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H.M. Mayer (Ed.) Minimally Invasive Spine Surgery  
*Second Edition*

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H.M. Mayer (Ed.)

# Minimally Invasive Spine Surgery

A Surgical Manual

*Second Edition*

With 492 Figures in 851 Parts and 36 Tables

 Springer

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H. MICHAEL MAYER, M.D. PH.D.  
Head and Medical Director, Associate Professor  
Spine Center Munich, Orthozentrum München, Orthopädische Klinik  
Harlachinger Strasse 51  
81547 Munich, Germany

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*To Frizzi, Lukas and Isabel  
for all their love and support*

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# Preface to the Second Edition

Five years have passed since the first edition of this book. Minimally invasive surgical techniques have become a significant part of the daily routine in spine surgery. Some of the techniques which have been described in the first edition have become standard in spine centres all around the world, others have been struggling to stand the test of time.

Three important trends could be observed in the past five years:

1. Microsurgical and endoscopic surgical techniques have been improved. The application spectrum has been enlarged and the results are now more reliable and predictable.
2. So-called “semi-invasive” techniques, mainly for the treatment of low back pain, have become more popular although evidence-based data concerning efficacy and success are still lacking.
3. Spine arthroplasty is the term for a significant change of paradigms in spinal surgery. Minimally invasive partial or total disc replacement in the degenerated cervical and lumbar spine, “dynamic” fixation, or disc-unloading techniques with innovative implants are being tested in various clinical studies all around the world. Autologous percutaneous disc chondrocyte transplantation is the first clinical attempt to achieve a biological regeneration of the degenerated disc.

This new, revised and extended edition of *Minimally Invasive Spine Surgery* contains all current applications of minimally invasive techniques for spine surgery. A total of 70 authors and co-authors have covered all aspects of minimally invasive spine surgery in 51 chapters, which has more than doubled the volume of the first edition.

Again we must point out that the book concentrates on surgical techniques and that it was our aim to provide the reader with the information necessary to perform these types of surgery. However, some of the techniques described are still part of an ongoing process of development and, although we have tried to give the reader a mainly unbiased and neutral description of the techniques, we are aware of the fact that this could not be realized for all chapters.

I thank all my colleagues for again spending their time to produce high-quality chapters, to share their tremendous experience with us and to provide us with the newest information.

I sincerely hope that our efforts will be honoured by a number of readers and that again we can all contribute to the development of minimally invasive techniques in spine surgery.

Munich, Summer 2005

*H. Michael Mayer*

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# Foreword to the First Edition

This book contains a wealth of information on aspects of minimally invasive spinal surgery. For a surgeon of my vintage, nearing the end of a career spanning the past forty years, I am reassured by the enthusiasm, dedication and seriousness of purpose of this new generation of surgeons and scientists whose work is outlined in the book.

In 1957 Walter Blount delivered his Presidential Address entitled: "Don't Throw Away the Cane" to the American Academy of Orthopaedic Surgeons. The gist of this monumental address was that, as hip surgery was evolving, the lessons of conservatism in management of hip disorders should not be forgotten. While preparing this Foreword I was reminded of its main message because it remains pertinent to present trends in the practice of spinal surgery.

The advanced techniques described in Dr. Mayer's book must not be attempted without intensive study of anatomy and a thorough understanding of spinal pathology. Throughout the text individual authors use the term "learning curve", a term which can spell disaster for the patient who may be on the "curve". Spinal surgery is potentially dangerous. Mastery of it is best gained by personal tuition under the guidance of a busy experienced surgeon. The trend towards learning surgical techniques in workshop settings or in short courses organised by manufacturers of surgical equipment, using plastic models or cadavers is not entirely good for trainees or for surgeons aiming to expand their practices into minimal invasive surgery of the spine, as it may lead to the triumph of technology over reason. By focussing on how to use the wide range of equipment required to perform these operations, biological factors which may adversely affect their use should not be neglected. For example even in the outstanding chapter "Microsurgery of the Cervical Spine" the Statement is made that: "Retractor blades may stick after many hours of surgery: they should be removed under irrigation and individually". One of the most important lessons to have emerged in recent years in spinal surgery has been that retractors should be released at regular intervals throughout an operation to prevent irreversible damage to the blood supply of the muscles at the site of surgery.

