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Advisor Guixing Qiu, MD

Spinal Deformities and
Cord Malformations
Radiological Evaluation & Clinical Relevance

脊柱脊髓畸形
——影像学与临床

主编 邱 勇 王以朋
Editors Yong Qiu, MD Yipeng Wang, MD



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谨献给用期待和痛苦让我积累起外科经验的脊柱畸形病人以及他们的亲人！

To the patients with spinal deformities and their families, whose sufferings and expectations have encouraged me so much to build up my experience in spinal surgery.

谨献给对我不懈鼓励和无限支持的 Agnieszka,Charlotte 和 Alexandre！

To Agnieszka,Charlotte and Alexandre, for their constant encouragement and support in making it all worthwhile.

—— 邱 勇 Yong Qiu,MD

谨以此献给带我走上脊柱畸形矫正领域的各位前辈，与我一同攻关的同事和关爱本事业的友人！

To the seniors who led me to the spinal deformity correction field, my colleagues who dealt with it in a very determined way and my dear friends who expressed their concern over this field!

—— 王以朋 Yipeng Wang,MD

内容提要

Summary

近年来脊柱外科手术技术和影像学技术的发展令脊柱脊髓畸形的诊治获得长足的进步，但脊柱脊髓畸形的多样性及其病因的复杂性令其诊断和治疗仍然较困难。编者在总结自己长期大量的临床实践经验和相关研究的基础上，广泛汲取国内外最新成果和经验，编撰了这本《脊柱脊髓畸形—影像学与临床》。全书500余页，分为两大部分22个章节，共涉及100余种脊柱疾患。第一部分着重介绍各类脊柱脊髓病变与畸形，包括脊柱先天性畸形、发育性畸形、各类综合征性疾病导致的脊柱畸形（结缔组织疾病、代谢性疾病或神经肌肉源性疾病），以及罕见疾病合并的脊柱脊髓畸形，疾病年龄跨越婴幼儿、青少年、成人以及老年退变性疾患；第二部分讨论脊柱肿瘤及肿瘤样病变与畸形。本书突破传统教科书以文字描述为主、难于理解的缺点，以大量的影像学资料为主，并对相应疾病的流行病学资料、临床表现、影像学特征、临床诊断和治疗方法作精炼的描述，辅以相关的病理学资料，内容直观易懂，实用性强，适合各级骨科、影像科、神经科医师及其他相关专业人员阅读参考。

为了与国际上脊柱外科临床研究和病例讨论要求相接轨，本书中所有的脊柱X线片（除特殊注明外）均为后前位片，即：X线片的左侧即为患者的左侧，右侧即为患者的右侧。另外，所有脊柱肿瘤病例、脊柱感染病例均有手术病理证实。

Significant progresses in the diagnosis and treatment of spinal deformities and cord malformations have been achieved in the past decades due to the advance in the radiological techniques and surgical treatment. However, challenges still exist in accurate diagnosis and treatment of spinal deformity because of the diversity in deformity and the versatility in etiopathogenesis. Based on the decades' clinical practice and related research work, and the comprehensive review on the current literature, the authors illustrate here more than one hundred various spinal deformities in this textbook. The first part of this book focuses on the spinal deformities, including congenital spinal anomalies, developmental spinal deformities, and spinal deformities caused by kinds of syndromic diseases (connective tissue disease, metabolic disease, neuromuscular disease and et al). The disease spectrum ranged from infant to elderly with degenerative disease. In the second part, spinal tumors and tumor-like lesions are introduced. Different from the traditional textbook with rich but verbiage text, this book illustrates the diseases based on the large number of radiological images, in addition with description on the epidemiological information, clinical presentation, radiological presentation, pathological information, clinical diagnosis and treatment methods. These made this book easy to be understood and become a useful textbook for orthopaedic surgeons, radiologists, and neurosurgeons.

Besides, All the spine X-ray images in the book (except for the specially annotated) are PA radiographs, as in accordance with the international standard for clinical study in spine surgery, which means, the left side of the X-ray image is the left side of the patient and the right side of the X-ray image is the right side of the patient. In addition, all the spinal tumor or infection cases are pathologically and surgically proved.

