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## 1 Application of imaging methods in neurophysiology – R. Jech (Prague)

Advances in computer techniques, statistical methods and new diagnostic procedures account for the growing importance of imaging methods in human brain functions research, with the discovery of function-related magnetic resonance (fMRI) as a major turning point. Unlike standard MR, fMRI can detect dynamic signal changes caused by local oxy-: deoxyhemoglobin ratio variation depending on neuronal activity (BOLD – blood oxygenation level dependence). Instead of showing neuronal activity directly, it does so merely by way of local changes in oxygenation and regional blood flow, depending on the actual nervous tissue consumption in the given area. fMRI is a kind of ‘chemical’ variant of evoked potentials as it makes use of similar methods of stimulation. While not actually visualizing the same neurophysiological processes, the two methods can, with some simplification, be combined. Whereas EP provide accurate information on the timing of mechanisms associated with impulse genesis and propagation, fMRI can pinpoint the brain cortex areas involved. Together, the methods offer qualitatively new information on ‘when’ and ‘where’ activation in the brain occurs. Standard MR, too, can be made use of for comparisons with EP, using the principle of statistical analysis, in which the density of each standard-MR voxel is correlated with a selected EP parameter. Similarly as in fMRI, significant results are then visualized in colour on the background of a morphological image of the brain. The areas thus highlighted then show the rate of the statistical dependence of the function parameter under study on the local mass volume. The new methods of analysis and synthesis open up unprecedented scope for learning more about the mechanisms of perception and human mentation.

## 2 Neurophysiological diagnosis of extrapyramidal disorders – P. Kanovsky (Brno)

Neurophysiological methods are helpful mainly for differential diagnosis and detailed identification of different types of extrapyramidal dyskinesia, but equally so in the differential diagnosis of parkinsonian syndromes and complications of Parkinson’s disease. Tremor, myoclonus and torsion dystonia are dyskinetic conditions where neurophysiological diagnosis is practically indispensable. Thus, polymyography and accelerometry are necessary for determining the patterns of tremor and detailed definition of the muscles involved. For precise topical diagnosis of myoclonus there is polymyography, EEG-EMG polygraphy, SEP (for the registration of giant potentials), and jerk-locked back averaging EEG. As for torsion dystonia, polymyography can identify its muscular pattern, while methods such as IPA and turns/amplitude analysis provides closer characteristics of the dystonic muscles. Dystonia can also be verified by tests for reciprocal inhibition of dystonic muscles, or by reciprocal inhibition of the H-reflex. Disordered cortical excitability and inhibition can also be studied with SEP and paired TMS. The scope for neurophysiological diagnosis is limited in

the case of chorea, tic and ballistic dyskinesia. In contrast, EMG is indispensable for anal and bulbar sphincter investigation; SEP for diagnosing cortical dysfunction asymmetry; and event-related EP in searching for signs of dementia. In Parkinson’s disease, the effect of dopaminergic therapy on disordered cortical functions (excitability and inhibition) can be tested with SEP and paired TMS.

## 3 SSRI and its effect on disturbed sleep in panic disorder – I. Valachovicova (Bratislava)

The 1990 ICSD classifies panic disorder as belonging in the group of dyssomnias associated with somatic or psychic disturbances. Characteristic features comprise difficulties in getting off to sleep and multiple nocturnal awakening. These can be put down to anxiety and/or attacks of anxiety. The attacks are accompanied by vegetative symptoms, appear unexpectedly, and cause abrupt awakening from nocturnal sleep. Studies of panic disorder refer to sleep electroencephalogram (EEG) abnormalities of high prevalence, around 70%. Frequent polysomnographic findings include increased phasic activity of REM sleep with numerous movements in sleep, impaired sleep continuity and effectiveness, reduced TSP, and increased rate of sleep stage alternation. Though still a moot point, the role of serotonin in the treatment of panic disorder is now known well enough thanks to our knowledge of SSRI. The use of 12-channel EEG for 24-h monitoring, EEG frequency analysis, sleep analysis and advanced software capable of comparing sleep cycles in 24-h records with sleep cycles in nocturnal hypnograms facilitates drug efficacy rating and therapy monitoring. Significant sleep quality improvement in SSRI-treated patients also had a correlate in the QL index tests.

## 4 Dynamic electrophysiological testing for the testing of clinical complaints in lumbar spinal stenosis – B. Adamova, S. Vohanka, J. Bednarik, L. Dusek (Brno)

A total of 32 patients (17 women, 15 men, aged  $57.5 \pm 13.4$  years) with clinically manifest LSS underwent prospective examination for significant changes in electrophysiological parameters on exertion with quantified walking on travolator and on their correlation with clinical parameters. Rated at the initial tests were: soleus muscle H-reflex, tibial n. F-wave, and m. abductor hallucis MEP – before and immediately after exertion. The following clinical parameters were estimated during the next 2 years’ prospective follow-up: presence of neurogenic claudication, resting low back pain and lumboischialgia, Oswestry score (degree of disability), presence and gravity of LE paresis. Tibial F-wave chrono dispersion was the only parameter marked by significant post-exertion changes; the changes correlated with the persistence or aggravation of neurogenic claudications and pain at rest during the subsequent period, as did the shorter distance covered on the travolator during the initial examination. The other electrophysiological parameters (soleus m. H-reflex, motor evoked potentials) showed no significant post-exertion dynamic changes.