At the beginning of this new millennium Dr. Michael Mayer has shown great foresight in assembling such an array of international experts to present a clear picture of what has been achieved in the least decade of the 20<sup>th</sup> Century and a view of what lies ahead as surgeons strive to harness the rapidly changing technologies in the fields of imaging, optics, endoscopy and instrument design for their wider use in minimal invasive spinal surgery. This book should become the vade mecum for spinal surgeons in this decade. The wide range of information in it covers technical details, logistical facts and many informative and balanced views on aspects of these new techniques. These authors form a worthy cohort of surgeons and scientists from differing backgrounds with common aims. They are voyagers heading into previously uncharted waters.

"But far forward voyagers".

T. S. Elliot, Four Quarters, p40. The Folio Society London, MC MI. XVIII

February 2000

*Henry Vernon Crock*  
Director of the Spinal Disorders Unit  
The Cromwell Hospital London

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# Preface to the First Edition

*“There is no darkness – there is just absence of light.”*

“Minimally invasive surgery” has been the key phrase dominating clinical and scientific efforts in all surgical specialties over the last decade. There has never been a comparable period in surgery where, within a short span of time, surgical technology has undergone such widespread and fundamental changes. These developments are due to the synergism produced by a parallel “explosion” of knowledge and technological abilities in modern radiological imaging techniques, in advanced surgical instrumentation and implant technology, as well as in intraoperative visualization using modern digital and conventional optical systems. Although there is controversy regarding the semantic correctness of the term “minimally invasive surgery” (because in the majority of the techniques only the surgical approach is “minimally invasive”), it is still synonymous of all surgical techniques which are “less” or, better, “suitably” invasive compared to conventional surgical approaches.

Spinal surgery is probably the subspecialty which has undergone the most revolutionary changes triggered by less invasive procedures. It all started with the inauguration of microsurgical and endoscopic procedures for the treatment of lumbar disc herniations in the mid-1970s. Today we are witnessing a variety of microsurgical and endoscopic techniques, as well as procedures, which require no direct visual control.

Most of these techniques are used in clinical studies but are still lacking basic scientific evidence, some techniques have already replaced standard techniques, while others have been generally accepted at least as alternatives to conventional surgical procedures. The majority of these techniques are highly sophisticated and require special surgical training or even laboratory training, which poses problems in particular for the surgeon not specialized in spine surgery. Scientific meetings are dominated worldwide by the presentation of minimally invasive spine surgery; however, it is difficult for the surgeon to keep abreast of the rapid developments and to be able to decide which technique he should adopt for his daily work.

It was our intention to present an overview of the most important and relevant microsurgical and endoscopic techniques which have been inaugurated over the last two decades. This book is neither a textbook nor a surgical atlas. It was our aim to provide the reader with clear information regarding terminology, history, indications, surgical principles, as well as a critical evaluation of the specific technique. It does not attempt to pass final judgement on the value and necessity of the various procedures; however, it may enable the reader to make her/his own assessment of the value and acceptability of each technique.

The book concentrates on surgical technique and provides the reader with the relevant information necessary to be prepared for the use of the different procedures.

I would like to express my deepest thanks to all colleagues who have contributed to this book and who have provided us with a tremendous amount of new information.

It is my sincere hope that this book will contribute to the further understanding and acceptance of minimally invasive philosophies in the emerging field of spinal surgery.

Munich, February 2000

*H. Michael Mayer*

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# List of Contributors

Max Aebi, M.D., Ph.D.

Institute of Evaluated Research in Orthopaedic Surgery, Murtenstrasse 35, P.O. Box 8354, 3001 Bern, Switzerland (Tel.: +41-31-6328713, Fax: +41-31-3817466, e-mail: maebi@orl.mcgill.ca)

Ronald I. Apfelbaum, M.D., Ph.D.

Professor of Neurosurgery, Department of Neurosurgery, University of Utah Medical Center, Suite 3B409, 30 North 1900 East, Salt Lake City, UT 84132, USA (Tel.: +1-801-5816908, Fax: +1-801-5814385, e-mail: ronald.apfelbaum@hsc.utah.edu)

Paul J. Apostolides, M.D.

