T. Kanno (Editor in Chief)
Y. Kato (Ed.)

Minimally Invasive Neurosurgery and Multidisciplinary Neurotraumatology

With 158 Figures, Including 14 in Color

Springer
Two meetings took place simultaneously in Nagoya in March 2005. Both the 6th International Congress of Minimally Invasive Neurosurgery (MIN) and the 3rd World Congress of the Academy for Multidisciplinary Neurotraumatology (AMN) were held at the same venue and successfully brought together experts in different areas of clinical neuroscience and neurosurgical subspecialties. With apparently quite different problems to deal with, both congresses had a lot in common. They brought specialists working in different areas closer together with the goals of applying the latest front-line instrumentation to the improvement of neurosurgical operative technique through less invasiveness and finding the optimal multidisciplinary approach for patients with neurotrauma, for whom neurosurgery alone is insufficient to ensure full recovery.

The ultimate goal of neurosurgeons is to minimize injury to the nervous system through their interventions and to create the best conditions for recovery. The concept of minimal invasiveness has evolved throughout the history of neurosurgery, blossoming in the last two decades as a result of technological improvements in neurosurgical instrumentation. These advances have been applied across all neurosurgical subspecialties and are not specific to any type of pathology or anatomical area. This has produced a revolutionary shift in neurosurgical practice in the operating room. However, minimal invasiveness does not directly translate as “neurosurgery of minimal surgical trauma.” The design of minimally invasive instrumentation has rapidly produced many new types of tools, requiring new basic and clinical knowledge combined at times with totally different surgical skills. Only after achieving these skills can neurosurgeons embark on the application of these new surgical procedures. This combination of scientific information and know-how, as in the whole science and art of neurosurgery, has to be obtained with the guidance of a mentor. Only in the hands of the knowledgeable, skilled, and experienced can the goal of minimal trauma through minimal invasiveness be achieved.

The trend toward minimal invasiveness will continue to progress and result in the ongoing refinement of neurosurgery. Minimally invasive techniques have already become part of the basic training of neurosurgical specialists. The spread of this idea and its realization out of a few specialized centers, convincing disbelieving traditionalists and realistically instructing the willing to improve their neurosurgical technique, have been the objectives of this meeting.
Neurotraumatology patients present an enormous challenge to society. Neurosurgical management of brain and spinal cord injury has been a frustrating area, as surgical methods, especially in moderate and severe injuries, have been limited to control of brain and spinal compression, control of intracranial pressure with its expected effect on cerebral blood flow, and structural repair of the supporting structures (skull, spine, brain and spinal cord coverings). Achieving the best outcome for the neurotraumatology patient, however, requires much more than that. This important issue has thus far been approached through the broadest spectrum of scientific knowledge, from the most fundamental biological sciences to the social sciences. Such a variety of approaches has for a long time been in need of a "center of gravity," a balancing point where facts and opinions can meet and be integrated. The management of neural injury is awaiting a breakthrough, and we should do our best to facilitate. As the majority of the new discoveries tend to appear at the integrating borderlines of two separate scientific areas, our duty is to bring together all scientists involved with neural injury. We all hope that the meeting has fulfilled this goal and is a step forward in bringing together previously distant areas of knowledge in neurotraumatology.

These proceedings contain the full text of the submitted reports, with the intention of providing the information and personal opinions of the participating speakers to those who were unable to attend. Although the discussions (sometimes containing the great wisdom of common sense and impressions from practice) are not included, we believe that readers will be able to obtain an accurate picture of events and their content. We hope that this book will attract them to these fascinating areas of innovation in clinical neuroscience.

