CARING FOR ADULTS WHO SURVIVED CHILDHOOD CANCER

Maude Landry, MD FRCPC

Hematologist at The Moncton Hospital

DISCLOSURES

- Consulting fees: Amgen, Roche, Bayer,
- Speaker's bureau/honoraria: Amgen, Novo Nordisk

OBJECTIVES

At the end of this presentation, the participant will be able to :

- Recognize the long-term risks and complications associated with childhood cancer and its treatment
- Identify available sources for evidence-based information to guide follow-up for adult survivors of childhood cancer
- Investigate and screen for possible complications related to the prior cancer and its treatments
- Manage ongoing chronic healthcare needs of this unique population

KEY POINTS

- 75% of childhood cancer survivors experience at least one adverse event and 40% at least one severe, life-threatening or disabling event - Survivors of childhood cancers need a life long systematic follow-up
- 85% of survivor of childhood cancer depend on their primary care physician for follow-up
- If your patient is a survivor of childhood cancer, you should have access to a clear Summary of Cancer Treatment provided by the pediatric cancer centre that treated them.
- Appropriate survivor care requires patient and physician knowledge about the long-term risks of cancer therapy
- Children's Oncology Group (COG) Centres accept referrals to assist with tracing back treatment summaries and preparing individualized follow-up plans.
- COG offers detailed guidelines on identifying, assessing and managing late effects of childhood cancer treatment.

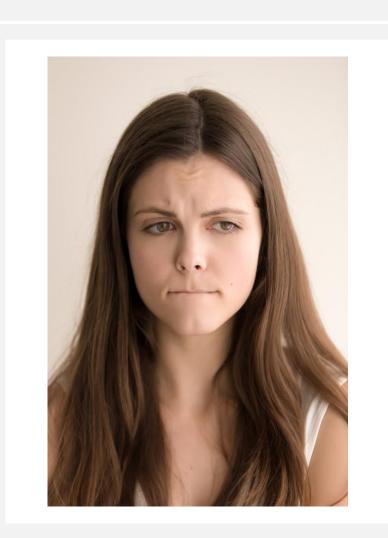
CASE I

18 yr old girl previously treated for Aplastic Anemia with Allogenic Stem Cell Transplant

4.5 years post BMT from her brother. Fully engrafted with 96% donor chimerism.

Complications from treatment:

- Chronic GVHD
 - residual oral GVHD (previous extensive skin and gut).
 - Vaginal dryness and atrophy
- Mental health issues with depression and anxiety, self harm
- Chronic neuropathic pain on Gabapentin
- Eating disorder?
- Heavy Marijuana use
- Left eye vitreous hemorrhage with vitrectomy (now developing cataract) developed while thrombocytopenic
- Abnormal PAP smears will need gyne follow up



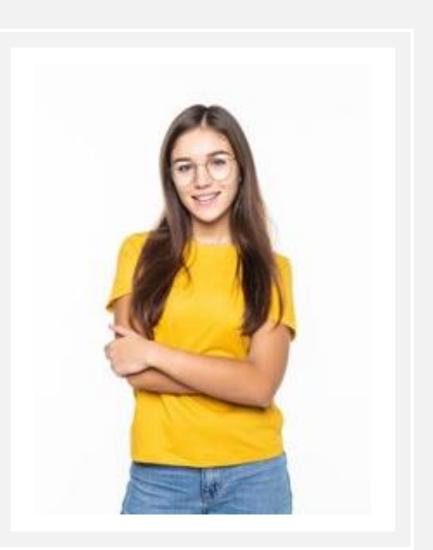
CASE 2

19 year old young woman who was treated with allogeneic BMT (MUCB) \sim 18 years ago for Infant ALL.

Treated with high dose chemo & TBI.

She has numerous complications including

- Tachycardia (unknown etiology) and diastolic dysfunction
- Cataracts
- Precocious puberty
- Type 2 diabetes
- Short stature
- Primary ovarian failure
- Mild renal impairment
- Migraines
- Hypertriglyceridemia
- Anxiety, emotional immaturity