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## 5 **Electrodiagnostic guidelines for the diagnosis of the occupational carpal tunnel syndrome – Z. Kadanka, J. Dufek, J. Hromada (Brno, Ostrava)**

The authors propose standards for laboratory confirmation of occupational carpal tunnel syndrome (CTS). To meet the criteria for a valid claim for compensation, electrophysiological proof has to be established of moderate median nerve damage in the carpal tunnel as required by CR Government regulation No. 290/1995. For standardization, the following tests are proposed: distal median n. motor latency (DML) across the carpal tunnel over a distance of 8 cm (oblique measurement), ulnar n. DML over a distance of 8 cm to m. ADV, and sensory conduction velocity to digit V (to rule out any diffuse process), median n. sensory conduction velocity over a distance of 14 cm to digits II or III, and, as an option, needle EMG from m. APB. Moderate damage to the median nerve in the carpal tunnel is diagnosed on the following preconditions: (1) clinical signs and symptoms of CTS; (2) differential diagnosis; and (3) electrophysiological measurements at a skin temperature of 32–36°C; and with the following criteria: (1) median n. sensory conduction velocity across the wrist to digits II or III <38 m/s or no response; (2) normal DML and ulnar nerve sensory conduction velocity to digit V; (3) median nerve DML >5.3 or no response; and (4) abnormal spontaneous activity in at least two locations measured with needle EMG from m. APB. – Moderate median nerve damage is confirmed if the first two and either the 3rd or 4th criteria are met.

## 6 **Electrophysiology in the diagnosis of autonomic neuropathy – P. Kucera (Bratislava)**

The autonomic nervous system (ANS) is an extensive neuronal network designed to regulate the body's internal environment by maintaining homeostasis and visceral functions control. – The hypothesis of a global toning function of its two components (central and peripheral) working in mutually functional antagonism has become untenable. Modern discoveries shows it as an intricate network of subsystems with selective action on each of the organ effectors mediated by selective pathways and nerves. This makes the diagnosis of ANS disorders very difficult and unfeasible with a simple, yet sufficiently sensitive test. Hence, ANS tests aim to study either the particular autonomic effectors' response to physical, pharmacological and physiological stimuli, or the integrity of autonomic reflex arcs. Prominent among these are electrophysiological methods for the diagnosis of autonomic neuropathies of organ systems (cardiovascular, gastrointestinal, urogenital, skin, etc.). A number of these are discussed. Thus, Ewing's battery of cardiovascular reflexes, now used by many clinical laboratories, has achieved wide clinical use with prospective standardization. The quantitative sudomotor axon reflex (QSART) and the sympathetic skin response tests are particularly useful in clinical electrophysiological practice. Problems still outstanding include: standardization of electrophysiological diagnostic techniques, choice of proper parameters for their evaluation, and their sensitivity and validity.

## 7 **Critical illness polyneuropathy – is it a part of multiple organ failure (neuromuscular failure)? – J. Bednarik, P. Vondracek, Z. Lukas, I. Cundrle, L. Dolezal, L. Dusek (Brno)**

A total of 55 critically ill patients (aged 29–77, mean 54 years) were prospectively examined over a 28-day period for signs of new polyneuropathy and/or myopathy (critical illness polyneuropathy – CIPM). Detailed electrophysiological analysis was carried out during the 1st week of critical illness, and at the end of the follow-up period (including the direct muscle stimulation method) to detect any new CIPM. A number of clinical variables of possible pathogenic influence were examined (age, sex, previous minor polyneuropathy, cumulative dose of non-depolarizing muscle blocking agents (NDMBA) and corticosteroids, duration of systemic inflammatory response syndrome (SIRS), daily total sepsis-related organ failure (SOFA) score. – The 28-day evaluation was completed in 30 patients; early mortality was 42%. New neuromuscular complications were detected in 53% at the end of the follow-up, polyneuropathy in 33%, myopathy in 13%, and polyneuropathy in 7%. An increase in the 28-day total SOFA scores came out as the salient indicator of developed neuromyopathy ( $P < 0.001$ ). The respiratory and CNS SOFA scores

were found significantly correlated with the development of neuromuscular complications in the critically ill. SIRS tended to be longer in the neuromuscular complications group ( $P = 0.068$ ) while signs of SIRS were lacking, and other parameters (including the cumulative dose of NDMBA or corticosteroids) were found unrelated to the development of CIPM. – Summed up, the aetiological influence of MOF and other factors (SIRS, corticosteroids, NDMBA) on the development of particular types of neuromuscular complications has yet to be proved. The rate of CIPM relative to the failure of other organs supports the concept of CIPM as a part rather than a consequence of MOF.

## 8 **Myotonic dystrophy – scope for diagnosing its congenital form – J. Kraus, A. Boday, V. Matoska, Z. Musova, T. Marikova, J. Haberlova (Prague)**

