Systematic Review and Meta-Analysis of Adjuvant Radiation Dose for Pediatric Patients (≤22y) with Non-Metastatic Intracranial Ependymomas

ASTRO 2024
Targeting Provider Wellness
FOR EXCEPTIONAL PATIENT CARE

Dartmouth Health

GEISEL SCHOOL OF MEDICINE AT DARTMOUTH

Authors: M. ROSE[1,2], R. SACHDEVA[2], Y. MEZGUELDI[2], R. YEN[2], L. SERRAJ[2], K. CORBETT[2,3], T. YOCK[4]

1 Dartmouth Cancer Center, Dartmouth-Hitchcock Medical Center, Lebanon, NH, USA
2 The Dartmouth Institute, Geisel school of Medicine, Dartmouth College, Hanover, NH, USA
3 Department of Pediatrics, Dartmouth-Hitchcock Medical Center, Lebanon, NH, USA
4 Department of Radiation Oncology, Massachusetts General Brigham, Harvard Medical School, Boston, MA, USA

INTRODUCTION

Ependymomas are the third most common brain tumors in children. Standard of care is surgery followed by adjuvant radiotherapy. Controversy in the literature still exists over optimal radiotherapy dose.

AIM

We completed a systematic review and meta-analysis. **Our aim was to use this methodology to determine the optimal dose for local control (LC), event-free survival (EFS), and overall survival (OS) in pediatric patients.**

METHOD

We searched MEDLINE (PubMed), Cochrane Database of Systematic Reviews, and Web of Science through January 2024. We included cohort studies that compared adjuvant radiotherapy of ≤54Gy to >54Gy in pediatric patients (≤22 years) with non-metastatic intracranial ependymomas. We assessed study quality using the Newcastle-Ottawa Quality Assessment Scale of Cohort Studies. We pooled studies using a random effects meta-analysis for hazard ratios (HR), 95% confidence intervals (CI), and assessed statistical heterogeneity via I^2. When HRs were unavailable, we transformed risks using established methods. We narratively summarized qualitative outcomes.

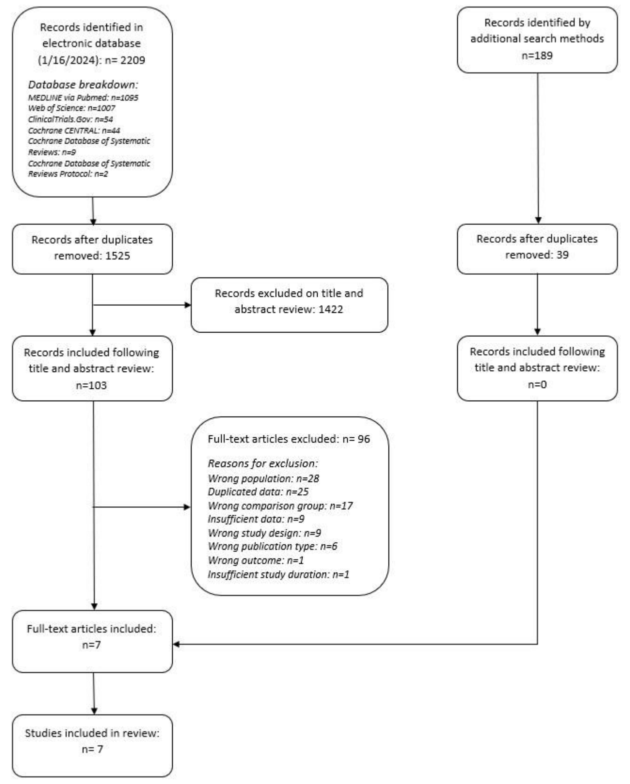

Figure 1: Flow diagram of method for including studies according to PRISMA guidelines

RESULTS

Seven studies met our inclusion criteria, covering a combined 1321 patients. Studies included a range of doses from 45-66.6Gy. Compared with >54Gy, we found no difference in LC for those receiving ≤54Gy (HR=0.83, 95% CI 0.56-1.24, I^2=49.1%), in EFS (HR=1.02, 95% CI 0.95-1.09, I^2=0.00%), and OS (HR=0.99, 95% CI 0.82-1.20, I^2=37.5%). Two studies reported on subtotal resection by radiotherapy dose, neither study reported a statistical differences in LC, EFS, or OS, though the number of patients was small (n≤30). Five studies reported on late effects, with brainstem radionecrosis, radiation-induced vasculopathy, and secondary tumors being the most frequent. Overall study quality was high, though lower scores were consistently seen in comparability of cohorts. No studies reported on molecular subgroups.