Division of Neurological Surgery, Barrow Neurological Institute, St. Joseph's Hospital and Medical Center, c/o Neuroscience Publications, Barrow Neurological Institute, 350 West Thomas Road, Phoenix, AZ 85013-4496, USA (Tel.: +1-602-4063593, Fax: +1-602-4064104, e-mail: neuropub@chw.edu)

Rudolf Beisse, M.D.

BG-Unfallklinik Murnau, Prof.-Küntschers-Strasse 8, 82418 Murnau, Germany (Tel.: +49-8841-48-2400, Fax: +49-8841-482334, e-mail: beisse@bgu-murnau.de)

Rudolf Bertagnoli, M.D.

Elisabeth Krankenhaus, St. Elisabethstrasse 23, 94315 Straubing, Germany (Tel.: +49-9421-7101816, Fax: +49-9421-72094, e-mail: Bertagnoli@ogp.de)

Michael Bierschneider, M.D.

Department of Neurosurgery, Berufsgenossenschaftl. Unfallklinik Murnau, Prof.-Küntschers-Strasse 8, 82418 Murnau, Germany (Tel.: +49-8841-480, Fax: +49-8841-482203)

Robert S. Biscup, M.S., D.O., F.A.O.A.O.

Cleveland Clinic Florida, Weston, 2950 Cleveland Clinic Blvd, Weston, FL 33331, USA (Tel.: +1-954-6595000, e-mail: www.clevelandclinic.org, PODICHV@ccf.org)

Heinrich Böhm, M.D.

Head and Chairman, Klinik für Orthopädie, Wirbelsäulen Chirurgie, und Querschnittgelähmte, Zentralklinik Bad Berka, Robert-Koch-Allee 1a, 99438 Bad Berka, Germany (Tel.: +49-36458-51400, Fax: +49-36458-53517, e-mail: ort@zentralklinik-bad-berka.de)

Bronek M. Boszczyk, M.D.

Wirbelsäulen Chirurgie, Klinik und Poliklinik für Orthopädische Chirurgie, Inselspital, Universitätsspital Bern, 3010 Bern, Switzerland (Tel.: +41-31-6322224, Fax: +41-31-6323600, e-mail: B.Boszczyk@gmx.net)

Salvatore Caserta, M.D.

Specialist in Orthopaedics and Traumatology, Istituto Ortopedico G. Pini, Primario, Centro Scoliosi e Patologia Vertebrale, Piazza C. Ferrari, 20123 Milan, Italy (Tel.: +39-02-58296325, Fax: +39-02-89011704, e-mail: caserta@gpini.it)

Hervé Chataigner, M.D.

Service de Chirurgie des Scolioses et Orthopédie Infantile, Hopital St. Jacques,  
2 Place Saint Jacques, 25000 Besancon Cedex, France (Fax: +33-3-81218586)

Lutz Claes, M.D., Ph.D.

Professor, Department of Orthopaedic Research and Biomechanics, Universität  
Ulm, Helmholtzstrasse 14, 89081 Ulm, Germany (Tel.: +49-731-50023481,  
Fax: +49-731-50023498, e-mail: Lutz.Claes@medizin.uni-ulm.de)

Arnold A. Criscitiello, M.D.

85 S. Maple Avenue, Ridgewood, NJ 07450-4561, USA

Henry V. Crock, M.D.

MS, FRCS, FRACS, Consultant Spinal Surgeon, 34 Sullivan Court, 109 Earl's Court  
Road, SW5 9RP, London, UK (Tel.: +44-20-72448416, Fax: +44-10-72440933,  
e-mail: ccrock@her-computer.com)

Manuel Dufoo-Olvera, M.D.

Hospital General „La Villa“, Av. San Juan de Aragón 285, Mexico City, Mexico  
(e-mail: mdufoo27@yahoo.com)

Hesham El Saghir, M.D.

Zentralklinik Bad Berka, Robert-Koch-Allee 1a, 99438 Bad Berka, Germany  
(Fax: +49-3645-853517, e-mail: ort@zentralklinik-bad-berka.de)

Daniel Fassett, M.D.