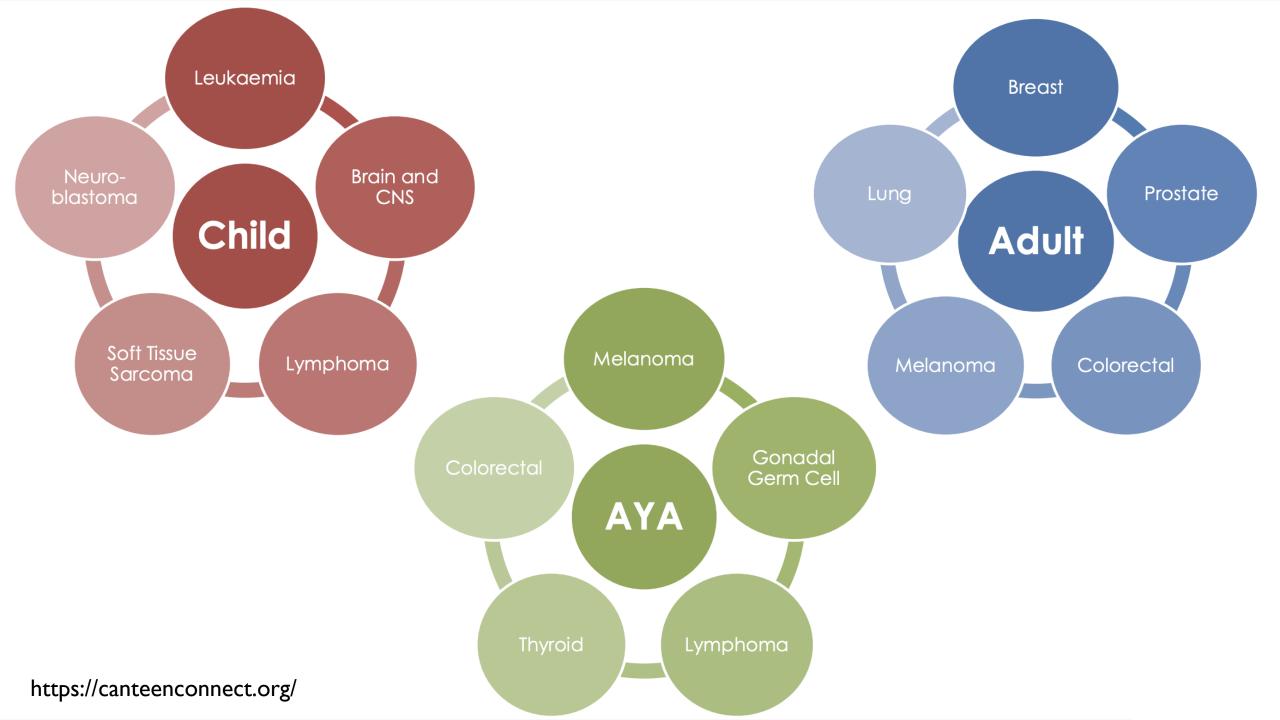


TRANSITIONING TO ADULT CARE

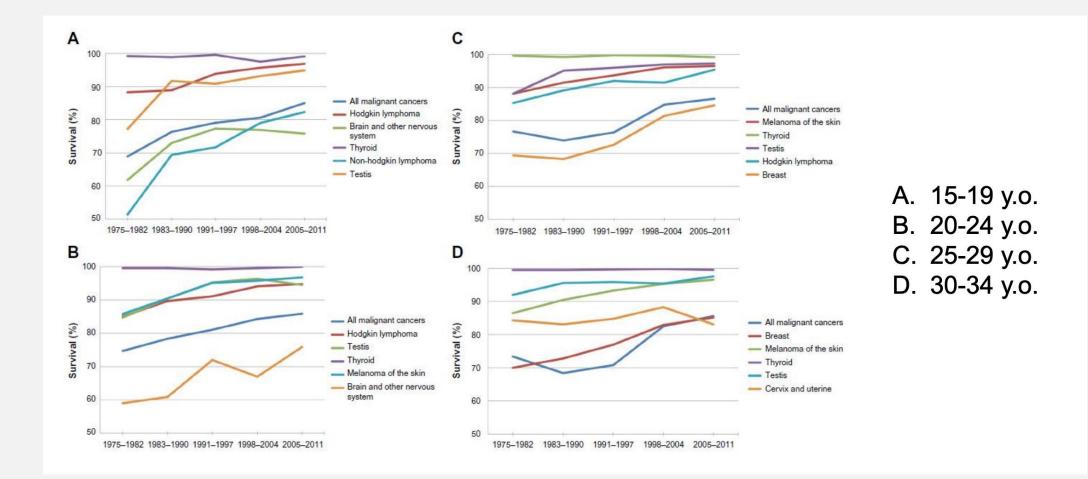


• Affects 15 per 100,000 children

- Affects 15 per 100,000 children
- The most common type of cancer in children is ALL (1/3)
- The most common solid tumors are brain tumors (e.g., glioma and medulloblastoma).



- "Late effects" of cancer treatment are defined as therapy-related complications or adverse effects that persist or arise after completion of treatment for a pediatric malignancy.
 - Organ dysfunction
 - Impaired growth and development
 - Neurocognitive problems
 - Secondary cancers



Friend et al. COAYA. 2017

- A retrospective study 1362 five-year childhood cancer survivors found that :
 - after a follow-up of 17 years, 75% of childhood cancer survivors had experienced at least one adverse event
 - 40% at least one severe, life-threatening or disabling event.

JAMA, 01 Jun 2007, 297(24):2705-2715

- Multiple large cohort stutides found :
 - Higher premature death rates
 - Increased risks of a range of physical and psychosocial problems

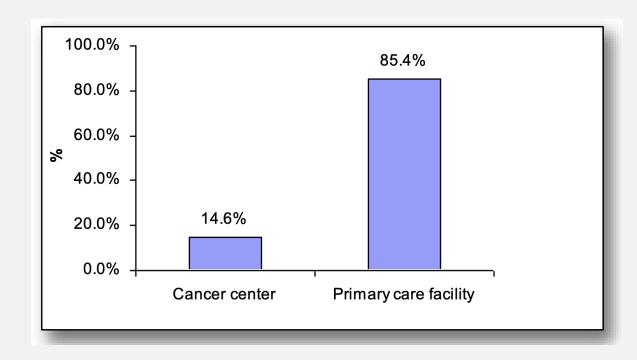
- Multiple large cohort stutides found :
 - Higher premature death rates
 - Increased risks of a range of physical and psychosocial problems

Survivors of childhood cancers need a life long systematic follow-up

YES BUT... BY WHO?



WHERE DO ADULT SURVIVORS OF CHILDHOOD AND AYA CANCER GETTING THEIR CARE?



Nathan et al. J Clin Oncol 2008

TRANSITIONING TO ADULT CARE

- Providing appropriate long-term follow-up is a major challenge
 - Most adult survivors of childhood cancer receive their follow-up care from a family physician
 - Often there has been no formal transition from the cancer centre
 - Patients generally are unaware of their long-term risks, have an inadequate understanding of their previous therapy, and arrive without a summary of their cancer treatment.

TRANSITIONING TO ADULT CARE

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CHILDREN'S ONCOLOGY GROUP (COG)

CHILDREN'S ONCOLOGY GROUP

- There are 16 Children's Oncology Group clinics/centres in Canada.
- They aim to protect health and promote quality of life for survivors of childhood cancer by providing services such as:
 - Assistance with researching patient histories and providing a summary of treatment.
 - Smooth transition to adult care
 - Offer detailed long-term follow-up guidelines
 - Collection of data on late effects to improve care of future generations of children with cancer.



Summary of Cancer Treatment (Abbreviated)

Demographics													
Name								Sex	Μ	۵F	Date of Birth	ı	
Cancer Diagnosis	S												
Diagnosis						Dat	e of Diag	nosis			Date Therap	y Comple	ted
Chemotherapy	🗆 Yes	🗆 No	If yes,	provide	e informa	ation b	elow						
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*For head/brain, necł **To convert cGy or r								de tota	I doses (including	boost dose, if giv	ven)	
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Chronic Graft-Vers	sus-Host Dis	sease (cGV	(HD)	Ever dia	ignosed?	D Y	es 🗖	No		Curr	ently active?	Yes	D No
Surgery 🗖 Ye	es 🗆 No) If y	es, provi	ide infor	mation	below							
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CHILDREN'S ONCOLOSY CROUP

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Cancer Diagnosis

Summary of Cancer Treatment (Abbreviated)

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Data prepared

The world's childhood cancer experts

Summary of Cancer Treatment (Abbreviated)

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Chronic Graft-Versus-Host Disease (cGVHD)	Ever diagnosed? 🗖 Yes 🗖 No	Currently active? Ves No