Myotonic dystrophy (DM1) is a multi-system disease of pronounced intra- and interfamilial variability, 1:8000 incidence, and autosomal dominant inheritance with the phenomenon of anticipation. Genetically altered RNA accumulated in the cell nucleus will cause; (a) myotonia owing to chloride channel splicing; and (b) diabetes owing to insulin receptor abnormality. The molecular cause of DM1 lies in dynamic mutation of the gene for myotonin protein-kinase on chromosome 19 affecting neighbouring genes (SIX5 and DMWD). The altered gene contains amplification of triplet repetitive CTG sequences. The PCR method together with Southern's analysis helped to find amplification in 18 families (44 cases). At least three generations were analyzed in seven families with 26 patients. Four children have congenital DM1 with positive family history. When they were born, their mothers' age was 25–34 years; two mothers show signs of DM1, one mother died at the age of 38. Polyhydramnios was seen in two pregnancies. One childbirth was induced, two were by C-section in the 35th–36th weeks, amniotic fluid turbidity was seen in two cases. All children were born hypotonic and poorly adaptable. Three had pedes quinovari. Signs of myotonia appeared in two at the ages of 3 and 11 years, respectively, in another boy with a typical phenotype, now 12, there is no myotonia at all. Retarded psychic development and hydrocephalus are present in three children. Molecular genetic tests corroborated DM1 at the age of 1 month up to 12 years. – The rate of CTG expansion is not a reliable criterion of the gravity of DM1 as the expansion of triplets is different in different tissues of each individual. Only infants ventilated for longer than 1 month have their lifetime curtailed to 15 months (even in cases where artificial ventilation had been discontinued before). Hence, clinical prudence is crucial in assessing the patient's condition.

## 9 **Three indices of distal median nerve conduction and their potential uses in diagnosing the carpal tunnel syndrome – F. Cibulcik, E. Kurca (Bratislava, Martin)**

Apart from a detailed assessment of the patient's subjective complaints and objective neurological tests, non-invasive diagnosis of the carpal tunnel syndrome (CTC) makes use of electroneurography (ENG), EMG, ultrasound and MRI, with the first two methods retaining their importance. – The orthodrome technique (median n. stimulation in the middle of the palm of the hand and registration in the wrist) was used to establish the mixed conduction velocity (MCV) in the carpal tunnel, the antidrome technique (median n. stimulation in the middle of the palm and registration from digit 2) – to measure the sensitive conduction velocity (SCV) in the terminal part of the median nerve (AN2). Antidrome stimulation of the median nerve in the wrist and registration from digit 2 helped to establish SCV along the two above sections of the nerve (AN1) and to produce the following three indices: PDI (proximal-distal index) representing the MCV:SCV ratio. PI (partial index 1) is the ratio of MCV through the carpal tunnel and SCV all along the nerve from the wrist to digit 2. PI 2 (partial index 2) is the ratio of SCV in the terminal part of the nerve from the middle of the palm of the hand to digit 2 and SCV all along the nerve from the wrist to digit 2. A group of healthy subjects and a group of CTC patients were investigated. On the basis of the results obtained, the diagnostic relevance of standard neurogram (AN1 AN2, ON) and the three indices (PDI, PI 1, PI 2) is discussed.

### 10 Thermal threshold testing – normative values and intraindividual variability – E. Moravcova, J. Bednarik (Brno)

A total of 50 healthy volunteers (25 women, 25 men) were examined in order to assess the normative values and intraindividual variability of the thermal threshold values. Nicolet Sensation II software and Peltier's contact thermal stimulator were employed for the purpose. Three algorithms were used: two methods of reaction time identification (RTI) – Limits I and II (random variant) and one method of constant stimuli – Levels, in two sites – thenar of left hand and dorsum of right foot. A total of 30 persons had all the tests repeated within one week for intraindividual variability assessment. The value of CS decreased and that of WS increased significantly in patients over 40, showing the need for different limits for that particular age group. In contrast, sex was found to have no significant influence on thermal threshold values. These were, however, significantly influenced by the type of tests (lower CS values and higher WS values in RTI tests) and by the speed of temperature change in RTI tests (lower CS values and higher WS values when a slower speed was used). Intraindividual variability was <3% in the upper extremities, and <7% in the LE, i.e. acceptable for longitudinal use of the TTT method.

### 11 Postural responses to lower limb muscles vibration in patients with cerebellar lesion – M. Saling, I. Lisa (Bratislava)

Patients with cerebellar lesions were studied for disordered kinesthesia due to limb movements. The aim was to analyze such patient's ability to perceive vibration-induced postural responses while standing upright. Vibration of different LE muscles makes the body adopt direction-specific postures. Postural responses in subjects standing upright were stabilographed in the course of 50 s. Vibrations ( $f = 100$  Hz, amplitude = 1 mm) were applied to the muscle bellies 10 s after the start of registration in the following combinations: m. tibialis anterior bilaterally, m. soleus l. dx + m. tibialis anterior l. sin., and vice versa. In healthy subjects, muscle vibration caused a gradual change of body posture until a new equilibrium was reached. The subjects were able to describe the direction of the tilt. The same process in patients with cerebellar lesion ended in a fall. The direction of the tilt was the same but the patients were unable to describe it even in the case of a fall. The results are evidence of the cerebellar patients' reduced power of adaptation to the vibration of postural muscles, as well as of impaired perception of evoked postural responses.

### 12 Does chronic use of botulotoxin influence neuromuscular jitter? – S. Vohanka, J. Bednarik, B. Adamova, D. Adamova (Brno)

Seven patients treated with botulotoxin A (BTXA) for abnormal movements were examined with the method of stimulated single-fiber myography from the extensor digitorum communis m. according to Trontelj and Stalberg to estimate the individual neuromuscular jitter of 20 neuromuscular junctions and average jitter. The group were examined in 1993 and again 7–8 years later, 2000–2001, each time just before the BTXA effect was out. The average cumulative dose of BTXA applied was 2963 u. (Botox<sup>®</sup>) was always applied off the area of the muscle examined. In 1993, the average MCD value was 20 us (15–25 us), in the years 2000–2001 – 21 us (17–26 us), on subtracting the envisage effect of age, the difference was 0.5 us. The overall average value of all individual jitters (pooled data) was 19.46 us (SD 8.59 us) in 1993, as distinct from 21.01 us (SD 9.76 us) 7–8 years later. The differences were non-significant ( $P = 0.59$ , or 0.23, respectively). No abnormal value was found in any of the tests. As the study showed, chronic treatment with BTXA, however long, has no effect on neuromuscular transmission in distant muscles.

