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Use of Carotid Ultrasound in Survivors of Childhood Cancer: A report from the Childhood Cancer Survivor Study (CCSS)

Background: Survivors of childhood cancer with history of radiation therapy (RT) to the head/neck/chest are at increased risk for stroke. Children's Oncology Group Guidelines recommend carotid ultrasound (CU) when clinically indicated or 10 years after RT≥40Gy to the neck. Yet, the use of CU has not been previously described.

Methods: 8,693 survivors of childhood cancer (median age at diagnosis 8.0 years, range 0-20; median age at evaluation 37.4, range 18-65) diagnosed between 1970-1999 were asked if they had ever had a CU. Cardiovascular disease (CVD) was defined as any of the following: stroke, congestive heart failure, hypertension, myocardial infarction, coronary heart disease, or arrythmia. Prevalence ratios (PR) were calculated; age and sex-adjusted multivariable Poisson regression models evaluated factors associated with CU.

Results: 4.9% (427) of survivors had a history of stroke and 28% (2,442) had a history of any CVD. Of these, 40.0% (171) with a history of stroke and 28.6% (748) with any CVD had CU. Comparatively, 14.6% (1,404) without a stroke and 11.1% (798) without any CVD had a CU (both $p<0.0001$ vs those with condition). Among survivors without CVD, having seen only a primary care physician was not associated with CU (PR 0.84 95% CI 0.58-1.25, $p = 0.36$), while seeing a cancer specialist (+/- a primary care physician) (PR 1.83 95% CI 1.23-2.79, $p = 0.036$) was associated with increased likelihood of CU compared to seeing neither. Survivors who had had other surveillance studies, including a colonoscopy (PR 1.76 95% CI 1.44-2.17, $p<0.0001$), skin cancer exam (PR 1.62 95% CI 1.30-2.03, $p=0.0002$), or mammogram (PR 2.06 95%CI 1.42-3.07, $p<0.0001$) were more likely to have a carotid ultrasound, compared to those without that test. Having a history of anthracyclines or RT to the neck were associated with higher prevalence of CU, with RT to the neck exhibiting a dose-response relationship (**Table**).

Conclusions: CU was more common among survivors with a history of stroke or other CVD event. In those without CVD, CU use was associated with anthracyclines and RT dose exposures and with care provided by a cancer specialist. A high proportion (70%) of survivors who received >40Gy RT to the neck have never had a CU, suggesting that greater awareness of guidelines is needed.

Multivariable model of treatments associated with CU in patients with no CVD

Treatment		**Never CU N(%)**	**Ever CU N(%)**	**PR***	**95% CI**		**P**
Anthracyclines	No	2815 (86)	450 (14)	1.00	-	-	-
	Yes	3158 (92)	276 (8)	1.95	1.67	2.27	<.0001
Neck RT dose	0 Gy	3388 (92)	281 (8)	1.00	.	.	.
	>0 - <40 GY	2464 (86)	394 (14)	1.54	1.32	1.79	<.0001
	>40 Gy	121 (70)	51 (30)	3.41	2.50	4.57	<.0001

*Adjusted for attained age and sex