Demographics Name	S	KA DM DF	Dute of Birth	
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Surgery	□ Yes	🗆 No	If yes, prov	ide information below	
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Other Ther	apeutic M	odalities	□ Yes I	□ No If yes, provide information below	
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Did the pati	ient receive	e systemic N	IIBG (in thera	peutic doses)? 🗖 Yes 🗖 No	
Summary	prepared l	by:			Date prepared:



CHILDREN'S ONCOLOGY GROUP

The world's childhood cancer experts

Long-Term Follow-Up Guidelines

for Survivors of Childhood, Adolescent, and Young Adult Cancers

Version 5.0 - October 2018





Website: www.survivorshipguidelines.org Copyright 2018 © Children's Oncology Group All rights reserved worldwide

http://www.survivorshipguidelines.org/

CHILDREN'S ONCOLOGY GROUP

The world's childhood cancer experts

http://www.survivorshipguidelines.org/

BC Children's Hospital

http://www.bcchildrens.ca/healthprofessionals/clinicalresources/oncology#LTFU--Guidelines



Ewing Sarcoma

Ewing Early FU Clinic Ewing Late Effects Clinic

Germ Cell Tumour

Germinoma, localized, focal RT, Early FU clinic Germinoma, localized, focal RT, Late FU clinic

Hodgkin Lymphoma

Hodgkin Lymphoma Early FU Clinic Hodgkin Lymphoma Late Effects Clinic

Liver Tumours

Liver Tumours Early FU Clinic Liver Tumours Late Effects Clinic



Allogeneic Blood & Marrow Transplant

BMT Myeloablative with TBI, Dx GVHD Early FU Clinic BMT Myeloablative with TBI, Dx GVHD Late FU Clinic BMT Myeloablative with TBI, no GVHD Early FU Clinic BMT Myeloablative with TBI, no GVHD Late FU Clinic BMT Myeloablative, no TBI, Dx GVHD Early FU Clinic BMT Myeloablative, no TBI, Dx GVHD Late FU Clinic BMT Myeloablative, no TBI, no GVHD Early FU Clinic BMT Myeloablative, no TBI, no GVHD Late FU Clinic BMT Myeloablative, no TBI, no GVHD Late FU Clinic BMT Non-myeloablative, no TBI, no GVHD Late FU Clinic.pdf BMT Non-Myeloablative, no TBI, no GVHD Late FU Clinic.

Acute Lymphoblastic Leukemia & Lymphoblastic Lymphoma

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CNS Tumours

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Hodgkin Lymphoma* Pediatric Surveillance & Follow-up Guidelines

	Months from end of therapy	Date	Location	H&P	CBC & ESR	CXR +/- Abdo US	Biochem	Urine tests	ECHO [#]	TSH & T4	PFTs	LH, FSH, Test or Est	Other
	0						End	of treatment	evaluations (per	protocol)			Summary for LTFU clinic
	3			+	+	+	+	+					
Clinic	6			+	+	+							Attenuated vaccine re- immunizations
dn-	9			+	+	+							
Early Follow-up	12			+	+	+	+	+	+	+	+		Live vaccine re- immunizations
ļ ∕	15			+	+								
Ear	18			+	+	+							
	21			+	+								
	24			+	+	+				+			
ic	30			+	+	+							
Clinic	36			+	+	+			+				
U C	42			+	+	+							
LTFU	48			+	+	+				+			
	60			+	+	+							Refer to Late Effects clinic
	Notes					US if abdo involvmt at Dx.	Lytes, LDH, Ca, Mg, PO4, Cr, urea, LFTs.	U/A, urine Prot:Cr & Alb:Cr ratio	[#] Insert added frequency based on cardiac guidelines (see over). ECG if clinical concerns	If chest RT only	Repeat Q2y if RT to lung or abN	Baseline age 12 y if CED ≥4 or clinical concerns. Rpt Q1y	

*Includes all stages, and patients treated with RT ^CED: Cyclophosphamide Equivalence Dose (see over)

Further Surveillance	
Semen Analysis	From age 18y in males
Anti-Mullerian Hormone	From age 16y in females if $CED \ge 6 \text{ g/m}^2$ or pelvic RT; or earlier if clinical concerns
Breast MRI and Mammogram	From later of age 25y or 8y after exposure if chest RT
Colonoscopy	From later of age 30y or 5y after exposure to abdominal RT

Caro	liac Surveillance Gui	idelines (BC)
Anthracycline	Radiation Dose**	Recommended Frequency
Dose*		of Echo
None	< 15 Gy or none	No Screening
	15 - < 35 Gy	Every 5 years
	35 Gy	Every 2 years
< 250 mg/m ²	< 15 Gy or none	Every 5 years
	15 Gy	Every 2 years
250 mg/m ²	Any or none	Every 2 years

*Based on total doses of doxorubicin or the equivalent doses of other anthracyclines

**Based on radiation dose with potential impact to heart (radiation to chest, abdomen, spine [thoracic, whole], total body [TBI]) COG LTFU Guidelines version 5.0 (Oct 2018)

Risk of Prolonged	Oligospermia	or Azoospermia
nush of i folongeu	ongospermia	or mzoospermia

Agent	Possible Risk	High Risk
Cyclophosphamide	> 4g/m ²	> 7.5 g/m ²
Busulphan		> 600
		mg/m ²
Melphalan		> 140
		mg/m ²
Ifosfamide	$> 42 \text{ g/m}^2$	$> 60 \text{ g/m}^2$
Procarbazine	$> 3 g/m^2$	$> 4 g/m^2$
Chlorambucil		$> 1.4 \text{ g/m}^2$
BCNU	> 300 mg/m ²	$> 1 g/m^2$
CCNU		> 500
		mg/m ²
Cisplatin	> 300 mg/m ²	> 600
-		mg/m ²
Testicular RT dose	> 200 cGy	> 1200 cGy

Risk of Premature Ovarian Insufficiency or

Procarbazine> 2 g/m²> 4 g/m²2Sisplatin> 300 mg/m²3							
Infertility							
Agent	Possible	High Risk	Ref				
-	Risk	_					
CED	$> 4 g/m^2$	$> 8 g/m^2$	1				
Procarbazine	$> 2 g/m^2$	$> 4 g/m^2$	2				
Cisplatin	> 300 mg/m ²		3				
-							
Dactinomycin	>12.2 mg/m2		4				
Ovarian RT dose*	> 100 cGy	> 1000 cGy	5				
*Age dependent (see 1	nomogram ⁵)						