Department of Neurosurgery, University of Utah Medical Center, Suite 3B409,  
30 North 1900 East, Salt Lake City, UT 84132, USA  
(Tel.: +1-801-5816908, Fax: +1-801-5814385, e-mail: dan\_fassett@excite.com)

Ilan Freedman, M.D.

Department of Trauma Surgery, The Alfred Hospital, Monash University and the  
National Trauma Research Institute, Commercial Road, Melbourne, VIC 3004,  
Australia  
(Tel.: +61-3-92763386, Fax: +61-3-92763804, e-mail: i.freedman@alfred.org.au)

Robert M. Galler, D.O.

Division of Neurological Surgery, Barrow Neurological Institute, St. Joseph's Hos-  
pital and Medical Center, c/o Neuroscience Publications, Barrow Neurological  
Institute, 350 West Thomas Road, Phoenix, AZ 85013-4496, USA  
(Tel.: +1-602-4063593, Fax: +1-602-4064104, e-mail: neuropub@chw.edu)

Timothy M. Ganey, M.D.

6104 River Terrace, Tampa, FL 33604, USA (Tel.: +1-813-2328794,  
Fax: +1-561-3650441, e-mail: Timganey@Tampabay.rr.com)

Jan Goffin, M.D., Ph.D.

Professor of Neurosurgery, University Hospital Gasthuisberg, Department of Neu-  
rosurgery, K.U. Leuven, Herestraat 49, 3000 Leuven, Belgium (Tel.: +32-16-344290,  
Fax: +32-16-344295, e-mail: jan.goffin@uz.kuleuven.ac.be)

Robert Greiner-Perth, M.D.

Chief of Department, Klinik für Wirbelsäulen Chirurgie, Orthopädische Chirurgie  
und Neurotraumatologie, SRH Waldklinikum Gera, Strasse des Friedens 122,  
07548 Gera, Germany  
(Tel.: +49-365-8283700, e-mail: ralph.greiner-perth@wkg.srh.de)

Frank Grochulla, M.D.

Spine Center Munich, Orthopädische Klinik München, Harlachinger Strasse 51,  
81547 Munich, Germany (Tel.: +49-89-62112011, Fax: +49-89-62112012,  
e-mail: FGrochulla@schoen-kliniken.de)

Erich Hartwig, M.D.

Department of Trauma-, Hand- and Reconstructive Surgery, Universitätsklinikum  
Ulm, Steinhövelstrasse 9, 89075 Ulm, Germany (Tel.: +49-731-50027347,  
Fax: +49-731-50027349, e-mail: Erich.Hartwig@medizin.uni-ulm.de)

G. Michael Hess, M.D.

OCM Orthopädische Chirurgie München, Steinerstrasse 6, 81369 Munich,  
Germany (Tel.: +49-89-47099755)

Hans Jaksche, M.D.

Director, Department of Neurosurgery, Berufsgenossenschaftl. Unfallklinik  
Murnau, Prof.-Küntscher-Strasse 8, 82418 Murnau, Germany (Tel.: +49-8841-480,  
Fax: +49-8841-482203)

Parviz Kambin, M.D.

Professor of Orthopaedic Surgery, Drexel University College of Medicine, 239 Che-  
ster Road, Dvon, PA 19333, USA (Tel.: +1-610-6888775, Fax: +1-610-9640337,  
e-mail: kambin@aol.com)

Lothar Kinzl, M.D., Ph.D.

Professor of Trauma Surgery, Director, Department of Trauma-, Hand- and Recon-  
structive Surgery, Universitätsklinikum Ulm, Steinhövelstrasse 9, 89075 Ulm,  
Germany (Tel.: +49-731-50027350, Fax: +49-731-50026740, e-mail: Lothar.Kinzl-  
@medizin.uni-ulm.de)

Paul Klimo Jr, M.D.

MPH, Department of Neurosurgery, University of Utah Medical Center,  
Suite 3B409, 30 North 1900 East, Salt Lake City, UT 84132, USA  
(Tel.: +1-801-5816908, Fax: +1-801-5814385, e-mail: paul.klimo@hsc.utah.edu)

Brett Knowles, M.D.

