Pediatric Head and Neck Tumors
Pediatric Head and Neck Tumors

A-Z Guide to Presentation and Multimodality Management
Preface

Treatment of children with head and neck tumors exemplifies the complex multidisciplinary care that defines modern pediatric practice. From benign to malignant conditions, each tumor and each patient requires a dedicated team of specialists that understand the disease and define the best course of action, applying the most effective treatments that maximize cure options with minimal adverse effects. Accomplishing these goals requires seamless integration of many disciplines, including pathology, diagnostic and interventional radiology, otorhinolaryngology, skull base, plastic and ocular surgery, and pediatric and radiation oncology.

The Head and Neck Tumors Program at Boston Children’s Hospital and Dana-Farber Cancer Institute was formed to provide a well-integrated team approach to children with those complex and often devastating diseases. In this book, we have invited a team of experts from our program to share their knowledge in the diagnosis and management of the tumors that we encounter in our practice. We would like this book to be an A to Z practical guide that provides concise reviews and treatment recommendations for the different tumors.

This work represents the efforts of many. We would like to thank all our colleagues who have so generously shared their expertise and their time, and the editors who have so patiently helped us in this process. Most of all, we are grateful to our patients and their families, whose courage and determination inspire us to continue to work, to learn, and to advance our knowledge in the treatment of these disorders.

Reza Rahbar, MD
Carlos Rodriguez-Galindo, MD
John G. Meara, MD, DMD, MBA
Edward R. Smith, MD
Antonio R. Perez-Atayde, MD, PhD
Contents

Part I  Evaluation and Management

1  Imaging ........................................................................................................................... 3
   Behroze Adi Vachha and Sanjay P. Prabhu

2  Reconstructive Surgery .............................................................................................. 13
   Brian Labow and Amir Taghinia

3  Chemotherapy ............................................................................................................... 23
   Carlos Rodriguez-Galindo

4  Radiotherapy ............................................................................................................. 31
   Karen J. Marcus

5  Interventional Radiology ............................................................................................ 39
   Raja Shaikh, Darren B. Orbach and Horatio M. Padua Jr.

6  Sentinel Lymph Node Biopsy ..................................................................................... 49
   Christopher Weldon

Part II  Disease Specific

7  Arteriovenous Malformations: Extracranial ............................................................. 55
   Rafael A. Couto and Arin K. Greene

8  Arteriovenous Malformations: Intracranial ............................................................. 63
   Brendan McNeish and Edward R. Smith

9  Capillary Malformations ............................................................................................. 73
   Rafael A. Couto and Arin K. Greene

10  Carcinoma/Undifferentiated Tumor ......................................................................... 81
    Jennifer W. Mack

11  Chiari Malformation .................................................................................................. 87
    Edward R. Smith, Lissa C. Baird and Benjamin C. Warf