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序

很荣幸获邀为《脊柱脊髓畸形——影像学与临床》一书撰写序言。我和邱勇教授自1990年认识，当时邱教授正在法国深造，专研脊柱侧弯矫形理论和技术。1997年他决定结束8年的国外留学和工作生涯，返回中国，希望以其专业知识和医疗技术，为全国众多脊柱侧弯病患者提供适当治疗。他回到南京鼓楼医院，着手筹建南京市脊柱畸形矫治中心，目前已是全国该领域中最具规模的矫治中心，鼓楼医院的脊柱外科亦名列全国领先医学专科之一。

多年来，邱教授一直致力提升脊柱外科临床服务和科研发展，他不断力求创新的精神，开辟多项脊柱外科新技术和研究，为无数脊柱畸形病患者治病疗伤，其卓越成就及优秀医者风范，备受各界推崇。由邱教授领导的多项开创性研究，屡获殊荣，包括国家科技进步奖，多次荣获省部级科学技术进步奖及省市医学新技术引进奖，并先后获颁全国劳动模范、全国五一劳动奖章等。

邱教授著作丰硕，曾于国内外的医学杂志发表大量优秀论文和研究报告，为国内及国际多种骨科和脊柱外科核心期刊的编委会成员，承担多项国家和省部级的科研题目，还多次于国际医学研讨会发表专题演讲，进一步促进医疗技术的提高及扩大国际知名度。此外，邱教授积极培养脊柱外科人才，除指导硕士及博士研究生，每年均组织举办多个大型国际及全国专业研讨会，包括全国脊柱畸形矫治及国家级继续医学教育学习班，促进国内外医疗和科研人员互相交流学习。邱教授竭诚推动骨科和脊柱外科教育发展，建树卓著。

《脊柱脊髓畸形－影像学及临床》一书由邱教授主编，联同南京鼓楼医院及北京协和医院脊柱外科的多位专家倾力撰写，对各类脊柱畸形疾患，包括脊柱先天性畸形、发育性畸形、结缔组织、代谢性畸形、脊柱肿瘤，以及脊柱畸形治疗相关并发症，系统及详细介绍了其影像学特征、临床诊断和治疗方法，并配以高质量的多媒体图片，包括X线、CT和MRI，让读者更深入了解各种脊柱畸形病例，以及有效的治疗方案，可媲美一本脊柱外科影像学的百科全书，也是临床医学的重要指导教材。

这本500余页的专著是邱教授和多位专家学者的心血结晶，筹备经年，各项专业理论、手术病例及脊柱畸形自然史的追踪，巨细无遗，是临床医学丛书中不可或缺的宝贵资料。

郑振耀 教授

香港中文大学副校长

矫形外科及创伤学讲座教授

2009年春



Foreword

I take great pleasure in writing the foreword for Professor Qiu Yong's edited book *Spinal Deformities and Cord Malformations: Radiological Evaluation and Clinical Relevance*. I met Professor Qiu back in 1990 in France where he took orthopedic residency training. After eight years of training and working in France, he returned to China in 1997, hoping to help those scoliosis patients with his profound knowledge and sophisticated skills in spine surgery. He soon established a Scoliosis Center at Drum Tower Hospital in Nanjing, which today has become the largest of its kind in China, thus making the hospital one of the nation's best in spine surgery.

During the past decades, Professor Qiu has been dedicated to research and treatment of spine diseases. He has developed innovative treatment methods and cured patients suffering from spinal deformities. He is not only a doctor respected for his superb skills and work ethics, but also a groundbreaking researcher, and he has won such awards as Technology Progress Awards at both national and provincial levels, National Best Worker, and National Career Star Award.

In addition to his role as doctor and researcher, Professor Qiu is also a distinguished scholar. He has published extensively in medical journals inside and outside China, and served on the editorial board of some prestigious domestic and international journals on orthopedics and spine surgery. Moreover, he has initiated many research projects that won grants from national and provincial science foundations. To keep abreast of the latest development in his field and to bring his discoveries to a wider community, he regularly attends and speaks at international conferences. Besides, Professor Qiu has made great contribution to cultivating young professionals and promoting idea exchanges in orthopedics and spine surgery through supervising master's and doctoral students, organizing national and international forums, and offering intensive training courses for spine surgeons all over China.