^Bevacizumab can cause ovarian failure; possibly acute and transient only⁶

1. Green Pediatr Blood Cancer 2014;61(1):53-67 2. Van der Kaaji J Clin Oncol 2012;30(3):291-299 3. Solheim Gyne Oncol 2015;136(2):224-229 4.Van Den Berg Hum Reprod 2018; 33(8):1474-1488 5. Wallace Int J Radiat Oncol;62(3):738-744 6. Imai Molec Clin Oncol 2017;6:807-810

Anthracycline Equivalent Dose				
Agent	Correction factor			
Doxorubicin	1.0			
Daunorubicin	0.5			
Epirubicin	0.67			
Mitoxantrone	4.0			
Idarubicin	5.0			
Chow I Clin Oncol 2015	33(5) 394-402			

Chow J Clin Oncol 2015;33(5);394-402

Dose (CED) Correction Agent factor Cyclophosphamide 1.0 0.244 Ifosfamide 0.857 Procarbazine 14.286 Chlorambucil BCNU 15 CCNU 16 Melphalan 40 Thiotepa 50 Nitrogen Mustard 100 Busulphan 8.823

Cyclophosphamide Equivalent

Green Pediatr Blood Ca 2014;61:53-67

*Lower doses are still possible risk

1. Green J Clin Oncol 2010;28:332-9

2. Meistrich Pediatr Blood Cancer 2009;53:261-6

3. Wyns Human Reprod Update 2010;16(3):312-328

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Oncology

BC Children's Hospital works collaboratively with the BC Cancer and the Children's Oncology Group to provide recommendations for investigation, treatment and follow-up for children with cancer.

Community Partners Resources

LTFU Guidelines

Referrals

You need a referral from a doctor to use this clinic: **Refer to Oncology** Refer to Hematology

Contact Us

Oncology/Hematology/BMT Room B315, 4480 Oak Street Vancouver, BC, V6H 3V4

Diagnostic Check list created by



		Date	Date	Date	Date
Name		-			
Diagnosis		yrs	yrs	yrs	yrs
Date off Treatment		post Dy	post Rx	post Rx	post Rx
At risk and Reason	I				
Eyes/Vision N	Y				
Teeth	Y				
	Y				
	Y				
	Y				
Lungs N	Y				
GI/Nutrition N Liver/Pancreas	Y				
	Y	_			
	Y				
Menses Tanner N Breasts	Y	_			
Bones/Joints	Y				
Skin	Y				
CNS	Y				
Growth	Y Y				
Immune Defence	Y				
School	Y				
Psychology N	Y				
	Y				
New Family History					
Lansky/ Karnofsky					

Diagnostic Check list created by



http://www.bcchildrens.ca/healthprofessionals/clinical-resources/oncology#LTFU--Guidelines

Name		Date	Date	Date	Date
Name Diagnosis Date off Treatment		– <u>yrs</u> post Rx	yrs post Rx	yrs post Rx	yrs post Rx
At risk and Reason					
Eyes/Vision N	v				
Teeth N					
Hearing	Y				
Thyroid N					
Heart N					
Lungs N	Y				
GI/Nutrition N	Y				
Liver/Pancreas N	Y				
Kidney/Bladder N	Y				
Reproductive Menses Tanner N	Y				
Breasts N	Y				
Bones/Joints N	Y				
Skin N CNS	Y		_		_
	Y				
N Immune Defence	Y				
	Y	_			
Psychology	Y				
N 2 nd Cancer	Y				
New Family	Y				
History Lansky/ Karnofsky					

LATE EFFECTS

End organ damages

- Cardiovascular
- Respiratory
- Renal
- Nervous system
- Vision
- Hearing

Growth and development

- Endocrine/metabolic
- Musculoskeletal
- Neurocognitive
- Mental Health

Fertility and reproduction

Cancer

- Recurrence
- Subsequent cancers

CANCER RISK

- Survivors of childhood cancer are at a lifelong increased risk of subsequent primary cancer
- Radiotherapy
 - Subsequent primary cancer usually within or just at the edge of the area originally irradiated.
 - Typically, > five years after treatment
 - increase in incidence with length of follow-up.

Chemotherapy

Particularly alkylating agents (e.g., cyclophosphamide) and epipodophyllotoxins (e.g., etoposide)

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Section #	Page	Sex	Therapeutic Agent	Potential Late Effect
·			Any Cancer Experi	ience
1	1		Any Cancer Experience	Adverse psychosocial/quality of life effects
2	3		Any Cancer Experience	Mental health disorders
3	4		Any Cancer Experience	Risky behaviors
4	5		Any Cancer Experience	Psychosocial disability due to pain
5	6		Any Cancer Experience	Fatigue; Sleep problems
6	7		Any Cancer Experience	Limitations in healthcare and insurance access
			Blood/Serum Proc	lucts
7	8		Diagnosed prior to 1972	Chronic hepatitis B
8	9		Diagnosed prior to 1993	Chronic hepatitis C
9	10		Diagnosed between 1977 and 1985	HIV infection
			Chemotherap	у
10	11		Any Chemotherapy	Dental abnormalities
11	12	Male	Alkylating Agents	Testicular hormonal dysfunction
12	14	Male	Alkylating Agents	Impaired spermatogenesis
13	16	Female	Alkylating Agents	Ovarian hormone deficiencies

Section #	Page	Sex	Therapeutic Agent	Potential Late Effect
14	18	Female	Alkylating Agents	Reduced ovarian follicular pool
15	20		Alkylating Agents	Acute myeloid leukemia; Myelodysplasia
16	21		Alkylating Agents	Pulmonary fibrosis
17	22		Alkylating Agents	Cataracts
18	23		Alkylating Agents	Urinary tract toxicity
19	24		Alkylating Agents	Bladder malignancy
20	25		Alkylating Agents	Renal toxicity
21	26		Heavy Metals	Ototoxicity
22	28		Heavy Metals	Peripheral sensory neuropathy
23	29		Heavy Metals	Renal toxicity
24	30		Antimetabolites	Neurocognitive deficits
25	31		Antimetabolites	No known late effects (cytarabine [low dose IV, IO, IT, SQ])
26	32		Antimetabolites	Hepatic dysfunction; Sinusoidal obstruction syndrome (SOS)
27	33		Antimetabolites	Reduced bone mineral density (BMD)
28	35		Antimetabolites	No known renal late effects (methotrexate)
29	36		Antimetabolites	Hepatic dysfunction
30	37		Antimetabolites	Neurocognitive deficits
31	38		Antimetabolites	Clinical leukoencephalopathy
32	39		Anthracycline Antibiotics	Acute myeloid leukemia
33	40		Anthracycline Antibiotics	Cardiac toxicity
34	42		Anti-Tumor Antibiotics	Pulmonary toxicity
35	44		Anti-Tumor Antibiotics	No known late effects (dactinomycin)
36	45		Corticosteroids	Reduced bone mineral density (BMD)
37	47		Corticosteroids	Osteonecrosis (avascular necrosis)
38	48		Corticosteroids	Cataracts
39	49		Enzymes	No known late effects (asparaginase)
40	50		Plant Alkaloids	Peripheral sensory or motor neuropathy