12  Cholesteatoma .......................................................................................................... 93
    Ilkka Kivekäs and Dennis Poe
<table>
<thead>
<tr>
<th>Chapter</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>13</td>
<td>Craniopharyngioma</td>
<td>101</td>
</tr>
<tr>
<td></td>
<td>Edward R. Smith and R. Michael Scott</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Dermoid: Head and Neck</td>
<td>111</td>
</tr>
<tr>
<td></td>
<td>Mark S. Volk</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Dermoid: Nasal</td>
<td>117</td>
</tr>
<tr>
<td></td>
<td>Stephen Kieran, John G. Meara, Mark Proctor and Reza Rahbar</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Encephaloceles</td>
<td>123</td>
</tr>
<tr>
<td></td>
<td>Christian J. Vercler, Frank W. Virgin, Reza Rahbar, Edward R. Smith and John G. Meara</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Esthesioneuroblastoma</td>
<td>131</td>
</tr>
<tr>
<td></td>
<td>Karen Watters, Edward R. Smith and Reza Rahbar</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Fibrous Dysplasia</td>
<td>139</td>
</tr>
<tr>
<td></td>
<td>Melissa S. Putman, Karen Watters, Reza Rahbar and Catherine M. Gordon</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>Foregut Duplication Cysts</td>
<td>149</td>
</tr>
<tr>
<td></td>
<td>Stephen Kieran, Antonio R. Perez-Atayde and Reza Rahbar</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>Germ Cell Tumors/Teratoma</td>
<td>153</td>
</tr>
<tr>
<td></td>
<td>Jacob R. Brodsky, Vikramjit S. Kanwar, Lisa M. Stafford, Reza Rahbar and A. Lindsay Frazier</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>Giant Cell Tumor</td>
<td>165</td>
</tr>
<tr>
<td></td>
<td>Bonnie L. Padwa</td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>Nasal Glioma</td>
<td>171</td>
</tr>
<tr>
<td></td>
<td>Frank W. Virgin and Reza Rahbar</td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>Hamartomas</td>
<td>175</td>
</tr>
<tr>
<td></td>
<td>Kenneth R. Whittemore, Jr.</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>Hemangiomas</td>
<td>183</td>
</tr>
<tr>
<td></td>
<td>Rafael A. Couto and Arin K. Greene</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>Juvenile Nasopharyngeal Angiofibroma</td>
<td>193</td>
</tr>
<tr>
<td></td>
<td>Karen Watters, Trevor McGill and Reza Rahbar</td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>Langerhans Cell Histiocytosis</td>
<td>203</td>
</tr>
<tr>
<td></td>
<td>Adam L. Green and Carlos Rodriguez-Galindo</td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>Leukemia and Lymphoma</td>
<td>211</td>
</tr>
<tr>
<td></td>
<td>Natasha M. Archer and Lynda M. Vrooman</td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>Lymphatic Malformations</td>
<td>221</td>
</tr>
<tr>
<td></td>
<td>Karen Watters, Raja Shaikh, Horacio M. Padua and Reza Rahbar</td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>Melanoma</td>
<td>231</td>
</tr>
<tr>
<td></td>
<td>Adam L. Green and Carlos Rodriguez-Galindo</td>
<td></td>
</tr>
</tbody>
</table>
30 Nasopharyngeal Carcinoma ................................................... 239
Carlos Rodriguez-Galindo

31 Neuroblastoma ...................................................................... 245
Natasha M. Archer and Suzanne Shusterman

32 Odontogenic Cysts ............................................................... 253
Sang Yoon Kim, Alfredo A. Dela Rosa and Bonnie Padwa

33 Odontogenic Tumors ........................................................... 261
Alfredo A. Dela Rosa, Sang Yoon Kim and Bonnie Padwa

34 Parathyroid Tumors ............................................................... 275
Biren P. Modi and Stephen A. Huang

35 Pilomatrixoma ...................................................................... 283
Christian J. Vercier and John G. Meara

36 Pituitary Region Tumors ........................................................ 287
Edward R. Smith

37 Retinoblastoma ..................................................................... 295
Carlos Rodriguez-Galindo, Darren B. Orbach and Deborah Vanderveen

38 Rhabdomyoma ..................................................................... 305
Karen Watters and Reza Rahbar

39 Salivary Gland Tumors .......................................................... 311
Paul Lennon and Michael J. Cunningham

40 Sarcoma: Bony Lesion ........................................................... 327
Lillian M. Guenther and Katherine A. Janeway

41 Sarcoma: Non-Rhabdomyosarcoma Soft Tissue Sarcomas .......... 337
Allison O’Neill and Carlos Rodriguez-Galindo

42 Sarcoma: Rhabdomyosarcoma ............................................... 347
Allison O’Neill, Karen Watters, Reza Rahbar
and Carlos Rodriguez-Galindo

43 Thyroglossal Duct Cysts ....................................................... 361
Joel W. Jones and Dwight T. Jones

44 Thyroid Tumors .................................................................... 369
Biren P. Modi and Robert C. Shamberger

45 Venous Malformations .......................................................... 379
Rafael A. Couto and Arin K. Greene

