Specials thanks to the following

Foundation Fund Renesance
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CERVICAL SPINE TRAUMA

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During my long career I had the opportunity to follow and actively support the dynamic development of spinal surgery in our country.

Orthopaedics and especially spinal surgery have recorded a significant upsurge all over the world in a historically short period particularly due to improved diagnostics and development of instrumentation and implants. One of the outcomes of evolution of spinal surgery in the Czech Republic is a unique publication Cervical Spine Trauma.

The Czech specialists have always kept up with the world surgery. One of the first surgeons to perform fusion of the lumbar spine was Eduard Albert (1841–1900) in 1895. His successor in Innsbruck and Vienna, Karel Maydl performed the first laminectomy, that he called resection of the spine, on 22 December 1882. In 1891, Karel Maydl was appointed Head of the Department of Surgery of the Prague University and laid foundations of modern Czech surgery. In 1902, Stanislav Tobiášek began to work at the same Department. Later he opened the first orthopaedic department in Bohemia. He was succeeded by Jan Zahradniček who also dealt in spinal surgery. His activity at the Department marks the beginning of a new era of the Czechoslovak orthopaedic surgery.

After World War II, the efforts in this field focused on development of spinal instrumentation and efficient spine surgery techniques. Harrington in the USA introduced the first comprehensive spinal instrumentation, Roy-Camille in France invented transpedicular implantation of screws and, subsequently, Friedrich Magerl introduced external fixator. It was particularly Magerl who has accelerated the development of spinal surgery as a specialization and who is one of the most prominent personalities in this field. He has based his work on the AO school, founded in 1958, with another outstanding personality M.E. Müller, leading the Department of Orthopaedic Surgery and Traumatology in St. Gallen. This department has hosted most of heads of university clinics from all over Europe over the years. In 1965, I established close cooperation with the Department in St. Gallen.

The seventies of the 20th century witnessed the introduction of CT and later also MRI examination that contributed considerably to further development of diagnostics of spinal injuries and classification systems. Magerl improved and developed new techniques of treatment of spinal injuries, including direct osteosynthesis of the dens axis, translaminar and transarticular screws. A revolutionary invention was external fixation, later converted to internal fixation, that has been used in various modifications until today. In cooperation with Bernard Jeanneret, Magerl was also involved in development of instrumentation for posterior cervical stabilization. In 1994, he published together with his colleagues a modern pathomorphological AO classification for fractures of the thoracolumbar spine. He has also introduced AO training courses for spinal surgeons that have undoubtedly conduced to standardization of findings and knowledge in the field of spinal surgery.

I had come to understand the big potential for development of the spinal surgery in our country and its importance during my three-month stay at the Department of Orthopaedic Surgery in Paris, headed by Robert Judet. There I met the Judet’s colleagues Letournell and Roy-Camille who introduced me into the mysteries of spinal surgery. Another milestone in the development of the Czech spinal surgery was a long-term stay of Otto Vlach in Twin Cities Scoliosis Center in the USA. After he returned home, he laid foundations of modern surgical treatment of scoliosis and other spinal defects here. In 1986, he published a book on treatment of scoliosis based on an extensive textbook by John H. Moe. For a long time the Department of Orthopaedic Surgery in Brno was actually the only institution in Czechoslovakia that dealt exclusively with surgical treatment of scoliosis. Otto Vlach is a top specialist in this field and was the first to teach us about destabilization effects of laminectomy without fixation, that was at that time performed routinely in spinal fractures with a neurological deficit.

After opening the Orthopaedic Department of 3rd Faculty of Medicine, Charles University in Prague, spinal surgery became one of its three main focuses, together with joint replacement and traumatology of the musculoskeletal apparatus. Our model was the Orthopaedic Department in St. Gallen, with Friedrich Magerl at its head. Thanks to our long-term cooperation a number of our colleagues had the opportunity to gain experience there through short fellowships.
In 1991, the Orthopaedic Department of 3rd Faculty of Medicine, Charles University organized a one-day symposium in Prague on “Spinal surgery – new techniques” with active participation of Professor Magerl and B. Janneret and in the same year the Department started to work on a research task under the grant IGA MZ 1771-3 on “Specification of the technique of stabilization of spine”. Under the research program the Department bought modern instruments and implants and at the beginning of 1992 it launched the process of implementation of these new progressive procedures.