Department of Trauma Surgery, The Alfred Hospital, Monash University and the  
National Trauma Research Institute, Commercial Road, Melbourne, VIC 3004,  
Australia (Tel.: +61-3-92763386, Fax: +61-3-92763804, e-mail: b.knowles@al-  
fred.org.au)

Andreas Korge, M.D.

Spine Center Munich, Orthozentrum München, Orthopädische Klinik, Harlachin-  
ger Strasse 51, 81547 Munich, Germany (Tel.: +49-89-62112011,  
Fax: +49-89-62112012, e-mail: AKorge@schoen-kliniken.de)

Thomas Kossmann, M.D.

Professor/Director, Department of Trauma Surgery and The National Trauma  
Research Institute, The Alfred Hospital, PO Box 315, Prahran, VIC 3181, Australia  
(Tel.: +61-3-92763386, Fax: +61-3-92763804, e-mail: t.kossmann@alfred.org.au)

Josef Krugluger, M.D.

Orthopaedic Surgeon, Friedrich-Lintner-Platz 3, 3003 Gablitz, Austria  
(Tel.: +43-2231-66307, Fax: +43-2231-6630730, e-mail: josef.krugluger@bhs.at)

Giovanni A. La Maida, M.D.

Istituto Ortopedico G. Pini, Primario, Centro Scoliosi e Patologia Vertebrale,  
Piazza C. Ferrari, 20123 Milan, Italy

Frank Langlotz, M.D., Ph.D.

Division Head-Computer Assisted Surgery, M.E. Müller Research Center for Or-  
thopaedic Surgery, Institute for Surgical Technology and Biomechanics, University  
of Bern, Murtenstrasse 35, 3001 Bern, Switzerland (Tel.: +41-31-6315957,  
Fax: +41-31-6315960, e-mail: Frank.Langlotz@MEMcenter.unibe.ch)

Ulf Liljenqvist, M.D.

Orthopaedic Surgery, Orthopaedic Department, Westfälische Wilhelms-Universität, Albert-Schweitzer-Strasse 3, 48149 Münster, Germany (Tel.: +49-251-837901, Fax: +49-251-8347989, e-mail: liljenqv@uni-muenster.de)

Gianluca Maestretti, M.D.

Hopital Cantonal Fribourg, Route de Bertigny, 1708 Fribourg, Switzerland (Tel.: +41-26-4267111, e-mail: MAESTRETTIG@hopcantfr.ch)

Greg Malham, M.D.

Department of Neurosurgery, The Alfred Hospital, Monash University and the National Trauma Research Institute, Commercial Road, Melbourne, VIC 3004, Australia (Tel.: +61-3-92763386, Fax: +61-3-92763804, e-mail: g.malham@alfred.org.au)

H. Michael Mayer, M.D. Ph.D.

Head and Medical Director, Associate Professor, Spine Center Munich, Orthozentrum München, Orthopädische Klinik, Harlachinger Strasse 51, 81547 Munich, Germany (Tel.: +49-89-62112011, Fax: +49-89-62112012, e-mail: MMayer@schoen-kliniken.de)

Geoffrey M. McCullen, M.D.

Neurological and Spinal Surgery, LLC, St. Elizabeth Medical Plaza, 575 So. 70th Street, Suite 400, Lincoln, NE 68510, USA (Tel.: +1-402-4883002, Fax: +1-402-4838787, e-mail: mcspinesurg@aol.com)

Hans-Jörg Meisel, M.D.

Chefarzt Neurochirurg. Klinik, BG-Kliniken Bergmannstrost, Merseburger Strasse 165, 06112 Halle/Saale, Germany (Tel.: +49-345-1327404, e-mail: meisel@bergmannstrost.com)

Bernardo Misaggi, M.D.

Instituto Ortopedico G. Pini, Primario, Centro Scoliosi e Patologia Vertebrale, Piazza C. Ferrari, 20123 Milan, Italy

Lutz-Peter Nolte, M.D., Ph.D.

M.E. Müller Research Center for Orthopaedic Surgery, Institute for Surgical Technology and Biomechanics, University of Bern, Murtenstrasse 35, 3001 Bern, Switzerland (Tel.: +41-31-6328679, Fax: +41-31-6324951, e-mail: Lutz.Nolte@MEMcenter.unibe.ch)

Michel Onimus, M.D.