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Section #	Page	Sex	Therapeutic Agent	Potential Late Effect
41	51		Plant Alkaloids	Vasospastic attacks (Raynaud's phenomenon)
42	52		Epipodophyllotoxins	Acute myeloid leukemia
			Radiation	
43	54		All Fields	Secondary benign or malignant neoplasm occurring in or near radiation field
44	56		All Fields	Dermatologic toxicity
45	57		Brain/Cranium	Brain tumor (benign or malignant)
46	58		Brain/Cranium	Neurocognitive deficits
47	59		Brain/Cranium	Clinical leukoencephalopathy
48	60		Brain/Cranium	Cerebrovascular complications
49	61		Brain/Cranium	Craniofacial abnormalities
50	62		Brain/Cranium	Chronic sinusitis
51	63		Neuroendocrine Axis	Overweight; Obesity
52	65		Neuroendocrine Axis	Growth hormone deficiency
53	67	Male	Neuroendocrine Axis	Precocious puberty
54	68	Female	Neuroendocrine Axis	Precocious puberty
55	69		Neuroendocrine Axis	Hyperprolactinemia
56	70		Neuroendocrine Axis	Central hypothyroidism
57	71	Male	Neuroendocrine Axis	Gonadotropin deficiency
58	73	Female	Neuroendocrine Axis	Gonadotropin deficiency
59	75		Neuroendocrine Axis	Central adrenal insufficiency
60	76		Eye	Cataracts
61	77		Eye	Ocular toxicity
62	78		Ear	Ototoxicity
63	80		Oral Cavity	Xerostomia; Salivary gland dysfunction
64	81		Oral Cavity	Dental abnormalities; Temporomandibular joint dysfunction
65	82		Oral Cavity	Osteoradionecrosis of the jaw
66	83		Neck/Thyroid	Thyroid nodules
67	84		Neck/Thyroid	Thyroid cancer

Section #	Page	Sex	Therapeutic Agent	Potential Late Effect
68	85		Neck/Thyroid	Hypothyroidism
69	87		Neck/Thyroid	Hyperthyroidism
70	88		Neck/Thyroid	Carotid artery disease
71	89		Neck/Thyroid	Subclavian artery disease
72	90	Female	Breast	Breast cancer
73	91	Female	Breast	Breast tissue hypoplasia
74	92		Lungs	Pulmonary toxicity
75	93		Lungs	Lung cancer
76	94		Heart	Cardiac toxicity
77	96		Spleen	Functional asplenia
78	98		GI/Hepatic System	Esophageal stricture
79	99		GI/Hepatic System	Impaired glucose metabolism/diabetes mellitus
80	100		GI/Hepatic System	Dyslipidemia
81	101		GI/Hepatic System	Hepatic toxicity
82	102		GI/Hepatic System	Cholelithiasis
83	103		GI/Hepatic System	Bowel obstruction
84	104		GI/Hepatic System	Chronic enterocolitis; Fistula; Strictures
85	105		GI/Hepatic System	Colorectal cancer
86	107		Urinary Tract	Renal toxicity
87	108		Urinary Tract	Urinary tract toxicity
88	109		Urinary Tract	Bladder malignancy
89	110	Male	Male Reproductive System	Testicular hormonal dysfunction
90	111	Male	Male Reproductive System	Impaired spermatogenesis
91	113	Female	Female Reproductive System	Ovarian hormone deficiencies
92	114	Female	Female Reproductive System	Reduced ovarian follicular pool
93	116	Female	Female Reproductive System	Uterine vascular insufficiency
94	117	Female	Female Reproductive System	Vaginal fibrosis/stenosis

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CHILDREN'S ONCOLOGY GROUP

The world's childhood cancer experts



OUR MISSION

To cure and prevent childhood and adolescent cancer through scientific discovery and compassionate care.

IMPORTANT: COVID-19 INFORMATION FOR SURVIVORS OF CHILDHOOD, ADOLESCENT, AND YOUNG ADULT CANCERS Download here: <u>COVID-19 (English)</u> <u>COVID-19(Spanish)</u> <u>COVID-19(French)</u>

Long-Term Follow-Up Guidelines for Survivors of Childhood, Adolescent, and Young Adult Cancers

Version 5.0 (October 2018)

New: Chinese Health Links (in Traditional [TC] and Simplified [SC] Chinese)

 Patient education materials, known as "Health Links" accompany the COG guidelines



Cataracts after Cancer Treatment

Childhood cancer treatment sometimes requires the use of medications or radiation that can increase the risk of developing cataracts. Because vision can have a significant impact on daily living, it is important for survivors who received these treatments to have their eyes checked regularly.

What is a cataract?

A cataract is clouding of the normally clear lens of the eye. Cataracts often develop slowly, but as the clouding increases, vision can be affected.

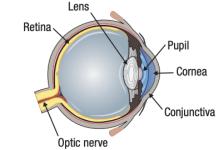
How does a cataract affect vision?

The eyes are remarkable organs, allowing light to be converted into impulses that are transmitted to the brain, where images are perceived. Light enters the eye through a clear layer of tissue known as the **cornea**. The cornea bends and focuses the light, and sends it through the opening of the eye known as the **pupil**. The pupil controls how much light enters the eye. Behind the pupil is the **lens** of the eye, which focuses the light onto the **retina**, the membrane along the back wall of the eye. The nerve cells in the retina change the light into electrical impulses and send them through the **optic nerve** to the brain, where the image is perceived. When the **lens becomes cloudy due to a cataract**, the image delivered to the retina becomes blurry.

What are the symptoms of a cataract?

Common symptoms of cataracts include:

- · Painless blurring of vision
- Sensitivity to light and glare
- Double vision in one eye
- Poor night vision
- Fading or yellowing of colors



 The need for frequent changes in prescriptions for glasses or contact lenses

What cancer therapies increase the risk of developing cataracts?

