

Advances and Technical Standards in Neurosurgery

Volume 40

Editor-in-Chief

Johannes Schramm

Volume Editors

Concezio Di Rocco

Nejat Akalan

For further volumes

<http://www.springer.com/series/578>



Sponsored by the
European Association of Neurosurgical Societies

Concezio Di Rocco • Nejat Akalan
Editors

Pediatric Craniovertebral Junction Diseases

Surgical Management of Craniovertebral
Junction Diseases in Children

 Springer

Editors

Concezio Di Rocco
INI-International Neuroscience Institute
Hannover
Germany

Nejat Akalan
Department of Neurosurgery
Hacettepe University
Sihhiye, Ankara
Turkey

ISBN 978-3-319-01064-9 ISBN 978-3-319-01065-6 (eBook)
DOI 10.1007/978-3-319-01065-6
Springer Cham Heidelberg New York Dordrecht London

© Springer International Publishing Switzerland 2014

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. Exempted from this legal reservation are brief excerpts in connection with reviews or scholarly analysis or material supplied specifically for the purpose of being entered and executed on a computer system, for exclusive use by the purchaser of the work. Duplication of this publication or parts thereof is permitted only under the provisions of the Copyright Law of the Publisher's location, in its current version, and permission for use must always be obtained from Springer. Permissions for use may be obtained through RightsLink at the Copyright Clearance Center. Violations are liable to prosecution under the respective Copyright Law.

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.

While the advice and information in this book are believed to be true and accurate at the date of publication, neither the authors nor the editors nor the publisher can accept any legal responsibility for any errors or omissions that may be made. The publisher makes no warranty, express or implied, with respect to the material contained herein.

Printed on acid-free paper

Springer is part of Springer Science+Business Media (www.springer.com)

Preface

The management of the congenital and acquired diseases of the craniovertebral junction (CVJ), that is, the occipital bone which surrounds the foramen magnum, the atlas, and the axis vertebrae, constitutes one of the more complex chapters of neurosurgery. This is particularly true in the pediatric population in which the neurosurgeon is faced with a large variety of congenital developmental anomalies and acquired diseases; the treatment of which is weighted by further problems possibly related to the necessity of not interfering with still-growing structures significantly.

The CVJ is essentially a bone enclosure which encompasses the medulla oblongata, the cervicomedullary junction, and the upper cervical spinal cord. Its anomalies may result in compression of the underlying neuronal structures along the entire circumference, in vascular compromise requiring surgical or medical therapy, and in abnormalities of the cerebrospinal fluid dynamics.

The basis for understanding surgical and medical problems generated by the diseases of this bone complex relies on a perfect knowledge of its embryology and the clear understanding of its functional anatomy and biomechanics. Pediatric neurosurgeons are called to face this stimulating region; the diseases of which may be nowadays managed with rewarding results even in the first years of age due to the progress of neurosciences, availability of advanced neuroimaging diagnostic tools, as well as improved surgical and anesthesiological techniques.

This dedicated volume of the series *Advances and Technical Standards in Neurosurgery* provides a comprehensive approach to the CVJ diseases and their management based on the multidisciplinary cooperation of neurosurgeons, anatomists, neuroradiologists, and neuroanesthesiologists. The contributing authors represent the European and also the world's most renowned clinical and surgical experts.

According to the traditional architecture of *Advance and Technical Standards in Neurosurgery*, the 12 chapters of the volume are organized in two parts of 7 (Advanced) and 5 (Standard) chapters, respectively.

The main topics highlighted concern the embryology, the normal and abnormal development of the CVJ, including the related vessels, the modern radiological

contributions to the diagnosis, the genetic and metabolic factors which may impact on the surgical strategies, the opportunities offered by the traditional operative techniques, and the recently introduced minimal and endoscopic surgical modalities. A special emphasis is also placed on to the evolution of the principles of surgical treatment as matured by the last-decade experiences in a still-open field of pediatric neurosurgery.

Bonn, Germany
Rome, Italy
Ankara, Turkey

J. Schramm
C. Di Rocco
N. Akalan

Contents

Technical Standards

- 1 Nosographic Identification and Management of Pediatric Craniovertebral Junction Anomalies: Evolution of Concepts and Modalities of Treatment. 3**
Arnold H. Menezes
- 2 Embryology, Classification, and Surgical Management of Bony Malformations of the Craniovertebral Junction. 19**
Dachling Pang and Dominic N.P. Thompson
- 3 Extracranial Segments of the Vertebral Artery: Insight in the Developmental Changes up to the 21st Year of Life. 111**
Vasović Ljiljana, Jovanović Ivan, Ugrenović Slađana, Vljaković Slobodan, Jovanović Predrag, and Đorđević Gordana
- 4 Imaging of the Craniovertebral Junction Anomalies in Children. . . 141**
Matylda Machnowska and Charles Raybaud
- 5 Anaesthesiological and Intensive Care Management in Craniovertebral Junction Surgery 171**
Orazio Genovese, Federica Tosi, Marco Piastra, Antonio Chiaretti, Giorgio Conti, Concezio Di Rocco, and Massimiliano Visocchi

Advances

- 6 Technical Advances in Pediatric Craniovertebral Junction Surgery 201**
Mark E. Oppenlander, James Kalyvas, Volker K.H. Sonntag, and Nicholas Theodore

7 Craniovertebral Junction Instability: Special Reference to Paediatric Age Group	215
Atul Goel	
8 Minimally Invasive Posterior Trans-muscular C1–C2 Screw Fixation Through an Anatomical Corridor to Preserve Occipitocervical Tension Band: Surgical Anatomy and Clinical Experience	261
Roberto Díaz, Miguel E. Berbeo, Luis M. Villalobos, Manuel F. Vergara, and Enrique Osorio	
9 Os Odontoideum Syndrome: Pathogenesis, Clinical Patterns and Indication for Surgical Strategies in Childhood	273
Massimiliano Visocchi and Concezio Di Rocco	
10 Craniovertebral Junction Anomalies in Achondroplastic Children	295
Vincent Reina, Genevieve Baujat, Brigitte Fauroux, Vincent Couloigner, Elise Boulanger, Christian Sainte-Rose, Philippe Maroteaux, Martine Le Merrer, Valérie Cormier-Daire, Laurence Legai-Mallet, Michel Zerah, and Federico Di Rocco	
11 Craniovertebral Junction Pathological Features and Their Management in the Mucopolysaccharidoses	313
Erik Pietro Sganzerla, Carlo Giussani, Marco Grimaldi, Rossella Parini, Pablo Ingelmo, Andrea Trezza, and Massimiliano Visocchi	
12 Pediatric Craniovertebral Junction Trauma	333
Mark E. Oppenlander, Justin C. Clark, Volker K.H. Sonntag, and Nicholas Theodore	
Author Index Volume 1–40	355
Subject Index Volume 1–40	369