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Abstracts

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CARDIOLOGY

1

MYOCARDIAL SPECT IN LEFT BUNDLE BRANCH BLOCK

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On myocardial perfusion SPECT (MPS) images, the frequently observed perfusion defect in the septal region without organic coronary stenosis in patients with left bundle branch block (LBBB) reduces the accuracy of the diagnosis of coronary artery disease (CAD). The aim of our study was to enhance the specificity by using a "disease-specific" reference database containing data of patients with LBBB and a low likelihood of CAD. MPS images of 170 patients with LBBB, studied between 1997 and 2003, were re-evaluated. Of patients imaged with Tl-201, 50 underwent coronary angiography (CAG) within 6 months of the perfusion study. Reconstructed polar maps were compared to a database of images of 14 patients with LBBB, who were retrospectively considered to have a low likelihood of CAD. Diagnostic performances were assessed with ROC analysis. Our method discriminates patients with CAD well from those without this disease (area under the ROC curve: 0.86 ± 0.05, while using a commercial, validated expert system we get: $0.63 \pm \pm 0.08$, $p < 0.05$). The use of a normal database constructed of patients with LBBB improved the specificity of diagnosing myocardial ischaemia on MPS images in our patient group.

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PITFALLS IN THE EVALUATION OF STREES/REST MYOCARDIAL PERFUSION SPECT EXAMINATION

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Aim: Estimate of the diagnostic value of the stress/rest myocardial perfusion SPECT study and correction of the pitfalls of this method.
Material and methods: The examinations were performed by Cardio-C (Mediso), with two fixed detectors in 90 degree, 180 degree rotation, 32 step, 70 seconds time option by step. Coronarography was the reference method to comparison results.
Results: Correspondence of the findings was found at the most of the examinations, but fals-negative and fals-positive results are also obtained in some cases. Technical problems are playing role between the causes of that, but the special status of the coronary circulation and other heart diseases could modify the results, too. The reverse redistribution (Thallium) and reverse perfusion (MIBI) needs a special evaluation and explanation.
Conclusions: The adequate indication and the correct preparation of the patients, the suitable equipments and the consensus of the different experts is very important in the improvement of the diagnostic value.

3

COMPARISON OF THE RESULTS OF INTRACORONARY PRESSURE MEASUREMENT AND STRESS SCINTIGRAPHY

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Background: The myocardial ischemia caused by a stenosis of the coronary artery can be assessed by nuclear perfusion study while the epicardial flow limitation can be measured by intracoronary pressure measurement. The 0.75 value of the fractional flow reserve (FFR) was established as the cut off value for reversible perfusion defect on the stress SPECT examination, but the correlation of the FFR values and the number of segments with reversibility of the perfusion defects has not determined.
Aim: to compare the perfusion defects obtained by stress MIBI SPECT with the FFR values detected by intracoronary pressure measurements concerning the related myocardial segments supplied by the stenotic coronary artery.
Material and methods: We used the echocardiographic 17 segments polar map to represent the left ventricle. The FFR were measured by pressure wire in 21 coronary arteries of 17 patients (9 with prior AMI). The associated 130 segments were projected on the left ventricular polar map. The rate of the segments with reversibility within the region supplied by the stenotic coronary artery (i.e. the number of segments with reversibility divided by the number of supplied segments associated with the measured lesion) and the number of segments with reversibility were compared with the FFR.
Results: The rate of the segments with reversibility found to be correlated better with the FFR values ($r = -0.57$, $p = 0.006$), than the number of segments alone ($r = -0.48$, $p = 0.03$).
Conclusion: During vasodilatation the translesional gradient determines the rate of reversibility of the perfusion defects within the supplied region. For clinical evaluation it seems to be useful to consider the lesion associated segments together with the FFR.

