

MEETING REPORT

THE FIRST SEMINAR FOR MAGNETIC RESONANCE IMAGING IN THE REPUBLIC OF MACEDONIA

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Abstract: The First Seminar for Magnetic Resonance Imaging in the Republic of Macedonia was held in August 2008 in the city of Ohrid. 150 professionals from 5 Balkan countries had an opportunity to hear over 30 lectures on MR given by renowned scientists from the US, Canada, Germany, Italy and Russia. A workshop on white matter in schizophrenia was held on the second day of the seminar, while the last day was reserved for young scientists from the region who presented their research in the field of MR.

Key words: magnetic resonance in medicine, central nervous system.

For three days in August 2008, the Republic of Macedonia was in the focus of the Balkan MR community. Thanks to the Global Outreach Program of the International Society for Magnetic Resonance in Medicine, 150 professionals from 10 countries came together in the beautiful city of Ohrid to learn about magnetic resonance and to discuss the future of MR in the region. In addition to the generous support of the ISMRM, GE Healthcare, Phillips Medical Systems, and Siemens Medical Solutions, this initiative received wide local support from the Macedonian academic community, the Macedonian government, and many corporate sponsors. What was initially imagined as a small local workshop, became the First International Seminar for MRI in the Republic of Macedonia, and laid the foundation for a Macedonian ISMRM chapter.

The programme of the seminar struck a fine balance between MR fundamentals and cutting edge interdisciplinary research. The speakers invited

by the ISMRM gave 16 lectures about the current state and future trends in MR, emphasizing the synergy between medical science, physics and engineering. Dr. John Pauly from Stanford University (Stanford, US) and Dr. Elfar Adalsteinsson from the Massachusetts Institute of Technology (Boston, US) gave the diverse audience an overview of basic MR physics and sequences. Dr. Mark Ladd from the Erwin L. Hahn Institute for MRI in Essen (Germany) talked about MR hardware and safety. The cardiovascular applications of MR were covered by Dr. Michael Markl from Freiburg University Hospital, (Freiburg, Germany) while the neurological applications of MRI were presented by Dr. Alberto Bizzi from the Neurological Institute in Milan (Italy) and Dr. Kelvin Lim from the University of Minnesota (Minneapolis, US).

The lectures of the ISMRM speakers were well complemented by the White Matter in Schizophrenia Workshop held on the second day of the seminar. Initiated by Dr. Gorazd Rosoklija from Columbia University, this workshop addressed the use of MR as an invaluable tool for interdisciplinary brain research. The invited speakers came from the US, Canada, and Russia and they shared their experiences about their use of MR and its subdisciplines in understanding the workings of the human brain.

Dr. Claire Beasley from the University of British Columbia (Vancouver, Canada) shared her findings on myelin-related proteins and metabolites in white matter in schizophrenia. Her team had carried out a series of studies to investigate cellular and molecular alterations in white matter regions in the major psychiatric disorders. She discussed the results from their investigation of the anterior limb of the internal capsule, which identified metabolic deficits, but no change in myelin- or axon-associated proteins in schizophrenia. The data from her recent studies of anterior cingulate and prefrontal white matter indicated subtle deficits in specific proteins and lipids that may be region- or disease-specific.

Dr. Christian Beaulieu from the University of Alberta (Edmonton, Canada) presented his work on diffusion and its link to neural microstructure. Dr. Beaulieu described diffusion as a fundamental property of water that can be used for novel image contrast in MRI of the brain. He focused on the relationship of water diffusion and its directional dependence on the underlying microstructure of neural fibers (e.g. axons, myelin, etc.), with special emphasis on modeling neurological systems both *in vitro* and *in vivo*.

Dr. Matthew Hoptman from the Nathan S. Kline Institute for Psychiatric Research at New York University (US) presented his findings about the clinical correlates of white matter MRI abnormalities in schizophrenia. His research is motivated by recent MRI and neuropathological studies which have

found that white matter tracts are abnormal in schizophrenia, suggesting a neural substrate for this dysconnectivity. In the past several years, his team has conducted a number of studies examining clinical correlates of white matter abnormalities in schizophrenia using diffusion tensor imaging (DTI). His findings showed associations between impulsivity and reduced inferior frontal white matter integrity, as well as between better executive, attentional, and memory function and higher FA in task-relevant neural circuits.

Dr. John Smiley from the Nathan S. Kline Institute for Psychiatric Research at New York University (US) presented the anatomy of the auditory cortex in schizophrenia (Smiley). His team used samples of bilateral superior temporal gyrus from schizophrenia and non-psychiatric postmortem brains, to examine the cellular and structural changes that occur in this region in schizophrenia. His findings suggest that schizophrenia may be especially associated with areas of multisensory integration located just behind the auditory cortex.

Dr. Sheng-Kwei "Victor" Song from the Washington University School of Medicine (St. Louis, US) spoke about using animal models to understand the pathological substrates of DTI abnormalities. In his presentation he spoke about the uses of diffusion tensor imaging (DTI) as a metric of the central nervous system white matter injury. Because anisotropy and mean apparent diffusion lack specificity, Dr. Song argued that directional diffusivities are a more specific marker of white matter pathology.

