals < 20 years of age have a h/o cancer;
- 1/640 adults between 20-39 have a h/o cancer during childhood
Cost of Cure:

- **Late effects**: any chronic or late occurring outcome, physical or psychological, that persists or develops beyond 5 years from the diagnosis of cancer.
Late Effects:

- Include *both* physical and psychological late effects
- 2/3 of childhood cancer survivors will experience at least one late effect
- Typically have more than one late effect
- ¼ of survivors will have a severe, life-threatening late effect
Late Effects:

- Some are easy to identify b/c of their visibility
  \((\text{Examples}):\)
  - Severe growth hormone deficiency
  - Severe cognitive impairment

- Other late effects may only be identified through screening tests
  \((\text{Examples}):\)
  - Hypothyroidism
  - Osteopenia
Children's Oncology Group
Long-Term Follow-Up Guidelines

- [www.survivorshipguidelines.org](http://www.survivorshipguidelines.org)
  - Developed in 2002
  - Hybrid of evidence-based and consensus-driven
  - **Goal**: systematic ongoing follow-up
    - Eg – frequency of LFTs, PFTs
  - **Goal**: early detection and early intervention
  - **NOT** designed for disease-related surveillance which is usually highest in the first few years
    - *Paradigm shift for oncologists*
Late Effects Counseling - 
*Based on therapy received:*

- Past 2 decades - many changes in treatment protocols
- Localized or biologically favorable, modification in treatment protocols to decrease risk of therapy-related complications
  - Example ALL and prophylactic cranial XRT removed from more contemporary treatment protocols
Bottom line:

- Not all survivors have similar risks for late effects
  - Wilms tumor (Vinc and actino)
  - Multiply relapsed ALL (MUD BMT with TBI)
<table>
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<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 Evaluation</th>
<th>Health Counseling Further Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>56</td>
<td>Cranial Orbital/Eye TBI</td>
<td>Cataracts</td>
<td>Treatment Factors: Radiation dose &gt; 10 Gy TBI &gt; 2 Gy in single fraction TBI &gt; 5 Gy fractionated Radiation combined with - Corticosteroids - Busulfan - Longer interval since treatment</td>
<td>Treatment Factors: Radiation dose &gt; 15 Gy Fraction dose &gt; 2 Gy TBI &gt; 5 Gy in single fraction TBI &gt; 10 Gy fractionated Cranial/orbital/eye radiation combined with TBI</td>
<td>HISTORY: Visual changes (decreased acuity, halos, diplopia) (Yearly)</td>
<td>PHYSICAL: Visual acuity Funduscopic exam to evaluate for lens opacity (Yearly)</td>
</tr>
</tbody>
</table>

### SECTION 56 REFERENCES


**SYSTEM = Ocular**

**SCORE = 1**
Surgical late effects:

- Splenectomy - risk for infection, particularly for Hodgkin's disease (HD) survivors diagnosed prior to 1988
- Amputation - cosmetic and functional deformities
- Abdominal surgery - adhesions and risk for intestinal obstruction
Chemotherapy-related endocrine late effects:

- **Alkylating agents**
  - e.g. cyclophosphamide, busulfan, carmustine, lomustine, mechlorethamine, melphelan, procarbazine

- **Females: premature ovarian failure**
  - Hot flashes
  - Osteoporosis
  - Sexual dysfunction
  - Potential infertility

- **Male survivors: azoospermia**
Endocrine late effects due to XRT:

- Central nervous system: pituitary dysfunction
  - Typically if XRT $\geq 40$ Gy
  - GH secretion: most vulnerable
    - Can occur at doses as low as 1800cGy
- Neck XRT: hypothyroidism and/or thyroid cancer
- Infradiaphragmatic radiation: gonadal damage
  - Eg: ovarian damage, premature menopause, decreased estrogen production risk for decreased bone mass (osteopenia/osteoporosis), fractures
Cardiovascular late effects:

- **Chemotherapy related:**
  - Anthracycline agents (eg doxorubicin, daunorubicin)
    - Progressive cardiomyopathy
    - Congestive heart failure
    - Arrhythmia, including prolonged QTc
    - Subclinical left ventricular dysfunction

- **Radiation related:**
  - Valvular disease
  - Atherosclerotic heart disease
  - Myocardial infarction
  - Pericardial fibrosis, pericarditis
Second Malignant Neoplasms:

- Breast cancer and chest XRT $\geq 20$ Gy
- Colon cancer and abdominal, pelvic XRT $\geq 30$ Gy
- Thyroid cancer and neck XRT
- Secondary leukemia and epipodophyllotoxins
- Soft tissue sarcomas associated with radiation therapy
- Basal cell carcinomas associated with radiation therapy exposure
Symptom Management/Palliative Care - An Integral Part of Survivorship Care

- **Pain**
  - Cancer survivors report chronic pain
  - Agreement exists for the treatment of acute pain
  - Little consensus on the treatment of chronic pain
  - Chronic pain treatment strategies include –
    - Medications (eg long-acting opioids)
    - CAM (eg acupuncture)
    - Psychological healing/coping strategies

- **Body image changes**
  - Physical activity programs
  - Psychosocial group based interventions
  - Referrals to specific psychotherapists eg - sexual therapists
Case Examples:
Example of late effects screening:

- **ALL survivors (both chemo alone and cranial XRT)** at-risk for obesity and metabolic syndrome
  - Blood pressure q year, fasting blood glucose and lipid profile every 2 years if obese and every 5 years if normal weight

- **Cranial radiotherapy**
  - Neurocognitive late effects - information-processing deficits, problems with receptive and expressive language, attention deficits
  - SMN risk
  - Pituitary dysfunction – GH deficiency, gonadotropin deficiency, hypothyroidism
Conclusions:

- 10 million survivor of cancer in the U. S. with 300,000 being childhood cancer survivors
- A childhood cancer survivor will need to be followed annually for late effects – www.survivorshipguidelines.org
- Symptom management/palliative care is an integral part of survivorship care given the risk for the development of physical, psychological and social late effects
- Less than 50% of childhood cancer survivors are receiving cancer-related long-term follow-up care
Thank you