Study	Year of publication	Journal	Study Design	Location/institution	n (n=1321)	Data source	Years data was collected	Radiation Technique
Ager et al.	2019	Pediatric Blood Cancer	Cohort	Utah/Huntsman Cancer Institute	515	National Cancer Database	2004-2015	3DCRT/IMRT/Proton
Ducassou et al.	2018	IJROBP	Cohort	France/SFCE	202	Multi-center	2000-2013	Proton/Photon
Indelicato et al.	2018	Acta Oncologica	Cohort	Florida/University of Florida	149	Single-institution	2007-2017	Proton
Merchant et al.	2009	Lancet Oncology	Cohort	Memphis/St. Jude	153	Single-institution	1997-2007	3DCRT/IMRT
Patteson et al.	2020	Neuro-oncology	Cohort	Boston/MGH	150	Single-institution	2001-2019	Proton
Peters et al.	2022	Neuro-oncology	Cohort	Germany/University Hospital Essen	105	Single-institution	2013-2018	Proton
Schroeder et al.	2008	IJROBP	Cohort	Texas/MD Anderson	22	Single-institution	1994-2005	IMRT

Table 1: Included studies' characteristics

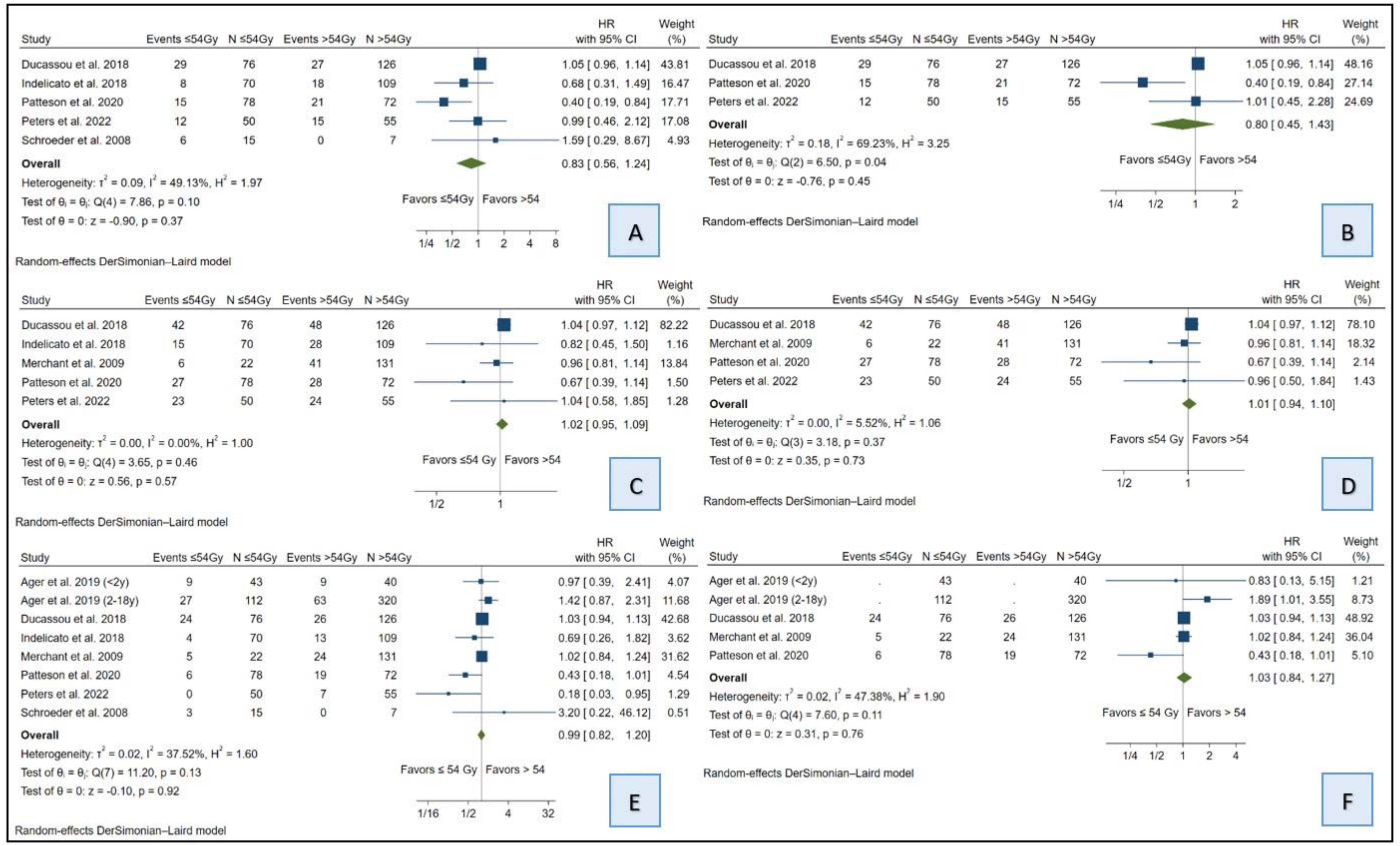

Figure 2: **Forest plots for HR.** A) LC HR including transformed data B) sensitivity analysis for LC HR excluding transformed data C) EFS HR including transformed data D) sensitivity analysis for EFS HR excluding transformed data E) OS HR including transformed data F) sensitivity analysis for OS HR excluding transformed data

CONCLUSIONS

We found no difference in LC, EFS, or OS for those treated with ≤54Gy compared to >54Gy. There was insufficient data to complete a subgroup meta-analysis on radiotherapy dosing based on extent of resection or molecular subgroups.

ACKNOWLEDGEMENTS

Medical librarians Elaina Vitale, MLS, and Heather Blunt, MLS, for assisting with the search strategy. Natalie Riblet, MD, and Pablo Martinez Camblor, PhD, assisted with reviewing the statistical analysis.

CONTACT INFORMATION

Email: Melanie.L.Rose@hitchcock.org