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HOLISTIC POLAR MAP FOR INTEGRATED EVALUATION OF CARDIAC IMAGING RESULTS

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To assess the myocardial territory associated with a coronary lesion, an Access based software was developed for translation of the coronary artery tree into a polar map (PM). The wall motion scores of the 17 left ventricular segments on the echocardiograms were projected also into the "holistic" PM by the same principles as for the nuclear medicine studies.
The generated PMs of the coronary angiography were compared with „real" ^{99}Tc-labelled MIBI single photon emission computed tomography (SPECT) PMs in order to test the accuracy of the localizing method. The overlap between the predicted segments associated by the coronary lesion and the stress perfusion defects (< 80% relative MIBI activity during stress test) was analyzed in the 10 patients after myocardial infarction with a (sub)total coronary occlusion. Furthermore the resting segmental wall motion scores were also integrated on the same PM. The distribution of the total of 170 segments with stress perfusion defects on MIBI SPECT and the rest wall motion abnormalities detected by echocardiography gave positive and negative predictive values of coronary occlusion of 0.94 and 0.81 against SPECT, and 0.82 and 0.76 against echocardiography, respectively.
While the distal part of the subtended territory always showed higher degree perfusion abnormality than the proximal one, the high positive predictive value proved that during the stress condition the perfusion defect could be detected practically all the subtended regions. The low negative predictive value of the coronary lesion for the wall motion abnormality was associated to the remodeling of the entire left ventricle.

5

EXAMINATION OF MYOCARDIAL VIABILITY BY DIFFERENT NON-INVASIVE METHODS (CASE REPORT)

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Myocardial viability, diagnostic techniques

Detecting the viable myocardium several diagnostic techniques can be used. The purpose of our current study is to compare these methods. Patients after myocardial infarction and before revascularization are examined with contrast enhanced cardiovascular magnetic resonance imaging, rest redistribution Tl-201 and nitrate administrated gated Tc-99m MIBI myocardial scintigraphy, 2-D and dobutamine stress echocardiography. We intend to repeat these examinations after revascularization. At this time one case is shown.
The 61-year-old patient had a history of anterior myocardial infarction, hypertension, diabetes mellitus. Because of angina pectoris he underwent coronary angiography which proved severe left main stenosis and three-vessel disease (occl.LAD, sten.DI, sten.OM, occl.RCA). All of the non-invasive diagnostic techniques showed necrosis in the greater part and hibernation in the smaller part or in the territory of the left anterior descending coronary artery. In the territory of the right coronary artery small size of hibernation was detected. During the coronary bypass surgery four vein and one artery bypass grafts were implanted. After the operation the patient was asymptomatic, with high work capacity and without angina pectoris. We experienced improvement of function and perfusion in the myocardium had been considered viable.
Likewise other evidences this case verifies that all of these examinations are capable to identify hibernating myocardiu. After examined all of the planed number of patients we can evaluate the diagnostic value of these methods.

6

THE PREDICTIVE VALUE OF I-131-MIBG AND TL-201 SCINTIGRAPHY FOR HIGH RISK OF CARDIAC DEATH

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Arrhythmias, MIBG-scintigraphy
Implantable cardioverter defibrillator

Backgroung: The damage of sympathetic innervation (SI) and resulting increased circulating catecholamine concentration may be responsible for malignant ventricular tachyarrhythmias (MVT). The implantable cardioverter defibrillator (ICD) is both a therapeutic modality for the pts with MVT preventing arrhythmias and a "detector" registrating continously the frequency and severity of MVT.
Our question was: is there any connection with the severity of the damage of SI "measuring" by MIBG scintigraphy (MIBG-Sc), and the myocardial perfusion detecting Tl-scintigraphy (MSc) and the clinical risk registered by ICD?
Material and methods: We examined (18 patients) with ICD, 10 patients after myocardial infarction (CAD), 8 patients with idiopathic cardiomyopathy (DCM). We performed in every case Tl-Sc and MIBG-Sc. On MIBG-Sc we analysed the diffuse MIBG uptake measuring the mediastinal/heart ratio and the regional abnormality. On Tl-Sc we analysed the severity, the extension of the perfusion abnormality. We compared the findings on MIBG and Tl-Sc ("mismatch") and all of these with ICD registration (frequency and duration of MVT).
Results: In the group of CAD, MIBG uptake was diffusely lower than the normal valne in 8/10 patients, regional abnormality were in 10/10 patients, Tl-Sc showed regional abnormality in 10/10 patients. Comparing the MIBG-Sc and Tl-Sc "mismatch" was detected in 10/10 patients and in 3 clinically severe cases the "mismatch" were the greatest. In the group of DCM pts the MIBG uptake showed both diffuse and regional abnormality in 8/8 patients. On Tl-Sc we could detect inhomogenity in 8/8 patients. "Mismatch" could be found in 8/8 cases, most severely in the 3 cases with severe findings on ICD registration.
Conclusion: In all patients with ICD, registered different severity of MVT, the damage of SI was verified. The "mismatch" between MIBG-Sc and Tl-Sc could be found as well. The most severe MIBG positivity, and the most expressed "mismatch" associated with the most severe clinical signs on ICD registration. Thus the severity of the damage of SI and the expressivity of the perfusion and SI "mismatch" may have a high prognostic value.