Tetsuo Kanno
President of the 6th MIN and the 3rd AMN
Aichi, Japan
Contents

Preface ................................................................. V
List of Contributors .................................................. XIII

Part 1 6th International Congress on Minimally Invasive Neurosurgery

The NASA Smart Probe for Real-time Tissue Identification: Potential Applications in Neurosurgery

Clinically Non-functional Pituitary Tumors: The Surgical and Biological Challenge
C.-O. Evans, R.K. Halkar, and N.M. Oyesiku ................................................................. 8

Tips for Correct Use of Navigation
E. Kohmura .......................................................... 17

Image-Guided Surgery for Gliomas

Recent Advances in Radiosurgery for Cerebral Arteriovenous Malformations: The University of Tokyo Experience
K. Maruyama, M. Shin, and T. Kirino ................................. 29

Intramedullary Spinal Cord Glial Tumours: Management Philosophy and Surgical Outcome

Surgical Tactics for Subaxial Spinal Cord Injury
J. Mizuno and H. Nakagawa ........................................ 47
Efficacy of Lateral Position on Minimally Invasive Cervical Expansive Open-Door Laminoplasty  
M. Nakajima, M. Chikama, and M. Tsuboi .......................... 53

MR Tractography for Minimally Invasive Neurosurgery  
K. Yamada, O. Kizu, and T. Nishimura .......................... 58

Intraoperative MRI  
M. Matsuda, A. Shiino, and S. Morikawa .......................... 69

Clinical Significance of Positron Emission Tomography in Brain Tumor Surgery  
K. Mineura ................................................ 73

The Biology of Glioma—A Discussion from the Standpoint of Photodynamic Diagnosis and Photodynamic Therapy  
T. Kuroiwa, Y. Kajimoto, S. Miyatake, and M. Miyashita ......... 80

MCA Embolism Local Fibrinolytic Intervention Trial (MELT) Japan  
M. Ezura, A. Takahashi, Y. Matsumoto, and A. Ogawa ............ 85

Direct Cerebral Bypass Supplements Indirect Bypass Procedures in Moyamoya Disease  
Y. Suzuki, N. Hatano, S. Takasu, N. Matsubara, Y. Kishida, and N. Mizutani .......................... 90

Treatment of Cerebral Vasospasm Following Subarachnoid Hemorrhage  

Retrocarotid Infracommissural Approach for Parasellar and Interpeduncular Tumors  

Genetically Modified Cell Line Grafting for the Treatment of Parkinson's Disease  
I. Date, T. Shingo, and T. Yasuhara ............................. 108

Controlled Secretion of β-endorphin from Human Embryonic Kidney Cells Carrying a Tet-on-NL1-β-endorphin Fusion Gene: Gene Therapy of Pain  
Y. Saitoh, Y. Eguchi, T. Yoshimine, and G. Boileau ............... 114

Human Gene Therapy for Malignant Gliomas  
T. Wakabayashi, J. Yoshida, M. Mizuno, M. Fujii, Y. Kajita, N. Nakahara, and H. Hatano .......................... 119
Neuronal Restoration of Memory Disturbances and Neuroprotection for Fall in Vegetation after Cardiac Arrest
N. Hayashi .......................................................... 124

Neuroprotection and Repair by Using Adult-derived Neural Stem Cell Grafting for Neurological Disorders
I. Date, T. Shingo, T. Yasuhara, K. Takahashi, and K. Muraoka ...................................................... 131

Diaphragm Pacing with a Spinal Cord Stimulator
T. Taira and T. Hori .................................................. 138

Intraoperative Monitoring of the Corticospinal MEP (D-wave) in Brain Tumor Surgery
T. Yamamoto, Y. Katayama, T. Nagaoka, K. Kobayashi, and C. Fukaya .................................................. 143

Functional Neurosurgical Rehabilitation in Craniovertebral Junction Abnormality. An Exemplary Case Report
K.R.H. von Wild .................................................... 152

Functional Electrical Stimulation for Spinal Cord Injury Rehabilitation at the University of Virginia and Duke University
E. Cooper, J. McElhaney, D. Han, B. Cooper, and B. Cooper ................................................................. 161

Treatment Results of Poor-grade (WFNS Grade V) Patients with Subarachnoid Hemorrhage
T. Sasaki, J. Nakagawara, T. Osato, K. Hayase, R. Takeda, and H. Nakamura ............................................ 165