Certain medications, including:

- Busulfan
- Corticosteroids, such as prednisone and dexamethasone

Radiation therapy to the following areas:

- Eye and surrounding tissue (orbits)
- Head or brain
- Total body irradiation (TBI)

Gastrointestinal System:

Gastrointestinal Health (English)(Spanish) (Chinese-TC) (Chinese-SC) Hepatitis (English)(Spanish) (Chinese-TC) (Chinese-SC) Liver Health (English)(Spanish) (Chinese-TC) (Chinese-SC)

Immune System:

Splenic Precautions (English)(Spanish)(French) (Chinese-TC) (Chinese-SC)

Musculoskeletal System:

Amputation (English)(Spanish) (Chinese-TC) (Chinese-SC) Bone Health (English)(Spanish) (Chinese-TC) (Chinese-SC) Limb Sparing Procedures (English)(Spanish) (Chinese-TC) (Chinese-SC) Osteonecrosis (English)(Spanish) (Chinese-TC) (Chinese-SC) Scoliosis and Kyphosis (English)(Spanish) (Chinese-TC) (Chinese-SC)

Neurological System:

Chronic Pain (<u>English</u>)(<u>Spanish</u>) (<u>Chinese-TC</u>) (<u>Chinese-SC</u>) Peripheral Neuropathy (<u>English</u>)(<u>Spanish</u>) (<u>Chinese-TC</u>) (<u>Chinese-SC</u>) Raynaud's Phenomenon (<u>English</u>)(<u>Spanish</u>) (<u>Chinese-TC</u>) (<u>Chinese-SC</u>)

Pulmonary System:

Bleomycin Alert (<u>English</u>)(<u>Spanish</u>) (<u>Chinese-TC</u>) (<u>Chinese-SC</u>) Pulmonary Health (<u>English</u>)(<u>Spanish</u>) (<u>Chinese-TC</u>) (<u>Chinese-SC</u>)

Reproductive System:

Female Health Issues (English) (Spanish) (Chinese-TC) (Chinese-SC) Male Health Issues (English)(Spanish) (Chinese-TC) (Chinese-SC)

Sensory:

Cataracts (English)(Spanish)(French) (Chinese-TC) (Chinese-SC) Eye Health (English)(Spanish)(French) (Chinese-TC) (Chinese-SC) Hearing Loss (English)(Spanish) (Chinese-TC) (Chinese-SC)

Subsequent Neoplasms:

Breast Cancer (English)(Spanish)(French) (Chinese-TC) (Chinese-SC) Colorectal Cancer (English)(Spanish) (Chinese-TC) (Chinese-SC) Reducing the Risk of Second Cancers (English) (Spanish) (Chinese-TC) (Chinese-TC) (Chinese-SC) Skin Health (English)(Spanish) (Chinese-TC) (Chinese-SC)

Gastrointestinal System:

Gastrointestinal Health (English)(Spanish) (Chinese-TC) (Chinese-SC) Hepatitis (English)(Spanish) (Chinese-TC) (Chinese-SC) Liver Health (English)(Spanish) (Chinese-TC) (Chinese-SC)

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- Treatment with other chemotherapy drugs that can also damage the lungs (see related Health Link: "Pulmonary Health")
- Exposure to high oxygen levels (such as during general anesthesia or SCUBA diving)
- Smoking
- Inhaling drugs, such as smoking marijuana

What monitoring is recommended for people who have received bleomycin for treatment of childhood cancer?

- A yearly medical check-up is recommended.
- Pulmonary function tests may show lung problems that are not apparent during a check-up. For this reason, it is helpful to have these tests done at least once (at least 2 years after completing cancer treatment) to find out if there are any problems. Your healthcare provider can decide if further testing is needed based on these results.
- In some cases, your healthcare provider may recommend repeating the pulmonary function tests
 if you are scheduled for surgery that requires general anesthesia to check for changes in the lungs
 that could increase the risk of breathing problems during or after anesthesia.

Are there any special precautions I should take?

If you received therapy with bleomycin, you should:

- Avoid SCUBA diving, unless you have had a complete check-up and have been advised by a
 pulmonologist (lung specialist) that diving is safe. During SCUBA diving, increased underwater
 pressures and high oxygen levels can damage the lungs.
- Tell your surgeon, anesthesiologist, and other healthcare providers about your medical history before any scheduled procedures that may require oxygen.
- Avoid breathing high concentrations of oxygen whenever possible, especially for long periods of time (such as over several hours). If you require oxygen, monitoring of your oxygen levels can usually be done so that you can receive the lowest oxygen concentration that is necessary.
- Get the pneumococcal (pneumonia) vaccine.
- Get yearly influenza (flu) vaccines.
- Don't smoke or use inhaled drugs such as marijuana. If you currently smoke, talk to your healthcare provider about a program to help you quit.

Written by Margery Schaffer, RN, MSN, CPNP, Cincinnati Children's Hospital Medical Center, Cincinnati, OH. Reviewed by Emmett H. Broxson, Jr., MD; Edward Walz, MD; Karen Stormer, RN, CNS, CPON®; Melissa M. Hudson, MD; Debra L. Friedman, MD; Neyssa Marina, MD; and Smita Bhatia, MD, MPH.

Additional health information for childhood cancer survivors is available at www.survivorshipguidelines.org



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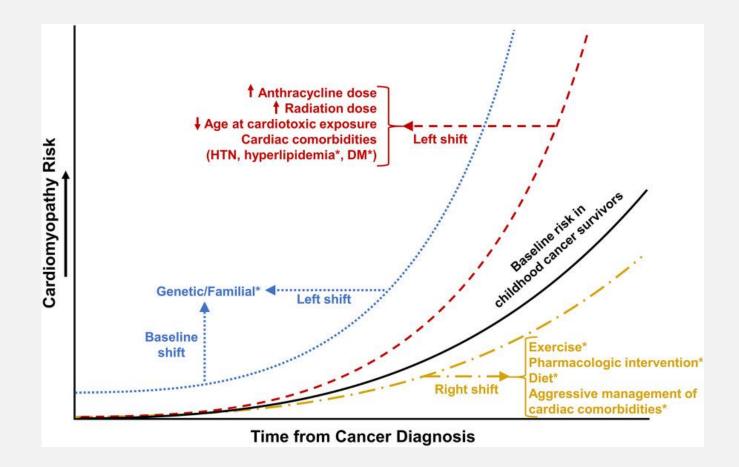
ENDOCRINE EFFECT

- Obesity/Metabolic syndrome
- DM
- Primary hypothyroidism
- Hypothalamic/pituitary dysfunction
- Decrease bone density
- Secondary thyroid cancer