The team specialized in spinal surgery at the Department included particularly Martin Krbec, Zdeněk Klézl and Jan Štulík. However, over a certain period spinal surgery was not adequately supported as a specialization and as a result, they left the Department. Zdeněk Klézl left in 1995 for the Orthopaedic Department of the Central Military Hospital in Prague, Martin Krbec was in 1999 appointed Head of the Orthopaedic Department in Brno, where he followed the trend launched by Otto Vlach. In 2009, Martin Krbec became Head of the Orthopaedic Department of 3rd Faculty of Medicine, Charles University in Prague and Zdeněk Klézl a senior spinal surgeon in Derby in United Kingdom. Jan Štulík left in 2001 for the University Hospital Motol in Prague, where he has built in few years an independent Center for Spinal Surgery, together with his colleagues Tomáš Vyskočil, Petr Šebesta and Jan Kryl.

Thanks to high productivity and top quality of the provided medical care, the Center for Spine Surgery University Hospital Motol has won recognition both in the Czech Republic and abroad. The Department is respected also for its activities in the field of research and development and education.

It is with great satisfaction that I follow the development of spinal surgery, the outcomes of these long-term exceptional efforts in such a highly demanding specialization. The present book summarizes the work of authors of several generations. It is the first comprehensive publication dealing with the issue of “Cervical Spine Trauma” in the Czech literature. Fourteen clinical chapters describe in detail individual injuries at different levels of the cervical spine. The monograph was prepared by a team of experienced authors who supplemented it with a wide range of their own high quality radiological material, as well as a number of instructional schemes. The list of references provides an exhaustive overview of the world literature related to this field.

The presented publication has a high scientific and educational value.

I wish to congratulate the authors.

Oldřich Čech
Professor Emeritus, Charles University
Spinal trauma surgery has evolved as a separate subspecialty within a wide range of spinal disorders. In this context, this book is a logical step forward, because it brings together all relevant aspects of cervical spine trauma treatment, following systematically the medical aspects and focusing on the surgical treatment. Although the book is primarily intended for trauma surgeons, it may be useful also to those who specialize in non-traumatic disorders, as it will help them get a better picture of the use of instrumentation, biomechanics of trauma and internal fixation and maximize the chance for a successful treatment of cervical spine injuries.

In this relatively circumscribed field the major inherent problems concerning data evaluation due to acuteness of the patients’ condition, distribution of cases among multiple Centers and a highly variable mix of spinal injuries, are well known. This has resulted in production of numerous underpowered and often controversial studies. Hence, a vast majority of textbooks, reviews, guidelines and publications that attempt to synthesize the literature usually conclude that further research is needed and no distinct recommendation can be made. However, treating physicians or surgeons must make prompt therapeutic decisions on a daily basis, regardless of the quality of literature. Therefore the experience of surgeons gained over decades of specialization in this field, is of extraordinary importance. This book offers a unique body of experience of specialists in the field of cervical spine trauma to both the future as well as the already established spine surgeons.

As the authors come from the Central Europe, their readership should be aware that the experience expressed in the book may differ from that in other parts of the world. This, however, should not be perceived as limitation of the applicability of the experience but rather as a contribution of the Central European approach to the world literature.

The recent decades have seen an explosion of innovations, significant progress as well as increasing complexity of cervical spine trauma management. Several new surgical techniques and treatment options have been established, that are included in this book. However, due to the continuous medical progress, obviously further changes are already taking place even during the process of publishing of this book, leaving the reader with a “snapshot” of the development of the body of knowledge.

