
Pediatric Oncology

Nalin Gupta
Anuradha Banerjee
Daphne A. Haas-Kogan
Editors

Pediatric CNS Tumors

Third Edition

 Springer

Editors

Nalin Gupta
San Francisco, CA
USA

Daphne A. Haas-Kogan
Boston, MA
USA

Anuradha Banerjee
San Francisco, CA
USA

ISSN 1613-5318

ISSN 2191-0812 (electronic)

Pediatric Oncology

ISBN 978-3-319-30787-9

ISBN 978-3-319-30789-3 (eBook)

DOI 10.1007/978-3-319-30789-3

Library of Congress Control Number: 2016943111

© Springer International Publishing 2017

This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed.

The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

The publisher, the authors and the editors are safe to assume that the advice and information in this book are believed to be true and accurate at the date of publication. Neither the publisher nor the authors or the editors give a warranty, express or implied, with respect to the material contained herein or for any errors or omissions that may have been made.

Printed on acid-free paper

This Springer imprint is published by Springer Nature
The registered company is Springer International Publishing AG Switzerland

*We dedicate this book to our children
Naya, Kavi
Shabnam, Hritik, and Tizita
Yonatan, Shira, and Maetal*

Preface

Pediatric brain tumors are a tremendous challenge for the treating physician. Their diverse biological behaviors, in the unique context of the developing nervous system, require flexible and tailored treatment plans. In the last 20 years, there has been an exponential increase in our understanding of the molecular and genetic basis of human malignancy. This is particularly true for pediatric tumors such as medulloblastoma, glioma, and neuroblastoma. The challenge for clinicians is using this array of new biologic information in a directed and rational manner to select effective and less toxic therapeutic agents.

As with previous editions, the goal of this textbook is to provide a current, biologically based perspective of the management of central nervous system tumors in children. Rather than present every tumor type in an encyclopedic manner, the common tumor types encountered in clinical practice are presented in the initial chapters. The epidemiology, pathological features, clinical presentation, diagnosis, and treatment are discussed for each tumor type. We have separated high- and low-grade glial tumors into separate chapters, mainly because the management and outcomes for these two broad groups of tumors are very different. Additional molecular and genomic data relevant to several tumor types have been added in this edition. In the final chapters, many of the diagnostic and treatment modalities common to all tumors are discussed with an emphasis on emerging and experimental techniques.

It is recognized that a variety of treatment strategies is utilized by many different practitioners and institutions. For the most part, the general management principles used by the authors, most of whom are at the University of California, San Francisco, are presented in the context of standard therapy. Although this approach may underemphasize other equally valid approaches, we believe that the reader will benefit from a coherent approach to the management of childhood tumors.

The editors acknowledge the contribution of the authors, our colleagues at the University of California, San Francisco, the editorial staff at Springer, and our many mentors in the preparation and assembly of this book.

San Francisco, CA, USA
San Francisco, CA, USA
Boston, MA, USA

Nalin Gupta
Anuradha Banerjee
Daphne A. Haas-Kogan

Contents

1	Low-Grade Gliomas	1
	Anuradha Banerjee and Theodore Nicolaides	
2	High-Grade Gliomas	37
	Jennifer S. Chang, Daphne A. Haas-Kogan, and Sabine Mueller	
3	Brainstem Gliomas	51
	Tiffany F. Lin and Michael Prados	
4	Ependymoma	69
	Cassie Kline, Craig Forester, and Anuradha Banerjee	
5	Embryonal Tumors	93
	David Raleigh, Corey Raffel, and Daphne A. Haas-Kogan	
6	Intracranial Germ Cell Tumors	121
	Steve Braunstein, Sean M. McBride, and Daphne A. Haas-Kogan	
7	Craniopharyngioma	145
	Lauren Ostling, Daphne A. Haas-Kogan, Robert H. Lustig, and Nalin Gupta	
8	Neuronal Tumors	171
	Dario J. Englot, Edward F. Chang, and Nalin Gupta	
9	Choroid Plexus Tumors	187
	Nalin Gupta	
10	Intramedullary Spinal Cord Tumors	199
	Jonathan D. Breshears, Peter P. Sun, and Kurtis I. Auguste	
11	Rare Tumors	221
	Sunanda Pejavar and Daphne A. Haas-Kogan	
12	Neurocutaneous Syndromes and Associated CNS Tumors	237
	Alexei Polishchuk, Daphne A. Haas-Kogan, and Sabine Mueller	
13	Modern Neuroimaging of Pediatric Brain Tumors	273
	Mark D. Mamlouk, Sean O. Bryant, Soonmee Cha, and A. James Barkovich	

14	Current Surgical Management	301
	Kurtis I. Auguste, Peter P. Sun, Corey Raffel, Mitchel S. Berger, and Nalin Gupta	
15	Chemotherapy	317
	Theodore Nicolaides, Biljana Horn, and Anuradha Banerjee	
16	Advances in Radiation Therapy	343
	Mekhail Anwar, Sean M. McBride, and Daphne A. Haas-Kogan	
17	Late Effects of Treatment and Palliative Care	365
	Eric Chang, Robert Goldsby, Sabine Mueller, and Anu Banerjee	

