

Contents

Preface	xi
Contributors	xiii
I Development and Clinical Aspects of the Pediatric Spine	
1 Neural and Vertebral Column Embryogenesis	3
<i>Sean M. Lew and Bruce A. Kaufman</i>	
2 Biomechanics of the Pediatric Spine	11
<i>Narayan Yoganandan, Brian D. Stemper, Bruce A. Kaufman, and Frank A. Pintar</i>	
3 Neuroimaging of the Spine and Spinal Neuraxis in Childhood	23
<i>Patrick D. Barnes</i>	
4 Clinical and Preoperative Evaluation of Pediatric Spinal Disorders	49
<i>Gordon T. Sakamoto, M. Gail Boltz, and Stephen L. Huhn</i>	
5 Anesthesia for Pediatric Spine Surgery	57
<i>Andrew Herlich and Elizabeth T. Drum</i>	
6 Neurophysiological Monitoring during Pediatric Spine Surgery	65
<i>Vedran Deletis and Francesco Sala</i>	
II Surgical Anatomy and Approaches to the Spine and Spinal Cord	
7 Neuroanatomy of the Spinal Cord	83
<i>Rick Boop and Daniel Kueter</i>	
8 Cervical Anatomy and Surgical Approaches	95
<i>Bryan C. Oh and Michael Y. Wang</i>	
9 Thoracic and Lumbar Anatomy and Surgical Approaches	102
<i>Se-Hoon Kim, Won-Ho Choo, and Daniel H. Kim</i>	
10 Lumbosacral Junction and Pelvic Anatomy and Surgical Approaches	121
<i>Karl M. Schmitt and Jonathan N. Grauer</i>	
III Congenital Anomalies and Developmental Disorders	
11 Craniovertebral Junction Anomalies	137
<i>Arnold H. Menezes</i>	

12	Chiari Malformations and Syringomyelia	148
	<i>Elizabeth C. Tyler-Kabara and W. Jerry Oakes</i>	
13	Open Dysraphism: Myelomeningoceles	172
	<i>John W. Walsh and Jorge E. Alvernia</i>	
14	Occult Spinal Dysraphism: Lipomyelomeningoceles	177
	<i>Richard C. E. Anderson and Marion L. Walker</i>	
15	Dermal Sinus	190
	<i>Jeffrey A. Pugh, Vivek Mehta, Ravi Bhargava, and Keith Aronyk</i>	
16	Split Cord Malformations	200
	<i>Jonathan P. Miller and Alan R. Cohen</i>	
17	Tethered Cord Syndrome	207
	<i>Ali Zomorodi and Timothy M. George</i>	
18	Lumbar Disk Herniations	217
	<i>Kurtus A. Dafford, Se-Hoon Kim, Max C. Lee, and Daniel H. Kim</i>	
19	Congenital and Developmental Spinal Stenosis	225
	<i>Joon Yung Lee, Moe R. Lim, and Alexander R. Vaccaro</i>	
20	Spondylolysis and Spondylolisthesis	236
	<i>Jean-Marc Mac-Thiong and Hubert Labelle</i>	

IV Neoplasms

21	Intramedullary Spinal Cord Tumors	259
	<i>Andrew Jea, Sanjiv Bhatia, and John Ragheb</i>	
22	Intradural Extramedullary Spinal Tumors	278
	<i>Gary L. Gallia and George I. Jallo</i>	
23	Neurofibromatosis	289
	<i>Issada Thongtrangan, Hoang Le, Peter O. Newton, Stephen L. Huhn, and Daniel H. Kim</i>	
24	Benign Primary Tumors of the Spine	306
	<i>Alexandre Arkader and John P. Dormans</i>	
25	Malignant and Metastatic Tumors of the Spine	320
	<i>Alexandre Arkader and John P. Dormans</i>	

V Vascular Malformations of the Pediatric Spine

26	Vascular Malformations of the Spinal Cord	337
	<i>Cormac O. Maher, Edward Smith, Mark Proctor, and R. Michael Scott</i>	
27	Spinal Arteriovenous Fistulas	344
	<i>J. Marc C. van Dijk, Bert A. Coert, and Gary K. Steinberg</i>	
28	Spinal Cord Cavernous Malformations	352
	<i>Bert A. Coert, J. Marc C. van Dijk, and Gary K. Steinberg</i>	

VI Inflammatory and Infectious Diseases of the Pediatric Spine

29	Inflammatory Diseases of the Spine: Ankylosing Spondylitis	361
	<i>Po-Quang Chen, Ing-Ho Chen, and Chien-Ming Chao</i>	
30	Inflammatory Diseases of the Spine: Juvenile Rheumatoid Arthritis	375
	<i>Katsuji Shimizu and Kei Miyamoto</i>	
31	Spinal Infection	381
	<i>James T. Guille</i>	

