the learning process. Pascal is used to implement a mathematical model of the pyramidal cell and to simulate the changes of the properties of the particular synapse in time during the learning process. It is possible to simulate synaptic properties such as conductivity, sensitivity, spacing effect, desensitization, forgetting, phosphorylation, the number of the NMDA and AMPA (alpha-amino-3-hydroxy-5-methyl-4-isoxazolepropionic) receptors, and monitoring the status of pyramidal cell parameters. The computer implementation of pyramidal cell makes it possible to easily analyse and verify the model at both conceptual and mathematical level, and provide a guidance to experimental research, determining what sort of new data might serve falsification or corroboration of the model. This is a new original explanation of the molecular and cytophysiological mechanisms involved in the memory formation at cell level. This model can explain short- and long-term memory formation.

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Association between pontocerebellar pathway atrophy and magnetization transfer ratios in multiple system atrophy

H. Naka[1], E. Nomura[1], H. Kajikawa[1], S. Nakamura[1], Y. Imon[2], T. Ohshita[2], K. Honjo[2], Y. Mimori[2] and M. Matsumoto[2]

[1]*Department of Neurology, Suiseikai Kajikawa Hospital; and* [2]*Department of Clinical Neuroscience and Therapeutics, Division of Integrated Medical Science, Hiroshima University, Graduate School of Biomedical Sciences, Hiroshima, Japan*

Background Multiple system atrophy (MSA) patients exhibit morphological atrophy of the pontocerebellar pathway, including the pons and middle cerebellar peduncle. We recently reported that MSA patients demonstrate decreased magnetization transfer ratios (MTRs) of the pons, middle cerebellar peduncle, putamen, and white matter of the precentral gyrus.

Objective To examine the association between pontocerebellar pathway atrophy and MTRs in MSA with magnetization transfer imaging (MTI).

Patients and methods In 12 patients, both the anteroposterior diameter of the pons and width of the middle cerebellar peduncle were measured on T1-weighted images. MTRs of the corresponding structures were calculated by region of interest analysis.

Results A significant positive correlation was observed between the anteroposterior diameter of the pons and MTRs calculated for both the pons and the middle cerebellar peduncle. There was also a significant positive correlation between the width of the middle cerebellar peduncle and MTRs calculated for both the pons and the middle cerebellar peduncle. In addition, a positive correlation was observed between the anteroposterior diameter of the pons and the width of the middle cerebellar peduncle. Finally, a trend for positive correlation of MTRs in the pons and middle cerebellar peduncle was also demonstrated.

Conclusions In MSA, the morphological degree of atrophy of the pontocerebellar pathway appears to be associated with the degree of structural changes in the components of the pathway as measured by MTI. Correlation between the structural diameter and MTR for both the pons and middle cerebellar peduncle was observed, indicating the presence of parallel pathological changes.

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FMRI of the perirolandic region for the foot

S. M. Golaszewski[1], W. Struhal[2], C. M. Siedentopf[3], E. Gallasch[4], F. M. Mottaghy[5], W. Eisner[6], S. Felber[3], F. Fazekas[1], M. D. Dimitrijevic[7] and F. Gerstenbrand[7]

[1]*Department of Neurology, University Hospital of Graz;* [2]*Department of Neurology, Kaiser Franz Josef Spital, Vienna;* [3]*Department of Neuroradiology, University Hospital of Innsbruck;* [4]*Department of Physiology, University of Graz, Austria;* [5]*Department of Nuclear Medicine (KME), Research Center Juelich, Germany;* [6]*Department of Neurosurgery, University Hospital of Innsbruck; and* [7]*Ludwig Boltzmann Institute for Restorative Neurology and Neuromodulation, Vienna, Austria*

Objective The aim of the study was the development of a paradigm for functional magnetic resonance imaging (fMRI) for the investigation of brain activity within the perirolandic region for the foot.

Methods Ten healthy male subjects (25–45 years) were stimulated with a vibrotactile stimulus on the foot. The stimulus was delivered through a fully automated moving magnet actuator with control of frequency (0–100 Hz) and amplitude (0–4 mm). To avoid adaptation phenomena a stimulus wave form was formed as the product of a fixed vibration carrier signal and a modulation term which varied sinusoidally. The carrier frequency was held constant at 100 Hz at a fixed modulation frequency of 25 Hz and a fixed stimulus intensity of 0.05 n throughout the fMRI run. Experiments were performed on a 1.5 tesla MR-scanner. For fMRI, we employed T2*-weighted single shot echoplanar sequences. Post-processing was performed off line with SPM99.

Results fMRI group data of the 10 subjects show brain activity: (1) bilaterally within the secondary somatosensory cortex located in the inferior parietal lobule; (2) contralaterally to the stimulated side within the primary sensorimotor cortex located in the pre- and postcentral gyrus; (3) bilaterally within the supplementary motor cortex medially lying in the superior frontal gyrus; and (4) on the right hemisphere within the anterior cingulate gyrus. Single subject analysis does not constantly show the brain activation pattern for the group.

Conclusion The results hold promise for the applicability of the presented stimulus in the functional diagnosis of patients with perirolandic lesions in the foot area.

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MRI brain and cervical spinal cord changes in motor neuron disease (MND) patients

D. Partyka, B. Tomik, L. Gawronski, A. Pichor and A. Szczudlik

Department of Neurology, Collegium Medicum, Jagiellonian University, Krakow, Poland

Introduction Magnetic resonance imaging (MRI) is performed primarily to exclude MND-mimic syndromes. However, some abnormalities can be detected in MND patients on T2-weighted images.

Objective To estimate the type and frequency of the changes in brain and spinal cord MRI in MND patients i.e. bulbar onset (BO), limb onset (LO) and cases with lower motor neuron signs only (LMNs).

Patients and methods Seventy-three MND patients underwent MRI examination. Brain MRI was carried out in 43 patients (Group A: BO 37%, LO 54%, LMNs 9%) and spinal cord MRI in 55 patients (Group B: BO 24%, LO 74%, LMNs 2%).

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