IMPAIRED GROWTH

- Multifactorial : underlying disease, complications of treatment (e.g., infection, vomiting), effects of the treatment itself
 - Cranial radiotherapy can cause growth hormone deficiency and impaired growth, which then may be compounded by other pituitary hormone deficiencies
 - Localized tumour treatments may affect growth and function of individual organs (e.g., spinal irradiation affects spinal growth and skeletal disproportion)
 - Chemotherapy alone may also have significant effects on growth

CARDIOVASCULAR EFFECTS



CARDIOVASCULAR EFFECTS

Be on the lookout for :

- Pericarditis
- Cardiomyopathy



- CAD and CVD (if irradiation of cerebrovascular structures)
- valve disease
- conduction defects
- Those who received either anthracyclines or radiation to a field that included the heart should have regular assessment (e.g., echocardiography)

CARDIOVASCULAR EFFECTS

- Risk factors of late-onset cardiotoxicity
 - Higher cumulative doses of anthracyclines
 - Younger age (< 5 years) at time of treatment
 - Female gender
 - Combination therapy with other agents
 - Mediastinal radiation

RENAL EFFECTS



Be on the lookout for :

- Glomerular toxicity
- Tubular toxicity (renal tubular acidosis, Fanconi syndrome, hypophosphatemic rickets)

Worst offenders :

Cisplatin, carboplatin, ifosfamide, radiation impacting the kidney, surgical resection of kidney

MUSCULOSKELETAL EFFECTS

Be on the lookout for

- Low lean-muscle mass/weakness
- decreased exercise capacity
- frailty or accelerated aging



Worst offenders :

 corticosteroids; doxorubicin; radiation therapy impacting brain, abdomen, or pelvis; lower extremity amputation

Radiation therapy impacting chest wall or thoracic spine can cause Scoliosis

HEPATIC EFFECTS

Be on the lookout for :

Hepatic dysfunction Steatosis/cirrhosis



Worst offenders :

Thioguanine, methotrexate, mercaptopurine, busulfan history of treatment related veno-occlusive disease

BONE HEALTH

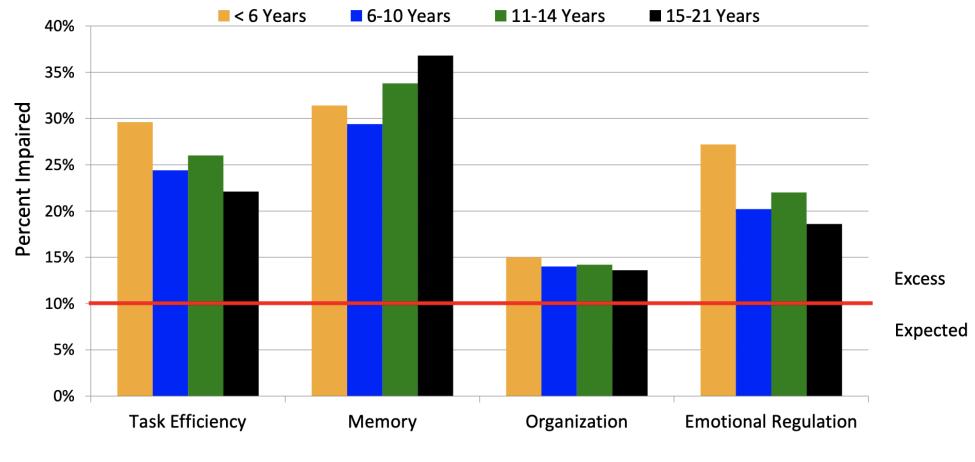
- Risk of low bone mineral density increases with:
 - high cumulative dose of steroids
 - high cumulative doses of methotrexate
 - cranial irradiation or bone marrow transplantation
- A baseline evaluation of BMD should be done at around two years after completion of treatment in patients with these risk factors and in those whose treatment puts them at risk of endocrine dysfunction

NEUROCOGNITIVE EFFECTS

Cranial radiation may cause the brain to age faster and increase the risk of early-onset dementia

- Regular evaluation of educational and psychosocial function later in life very important for all childhood cancer survivor.
 - Refer for neuropsychological assessment if problem suspected
 - Methylphenidate (MPH) can improve neurocognitive and learning outcomes in selected patients

CNS Tumor and Leukemia Survivors by Age at Diagnosis

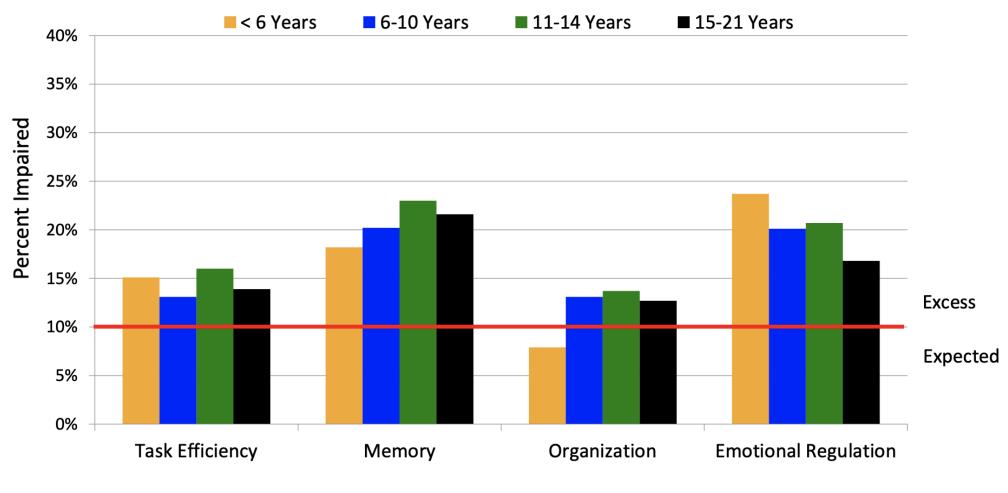


Neurocognitive Questionnaire

(Prasad et al, J Clin Oncol, 2015)

N=3360

Lymphoma and Sarcoma Survivors by Age at Diagnosis



Neurocognitive Questionnaire

OPHTHALMOLOGICAL AND AUDITORY EFFECTS

- Ophthalmological
 - Cataracts Busulfan, radiation impacting the eye
- Auditory
 - Sensorineural hearing loss, tinnitus, vertigo Cisplatin, carboplatin, radiation impacting the ear
 - Tympanosclerosis, otosclerosis, eustachian tube dysfunction, conductive hearing loss Radiation impacting the ear

NERVOUS SYSTEM EFFECTS

Be on the lookout for :

• Peripheral sensory or motor, neuropathy

Worst offenders :

Cisplatin, Vinca alkaloids

- Leukoencephalopathy
 - spasticity, ataxia, dysarthria, dysphagia
- hemiparesis, seizures

HD or IT Methotrexate/cytarabine Brain RoTx

FERTILITY/GONADAL ISSUES

- Female survivors are potentially at risk of developing menopause before age 40 and having premature reduced ovarian reserve.
- Women treated with an alkylating agent plus radiation to the abdomen and pelvis have a cumulative incidence of premature menopause approaching 30%.
- Males are at risk of oligospermia or azoospermia.