The book *Spinal Deformities and Cord Malformations: Radiological Evaluation and Clinical Relevance* presents remarkable work by Professor Qiu and his colleagues at Drum Tower Hospital and Peking Union Hospital on a variety of spinal deformities, including congenital spinal deformity, developmental deformity, spinal tumors and other associated diseases. With detailed analyses of radiographic features and clinical treatment methods as well as multimedia graphs such as X-ray, CT and MRI, it provides readers with an in-depth knowledge about all kinds of spinal deformities and their treatment plans. Readers can use it either as a textbook of clinical practice or as an encyclopedia of spinal radiography.

For Professor Qiu and other contributing authors, this over 500-page book reflects their years of unceasing interest and hard work in developing theories and methods for treating spinal deformities. With detailed records of clinical cases, it is undoubtedly an invaluable asset in spine surgery.

Jack C.Y. Cheng

Vice Chancellor of Chinese University of Hong Kong
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Spring of 2009

前言

近年来脊柱外科尤其脊柱畸形外科矫治水平不断提高，脊柱外科相关肿瘤及肿瘤样病变的诊断和治疗也取得长足进步，脊柱畸形和肿瘤这两类疾病尤其注重术前的影像学评估，同时随着CT和MRI的更新换代，脊柱外科的影像学诊断手段得到迅速发展。因此一本将脊柱畸形和肿瘤的影像学与临床紧密结合著作必定会对脊柱外科医师、影像诊断医师、神经内外科医师、肿瘤科医师、放疗科医师的临床工作有极大的指导价值。

本书着重突出影像学的评估和诊断，为了方便读者理解、记忆，对疾病的描述更加直观、形象，此书对每种疾病均配上图片和说明来描述其影像学特征性表现，因而此书500余页，有一半篇幅是图片构成；在此基础上，纲要式地列出对临床应用有直接指导价值的病因学、诊断与鉴别诊断、临床表现、自然史与预后、治疗方法，使得读者在短时间内对某一疾病有一个全面系统的认识。本书从脊柱外科和影像学临床医生的角度来解读各种脊柱疾病的影像学特征，更重要的是书中还同时提出各种评估方法和影像学特征的临床实际意义，这样的一次尝试目的就是想让这本书成为临床医生和影像诊断医生的一本工具书；临床医生可以把它当作一本影像学图谱；影像诊断医生可以把它当作临床指导手册。

作为一本注重影像学直观表现的临床指导专著，编者在筹划之初就认识到影像学资料的广泛、全面、系统和图片高质量的重要性，以及脊柱畸形自然史的长期追踪和矫治的远期随访对临床经验积累的巨大帮助。为此编者用数十年的时间精心收集整理了一个脊柱外科多媒体临床资料库，目前已包含6000余例各类脊柱疾患影像学 and 临床资料，本书图片素材均来自这一数据库。所以在这本书中，读者可以看到很多非常珍贵和少见的影像学资料，如特发性脊柱侧凸50年的自然史追踪和世界文献报道不超百例的Gorham病伴脊柱侧凸。水滴石穿，集腋成裘，希望编者的点滴积累能对读者的临床工作有所帮助。

为了保证本书的公正、客观和科学，本书还邀请了在脊柱外科领域拥有极高造诣的邱贵兴院士作为主审，他高屋建瓴、精益求精、一丝不苟的审阅和修改保证了本书较高的学术水准，在此笔者表示由衷的感谢！

在本书的编写和配图过程中，南京鼓楼医院和北京协和医院脊柱外科的同仁倾注了大量宝贵的精力、时间和智慧，尤其是马薇薇医师，没有她日积月累、不畏繁琐对每例手术病例细致地收集整理，本书无法成文。殷刚、陈文俊、李卫国医师及邵翔博士也做了不少工作，我们对他们的辛勤付出和支持万分感谢！

此书是笔者和全体编委数十年的心血和经验总结，修改十余次，历时三载方与读者见面，一方面是由于编者工作的耽怠，另一方面也是想把此书做到尽量精致完美。由于才疏学浅，此书如还存在瑕疵和错误，敬请指正！