Index ....................................................................................... 387
Contributors

Natasha M. Archer  Department of Pediatric Hematology-Oncology, Dana-Farber/Boston Children’s Cancer and Blood Disorders Center, Roxbury, MA, USA

Lissa C. Baird  Department of Neurosurgery, Oregon Health & Science University, Portland, OR, USA

Jacob R. Brodsky  Department of Otolaryngology and Communication Enhancement, Boston Children’s Hospital, Harvard Medical School, Boston, MA, USA

Rafael A. Couto  Department of Plastic and Oral Surgery, Boston Children’s Hospital, Harvard Medical School, Boston, MA, USA

Michael J. Cunningham  Department of Otolaryngology and Communication Enhancement, Boston Children’s Hospital, Harvard Medical School, Boston, MA, USA

Alfredo A. Dela Rosa  Department of Oral and Maxillofacial Surgery, University of the Pacific, School of Dentistry, San Francisco, CA, USA

A. Lindsay Frazier  Department of Pediatric Oncology, Dana-Farber Cancer Institute, Boston, MA, USA

Catherine M. Gordon  Department of Adolescent Medicine, Hasbro Children’s Hospital, Providence, RI, USA

Adam L. Green  Pediatric Oncology, Dana-Farber Cancer Institute, Boston, MA, USA

Lillian M. Guenther  Department of Medicine, Boston Children’s Hospital, Harvard Medical School, Boston, MA, USA

Stephen A. Huang  Department of Medicine, Boston Children’s Hospital, Harvard Medical School, Boston, MA, USA

Katherine A. Janeway  Department of Pediatric Oncology, Boston Children’s Hospital, Harvard Medical School, Boston, MA, USA

Dwight T. Jones  Department of Otolaryngology - Head and Neck Surgery, University of Nebraska College of Medicine, Omaha, NE, USA

Vikramjit S. Kanwar  Pediatric Hematology-Oncology, Albany Medical Center, Albany, NY, USA

Stephen Kieran  Department of Otolaryngology, Boston Children’s Hospital, Harvard Medical School, Boston, MA, USA

Sang Yoon Kim  Department of Oral and Maxillofacial Surgery, INOVA Fairfax Hospital, Vienna, VA, USA
Ilkka Kivekäs Department of Otolaryngology and Communication Enhancement, Boston Children’s Hospital, Harvard Medical School, Boston, MA, USA

Department of Otorhinolaryngology, Tampere University Hospital and the University of Tampere, Tampere, Finland

Brian Labow Department of Plastic and Oral Surgery, Boston Children’s Hospital, Harvard Medical School, Boston, MA, USA

Paul Lennon Department of Otolaryngology and Communication Enhancement, Boston Children’s Hospital, Harvard Medical School, Boston, MA, USA

Jennifer W. Mack Dana-Farber Cancer Institute, Boston, MA, USA

Department of Pediatric Hematology/Oncology, Boston Children’s Hospital, Harvard Medical School, Boston, MA, USA

Karen J. Marcus Pediatric Radiation Oncology, Dana Farber/Boston Children’s Cancer and Blood Disorders Center, Brigham and Women’s Hospital, Harvard Medical School, Boston, MA, USA

Trevor McGill Department of Otolaryngology and Communication Enhancement, Boston Children’s Hospital, Harvard Medical School, Boston, MA, USA

Brendan McNeish Boston Children’s Hospital, Harvard Medical School, Boston, MA, USA

John G. Meara Department of Plastic and Oral Surgery, Boston Children’s Hospital, Harvard Medical School, Boston, MA, USA

Biren P. Modi Department of Surgery, Boston Children’s Hospital, Harvard Medical School, Boston, MA, USA

Allison O’Neill Department of Pediatric Oncology, Harvard Medical School, Dana-Farber/Boston Children’s Hospital Cancer and Blood Disorders Center, Boston, MA, USA

Darren B. Orbach Department of Radiology, Boston Children’s Hospital, Harvard Medical School, Boston, MA, USA