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EVALUATION OF MYOCARDIAL STUNNIG BY ECG GATED MYOCARDIAL PERFUSION SPECT

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Myocardial stunning (MS) is characterised by delayed functional recovery after transient ischaemia. ECG gated myocardial perfusion SPECT (G-SPECT) detects myocardial perfusion and function simultaneously. 27 patients with suspition of MS were selected out of a larger patient group referred for assessing myocardial ischaemia by G-SPECT. Myocardial segments with over 70% of the maximal perfusion activity were considered as good perfused ones. Segmental perfusion, wall motion and wall thickening were evaluated (Mediso Interwiew^{R} and Emory Cardiac Toolbox^{R}). Perfusion and functional data were correlated with the localisation and severity of coronary stenoses assessed by coronarography. 59% of the segments showing good resting perfusion with functional deficit were perfused by stenosed coronary arteries while only 40% of those without functional deficit ($p < 0.01$). In segments without transient ischaemia, the difference was more pronounced ($p < 0.001$).
Presence of MS based on G-SPECT evaluation in segments with equivocal signs of transient ischaemia reinforces the evidence of ischaemia. MS in segments without transient ischaemia gives evidence of the stenosis of the corresponding coronary artery.

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PULSE-PRESSURE PREDICTS TRANSIENT MYOCARDIAL PERFUSION ABNORMALITIES DURING DIPYRIDAMOLE STRESS TEST

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Background: There is now increasing evidence that high pulse pressure (PP) is an indicator of large artery stiffness and an independent risk factor of cardiovascular, especially coronary mortality (1). In this study we investigated the relationship between the pulse pressures measured during intravenous dipyridamole (DP) stress test and the results of myocardium perfusion scintigraphy (MIBI) in patients with suspected coronary artery disease.
Material and methods: Study design: retrospective analysis. Patients: 142 consecutive out-patients, who were scheduled for MIBI by cardiologists in 2004. Each patient was routinely monitored (12 leads ECG records, ECG monitor, NIBP measured on the upper arm) during the DP test. Measurements were performed prior to test as baseline (heart rate = HR_b, systolic = SBP_b, diastolic = DBP_b, and PP_b), during the DP administration and at the end of 4 min (…., PP_4). Thereafter MIBI examination was performed. For statistical analysis ROC and chi-square tests were used with SPSS 11.5.
Results: 142 patients (male: 56, female: 86) were recruited to the study. Mean ± ± SD values of female vs. male patients were the following: Age: 54 ± 8.1 *vs.* 57 ± ± 11.3 years. Weight: 76 ± 14.5 *vs.* 84 ± 8.7 kg. SPB: 147 ± 26.1 *vs.* 152 ± 18.0 mm Hg. DBP: 85 ± 8.8 *vs.* 90 ± 10.6 mm Hg. PP_b: 63 ± 18.1 *vs.* 62 ± 14.1 mm Hg, PP_4: 63 ± 17.3 *vs.* 63 ± 15.8, MIBI pos.: 30 *vs.* 31, respectively. In obese male patients (kg > 80) we found that $PP_4 \geq 60$ mm Hg indicates transient myocardial perfusion abnormalities (positive MIBI) with a sensitivity 80% and specificity 70% (AUC: 0.792, $p < 0.05$). Significantly more frequent positive MIBI tests were found in patients with $PP_4 \geq 60$ mm Hg in this high-risk group ($p < 0.01$). However, in obese female patients (kg > 65) PP_4 was not a reliable predictor of positive MIBI examination (AUC: 0.673, 55.2%, 58%, NS, respectively).
Conclusions: In multi-risk patients (male, obesity) a high PP_4 may indicate transient myocardial ischemia detected by MIBI examination, which has a diagnostic importance regarding the coronary morbidity. Our results are supported by studies which emphasize the high pulse pressure as a strong predictor for cardiovascular mortality (2). Further prospective examinations are warranted in a larger patient population, stratified according to the body mass index (BMI).