	32 Spinal Tuberculosis	390
	<i>Tsai-Sheng Fu, Chak-Bor Wong, and Wen-Jer Chen</i>	
VII	Pediatric Neuromuscular Disease and Spinal Deformity	
	33 Neuromuscular Spinal Deformity and Treatment	399
	<i>Linda Park D'Andrea</i>	
	34 Selective Dorsal Rhizotomy and Treatment of Childhood Spasticity	407
	<i>Juan Alzate and Rick Abbott</i>	
	35 Muscular Dystrophy	425
	<i>John C. Y. Leong and Yun H. Li</i>	
	36 Spinal Deformity in Cerebral Palsy	443
	<i>Peter O. Newton and Roderick M. Capelo</i>	
	37 Poliomyelitis Scoliosis	457
	<i>Po-Quang Chen and Chien-Ming Chao</i>	
	38 Spinal Deformity in Myelomeningocele	467
	<i>Michael A. Flippin, Sarah Canale, and Behrooz A. Akbarnia</i>	
VIII	Pediatric Spinal Trauma and Surgical Management	
	39 Spinal Cord Injury in Children: Evaluation and Early Treatment Principles	481
	<i>Scott L. Simon and Randal R. Betz</i>	
	40 Cervical Spine Trauma in Children, Including Spinal Cord Injury without	489
	Radiographic Abnormality	
	<i>David D. Limbrick Jr., Julie C. Leonard, Neill M. Wright, and Jeffrey Leonard</i>	
	41 Pediatric Thoracolumbar Spine Trauma	501
	<i>David H. Clements III and Kevin P. McCarthy</i>	
	42 Injury Modulation and Spinal Cord Regeneration	508
	<i>M. Darryl Antonacci and Richard F. Frisch</i>	
IX	Pediatric Spinal Deformities and Treatment	
	43 Congenital Scoliosis	529
	<i>John B. Emans and Daniel J. Hedequist</i>	
	44 Congenital Kyphosis	544
	<i>Daniel J. Hedequist</i>	
	45 Spinal Deformity Secondary to Dysplasias and Other Diseases	555
	<i>Paul D. Sponseller and Addisu Mesfin</i>	
	46 Infantile and Juvenile Scoliosis	569
	<i>Cary R. Templin and John F. Sarwark</i>	
	47 Nonsurgical Treatment of Adolescent Idiopathic Scoliosis	580
	<i>Michael F. O'Brien and Peter O. Newton</i>	
	48 Surgical Treatment of Adolescent Idiopathic Scoliosis	602
	<i>Michael F. O'Brien and Peter O. Newton</i>	
X	Special Techniques for Treatment of Spine Deformity	
	49 Nonsurgical Treatment of Spinal Deformities	635
	<i>Po-Liang Lai and Wen-Jer Chen</i>	
	50 Pediatric Occipital Cervical Instrumentation	644
	<i>Jeremy C. Wang and Regis W. Haid Jr.</i>	

51	Pediatric Anterior Cervical Instrumentation.....	650
	<i>Eli M. Baron and Devanand A. Dominique</i>	
52	Pediatric Instrumentation of the Posterior Subaxial Spine.....	656
	<i>David M. Wallach</i>	
53	Decision Making on Anterior versus Posterior versus Combined Approaches for Idiopathic Adolescent Scoliosis	669
	<i>Keith H. Bridwell</i>	
54	Posterior Instrumentation for Thoracic, Thoracolumbar, and Lumbar Scoliosis	682
	<i>Fernando E. Silva and Lawrence G. Lenke</i>	
55	Scheuermann Disease	698
	<i>Thomas G. Lowe</i>	
56	Anterior Instrumentation for Thoracic, Thoracolumbar, and Lumbar Spine	711
	<i>Yasuhiro Shono and Kiyoshi Kaneda</i>	
57	Endoscopic and Mini-Open Treatment Techniques for Idiopathic Scoliosis	723
	<i>David H. Clements III and Kevin P. McCarthy</i>	
58	Thoracoscopic Anterior Release and Fusion in the Prone Position	731
	<i>Daniel J. Sucato</i>	
59	Osteotomies for Correction of Pediatric Spine Deformities	742
	<i>Carrie A. Diulus, Daniel Shedid, and Isador H. Lieberman</i>	
60	Vertebrectomy and Posterior Subtraction Osteotomies for	754
	Correction of Severe Thoracic and Lumbar Spinal Deformity <i>Stephen Ondra and Tyler Koski</i>	
61	Sacropelvic Fixation	765
	<i>Angel Macagno, Michael F. O'Brien, and Nathan Lebwohl</i>	
62	Operative Management of High-Grade Spondylolisthesis:	787
	Techniques for Deformity Reduction <i>Murat Pekmezci and Sigurd H. Berven</i>	
63	Treatment of Thoracic Insufficiency Syndrome Associated with Exotic	798
	Scoliosis with VEPTR Expansion Thoracoplasty <i>Robert M. Campbell, John T. Smith, and Jack M. Flynn</i>	
64	Growing Rod Technique for the Treatment of Progressive Early-Onset Scoliosis in	810
	Fusionless Surgery for Spine Deformity <i>Behrooz A. Akbarnia</i>	
65	Indications for Revision Surgery in the Field of Pediatric Spinal Problems	819
	<i>Andrew G. S. King</i>	
XI	Rehabilitation	
66	Rehabilitation of Children with Spinal Cord Injury.....	831
	<i>M. J. Mulcahey and Randal R. Betz</i>	
Index		839