

ASCO abstract

Title: Development and validation of a prediction model for kidney failure in long-term survivors of childhood cancer: a report from the Childhood Cancer Survivor Study (CCSS)

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Background: Kidney failure (need for dialysis or kidney transplantation, or death due to kidney disease) is a rare but serious late effect for survivors of childhood cancer. We aimed to develop a model using demographic and treatment characteristics to predict individual risk of kidney failure among five-year survivors of childhood cancer.

Methods: CCSS survivors without kidney failure at five years after cancer diagnosis (n = 25,483) were assessed for subsequent kidney failure by age 40. Outcomes were self-reported and corroborated by the Organ Procurement and Transplantation Network and the National Death Index. A sibling cohort (n = 5045) served as a comparator. Piecewise exponential models with backward selection estimated the relationships between potential predictors and kidney failure and were converted to integer risk scores. Additional results from the St. Jude Lifetime Cohort Study (SJLIFE, n = 2490) and the National Wilms Tumor Study (NWTs, n = 6760) validated the models.

Results: Among CCSS survivors, 204 developed late kidney failure. We developed a model with sex, race/ethnicity, age at cancer diagnosis, nephrectomy, exposure to specific chemotherapy, any abdominal radiation, presence of genitourinary anomalies, and early-onset hypertension (Table). Risk scores achieved an area under the curve (AUC) and concordance (C) statistic of 0.65 and 0.68 for kidney failure by age 40. Validation cohort AUC and C statistics were 0.83/0.86 for SJLIFE (8 cases) and 0.61/0.63 for NWTs (91 cases). An alternative model with specific chemotherapy doses and kidney-specific radiation dosimetry had similar AUC and C statistic (0.67/0.70). Integer risk scores were collapsed to form statistically distinct low (score <3; 87 cases of 17,326), moderate (score 3-5; 63 cases of 4667), and high (score 6+; 18 cases of 401) risk groups. These groups corresponded to cumulative incidences in CCSS of kidney failure by age 40 of 0.6% (95% CI 0.4-0.7%), 2.3% (95% CI 1.6-3.2%), and 9.4% (95% CI 4.4-16.7%), compared with 0.2% (95% CI 0.1-0.5%) among siblings.

Conclusions: Using readily available information, we were able to identify low, moderate, and high risk groups for developing kidney failure following treatment for childhood cancer. These prediction models may help guide screening and interventional strategies for higher risk survivors.

Table: Risk scores by variable for kidney failure prediction model*

Male sex (vs Female)	1
Black, non-Hispanic race/ethnicity (vs Other)	1
Age <10y at cancer diagnosis (vs 10+y)	1
Nephrectomy (vs None)	2
Ifosfamide (vs None)	2
Platinum (vs None)	1
Anthracycline (vs None)	1
Abdominal radiation (vs None)	1
Kidney/bladder/genital anomalies (vs None)	2
Hypertension within 5y of cancer diagnosis (vs None)	4

*Risk scores 0, 1, 2, 3, and 4 correspond to relative risks <1.3, 1.3-1.9, 2.0-2.9, 3.0-4.9, and ≥ 5.0 , respectively

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