Dr. Natalia Uranova from the Russian Academy of Sciences (Moscow, Russia) gave insights into the ultrastructure of myelin and oligodendrocytes in schizophrenia. She led a pilot electron microscopic qualitative and morphometric study of the ultrastructure of myelinated fibers and glial cells in the white matter adjacent to the prefrontal cortex. Her data suggested that abnormalities of myelinated fibers in schizophrenia are associated with damage to the myelin sheaths, altered myelin/axon integrity, axonal atrophy, altered metabolism and deficit of oligodendrocytes.

Dr. Andrew Dwork from Columbia University (New York, US) wrapped up the workshop by providing a summary of the previous presentations and relating the MRI findings to post mortem histology of white matter in schizophrenia. He paid particular attention to the discrepancy between MR diffusion findings and autopsy results, and provided several possible explanations for these discrepancies.

Finally, the regional component of the seminar consisted of talks and posters by researchers from five Balkan countries (Bosnia and Herzegovina, Bulgaria, Macedonia, Serbia, and Slovenia.) In their presentations, the researchers told their colleagues about the MR work done in their institutions and about the opportunities for Balkan collaboration.

Dr. Lejla Arnautalic from the University Clinical Centre in Tuzla (Bosnia and Herzegovina) discussed several methods for diagnostics of the spinal cord. She compared X-ray, CT and MRI techniques, and demonstrated the benefits of MRI through a case study of a 5-year-old girl with malformation of her left leg due to spinal cord abnormalities.

Dr. Marko Dakovic from the University of Belgrade (Serbia) presented a 3D CSI spectroscopy method which represents a non-invasive alternative to evaluation of prostate tissue pathologies. He showed that metabolic maps generated on basis of Cho/Ci ratio determination can be used in distinguishing between benign hyperplasia, adenocarcynoma and normal tissue of prostate.

Dr. Tomas Seruga from the University Clinican Centre in Maribor (Slovenia) presented a technique based on diffusion-weighted imaging that detects hyperacute cerebral ischaemic infarction within the first hour of the onset of clinical symptoms. He also spoke about the use of MR angiography for detecting lesions of the vessel walls, which allows the planning of endovascular treatment.

Dr. Silvana Markovska-Simoska from the Macedonian Academy of Sciences and Arts gave a review of the objectives of the current Neuro-COST Actions. She emphasized the application of fMRI in studies aimed at understanding the information flow between the cortical areas in humans during particular motor and cognitive tasks, and gave an outline of the opportunities for regional collaboration in the field.

Dr. Lidija Ololoska-Gagoska from Ss. Cyril and Methodius University (Macedonia) developed a model for calculating the distribution of electric fields in the human body. This model can be used to calculate the specific absorption rate that results from exposure to MR radiation, and to analyse the biological effects on humans from such an exposure.

Bistra Iordanova from Carnegie Melon University (US) spoke about cellular and molecular MRI and its use for imaging gene expression non-invasively. In particular, she proposed an improved ferritin chimera, genetically engineered to exhibit stronger paramagnetic properties and serve as an MRI gene reporter for molecular applications.

Nikola Stikov from Stanford University (US) presented his work on integrating diffusion tensor imaging (DTI) with quantitative magnetization transfer techniques for evaluating the myelin content of white matter. The integration of these two complementary techniques enables identification of highly myelinated fiber tracts *in vivo*. It also gives insights into white matter microstructure, such as the thickness of the myelin sheath.

The participants expressed great interest in the ISMRM, as evidenced by the number of applications for associate ISMRM membership. By the end of the seminar there were enough applications for forming a Macedonian ISMRM chapter, and the number of applicants is still growing.

This seminar was one of the biggest interdisciplinary events ever held in Macedonia. It was endorsed by three departments of Ss. Cyril and Methodius University, received invaluable support from Dr. Momir Polenakovic at the Macedonian Academy of Sciences and Arts, and brought together a diverse group of medical doctors, physicists and engineers. The evening social events provided an opportunity for networking in the relaxing atmosphere of Lake Ohrid and its surroundings. Encouraged by the warm reception and positive feedback from all participants, we are already starting preparations for the next seminar in 2011.

Резиме

ПРВ СЕМИНАР ЗА МАГНЕТНА РЕЗОНАНСА ВО РЕПУБЛИКА МАКЕДОНИЈА

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Во август 2008 под покровителство на Меѓународното здружение за магнетна резонанса во медицината во Охрид се одржа Првиот семинар за магнетна резонанса во Република Македонија. На семинарот присуствуваа околу 150 професионалци од пет балкански земји, кои имаа можност да слушнат повеќе од 30 предавања на реномирани научници од САД, Канада, Германија, Италија и Русија. Во состав на семинарот се одржа и работилница за белата материја во шизофренијата, а на крајот од семинарот млади научници од регионот ги презентираа своите истражувања во полето на магнетната резонанса.

Клучни зборови: магнетна резонанса

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