Interventional & Neurointerventional Radiology, Department of Radiology, Boston Children’s Hospital, Harvard Medical School, Boston, MA, USA

Padua Jr. Department of Radiology, Boston Children’s Hospital, Harvard Medical School, Boston, MA, USA

Horacio M. Padua Department of Radiology, Boston Children’s Hospital, Harvard Medical School, Boston, MA, USA

Bonnie L. Padwa Department of Plastic and Oral Surgery, Boston Children’s Hospital, Harvard Medical School, Boston, MA, USA

Antonio R. Perez-Atayde Department of Pathology, Boston Children’s Hospital, Harvard Medical School, Boston, MA, USA

Dennis Poe Department of Otolaryngology and Communication Enhancement, Boston Children’s Hospital, Harvard Medical School, Boston, MA, USA

Sanjay P. Prabhu Department of Radiology, Boston Children’s Hospital, Harvard Medical School, Boston, MA, USA

Mark Proctor Boston Children’s Hospital, Harvard Medical School, Boston, MA, USA

Melissa S. Putman Department of Endocrinology, Boston Children’s Hospital, Harvard Medical School, Boston, MA, USA
Reza Rahbar  Department of Otolaryngology and Communication Enhancement, Boston Children’s Hospital, Harvard Medical School, Boston, MA, USA

Carlos Rodriguez-Galindo  Department of Pediatric Oncology, Dana-Farber/Boston Children’s Hospital Cancer and Blood Disorders Center, Harvard Medical School, Boston, MA, USA

R. Michael Scott  Boston Children’s Hospital, Harvard Medical School, Boston, MA, USA

Raja Shaikh  Department of Interventional Radiology, Boston Children’s Hospital, Harvard Medical School, Boston, MA, USA

Robert C. Shamberger  Department of Surgery, Boston Children’s Hospital, Harvard Medical School, Boston, MA, USA

Suzanne Shusterman  Department of Pediatric Hematology-Oncology, Dana-Farber/Boston Children’s Cancer and Blood Disorders Center, Boston, MA, USA

Edward R. Smith  Department of Neurosurgery, Boston Children’s Hospital, Harvard Medical School, Boston, MA, USA

Lisa M. Stafford  College of Nanoscale Engineering, Albany, NY, USA

Amir Taghinia  Department of Plastic and Oral Surgery, Boston Children’s Hospital, Harvard Medical School, Boston, MA, USA

Behroze Adi Vachha  Department of Radiology, Beth Israel Deaconess Medical Center, Harvard Medical School, Boston, MA, USA

Deborah Vanderveen  Boston Children’s Hospital, Harvard Medical School, Boston, MA, USA

Christian J. Vercler  Department of Plastic and Oral Surgery, Boston Children’s Hospital, Harvard Medical School, Boston, MA, USA

Section of Plastic Surgery, University of Michigan, Ann Arbor, MI, USA

Frank W. Virgin  Department of Otolaryngology Head and Neck Surgery, Monroe Carell Jr. Children’s Hospital at Vanderbilt, Nashville, TN, USA

Mark S. Volk  Department of Otolaryngology and Communication Enhancement, Boston Children’s Hospital, Harvard Medical School, Boston, MA, USA

Lynda Vrooman  Boston Children’s Hospital, Harvard Medical School, Boston, MA, USA

Benjamin C. Warf  Department of Neurosurgery, Boston Children’s Hospital, Harvard Medical School, Boston, MA, USA

Karen Watters  Boston Children’s Hospital, Harvard Medical School, Boston, MA, USA

Department of Otolaryngology and Communication Enhancement, Boston Children’s Hospital, Harvard Medical School, Boston, MA, USA

Christopher Weldon  Department of Surgery, Boston Children’s Hospital, Harvard Medical School, Boston, MA, USA

Kenneth R. Whittemore, Jr.  Department of Otolaryngology and Communication Enhancement, Boston Children’s Hospital, Harvard Medical School, Boston, MA, USA