邱 勇 王以朋

2009年春



Preface

There has been in recent years continuous progress in spine surgery, especially spine deformity correction. There has also been rapid development in the diagnosis and treatment of spinal tumors and tumor-like diseases. Pre-surgery radiographic evaluation is highly emphasized during the treatment of spinal deformities and tumors. With new CT scan and MRI technology, more advanced methods of radiographic diagnosis have been applied in spine surgery. Therefore, a book devoted to the radiographic and clinical diagnosis of spinal deformities and tumors is of great significance to guide the clinical practice of spine surgeons, radiologists, neurosurgeons, neurologists, oncologists and radiotherapists.

This book foregrounds radiographic assessment and diagnosis. To facilitate readers' understanding and memory, description of each disease is accompanied by radiographs to vividly illustrate its features and symptoms. Half of the 500 pages are photos. Moreover, an outline of clinically significant etiology, differential diagnosis, clinical manifestations, natural history and prognosis and treatment methods are provided to help readers attain a systematic understanding of a given disease within a short period of time. Written from the perspective of a spine surgeon and imaging clinician, this book expounds radiographic evaluation of different kinds of spine diseases, and more importantly, the clinical relevance of a variety of imaging techniques. Clinicians or radiologists can use this book either as a reference book or an atlas of radiographs, or clinical guidebook.

Since the early stage of the book, the authors have realized the importance of the extent, scope, quality and representativeness of the radiographs, as well as the invaluable insight the long term follow-up of spinal deformities and corrections could offer the clinical physicians. In accordance, the authors spent decades constructing a multimedia databank of spine surgery, which includes over 6,000 cases and profiles of spinal deformities. Readers can view in this book many rare radiographs, such as the tracking of 50 years of the natural history of idiopathic scoliosis and scoliosis associated with Gorham disease, only 100 cases of which were reported in the international journals. Many a little makes a mickle. We hope that the resources we compile can help the readers.

We were fortunate to have invited Academician Qiu Guixing, a legendary spine surgeon, to be the advisor, whose visionary and meticulous supervision of the book ensured its academic excellence. We feel truly indebted.

Our heartfelt thanks also go to colleagues at Nanjing Drum Tower Hospital and Peking Union Hospital, who contributed invaluable time, energy and wisdom, especially to Dr. Ma Weiwei. Without her persistence and immaculate documentation of each individual case of surgery, it would be impossible for us to complete the book. And cordial thanks are expressed to Dr. Yin Gang, Dr. Chen Wenjun, and Dr. Li Weiguo, and the PhD candidate Shao Xiang, who have spent a lot of time and energy in making the book possible. We are very grateful to their hard work and support.

It took us three years and a dozen revisions to embody our decades of experience in the current edition. We are, though with an aspiration for perfection, responsible for all the possible mistakes or errors. We welcome your comment and suggestions!

Yong Qiu, Yipeng Wang
Spring 2009

主编简介



邱 勇,男,1960年出生,1988年毕业于苏州医学院获硕士学位,1989年赴法国留学,师从Cotrel和Dubousset两位现代脊柱外科学界大师。1997年回国后在南京鼓楼医院创建了脊柱外科,现任鼓楼医院骨科、脊柱外科主任,南京大学医学院博士生导师;兼任美国脊柱侧凸研究会会员(SRS)、国际CD脊柱外科学会会员(Groupe International CD)、国际脊柱功能重建学会会员(SAS)、法国脊柱侧弯研究会会员(Groupe d'Etude Scoliose de France)、中国医师协会骨科医师分会副会长、中华医学会骨科学分会常务委员、中国康复医学会脊柱脊髓损伤专业委员会副主任委员等学会任职,以及《European Spine Journal》(欧洲脊柱外科)杂志编委、《Spine》脊柱(中文)杂志副主编、《中国脊柱脊髓杂志》副主编、《中国骨与关节外科》杂志副主编、《中华骨科杂志》常务编委、《中华外科杂志》编委等社会任职。