Orthopaedic Surgery, 1, rue de l'Eglise, 25240 Gellin, France (Tel./Fax: +33-381-691880, e-mail: michel.onimus@wanadoo.fr)

Philippe Otten, M.D.

Hopital Cantonal Fribourg, Route de Bertigny, 1708 Fribourg, Switzerland (Tel.: +41-26-4267111)

Luca Papavero, M.D., Ph.D.

Associate Professor, Neurochirurgische Klinik, Universitätsklinikum, Hamburg-Eppendorf, Martinistrasse 52, 20246 Hamburg, Germany (Tel.: +49-40-428032757, Fax: +49-40-42803, e-mail: papavero@uke.uni-hamburg.de)

Vinod Podichetty, M.D., M.S.

Director, Spine Research Studies, Cleveland Clinic Florida, Weston, 2950 Cleveland Clinic Blvd, Weston, FL 33331, USA (Tel.: +1-954-6595000, e-mail: PODICHV@ccf.org)

Ganesh Rao, M.D.

Department of Neurosurgery, University of Utah Medical Center, Suite 3B409,  
30 North 1900 East, Salt Lake City, UT 84132, USA (Tel.: +1-801-5816908,  
Fax: +1-801-581-4385, e-mail: ganesh.rao@hsc.utah.edu)

Stephen Ritland, M.D.

Chiurgie Vertébrale, Cabinet: Eden Palace, 141, rue d'Antibes, 06400 Cannes,  
France (Tel.: +33-4-97166800, Fax: +33-4-97166801)

Björn Robert, M.D.

Department of Neurosurgery, Berufsgenossenschaftl. Unfallklinik Murnau,  
Prof.-Küntschers-Strasse 8, 82418 Murnau, Germany (Tel.: +49-8841-480,  
Fax: +49-8841-482203)

Wilhelm Rulffes

Product Management, Spine/P&R Surgery, Carl Zeiss, 73446 Oberkochen, Germany  
(Tel.: +49-7364-204803, Fax: +49-7364-204823, e-mail: rulffes@zeiss.de)

Sebastian Ruetten, M.D.

Department for Spine Surgery and Pain Therapy (Head: Sebastian Ruetten M.D.,  
Ph.D.), Center for Orthopaedics and Traumatology, St. Anna-Hospital Herne, Ger-  
many, (Director: Georgios Godolias, M.D., Prof.) Department for Radiology and  
Microtherapy, University of Witten/Herdecke, Hospitalstr. 19, 44649 Herne, Germany  
(Tel.: +49-2325-986-2000, Fax: +49-2325-986-2049, e-mail: spine-pain@annahospita-  
l.de, www.annahospital.de)

Jeffrey A. Saal, M.D.

SOAR, Physiatry Medical Group, 500 Arquello Street, Suite 100, Redwood City,  
CA 94063, USA (Tel.: +1-650-9951259, Fax: +1-650-9951275, e-mail:  
dubuk@sbcglobal.net)

Walter F. Saringer, M.D., Ph.D.

Klinik für Neurochirurgie, Allgemeines Krankenhaus Wien, Universitätsklinik,  
Währinger Gürtel 18–18, 1090 Vienna, Austria (Tel.: +43-1-404002565,  
Fax: +43-1-404004566, e-mail: walter.saringer@meduniwien.ac.at)

Michael K. Schäufele, M.D.

Assistant Professor, Department of Orthopaedics, Emory Healthcare, Spine Center,  
2165 North Decatur Road, Decatur, GA 30033, USA (Tel.: +1-404-7787168,  
Fax: +1-404-7787117, e-mail: Michael\_Schaufele@emoryhealthcare.org)

Markus Schultheiss, M.D., Ph.D.

Department of Trauma-, Hand- and Reconstructive Surgery, Universitätsklinikum  
Ulm, Steinhövelstrasse 9, 89075 Ulm, Germany (Tel.: +49-731-50027257,  
Fax: +49-731-50027349, e-mail: Markus.Schultheiss@medizin.uni-ulm.de)

Jacques Sénégas, M.D.