ANGIOLOGY

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LYMPHOSCINTIGRAPHY IN PATIENTS WITH CHRONIC VENOUS INSUFFICIENCY

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Aim: To evaluate of the lymphatic flow abnormalities by lymphoscintigraphy (LS) in patients with severe stages of chronic venous insufficiency (phlebolymphedema, leg ulcer).
Material and methods: LS was performed in 68 patients with clinically suspected secondary lymphedema. Thirty-eight patients had chronic venous insufficiency (group A) and 30 leg ulcer with venous-origin (group B). A normal value was calculated on the basis the LS results in 10 normal extremities (control group). In patients with pathological LS side difference score (SDS) was also calculated and in the group B SDS was compared with the clinical edema score (CES).
Results: In group A LS revealed decreased lymphatic flow in 32 patients (84%) and was normal in 6 cases (16%). The disease was bilateral in 24 cases without any clinically proven side difference, although LS showed side difference in 15 of them (62%). In group B in 26 cases (87%) LS showed abnormal finding and was normal in 4 cases (13%). In 5 cases without clinical evidence of asymmetry, with LS side difference was verified. In the group B patients with unilateral disease SDS showed significant, although weak and negative correlation with CES ($r = -0.3$, $p < 0.02$) suggesting relatively increased lymphatic flow.
Conclusion: LS can be helpful to clarify the characteristics of the secondary lymphedema. In group A the results of LS give additional information for reconsideration of classification and therapy planning. In the unilateral leg ulcer group increased lymphatic flow might be a compensation of decreased venous flow.

NEUROLOGY

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COMPARISON OF THE SPECT INVESTIGATIONS PERFORMED WITH STRIATAL PHANTOM

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Aim: The aim of this study was to investigate the intra- and interobserver variability of the visual and semiquantitative evaluation of the striatal SPECT phantom images.
Material and methods: The three-dimensional, tissue-equivalent phantom was alternatively filled with ^{123}I and ^{99m}Tc radioisotopes, respectively (rest brain compartment: 5 kBq/ml, striatal compartment: 25 kBq/ml). Images were performed on three SPECT devices, using the same protocol. The phantom was investigated on an MR equipment as well. Images were evaluated by three independent observers. The ratios of the frontal and occipital striatal regions were semiquantitatively determined using the ROI technique, based on MR images.
Results: There were no differences between the visual results. From the three different SPECT investigations, the ratio of the dispersions and medians, in percentage was found to be: 8,15/9,5/7,5% for ^{99m}Tc; and: 9.8/11.5/8.1% for ^{123}I, respectively.
Conclusion: The visual and the semiquantitative analysis proved to be perfectly reproducible. There was no correlation between the results, and the investigator, the equipment type, or the used radioisotope.

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ECONOMIC IMPACT OF PARKINSONCS DISEASE — THE IMPORTANCE OF EARLY AND CORRECT DIAGNOSIS

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Parkinson's disease is the second most common chronic, progressive, degeneraive neurological disorder, characterized by slowness of movements, rigidity, tremor and postural instabilty. The occurence in the population above 65 years may be ten time higher than under 65. About 4 million people are suffering from this disease all around the world, 1 million in the USA. In the UK 120 000 patients have been registered, where 1 of every 20 patient is under 40 year. Paralell with the the increase of the age four times more patients are estimated by 2040 in the USA. The yearly increase of prevalence above 70 years is about 2%.
The cost of the therapy in UK is calculated 560 000 — 1 million pounds/year/100 000 inhabitants. Parkinsoncs disease appears to be one of the "most expensive" disease in Germany, as well.
The costs will be increased by the occurence of motor fluctuation, psychosis and other complications. More and more studies report that the so-called indirect costs in the late stages of the disease are much higher than the "active"-pharmaceutical treatment.
The incidence and prevalence of Parkinsoncs disease is similar all around the world. According to some estimated data about 20 000 PD patients might be taken into account in Hungary, and further 1500–2000 new patients (*de novo*) are to be registered. To establish an early and correct diagnosis of PD is essential. The role of dopamine transporter imaging in the diagnostic work-up is of great importance. These methods helps:
— to estimate the preclinical nigrostriatal terminal dysfunction;
— to support diagnosis with early disease;
— to support differential diagnostic problems;
— to monitor disease progression.