### 13 Antidrome neurogram of medial plantar nerve in the diagnosis of diabetic neuropathy – E. Kurca, P. Kucera (Bratislava)

Along with angiopathy, retinopathy and nephropathy, neuropathy is the most frequent organ complication of diabetes mellitus. Its basic diagnosis is based on: (1) the patient's subjective complaints; (2) objective clinical tests; (3) conduction studies of motor and sensory fibres (electroneurography – ENG); (4) quantitative tests of selected modalities of superficial and deep sensitivity; and (5) quantitative tests of selected ANS functions. Peripheral ENG has long now been the 'gold standard' in diagnosing diabetic neuro-

pathy. In our study, a group of healthy subjects (men, women aged 20–40 years) and an age- and sex-matched group of patients with type-I diabetes mellitus with asymptomatic or moderately symptomatic neuropathy (fatigability, paresthesia, LE convulsions). A standard antidrome neurogram of the sural nerve and a homolateral antidrome neurogram of medial plantar nerve were made (registration with ring-shaped electrodes from the thumb, conventional middle phalanx stimulation). The results confirm a markedly higher rate of detection of neuropathy yielded by the medial plantar nerve neurogram compared with sural nerve neurography. This logically due to the fact that diabetic and many other neuropathies affect the longest nerve fibres. Technically speaking, medial plantar n. ENG is a very simple affair, yet, surprisingly enough, clinical practice continues to make routine use of surgical nerve ENG alone.

### 14 Analysis of motor units in patients with dilation and conduction cardiomyopathy – S. Vohanka, M. Vytopil, Z. Lukas, L. Dusek (Brno)

A total of 37 patients with dilation cardiomyopathy or major dysrhythmia requiring pacemaker implantation (age at complaints manifestation <40 years) and found to have no other cause (IHD, alcoholism, etc.) had electromyography (EMG including quantitative analysis of motor unit potentials – MUP) and muscle biopsy performed.

Histological tests were rated as normal, borderline tending toward myopathy, and as myopathic. MUP analysis was rated from degree 0 (normal) up to degree 5 (five and more abnormalities in the parameters under study: amplitude, width, outliers). No statistically significant relation was found between the degree of EMG pathology and histological test results (contingence table test:  $P = 0.442$ ). Greater MUP abnormality (degrees 4 and 5) though, was found solely in patients with a histological picture of myogenicity (statistically inconclusive). Of prognostic significance for the results of histological tests were the average values of MUP amplitude ( $P = 0.037$ ) and width ( $P = 0.022$ ) in m. vastus lateralis; as for the amplitude, it is also possible to find a discriminatory (cut-off) value tending toward a myogenic lesion: this is predicted by an average amplitude <700  $\mu$ V. A similar predictive quantity was found in the width of average MUP values in the deltoid m. ( $P = 0.077$ , discriminatory borderline = 8.3 ms). Tests of the biceps brachii and anterior tibial muscles failed to show any significance in this respect.

### 15 Congenital monomelic LE atrophy with mixed central and peripheral motor neuron lesion due to developmental anomaly of lumbar intumescence and caudal roots – an electrophysiological study – P. Jombik (Zvolen)

Congenital developmental anomalies of extremities taking the form of hypogenesis or deformity may be caused by primary disorder in the development of bones, muscles, neuromuscular junction or peripheral motor neuron. These anomalies are often associated with disordered development or incomplete closure of the neural tube with signs of occult or manifest spinal dysraphism. Some forms of the former may lead to a progressive neurological deficit later in life, though this can be prevented if diagnosed and treated in good time. The case is presented of a girl with congenital hypogenesis of the distal part of a LE with signs of central and peripheral motor neuron involvement and minor peripheral sensory neuron affection, with radiological pictures within norm. EMG, NCS, F-wave study, tibial SEP and MEP show predominant involvement of peripheral motor neuron segments S1 and 2. Markedly reduced motor conduction velocity, mostly in the proximal segment, is indicative of caudal roots hypomyelination. The right LE central motor neuron damage is topical evidence of simultaneous focal lesion of the lumbar intumescence.

### 16 Somatosensory evoked potentials in vertebrogenic myelopathies – E. Pristasova, G. Timarova, A. Mäsiar (Bratislava)

A total of 35 patients with clinical signs of cervical myelopathy (CM) and MR evidence of primary and/or secondary stenosis of cervical spinal canal were tested for SEP after stimulation of median nerve (NM) (25 persons) and posterior tibial n. (NTP) (20 patients) in a total of 95 tests. The most frequent abnormalities were prolonged N9–N13 conduction time

and low N13 and N20 amplitudes on NM stimulation, and low P40 amplitude, its prolonged latency and longer central time of conduction after NTP stimulation. MR signs of cervical myelopathy were found in 10 patients (28.3%). Abnormal SEPs were seen in 13 patients (52%) on NM stimulation, and in 18 patients (90%) on NTP stimulation. – There was considerable NTP-SEP sensitivity to CM, and lower NM-SEP sensitivity, though still markedly greater than MR-defined myelopathy in terms of structural spinal-cord changes. Since there is no known prevention of CM, early surgical decompression may prevent progression of the disease. In Takahashi's group, 56% patients with MR-increased signal in T2-weighting in the cervical spinal cord failed to improve in contrast to the group without abnormal signal where only 15% failed to improve (Takahashi et al., 1989). SEP sensitivity to spinal cord conduction disorders was very high in our group (higher than MR sensitivity to signs of CM), which is why in the strategy of early surgery for CM it features as a highly sensitive, non-invasive diagnostic method.