Minimally Invasive Spinal Surgery Using Instrumentation
H. Nakase, Y. Ida, Y.-S. Park, H. Hirabayashi, S. Kawaguchi, and T. Sakaki .................................................. 170

Clinical Experience with Endoscope-controlled Removal of Intrameatal Vestibular Schwannomas
T. Hori, T. Maruyama, and M. Chernov .................................................. 176

Neuroprotective Approaches in Experimental Model of Cerebral Venous Infarct

Treatment of Ruptured Intracranial Aneurysm: Our Approach

Endoscopic Endonasal Transsphenoidal Surgery for Pituitary Macroadenoma
S.K. Sankhla .......................................................... 195
Microsurgical Treatment of Posterior Cranial Fossa Tumors Via Keyhole Approaches

The NASA Nanoelectrode Array for Deep Brain Stimulation: Monitoring Neurotransmitters and Electrical Activity Plus Precise Stimulation
R. Andrews, J. Li, A. Cassell, J. Koehne, M. Meyyappan, B. Nguyen-Vu, N. Huang, and L. Chen .................. 212

Part 2 3rd World Congress of the Academy for Multidisciplinary Neurotraumatology

Phenomenological Aspects of Consciousness: Coma Scale in Chronic Stage (Chronic Coma Scale Score; CCSs)
T. Ohta ................................................... 219

Right Median Nerve Electrical Stimulation for the Vegetative State
E. Cooper, B. Cooper, and J. Chen .............................................. 220

An Ecologically Valid System for Classifying Severity of Traumatic Brain Injury in Children
G.P. Prigatano ............................................. 225

Some Keys to Neurorehabilitation Related to the Circuitry of Emotion in the Brain
J. León-Carrión ........................................... 233

Multidisciplinary Treatment for Trauma—The AMN View
K.R.H. von Wild ............................................ 240

Ventricular Enlargement after TBI—Shunt or No Shunt
H. Tritthart ............................................... 251

Ex vivo Expansion and Neural Differentiation of Bone Marrow-derived Cells under Serum-free Condition
T. Magaki, K. Kurisu, and T. Okazaki ..................................... 257

Head Trauma Related Epilepsy

Recent Projects on Neurotrauma in Japan
M. Shigemori .............................................. 268

Head Injury in Buenos Aires City: Main Features
P.S. Marchio, I.J. Previgliano, C.E. Goldini, F. Murillo-Cabezas, and A. Basso .......................................... 274
Can Mild Head Injury Affect the Quality of Life by Neuropsychological Disturbances?
A.V. Ciurea, L. Tataranu, and V. Rotarescu .................................................. 283

Simple and Effective Assessment of Posttraumatic Higher Brain Function Disorders with Special Reference to the Prefrontal Area
K. Uemura ........................................................................................................ 293

Neurobehavioral Sequelae in Neurotraumatology
A.-L. Christensen ............................................................................................. 310

Clinical Analysis of the Patients with Anterior Skull Base and Craniofacial Injury in the Acute Head Trauma
Y. Node, T. Tamaki, and A. Teramoto .............................................................. 316

Oxidative Injury and Antioxidant Therapy in Acute Brain Injury
Y. Ikeda ........................................................................................................... 321

The Development of Brain Hypothermia Treatment for Severe Brain Trauma: New Finding of Brain Injury Mechanism, ICU Management Technique and Pitfall
N. Hayashi ....................................................................................................... 328

Hemodynamic Efficacy of Neuroleptanesthesia for Therapeutic Hypothermia in Acute Brain Injury

Different Cytokine Responses between Induced and Accidental Hypothermia: An Implication for Controversies over Neuroeffective of Therapeutic Hypothermia
M. Aibiki ......................................................................................................... 339

Multidisciplinary Treatment Including Brain Hypothermia for Severe Brain Injury
Y. Takasato and T. Hayakawa ........................................................................ 343