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EFFICACY OF 123I-FP CIT (DATSCAN) SCINTIGRAPHY IN GENERAL NEUROLOGICAL DISTRICT DEPARTMENT AND IN SPECIALIZED MOVEMENT DISORDERS CENTER

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Aim: 123I-FP CIT (DaTSCAN) scintigraphy is indicated for detecting loss of functional dopaminergic neuron terminals in the striatum of patients with clinically uncertain Parkinsonian Syndromes, in order to help differentiation of Essential Tremor from Parkinsonian Syndromes related to idiopathic Parkinson´s Disease, Multiple System Atrophy and Progressive Supranuclear Palsy. It enables to diagnose Parkinsonian Syndromes early in incipient phases of these diseases. The aim of our study coordinated by VZP/General Health Insurance Company/was to evaluate all benefits of this investigation under different conditions of general neurological district department and specialized movement disorders center.
Material and methods: All patients were examined 3 hours after i.v. administration of 185 MBq 185 MBq 123I-FP CIT using dual-head SPECT gamma cameras. Basic visual evaluation was supported by semi quantitative one. The indexes of specific activity (ISA) of the tracer in nc. caudatus (NC), putamen (P) and striatum (S) for the left and right hemisphere were calculated: ***ISA = (ROI-crbl)/crbl*** (*ROI* = counts in the evaluated region, *crbl* = counts in cerebellum with nonspecific accumulation of radiopharmaceutical only).
Results: The diagnoses of movement disorders were confirmed due to 123I-FP CIT scintigraphy in 57%, specified in 27% and changed in 16% of patients examined and treated at general neurological department. The results in highly selected group of patients treated at the specialized movement disorder center were similar and diagnoses were confirmed approximately in 60%, specified in 30% and changed in 10%.
Conclusion: 123I-FP CIT scintigraphy is helpful in selected patient group of patients with movement disorders treated not only at general neurological district department but also at specialized movement disorder center. In some cases when 123I-FP CIT is able to exclude false positive diagnosis of Parkinsonian Syndromes, the scintigraphy could bring direct economical benefit due to elimination of unnecessary medical treatment.

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RCBF CHANGES IN PARKINSONIAN PATIENTS WITH DEMENTIA

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Background and aims: Dementia is 2–6 fold more frequent in Parkinson's disease patients than in controls. It presents a number of diagnostic problems due to the lack of standard diagnostic criteria, bradyphrenia, side effects of therapy and concomitant depression. Psychometric testing meets difficulties. The aim of the study is to evaluate cerebral blood flow changes in Parkinsonian demented patients as well as to evaluate rCBF SPECT scanning as a diagnostic tool in this group of patients.
Material and methods: 44 patients with Parkinson's disease (PD) were enrolled in the study: non-demented (11 patients), with mild cognitive impairment (20 patients), demented ones (13 patients); control group were grupę kontrolną stanowiło 20 zdrowych ochotników. rCBF SPECT scanning hads been performed using ^{99m}Tc--HMPAO (Amersham, UK) i and a triple-head gammacamera MS-3 (Siemens, Germany). We evaluated inter-hemispheric asymmetries using asymmetry index (AI) and regional cerebral perfusion using cerebellar normalisation. MRI scanning has been performed using 0.5 T device Gyroscan (Philips, Holland) and ARWMC scale.
Results: PD patients had a lower cerebral perfusion in all cerebral areas except thalami and basal ganglia. PD patients with dementia additionally had more pronounced temporal and occipital hypoperfusion. A number of focal perfusion deficits in PD demented patients was higher than those without dementia in left, but not right hemisphere. MRI results were not contributory to differental diagnosis of dementia in PD patients.
Conclusions: those results may suggest a mixed: neurodegenerative and cerebrovascular etiology of dementia. rCBF SPECT scanning may be useful in diagnosis of cognitive impairment in PD patients.

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NEUROANATOMICAL CORRELATES OF POST-STROKE APHASIAS ASSESSED BY RCBF BRAIN SPECT STUDIES