#### 17 Paired transcranial magnetic stimulation in patients with Parkinson's disease – M. Bares, P. Kanovsky, H. Klajblova, I. Rektor (Brno)

The purpose of the study was to determine the effect of dopaminergic stimulation on intracortical excitability in early Parkinsonian disease patients with no history of dopaminergic therapy. A total of 10 Parkinsonians were examined with paired TMS before, after 3 and after 6 months of levodopa treatment. Paired stimuli (inter-stimulus intervals of 3, 5, 7, 10, 15, 20, 100, 150, 200, 250 ms; first stimulus – subliminal, second stimulus – supraliminal) were mixed at random with single stimuli. – A significant difference in intracortical inhibition and intracortical facilitation was found between PD patients prior to starting levodopa treatment and healthy individuals ( $P < 0.5$ ). There was no significant difference in the impaired intracortical excitability of Parkinsonians after 3 months of treatment with levodopa. However, after 6 months of treatment, a statistically significant difference was found when compared with starting values. The PDRS scale was significantly lower as early as 3 months from the start of levodopa therapy in patients with PD. Neither the motor threshold nor long ISIs (100, 150, 200, 250 ms) differed from the control group values throughout the period under study. – The changed intracortical excitability after 6 months of levodopa treatment suggests that neuronal subcortico-cortical inhibitory and facilitatory circuits are modulated by induced dopaminergic stimulation. The difference between clinical improvement of PD patients after 3 months of levodopa treatment and the immutable parameters of intracortical excitability compared with the initial values appears to be due to improvement in the basal ganglia as a result of dopaminergic stimulation with its effect on the situation in the motor cortex.

#### 18 Diagnostic spectrum of VEP application in neurology – J. Chlubnova, J. Kremlacek, M. Kuba (Hradec Kralove)

VEP examination is a non-invasive method for diagnosing neuro-ophthalmological disorders. However, pattern-reversal VEP are practically the only ones in clinical use. Their parameters depend strongly on visual acuity, and they can only test the parvocellular part of the optic tract. Hence, the parallel use of moving stimuli targeting the magnocellular system. The authors have tested two types of motion-onset VEPs: (1) linear motion of low contrast and low spatial frequency pattern – M-VEP; and (2) centrifugal radial motion ('expansion') E-VEP. The diagnostic value of VEP is greater if a combination of standard (R-VEP) and extended (M-VEP, E-VEP) is used. During the past 5 years, 296 neurological patients were examined using this combination. Monocular VEP from six unipolar derivations: Oz, Or, Ol (5 cm to the right and left of the Oz position), Cz, Pz, and Fz were recorded and evaluated against the A2 reference value. – Five subgroups of cases could be diagnosed on clinical suspicion: suspected demyelination – 60%, definite multiple sclerosis – 10%, borreliosis – 7%; these together represented the largest group. Next came cephalaea (7%) followed by arachoiditis, various traumatic lesions and other types of brain involvement – 16% taken together. In all these subgroups, combined VEP examination, including the two types of motion-onset VEP, increased sensitivity by about 28% against tests using PR-VEP alone.

#### 18 Anatomical aspects acting on visual evoked potentials in healthy persons – R. Jech (Prague)

Visual evoked potentials (VEP) are the most variable modality of EP in humans, apparently due to the great anatomical variability of striatal and extrastriatal cortex, i.e. where VEPs are generated. The purpose of the study was to bring quantitative proof of anatomical connections between sight and basic VEP parameters. – VEP, ERG and MR of the brain were studied in 37 healthy volunteers (30 women, 7 men,  $41 \pm 10$  years). VEP and ERG were elicited by means of monocular all-field stimulation with a b. + w. chequered stimulus (square size  $126'$ , white brightness  $120 \text{ cd/m}^2$ , contrast 99%), at 2 Hz reversion. MR (1.5T; fast-field 3D) yielded from each subject 54 axial T1-weighted 3mm sections (TR = 35 ms, TE = 10 ms, FA = 45). VEP-MR synthesis was done in two ways: (1) linear regression of the length of each optic tract segment with retinocortical time (RCT) and subsequent comparison with velocity calculated from the share of length and RCT; and (2) voxel-wise correlation analysis of each voxel of white and grey matter with P100 latency and N70/P100 amplitude. The results showed RTC as being a function of the optic tract length. According to linear regression, the tract lengthening of 1 mm makes for an 0.5 ms increase in RCT, consistent with conduction velocity of some 2 m/s as well as with the velocity expressed in terms of total length relative to RCT. Hence, the agreement of the two results suggests that the P100 is generated while the signal enters the primary visual cortex. The result is in conspicuous agreement with the velocity estimated from the predicted properties of myelinated axons  $0.5 \mu\text{m}$  in diameter, or with that of thalamocortical reverberation estimated from the EEG alpha rhythm. Moreover, the only significant white-matter areas in positive correlation with the N70/P100 amplitude were the dorsal poles of the two occipital lobes where the white matter adjoins the primary visual area, highlighting that part of the white matter which is intersected by a projection from the foveal region which is crucial for the induction of VEP.