Therapeutic Moderate Hypothermia for Severe Traumatic Brain Injury: A Review
D.W. Marion .................................................................................................... 350

Early Decompressive Surgery for Spinal Cord Injury: Rationale Based on Experimental Study
T. Morimoto, Y. Shin, R. Tei, and Y. Hirokawa ............................................ 359
Acetazolamide Vasoreactivity Evaluated by Transcranial Ultrasonic Power Harmonic Imaging and Doppler Sonography
   T. Shiogai, A. Morisaka, Y. Arima, K. Ikeda, N. Takayasu, Y. Nagakane, K. Yoshikawa, T. Mizuno, M. Nakagawa, and H. Furuhata ........................................... 360

Neurointensive Care with Multimodal Monitoring
   M. Honda and Y. Seiki ....................................... 368

Right Median Nerve Electrical Stimulation for Coma Treatment—Recent Experience in Lithuania and the U.S.A.
   S. Rocka, E. Jarzemskas, E. Cooper, and B. Cooper ................. 376

Management of Patients with Traumatic Brain Injury: Our Strategy
   H. Fujisawa, E. Suehiro, H. Yoneda, and M. Suzuki ................... 386

Clinical Features in the Patients with “Platform Accident” in Tokyo
   Y. Node, T. Tamaki, and A. Teramoto ........................... 391

Screening for Hypopituitarism Following Traumatic Brain Injury (TBI)

Development of the New Coma Scale: Emergency Coma Scale (ECS)
   M. Wakasugi, H. Okudera, T. Ohta, T. Asahi, A. Igawa, and D. Tange .............................................. 400

Pre-hospital Care for Patients with Severe Traumatic Brain Injury: A Retrospective Analysis of JAPAN Neurotrauma Data Bank
   A. Satoh, H. Nakamura, and The Japan Neurotrauma Databank Committee ................................................ 404

Key Word Index .............................................. 413
List of Contributors