FERTILITY/GONADAL ISSUES

Impact of Cancer and Treatment on Female Fertility

- Damage to uterus (fibrosis, vascular insufficiency)
 - Impaired mplantation
 - Pre-term loss
- Hormonal dysfunction (neuroendocrine)
- Germ Cell Loss
 - Surgery
 - Radiation
 - Chemotherapy

FERTILITY

- High-dose radiation to the pelvis/ uterus (> 500 Gy), compared to survivors who did not receive radiotherapy, were at significantly higher risk of having infants who were
 - preterm (50.0% vs. 19.6%), low birth weight (36.2 vs. 7.6%), and small for gestational age (18.2 vs. 7.8%).
- Exposition to chemotherapy, radiation therapy or both :
 - Not at increased risk of having children with congenital or chromosomal abnormalities

Cardonick EH. Overview of fertility and pregnancy in cancer survivors.

FERTILITY

- Fertility preservation (banking eggs or sperm) is now available for post pubertal children with cancer.
- Freezing ovarian or testicular tissue is considered experimental and is not available in Canada,

JOURNAL OF CLINICAL ONCOLOGY

Interventions to Address Sexual Problems in People With Cancer: American Society of Clinical Oncology Clinical Practice Guideline Adaptation of Cancer Care Ontario Guideline

Jeanne Carter, Christina Lacchetti, Barbara L. Andersen, Debra L. Barton, Sage Bolte, Shari Damast, Michael A. Diefenbach, Katherine DuHamel, Judith Florendo, Patricia A. Ganz, Shari Goldfarb, Sigrun Hallmeyer, David M. Kushner, and Julia H. Rowland

- Discuss sexual health and dysfunction resulting from cancer or its treatment.
- Psychosocial and/or psychosexual counseling should be offered to all patients with cancer,

Check for updates

ARTICL

- improve sexual response, body image, intimacy and relationship issues, and overall sexual functioning and satisfaction.
- Medical and treatable contributing factors should be identified and addressed first.

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 In women with symptoms of vaginal and/or vulvar atrophy, lubricants in addition to vaginal moisturizers may be tried as a first option. Lowdose vaginal estrogen, lidocaine, and dehydroepiandrosterone may also be considered in some cases.

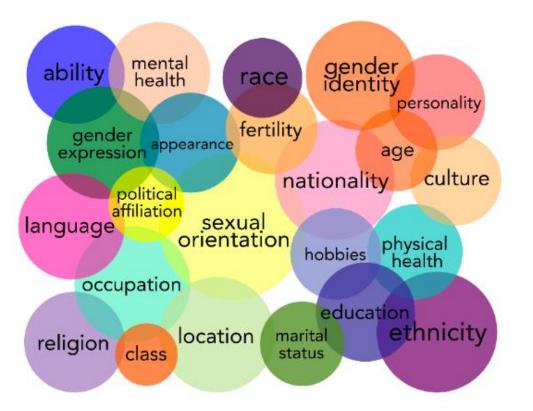
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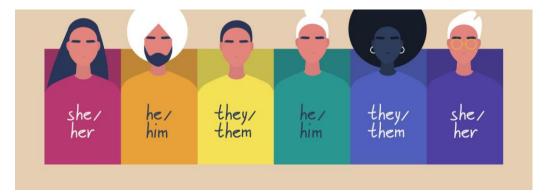
updates

ARTICL

 In men, medication such as phosphodiesterase type 5 inhibitors may be beneficial, and surgery remains an option for those with symptoms or treatment complications refractory to medical management.

YOUR WORDS MATTER : ADAPT THEM TO YOUR PATIENTS' REALITY





TALKING ABOUT SEX

Ressources :

- teens.aboutkidshealth.ca/cancer
- teenhealthsource.com
- www.macmillan.org.uk/Cancerinformat ion/teensandyoungadults/Relationships sexandfertility/Cancerandsexuality/Ca ncera ndsexuality.aspx
- www.sexandu.ca

PSYCHOSOCIAL

 Mental Health Depression/mood disorders Cancer-related anxiety Post-traumatic stress Physical/Body image Weight loss/gain Loss of organs/tissues 	 Education/Vocation Academic underachievement Vocational limitations Under/unemployment Loss of job/benefits Insurance discrimination Access to health care
 Chronic Symptoms Fatigue/ low energy Disrupted sleep Poor memory/concentration Chronic pain Self-care Independent living 	 Financial/economic Debt (medical/other) Social Interaction Family/peer relationships Social withdrawal/isolation Intimacy/marriage/family Cancer-related stigma

Scholarships/educational funds available:

All:	Terry Fox (humanitarian award)	http://terryfoxawards.ca/applicant-information/
Oncology Patients:	Childhood cancer Canada Undergraduate & graduate scholarships Emmy Duff	http://www.childhoodcancer.ca/get-help/survivor- scholarship/ http://www.emmyduffscholarship.org/
Brain Tumour	Brain Tumour Foundation of	http://www.braintumour.ca/4472/education-
Patients:	Canada	<u>awards</u>
Women only, age 18- 40 years at diagnosis with any cancer	Pink Pearl Foundation	http://www.pinkpearlfoundation.org/scholarship- application/

Anyone: <u>ScholarshipsCanada.com</u>

KEY POINTS

- 75% of childhood cancer survivors experience at least one adverse event and 40% at least one severe, life-threatening or disabling event -Survivors of childhood cancers need a life long systematic follow-up
- 85% of survivor of childhood cancer depend on their primary care physician for follow-up
- If your patient is a survivor of childhood cancer, you should have access to a clear Summary of Cancer Treatment provided by the pediatric cancer centre that treated them.
- Appropriate survivor care requires patient and physician knowledge about the long-term risks of cancer therapy
- Children's Oncology Group (COG) Centres accept referrals to assist with tracing back treatment summaries and preparing individualized follow-up plans.
- COG offers detailed guidelines on identifying, assessing and managing late effects of childhood cancer treatment.