#### 19 Meta-analysis of enlarged visual evoked potentials in multiple sclerosis – J. Szanyi, M. Kuba, J. Kremlacek, R. Talab, J. Zizka (Hradec Kralove)

Diagnosing multiple sclerosis (MS) early enough still poses problems. We are still in the dark as to the correlation between clinical signs and symptoms, evoked potentials (EP) and MRI. The aim of the present study was to compare the sensitivity of VEP and MRI relative to MS. – 67 patients with suspected MS had clinical examination, VEP tests and MRI scans performed; definite MS was diagnosed conclusively in 39 of them. All had the parvocellular and magnocellular subsystems of the optic tract examined separately by means of pattern-reversal VEP and motion-onset VEP. The former were found abnormal in 23 (P100 latency of  $141 \pm 23$  ms), the latter in 17 patients (N160 latency =  $186 \pm 24$  ms). The combined VEP examination proved optic nerves demyelination in 64% of the MS patients. MRI was sensitive in 79% of the group. However, in four normal-MRI patients (10%) at least one of the two VEP variants was delayed. Normal MRI and VEP in clinically straightforward MS were seen in 4 cases (10%). The results strongly support the combined use of VEP + MRI as a means of increasing the sensitivity of early diagnosis of MS.

#### 20 Visual event-related EP in the diagnosis of young children's ADD and ADHD – S.E. Petranek (Prague)

A total of 20 pre-school children aged 5–6 years (14 boys, 6 girls) suffering from the MBD (ADD, ADHD) syndrome were tested. Their IQ was within physiological norm, they were free from visual defects, and used no medication. The control group consisted of 15 age-matched children (10 boys, 5 girls) rated as problem-free by their kindergarten teachers, also without visual defects and using no medication. Odd-ball-type visual ERP were used: a red circle, 6 cm in diameter, on a black background as the non-target stimulus, and a red triangle, 6 cm high, also on a black background, as the target stimulus. The task was to press the computer mouse button on the appearance of the target stimulus. Under study was the latency of N1, P2, N2 and P3 and the amplitude of N2 and P3 in response to the target stimulus, and N1 and P2 latency – to the non-target stimulus. The MBD group showed a significantly prolonged P3 latency (91

ms on average) and a significant decrease in P3 amplitude (12  $\mu$ V), a significantly prolonged N2 latency (42 ms on average) and a significant decrease in N2 amplitude (6  $\mu$ V on average) in comparison with the controls. The rest of the parameters showed no statistically significant differences. – The idea was to find the simplest possible tests for everyday practice. The age group was chosen with regard to the often emphasized need for an early diagnosis and early start of treatment for the best results. Repeated proof of prolonged P3 latency points to a dysfunction of the process of categorization within conscious detection of changes. N2 latency prolongation then suggests that in many cases there is also a dysfunction of automatic information processing. For MBD diagnosis, it seems useful to include P3 scrutiny in the series of routine tests (psychological tests, neurological examination, EEG and/or social investigation).

#### **21 ERD/ERS and P300 in a visual oddball paradigm: an SEEG study from mesial temporal structures – D. Sochurkova, M. Brazdil, P. Jurak, I. Rektor (Brno)**

The simultaneous occurrence of ERD/ERS (event-related de/synchronization) and P300 in a visual oddball paradigm was studied in patients undergoing SEEG in preparation for surgical treatment for epilepsy. Phase-linked (P300) and phase-non-linked (ERD/ERS) responses were studied in 6 patients. EEG data from mesial temporal structures (amygdala, hippocampus, gyrus parahippocampalis) were analyzed with two methods: (1) averaging with evoked potential induction (P300); and (2) performance and amplitude analysis using comprehensive demodulation with ERD/ERS expression in the theta (4–7 Hz), alpha 1 (8–10 Hz), alpha 2 (10–12 Hz), beta (16–24 Hz) and gamma (35–45 Hz) bands. EP was subtracted from each run prior to demodulation. The two phenomena were rated separately after target and frequency stimuli. Target stimuli repeatedly induced the P300 wave and altered oscillation in the theta and both alpha bands in all the structures under study. Only subtle changes of no significance were noted in response to frequency stimuli. No amplitude or performance changes were found in the gamma band. The most significant and constant parallel occurrence of both phenomena was seen in the hippocampal formation. Visual information processing in an event-related oddball paradigm was accompanied by the simultaneous presence of both electrophysiological phenomena. Changes of oscillation in theta and alpha bands were found in phase-linked ERP (P300).