Contributors

Mekhail Anwar Department of Radiation Oncology, University of California San Francisco, San Francisco, CA, USA

Kurtis I. Auguste Departments of Neurological Surgery and Pediatrics, University of California San Francisco & UCSF Benioff Children's Hospital, San Francisco, CA, USA

UCSF Benioff Children's Hospital Oakland, Oakland, CA, USA

Anuradha Banerjee Division of Hematology/Oncology, Departments of Pediatrics, University of California San Francisco & UCSF Benioff Children's Hospital, San Francisco, CA, USA

A. James Barkovich Departments of Radiology and Biomedical Imaging, Neurology, Pediatrics & Neurosurgery, University of California San Francisco & UCSF Benioff Children's Hospital, San Francisco, CA, USA

Mitchel S. Berger Department of Neurological Surgery, University of California San Francisco, San Francisco, CA, USA

Steve Braunstein Department of Radiation Oncology, University of California San Francisco, San Francisco, CA, USA

Jonathan D. Breshears Department of Neurological Surgery, University of California San Francisco, San Francisco, CA, USA

Sean O. Bryant Departments of Radiology, Diversified Radiology of Colorado, PC, Lakewood, CO, USA

Soonmee Cha Radiology & Neurological Surgery, University of California San Francisco, San Francisco, CA, USA

Edward F. Chang Departments of Neurological Surgery & Physiology, University of California San Francisco, San Francisco, CA, USA

Eric Chang Department of Radiation Oncology, University of California Los Angeles, Los Angeles, CA, USA

Jennifer S. Chang Department of Radiation Oncology, University of California San Francisco & UCSF Benioff Children's Hospital, San Francisco, CA, USA

Dario J. Englot Department of Neurological Surgery, University of California San Francisco, San Francisco, CA, USA

Craig Forester Division of Hematology/Oncology, Departments of Pediatrics, University of California San Francisco & UCSF Benioff Children's Hospital, San Francisco, CA, USA

Robert Goldsby Division of Hematology/Oncology, Departments of Pediatrics, University of California San Francisco & UCSF Benioff Children's Hospital, San Francisco, CA, USA

Nalin Gupta Division of Pediatric Neurosurgery, Departments of Neurological Surgery and Pediatrics, University of California San Francisco & UCSF Benioff Children's Hospital, San Francisco, CA, USA

Daphne A. Haas-Kogan Department of Radiation Oncology, Brigham and Women's Hospital, Dana-Farber Cancer Institute & Boston Children's Hospital, Boston, MA, USA

Biljana Horn Blood and Marrow Transplant Program, Department of Pediatrics, University of California San Francisco & UCSF Benioff Children's Hospital, San Francisco, CA, USA

Cassie Kline Division of Hematology/Oncology, Departments of Pediatrics, University of California San Francisco & UCSF Benioff Children's Hospital, San Francisco, CA, USA

Tiffany F. Lin Division of Hematology/Oncology, Department of Pediatrics, University of California San Francisco & UCSF Benioff Children's Hospital, San Francisco, CA, USA

Robert H. Lustig Department of Pediatrics & Institute for Health Policy Studies, University of California, San Francisco, CA, USA
UCSF Benioff Children's Hospital San Francisco, San Francisco, CA, USA

Mark D. Mamlouk Division of Neuroradiology, Kaiser Permanente Santa Clara, Santa Clara, CA, USA

Sean M. McBride Department of Radiation Oncology, Memorial Sloan Kettering Cancer Center, New York, NY, USA

Sabine Mueller Departments of Neurology, Neurosurgery and Pediatrics, University of California San Francisco & UCSF Benioff Children's Hospital, San Francisco, CA, USA

Theodore Nicolaides Division of Hematology/Oncology, Departments of Pediatrics and Neurological Surgery, University of California San Francisco & UCSF Benioff Children's Hospital, San Francisco, CA, USA

Lauren Ostling Department of Neurological Surgery, UCSF Benioff Children's Hospital Oakland, Oakland, CA, USA

Department of Neurological Surgery, University of California San Francisco, San Francisco, CA, USA

Sunanda Pejavar Department of Radiation Oncology, Sharp Memorial Hospital, San Diego, CA, USA

Alexei Polishchuk Department of Radiation Oncology, University of California San Francisco, San Francisco, CA, USA

Michael Prados Departments of Neurological Surgery & Pediatrics, University of California San Francisco, San Francisco, CA, USA

Corey Raffel Department of Neurological Surgery, University of California San Francisco & UCSF Benioff Children's Hospital, San Francisco, CA, USA

David Raleigh Department of Radiation Oncology, University of California San Francisco, San Francisco, CA, USA

Peter P. Sun Department of Neurological Surgery, UCSF Benioff Children's Hospital Oakland, Oakland, CA, USA