I wish to congratulate the authors on this excellent book which I am sure will make the decisions of surgeons in the everyday practice much easier. The authors, experts in cervical spine trauma care, have used their long-term clinical experience to formulate recommendations that may be helpful in the efforts to provide the patients with the best possible treatment. I hope that you will enjoy this book and believe that it will bring benefit both to you and to your patients.

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1. Introduction

In the past, spinal surgery was only a marginal discipline at many orthopedic and neurosurgical departments, both in the Czech Republic and abroad. Gradually it has won respect as an independent discipline or at least as a sub-specialization singled out from the mentioned disciplines. In the Czech Republic, the Czech Society of Spinal Surgery was founded in 1999. It associates orthopedic surgeons, neurosurgeons and trauma surgeons involved in the treatment of diseases and injuries of the spine and the spinal cord. The Society has soon become a respected member of the Czech Medical Society of Jan Evangelista Purkyně. It has organized eight annual congresses, developed the concept of the discipline, created the database of spinal operations and a register of spinal cord lesions. The database was also used to categorize spinal surgery departments. Currently, there are 20 of them in the Czech Republic of different categories, of which 3–4 top quality departments are fully comparable with the European clinical and scientific standard. Another achievement in this field is development of a network of spinal injury units dealing with the treatment of patients with spinal cord injuries.

Ten years ago, the concept of spinal surgery as an independent discipline was quite unthinkable. Since then the situation has changed and the experience both in the Czech Republic and abroad proves that this idea is feasible and specialized departments call the tune in further development. Therefore, it seems appropriate to explain the respective concepts in historical consequences.

What is spinal surgery? It is a medical discipline that builds on orthopedic surgery, neurosurgery and, taking into account surgical approaches, also on general surgery. It deals particularly with the operative but also with non-operative treatment of spinal diseases. Surgical treatment of spinal diseases has developed along two basic trends, the orthopedic and neurosurgical one. Spinal surgery aims to link the two trends together, make use of their benefits and ensure further advancement. It may be divided according to three basic criteria, namely anatomical location, diagnosis and type of the surgical intervention. In anatomical terms, the spine is divided into the upper cervical spine and cranio cervical junction, the lower cervical spine, the thoracic spine, the lumbar spine, sacrum and coccyx. In diagnostic terms, it covers injury, degenerative change, deformity, tumor, inflammation or manifestations of a systemic disease; and in surgical terms, it includes a simple resection, internal fixation, bone fusion of the surrounding spinal segments or mobile stabilization.

The remarkable progress in spinal surgery as a separate discipline would be impossible without a parallel development in the field of asepsis, instrumentation, anesthesiology or imaging methods. The first attempts at treatment of spinal injuries that had to do without achievements which we have at our disposal today, are highly admirable. Today it is hard to imagine for instance an operation without electrocoagulation that has considerably reduced both blood loss and duration of surgery.

The book contains 16 chapters focused on the most important information that is essential for treatment of cervical spine injuries. Knowledge of anatomy of the occipitocervical junction, the lower cervical spine and the cervicothoracic junction is crucial for insertion of fixation components into the occipital bone and individual vertebrae. Biomechanical relations are decisive for the extent of spinal fusion and placement of fixation on the anterior, posterior or, if necessary, on both sides of the spine in markedly unstable injuries.

Indication for surgery should be based on a careful clinical examination and the corresponding radiological, CT or MRI findings. The current CT technology provides a reliable image in a few minutes and subsequently reconstructs any bone injury from the head down to the pelvis, including the complicated occipitocervical, cervicothoracic and lumbosacral regions. In patients with neurological deficit, MRI provides a detailed image of spinal cord injury, posterior ligamentous complex, anterior longitudinal ligament and especially of the intervertebral disc.

Knowledge of surgical approaches is essential for treatment of cervical spine injuries. We recommend to perform anterior approaches to the upper cervical spine and cervicothoracic junction always in cooperation with the respective specialists. Injuries most frequently