#### **22 Intracerebral registration of event-related evoked potentials – M. Bares, I. Rektor, P. Kanovsky, H. Streitova (Brno)**

The aim was to study cortical and subcortical structures involvement in the processing of sensory and event-related information. – 21 patients with intractable frontal/temporal epilepsy had intracerebral registration of contingent negative variation in an audio-visual paradigm with motor tasks performed from different cortical areas (primary sensorimotor – SM1, supplementary motor area – SMA, premotor and dorsolateral prefrontal cortex – DLPC) and basal ganglia – BG. Under scrutiny were medium- and long-latent evoked potentials (EP) in response to acoustic and visual stimuli. – Event-related EP generators were found in four time intervals (70–120, 120–200, 200–300, over 300 ms). (1) EP after acoustic stimulus: a statistically significant presence of EP was in excess of 120 ms in the SMA, DLPC, premotor cortex and basal ganglia, in excess of 200 ms in SM1. In the 70–120 ms interval, the occurrence was significant in the SM1, DLPC and premotor cortex. EP after visual stimulus: a statistically significant occurrence of EP over 120 ms was in the SM1, SMA, premotor cortex and DLPC (except in the 200–300 ms interval – SM1). EP occurrence was significant in the BG ( $P < 0.05$ ). (2) No statistically significant difference in EP latencies was seen between the cortex and BG. – SM1, SMA, DLPC and premotor cortex and basal ganglia constitute a cortico-subcortical circuit important for the generation of medium- and long-latent EP in the motor task event-related paradigm. Sensory and event-related information with a motor task is processed in parallel in different areas of the cortex and basal ganglia.

#### **23 Somatosensory ERP in an oddball paradigm – an intracranial study – M. Brazdil, I. Rektor, R. Roman, P. Daniel (Brno)**

Independence of sensory modality and physical parameters of stimuli is a characteristic feature of ERP (event-related potentials) elicibility. Hence, ERPs – including their P3 component – can be elicited by visual and somatosensory as well as conventional auditory stimuli. While visual and auditory ERPs have repeatedly come under study by means of intracerebral registration, this is not the case of somatosensory ERPs. – As part of their pre-operative preparation, seven pharmaco-resistant epileptics had, for purely clinical reasons, long-term invasive video-EEG performed by means of intracerebral and/or subdural electrodes. The group consisted of 6 men and 1 woman aged 19–37 years (mean 26.3). To assess the part played by different cortical structures in the development of somatosensory ERPs, the patients underwent a simple oddball paradigm test in bilateral somatosensory stimulation of the median nerve during the video-EEG monitoring. Square-wave electrical pulses of 1 ms duration and stimulation intensity double the individual 'subjective sensitive threshold' were used for the purpose. Target stimuli were applied at random to the dominant extremity, frequency stimuli to the non-dominant extremity at a ratio of 1 to 5. On averaging, the target stimuli elicited a series of EEG potentials with the P3 component predominating on the scalp and in a number of brain structures. Mesiotemporal and prefrontal cortical structures on both sides were intracerebrally identified as the most prominent P3 generators. No significant difference was found in the localization of somatosensory generators and the previously examined visual ERPs.

#### **24 EEG coherence changes in dementia – M. Brunovsky, P. Novackova, M. Matousek (Praha)**

The EEG picture of dementia in Alzheimer's disease (AD) is marked by a growing representation of slow activities. The rate of cognitive function loss in AD is correlated with the degree of EEG slow-down in terms of EEG coherence changes. The aim was to try and determine this degree (characterized by the value of MMT) by using the model of multiple regression. A total of 38 patients (mean age 70.76 years) with AD dementia diagnosed according to DSM-III-R were investigated by clinical means, by MMT scoring (mean value 18.16), and by EEG using spectral analysis and determination of local, longitudinal and transverse coherences in six EEG bands (delta, theta, alpha 1, alpha 2, beta 1 and beta 2). The multiple regression model was then used to estimate the degree of cognitive function impairment from the EEG record. Among the findings were a significant decrease in longitudinal intrahemispheric coherences in the alpha band markedly correlated with the degree of dementia ( $P < 0.05$  and  $P < 0.01$ ), and a significant increase in the longitudinal and transverse coherences in the delta band, also significantly correlated with the degree of dementia ( $P < 0.05$ ). The use of variables obtained from spectral analysis calculations and longitudinal coherences permitted us, in the multiple regression test, to estimate the degree of cognitive function impairment (expressed in terms of MMT) with a fairly high precision ( $r = 0.81$ ). – Estimation of EEG coherence changes can facilitate the diagnosis and degree of gravity of AD since coherences appear to be a more sensitive indicator than other methods of EEG estimation and processing.

#### **25 Ictal and postictal symptoms of lateralization – video presentation with examples of epileptic paroxysms – M. Tomasek, P. Marusic (Prague)**

Ictal and postictal symptoms of lateralization permit to identify the symptomatogenic zone of epileptic attack development. A systematic analysis is presented of further significant symptoms – automatisms with preserved ability to react, asymmetric tonic posture of extremities, postictal hemiparesis, postictal aphasia and postictal nose rubbing – with examples of cases monitored at the Video EEG Monitoring Unit of the Teaching Hospital MOTOL Department of Neurology.

**26 Cumulation of paroxysms and status epilepticus in the 2nd trimester of pregnancy (Case report) – D. Trstensky, E. Kurca, B. Pithova, M. Drobny, B. Saniova, D. Masarova, J. Zelenakova (Martin)**

The case is presented of a 26-year old woman with a 9-year history of partial epileptic paroxysms of complex symptomatology linked to the menstrual cycle. In the 23rd week of her first pregnancy, she was admitted in the department of neurology for an increased rate of diverse types of partial epileptic attacks. In spite of intensive peroral and intravenous therapy, the rate of seizures went on increasing up to 6/h when the patient ceased coming round between attacks. The paroxysms contained a minimal convulsive motor component while EEG revealed generalized spike-wave activity of around 3.5 Hz. Referred to the department of anaesthesiology and intensive medicine, the patient had barbiturate coma induced with artificial pulmonary ventilation. However, the cumulation of paroxysms and status epilepticus continued until valproate was given i.v. The rather rare occurrence of status epilepticus in pregnancy and problems of its management are discussed with particular view to the fact that three quarters of the cases so far described by other authors were women in the third trimester of pregnancy.