Professor, Chirurgie du Rachis, Centre Aquitain du Dos, Clinique Saint Martin,  
Allée des Tulipes, 33608 Pessac, France  
(Tel.: +33-5-57020000, Fax: +33-5-57020202, e-mail: js@cad-fr.com)

Volker K.H. Sonntag, M.D.

Professor of Neurosurgery, Division of Neurological Surgery, Barrow Neurological  
Institute, St. Joseph's Hospital and Medical Center, c/o Neuroscience Publications,  
Barrow Neurological Institute, 350 West Thomas Road, Phoenix, AZ 85013-4496,  
USA (Tel.: +1-602-4063593, Fax: +1-602-4064104, e-mail: neuropub@chw.edu)

Ralf Stücker, M.D., Ph.D.

Associate Professor, Kinderorthop. Abteilung, Altonaer Kinder-Krankenhaus,  
Bleickenallee 38, 22763 Hamburg, Germany  
(Tel.: +49-40-88908382, Fax: +49-40-88908386, e-mail: stuecker@akkev.net)



Daniel J. Sucato, M.D.

Texas Scottish Rite Hospital, 1222 Welborn Street, Dallas, TX 75219, USA  
(Tel.: +1-212-5597685, e-mail: Dan.Sucato@tsrh.org)

Jean Taylor, M.D.

Chiurgie Vertebrale, Cabinet: Eden Palace, 141, rue d'Antibes, 06400 Cannes, France  
(Tel.: +33-4-97166800, Fax: +33-4-97166801, e-mail: DrJeanTaylor@worldonline.fr)

A. Giancarlo Vishteh, M.D.

Division of Neurological Surgery, Barrow Neurological Institute, St. Joseph's Hospital and Medical Center, c/o Neuroscience Publications, Barrow Neurological Institute, 350 West Thomas Road, Phoenix, AZ 85013-4496, USA  
(Tel.: +1-602-4063593, Fax: +1-602-4064104, e-mail: neuropub@chw.edu)

Karsten Wiechert, M.D.

Spine Center Munich, Orthozentrum München, Orthopädische Klinik, Harlachinger Strasse 51, 81547 Munich, Germany (Tel.: +49-89-62110, Fax: +49-89-62111111, e-mail: KWiechert@schoen-kliniken.de)

Hans-Joachim Wilke, M.D., Ph.D.

Ass. Professor, Department of Orthopaedic Research and Biomechanics, Universitätsklinikum Ulm, Helmholtzstrasse 14, 89081 Ulm, Germany  
(Tel.: +49-731-5023481, Fax: +49-731-5023498, e-mail: hans-joachim.wilke@medizin.uni-ulm.de)

Anthony T. Yeung, M.D.

Arizona Institute for Minimally Invasive Spine Care, 1635 E. Myrtle Avenue #400, Phoenix, Arizona; Voluntary Clinical Associate Professor, Department of Orthopedic Surgery, University of California San Diego, School of Medicine, California, USA (Tel.: +1-602-9442900, Fax: +1-602-9440064, e-mail: dryeung@sciatica.com)

Christopher A. Yeung, M.D.

Arizona Institute for Minimally Invasive Spine Care, 1635 E. Myrtle Ave. #400, Phoenix, Arizona; Voluntary Clinical Instructor, Department of Orthopedic Surgery, University of California San Diego, School of Medicine, California, USA (Tel.: +1-602-9442900, Fax: +1-602-9440064, e-mail: cayeung@sciatica.com)

Jason P. Young, M.D.

Microsurgery and Brain Research Institute, Departments of Anatomy and Neurosurgery, St. Louis University, School of Medicine, St. Louis, MO 63104, USA

Julie C. Young, M.D.

Microsurgery and Brain Research Institute, Departments of Anatomy and Neurosurgery, St. Louis University, School of Medicine, St. Louis, MO 63104, USA

Paul H. Young, M.D.

Microsurgery and Brain Research Institute, Departments of Anatomy and Neurosurgery, St. Louis University, School of Medicine, St. Louis, MO 63104, USA (e-mail: paulyoung@mbri.net)

Hansen A. Yuan, M.D.

Professor of Neurosurgery, 550 Harrison Center #130, Syracuse, NY 13202, USA (Tel.: +1-315-4644472, Fax: +1-315-4645223, e-mail: Yuanh@upstate.edu)

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# General