Abe, K.  22
Adachi, N.  101
Aibiki, M.  339
Aimaretti, G.  396
Alam, S.  186
Andrews, R.  3, 212
Arima, Y.  360
Asahi, T.  400
Basso, A.  274
Bhattacharya, R.N.  36
Boileau, G.  114
Cassell, A.  212
Chen, Jefferson  220
Chen, Jian  202
Chen, L.  212
Chernov, M.  176
Chikama, M.  53
Christensen, A.-L.  310
Ciurea, A.V.  283
Cooper, Branan  161
Cooper, Bryan  161, 220, 376
Cooper, E.  161, 220, 376
Croce, G.C.  396
DaSilva, L.  3
Date, I.  108, 131
Easwer, H.V.  36
Eguchi, Y.  114
Evans, C.-O.  8
Ezura, M.  85
Fujii, M.  119
Fujisawa, H.  335, 386
Fukaya, C.  143
Furuhata, H.  360
Ghigo, E.  396
Goldini, C.E.  274
Gong, Z.  202
Guerrero, M.  3
Halkar, R.K.  8
Han, D.  161
Hashimoto, H.  260
Hatano, H.  119
Hatano, N.  90
Hayakawa, T.  343
Hayase, K.  165
Hayashi, N.  124, 328
Hirabayashi, H.  170
Hirata, M.  96
Hirokawa, Y.  359
Honda, M.  368
Hori, T.  138, 176
Hoshida, T.  260
Huang, N.  212
Huang, Q.  202
Ida, Y.  170
Igawa, A.  400
Ikeda, K.  360
Ikeda, Y.  321
Ishii, T.  96
Jarzemskas, E.  376
Kajimoto, Y.  80
Kajita, Y.  119
Kamada, Y.  101
Kanno, T.  186
Kasaoka, S.  335
Katayama, Y. 143
Kato, Y. 186
Kawaguchi, S. 170
Kim, Y.-J. 260
Kimura, R. 181
Kirino, T. 29
Kishida, Y. 90
Kizu, O. 58
Kobayashi, A. 96
Kobayashi, K. 143
Kobitsu, K. 260
Koehne, J. 212
Kohaya, N. 101
Kohmura, E. 17
Kurisu, K. 257
Kuroiwa, T. 80
Lan, Q. 202
León-Carrión, J. 233
Li, J. 212
Liu, S. 202
Lu, Z. 202
Maekawa, T. 335
Magaki, T. 257
Mah, R. 3
Marchio, P.S. 274
Marion, D.W. 350
Maruyama, K. 29
Maruyama, T. 176
Mathew, A. 36
Matsubara, N. 90
Matsuda, M. 69
Matsumoto, Y. 85
McElhaney, J. 161
Menon, G. 36
Meyyappan, M. 212
Mineura, K. 73
Miyake, H. 181
Miyashita, M. 80
Miyatake, S. 80
Mizuno, J. 47
Mizuno, M. 119
Mizuno, T. 360
Mizutani, N. 90
Mochizuki, T. 96
Monobe, T. 101
Morikawa, S. 69
Morimoto, T. 359
Morisaka, A. 360
Muraoka, K. 131
Murillo-Cabezas, F. 274
Muthurethinam, T. 36
Nagakane, Y. 360
Nagaoka, T. 143
Nagashima, H. 96
Nair, S. 36
Nakagawa, H. 47
Nakagawa, M. 360
Nakagawara, J. 165
Nakagomi, T. 96
Nakahara, N. 119
Nakajima, M. 53
Nakamura, H. 165, 404
Nakase, H. 170, 181, 260
Nakashima, K. 101
Namba, H. 22
Nguyen-Vu, B. 212
Nishikawa, M. 101
Nishimura, T. 58
Nishioka, T. 181
Node, Y. 316, 391
Oda, Y. 335
Ogawa, A. 85
Ohnishi, H. 101
Ohta, T. 219, 400
Okabayashi, K. 335
Okazaki, T. 257
Okudera, H. 400
Osato, T. 165
Oyesiku, N.M. 8
Papasin, R. 3
Park, Y.-S. 170
Perino, C. 396
Perrone, K. 396
Prashant, K. 186
Previgliano, I.J. 274
Prigatano, G.P. 225
Qian, Z. 202
Rago, R. 396
Rajamani, S.S. 186
Rajesh, B.J. 36
Rao, B.R.M. 36
Rocka, S. 376
Rotarescu, V. 283
Rovere, S. 396
Saitoh, Y. 114
Sakai, N. 22
Sakaki, T. 170, 181, 260
Sankhla, S.K. 195
Sano, H. 186
Sasaki, T. 165
Satoh, A. 404
Seiki, Y. 368
Shigemori, M. 268
Shiino, A. 69
Shin, M. 29
Shin, Y. 359
Shingo, T. 108, 131
Shiogai, T. 360
Shirouzu, M. 96
Suchiro, E. 386
Suzuki, M. 386
Suzuki, Y. 90
Taira, T. 138
Takahashi, A. 85
Takahashi, K. 131
Takasato, Y. 343
Takasu, S. 90
Takayasu, N. 360
Takeda, R. 165
Takeshima, S. 260
Takeshima, Y. 181
Tamaki, R. 181
Tamaki, T. 316, 391
Tanaka, T. 22
Tange, D. 400
Taomoto, K. 101
Tataranu, L. 283
Tei, R. 359
Terakawa, S. 22
Teramoto, A. 316, 391
Tokuyama, T. 22
Tritthart, H. 251
Tsuboi, M. 53
Tsuruta, R. 335
Uemura, K. 293
von Wild, K.R.H. 152, 240
Wakabayashi, T. 119
Wakasugi, M. 400
Watanabe, S. 186
Yamada, K. 58
Yamamoto, S. 22
Yamamoto, T. 143
Yamashita, S. 335
Yasuhiara, T. 108, 131
Yokota, N. 22
Yoneda, H. 386
Yoneda, M. 186
Yoshida, J. 119
Yoshikawa, K. 360
Yoshimine, T. 114