**27 Epilepsy and sleep – different types of interaction – E. Nesporek, P. Busek (Prague)**

The epilepsy – sleep interaction can be divided into two categories: sleep action on epilepsy and epilepsy action on sleep. Sleep, especially sleep deprivation effects on epilepsy are sufficiently well described as are sleep structure disorders in severe, mainly temporal types of epilepsy. Our communication aims at highlighting some of the rather rare cases of sleep being influenced by epilepsy, in particular: (1) epileptic seizures associated with the deeper stages of NREM sleep; their frequent occurrence during the night may lead to sleep deprivation; (2) epileptic seizures linked solely to the sleep onset – frequently marked by clinical and EEG quiescence in vigilance and in sleep. Sleep-onset-linked paroxysms pose a diagnostic problem, and may lead to more serious sleep-onset disorders; and (3) ictal awakening. Many clinically manifest attacks are preceded by brief awakening, sometimes the only clinical sign of an abortive epileptic process. Hence, the authors are inclined to believe that the paroxysm is the primary feature and that the awakening comes as its consequence, and not the other way round.

**28 EEG analysis during hypnagogium – J. Faber, T. Tichy, M. Novak, P. Svoboda, V. Tatarinof (Prague)**

Ethological conditions and time reactivity was observed during EEG recording in 40 persons. The clinical set consists from 18 healthy students, 12 epileptic and 10 persons with dementia. Spontaneous and provoked changes of consciousness are defined by thalamocortical reverberation system (TCRS), which activity is quite easy observable by EEG curve and its analysis: we used fast Fourier transformation (FFT), the 20th digress polynome (POL) and non-linear functions (attractor, ATR) calculated offline from digitalized EEG curves during lucid vigilance, reaction time up to (RT) 400 ms, relaxation (RT up to 800 ms) and somnolence (RT more than 800 ms). We found RT delay in good correlation with results of all three analytical methods: the longer time the higher delta and lower alpha activity in EEG spectrum and the looser shape of attractors. However the

relaxation state is a little exception, the RT is prolonged simultaneously with alpha power increasing. We are able distinguish the states during 3 s. This phenomenon occurred independently on the cause of delta increasing: sleep, hyperventilation or subclinical epileptic discharges. Hypnagogium is a complex state. We suggest ability of analytical methods represent the EEG information content and indirectly the microEEG, which in shape of impulses of neurons circulates between thalamus and cortex.

**29 Diagnostic spectrum of patients examined in the neurological department sleep laboratory in 1998–2000 – M. Tormasiova, E. Gerocová, Z. Tomori, M. Knapcik (Kosice)**

A total of 75 patients with sleep disorders were examined in the sleep laboratory of Košice University Medical School in 1998–2000. Sixteen of them were referred to us by different neurological centres in Slovakia and 34 by local neurologists and GPs in Košice. The rest (25) presented with insomnia and rhonchopathy on their own account in response to publicity. Our polysomnograph ALICE 3 and portable Night Watch set permit to monitor more than 20 parameters (EEG, EOG, EMG, ECG, snoring registration, blood oxygen saturation, thoracic and abdominal movements, ventilated air flow, body position, limb movements, etc.) for standard diagnosis of sleep disorders. Excessive daytime sleepiness rating is objectivized with the multiple sleep latency tests. A diagnostic spectrum is presented of patients with sleep and vigilance disorders in the form of brief case reports with diagnostic procedures and reference to recent discoveries concerning the etiology and therapy of different types of dyssomnia.

**30 First experience with modafinil for the treatment of narcolepsy – M. Moran (Brno)**

Narcolepsy, a disease with a prevalence of 0.1–0.2%, is marked by imperative excessive daytime sleepiness (EDS), cataplexy, hypnagogic hallucinations and sleep drunkenness, though not all of these symptoms need be expressed. Typical features of EDS as the gravest of the tetrad are: sleep onset suddenness, irresistibility and often even unexpectedness, refreshing nature of daytime naps, multiple episodes during the day, short duration, problem-free awakening. As there is no causal therapy, symptomatic treatment is aimed at EDS and manifestations of excessive REM sleep facilitation. Modafinil as an alpha-1 adrenergic antagonist has no effect on the dopaminergic system but is related to hypocretin in the anterior hypothalamus. Its mode of action is different as regards the site of methylfedinate effect, and range of receptors attacked: modafinil – anterior hypothalamus, periaqueductal grey and pons, methylfedinate – mediofrontal cortex and striatum. The former is now seen as a drug of choice in narcoleptic EDS. – In the 12/2000–9/2001, modafinil was used for the treatment of 6 narcoleptics who failed to respond sufficiently to methylfedinate, ephedrine and piracetam. The results after 6 months of modafinil treatment are compared with an equally large group treated with the conventional drugs. Both groups were simultaneously given equal doses of clomipramine. Modafinil proved to be well tolerated and to have a better effect on EDS control assessed subjectively with the Ullanlin scale, and partially better objectively in terms of the MSLT. The drug is suitable for primotherapy and for chronic treatment of narcoleptics. While it falls short of sufficient control of cataplexy, it is well tolerated. Contraindications include IHD, left ventricular hypertrophy, cardiac arrhythmia, and pregnancy.