

Clinical Outcomes and Efficacy of Stereotactic Body Radiation Therapy in Children, Adolescents, and Young Adults with Metastatic Solid Tumors

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Abstract

Purpose Pediatric patients with metastatic solid tumors historically have a poor overall survival. Some pediatric patients may still be potentially curable with aggressive local therapy to metastatic disease. The purpose of this study is to report results of the use of SBRT in the treatment of pediatric metastatic disease. Materials and Methods Pediatric patients who received SBRT between the years 2000-2020. Study endpoints included local control (LC), progression free survival (PFS), overall survival (OS), cumulative incidence (CI) of death or local failure and toxicity. The endpoints with respect to survival and LC were calculated using the Kaplan-Meier estimate. The cumulative incidence of local failure was calculated using death as a competing risk. Results 16 patients with 36 lesions irradiated met inclusion criteria. The median OS and PFS was 17 months and 15.7 months, respectively. The 1-year OS was 75%. The 6- and 12-month LC was 85% and 78%, respectively. There were no local failures in lesions receiving a BED10[?]100 Gy. Patients who had [?]5 metastatic lesions at first recurrence had a superior 1-year OS of 100% versus 50% with >5 lesions. One patient (6.3%) experienced a grade 3 CNS toxicity. Conclusions LC was excellent with SBRT delivered to metastatic disease, particularly for lesions receiving a BED10[?]100 Gy. High-grade toxicity was rare in our patient population. Patients with [?]5 metastatic sites have a significantly better OS compared to >5 sites. Future prospective trials with multi-institutional collaboration will be necessary to evaluate appropriate patient selection and the optimal radiation dose regimen.

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Short Running Title: SBRT in Metastatic Pediatric Tumors

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Conflicts of Interest: J.D.P. reports support from Varian Medical Systems and speaking fees from Depuy Synthes outside the current work.

Ethics: The procedures followed for the purposes of this study were in accordance with the ethical standards of the responsible committee on human experimentation (institutional or regional) or with the Helsinki Declaration (1964, amended in 1975, 1983, 1989, 1996 and 2000) of the World Medical Association.

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Data Sharing Statement: Data for these analyses can be made available by request provided approval from our Institutional Review Board.

Abbreviations table:

LC	Local control
PFS	Progression-free survival
OS	Overall Survival
CI	Cumulative incidence
BED ₁₀	Biologic Equivalent dose (alpha/beta 10)
CNS	Central Nervous System
SBRT	Stereotactic body radiation treatment
RT	Radiotherapy
AYA	Adolescent and young adult
CT	Computed tomography
MRI	Magnetic resonance imaging
PET/CT	Positron emission tomography/computed tomography
ITV	Internal target volume
CTV	Clinical target volume
PTV	Planning target volume
4DCT	4-dimensional computed tomography
VMAT	Volumetric modulated arc therapy
FFF	Flattening filter free
MV	Megavoltage
SIMT	Single isocenter multi target
AAPM	American association of physicists in medicine
IQR	Interquartile range
NA	Not applicable
CR	Complete response
PR	Partial response
NSCLC	Non-small cell lung cancer
QOL	Quality of life
COG	Children's Oncology Group

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