邱勇教授长期从事脊柱外科临床和基础研究工作。在国内外发表多篇高质量学术论文,其中SCI收录论文27篇;参编专著26部。获得中华医学科技奖1项,国家科技进步二等奖1项,教育部提名国家科技进步奖1项,江苏省科技进步奖4项,市级科技进步奖3项,江苏省医学新技术引进奖9项。结合中国国情对脊柱侧凸三维矫形技术作了符合中国患者的技术改进,尤其在特发性脊柱侧凸发病机制的研究中获得丰硕成果,受到国际学术界高度关注。自归国12年来已为全国各地的近4000余名患各种高难度脊柱疾患的病人进行了矫形手术,获得满意疗效。积极参与社会公益和慈善事业,为边远贫困的残疾儿童提供免费治疗和不计费用远赴西藏、内蒙、广西等地进行慈善手术。先后荣获“中国医师协会第二届中国医师奖”“全国劳动模范、全国先进工作者”“全国五一劳动奖章”等光荣称号,许多事迹被中央电视台、江苏电视台、健康报、扬子晚报等主流媒体广泛报道。



Biography of Editors

Yong Qiu was born in 1960. He graduated from Suzhou Medical College in 1982 and received Master Degree in 1988. In 1989, he went to France for orthopedic residency training, under the guidance of Prof. Cotrel and Prof. Dubousset, both of whom are the top great masters in the field of Spine Surgery. Prof. Qiu went back to homeland in 1997, and built up the department of Spine Surgery in Drum Tower Hospital of Nanjing University. Now, he is the Chief Director of the Orthopedics Department and Spine Surgery, and also is accredited as Tutor of Ph.D students in Medical School of Nanjing University.

Prof. Qiu's achievements have earned him positions in a wide range of national and international medical organizations in the fields of Spine Surgery. He has become a member of world-famous societies, including Scoliosis Research Society, Groupe International CD, Spine Arthroplasty Society and Groupe d'Etude Scoliose de France. And he also assumes numerous leadership roles in nationally respected medical organizations including the Orthopedic Division of Chinese Medical Association, the Orthopedic Division of Chinese Medical Doctor Association, the Spinal Injury Committee of Chinese Rehabilitation Society, and so on. As an outstanding expert in Spine Surgery, he is the editorial committee member of famous peer-reviewed publications such as European Spine Journal and Chinese Journal of Surgery. He is Co-editor-in-chief of Chinese Journal of Orthopedics, Chinese Journal of Spine and Spinal Cord, and Chinese Journal of Bone and Joint Surgery.

In Prof. Qiu's professional life, research into spine surgery continues to be an important constant. He is devoting himself to the clinical practice and basic research in spine surgery, and has improved the modern spinal correction technique in order to make it most suitable for China's patients with spinal deformities. During the passed twelve years, he has completed nearly 4,000 correction surgeries for patients with severe spinal deformities, with a high correction rate and a reaseanable complication rate. Further, he leads his team in the basic research related to scoliosis. His team has gained a rich output especially in the etiopathogenesis of idiopathic scoliosis, which has been paid a close attention to internationally.

Prof. Qiu is a prolific author who has published a lot of his research findings in journal articles, abstracts, textbooks, and in editorials. He has presented his scientific findings in peer-reviewed journals and at professional national and international meetings. There are totally 27 articles in journals indexed by SCI, and he has participated in contributions of 26 books on Spine Surgery. At the same time, he sticks to holding the National Symposium on Spinal Deformities every year, and to training more than 1,000 spine surgeons who come from all over the country, with the only purpose of making the advanced concepts and techniques in spine surgery more widespread.

Prof. Qiu is an active participant in the act of public benefits and charity, with a benevolent mind and advanced crafts. Every year, he and his colleagues treat a couple of young patients coming from a faraway depressed area for free. He is always taking a long way to Tibet, Inner Mongol, Guangxi Province and other places to perform correction surgery for charity. His distinguished achievements have been extensively reported by mainstream media including CCTV and People's Daily.


主编简介



王以朋，1956年7月出生于吉林省长春市。1982年毕业于白求恩医科大学，毕业后分配至北京协和医院工作。1989—1991年在美国肯德基州立大学医学院 Shriners 医院，完成 Fellowship 培训。1991—1995年在美国加州大学尔湾分校医学院骨科和生物力学实验室进行基础研究，完成博士后训练。现任北京协和医院副院长、教授、博士生导师。

自工作以来及在美国学习期间，一直致力于脊柱侧凸、后凸的矫形、侧凸分型、选择性融合、胸腰弯 / 腰弯前路与后路矫形效果比较、上胸弯的识别与处理等方面的研究。在骨科常见病、多发病及疑难病的诊断和治疗方面具有丰富的临床经验，尤其擅长脊柱外科、关节外科及骨质疏松症的临床诊治。对脊柱侧凸、后凸的临床诊治；脊柱肿瘤的切除固定；脊柱结核的治疗；脊柱骨折、椎管狭窄、脊柱滑脱的减压、复位、内固定；颈椎病以及腰椎间盘突出症等各种脊柱疾病的治疗具有丰富的临床实践经验。

学风严谨，勤于钻研，先后在国际著名脊柱外科杂志“Spine”及国内多种核心期刊上发表论文、评述100余篇。参加编写《骨科手术学》（第3版）《脊柱外科新手术》（第1版、第2版）《骨科效率手册》、《关节疾病怎么办》、《脊柱侧弯外科学》等多部著作。兼任中华医学会北京分会骨科专业委员会副主任委员、北京骨质疏松学会副主任委员、中华医学会骨科学分会脊柱学组委员、骨质疏松学组副组长、AOSpine 中国理事、SDSG 中国部成员等。是中华骨科杂志、中华外科杂志、J of Orthopedic Surgery and Research 等多刊编委。作为项目负责人主持国家级及省部级科研项目多项，对特发性脊柱侧凸、早发性脊柱侧凸等疾病进行了深入研究。作为主要参与者，曾荣获国家级及省部级科技奖项多项。已培养多名研究生。



Biography of Editors

Yipeng Wang was born in July in 1956 in Changchun, Jilin province. He graduated from the Norman Bethune Medical College in 1982 and worked in the Peking Union Medical College Hospital since then. From 1989 to 1991, he completed the 3 years' fellowship training in the Shriners Hospital, Kentucky State University Medical School in the United States. From 1991 to 1995, he worked in the Orthopedics and Biomechanics laboratory in University of California Irvine Medical School for post-doctoral training. At present he is a full professor of Orthopedics and is appointed as the vice-president of Peking Union Medical College Hospital. He is also a supervisor for the Master students & PhD candidates.

After graduation and during his stay in the United States, he had spent a lot of time on the researches of scoliosis and kyphosis, scoliosis classification, selective fusion, comparison of anterior and posterior approaches for thoracolumbar/lumbar scoliosis, recognition and treatment of the proximal thoracic curve, etc. He has great experience in the diagnosis and treatment of skeletal disorders, especially in the clinical treatment and related basic research of spinal surgery, joint surgery and osteoporosis. He is an expert of spinal deformity correction, spinal tumor resection, diagnosis and treatment of spinal tuberculosis, cervical spondylosis and protrusion of intervertebral disc, decompression and reduction of spinal fracture, spinal stenosis and spondylolisthesis.

He has published more than 100 articles in international journals and Chinese Journals, such as *Spine*, *Natl Med J China*, *J Spinal Surg*, *Chin Med Sci J*, *Chin J of Spine and Spinal Cord*. As an editor, he has published more than 10 medical books including the *Operative Orthopaedics*, "The current techniques in spine surgery", "Scoliosis Surgery", and some others. He is appointed as the vice-president of Beijing Orthopedic Association, vice-president of Beijing Orthopedic Association Osteoporosis Committee, vice-president of Osteoporosis Society of Chinese Orthopedic Association. He is also a member of Spine Society of Chinese Orthopedic Association, a board Member of AO Spine International China Chapter and SDSCG China Section. He is the member of the editorial board of *Chinese Journal of Orthopedics*, *Chinese Journal of Surgery*, *Journal of Orthopedic Surgery and Research*, etc. Aside from the busy clinical work and teaching task, he also does scientific researches on idiopathic scoliosis, early onset scoliosis which were supported by different funds. As the co-researcher, he has gained over 10 prizes, nation-based, province-based or others for the scientific researches. And as a supervisor, he has supervised some masters and doctors.

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