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Background and aim: A large variety of acquired aphasic syndromes can be correlated to relatively specific brain lesions located at distinct sites in the left cerebral hemisphere. The aim of the study was to determine neuroanatomical correlates of aphasia following cerebrovascular accident.
Material and methods: The study involved 50 stroke patients with a single left--hemisphere lesion and residual mild to severe aphasia. Language, assessed by the Boston Diagnostic Aphasia Examination (BDAE). rCBF SPECT scanning hads been performed using ^{99m}Tc-HMPAO (Amersham, UK) i and a triple-head gammacamera MS-3 (Siemens, Germany). We evaluated inter-hemispheric asymmetries using asymmetry index (AI) and regional cerebral perfusion using cerebellar normalisation.
Results: In Broca's aphasia were predominant changes in frontal lobe and — in lesser degree in occipital lobe and striatum; in Wernicke's aphasia mostly changes in tempotal and occipital cortex were seen. In global aphasia rCBF SPECT scanning showed largest perfusion deficits in perisylvian area and thalamus, also in basal ganglia; however, the normal rCBF perfusion was seen only i occipital area.
Conclusions:
1. Results indicate a need for reevaluation of neuroanatomical correlates in aphasia, particularly elucidating the role of subcortical damage.
2. In particular types of aphasia we meet different locations of vascular damage.

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FULLY AUTOMATIC DELINEATION OF STRIATUM IN DOPAMINE SPECT INVESTIGATIONS

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Objectives: The number of performed SPECT investigations with pre- and post synaptic dopaminerg ligands are increasing. In the majority of cases the semiquantitative evaluation of these studies are based on fixing basal ganglia ROIs manually. There are different efforts in the nuclear medicine community to make these evaluations fully automatic. This can be achieved by registering the images into the MNI space and masking areas with predefined MNI VOIs. However due to the inevitable errors of registrations in cases of small VOIs (like striatum) the results can be misleading. (Fig. 1. method 2) The aim of our study was to introduce an automatic method that can consider and correct errors deriving from misregistration.
Material and methods: 11 healthy individuals underwent a ^{99m}Tc-TRODAT SPECT investigation. Three methods were tested: 1. traditional manually fixed ROIs; 2. registration images into MNI space, and standard VOIs (number of voxels: 2815, WFU Pickatlas) were fixed on striatum; 3. On the registered images dilated VOI (WFU Pickatlas, 4 voxels dilatation of original striatum) masked striatum. The increased VOI was then narrowing by a special smoothing algorithm in order to precisely delineate the suspected striatal area (the final size of VOI became 2815 voxel also) (Fig. 1. method 3). In the latter two methods the same predefined occipital VOI (voxel size: 7466) was used. The reliability was estimated by test-retest variability (TRV) and intraclass correlation coefficient (ICC). In these normal cases the gold standard was the method 1.
Results: In case of striatum VOIs: comparing the method 2 with the method 1 the TRV was 21 ± 9% (mean ± SD), ICC was 0.92 (0.73–0.98) (95% CI), while comparing method 3 with method 1 TRV was 15 ± 8%, ICC was 0.96 (0.88–0.99). The method 3 always overestimated the method 1, while method 1 always overestimated method 2. In the case of occipital cortex: TRV was 13 ± 8%, ICC was 0.96 (0.87––0.99). There was no significant difference in the mean values of the automatically and manually fixed occipital masks.
Conclusion: The evaluation shows that our method (method 3) can improve the reliability of our results in the case of small areas like striatum, while using larger masks (like occipitum) the automatic and manual methods gives the same values. This can be interpreted that smaller VOIs more sensitive to errors of registration.

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NON-PARAMETRIC STATISTICAL ANALYSIS OF BRAIN SPECT- AND PET STUDIES

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A large amount of gray matter can be excluded from the statistical parametric analysis of brain SPECT- and PET images because of inadequate F-statistics. This problem may be solved by time consumption of robust non parametric tests. To meet this challenge, we elaborated a voxel-based non-parametric software package running on a computer cluster for the statistical analysis of our clinical projects. This program reads input data from the primary SPECT or PET images or the adjusted volumes generated by the SPM tools, as well. The current version is suitable for the analysis of the correlation between brain images and physiological parameters or finding the functionally correlated areas. In the case of population comparison it is useable to compare two or more populations or investigate the effect of any treatment on the same population.
The program was checked by perfusion and FDG-PET studies relating to group comparison and functional correlation analysis.

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ACETAZOLAMIDE-SENSITISED QUANTITATIVE BRAIN PERFUSION SPECT IN DEPRESSION AND ALZHEIMER DISEASE

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Aim: the risk of stroke and dementia is higher at patient suffering from depression. Little is known about the possible pathophysiologic mechanism of it. So we compared the basic quantitative global and regional blood flow, and blood flow cerebrovascular reserve capacity (CVRC) at patients, suffering from depression (D) and Alzheimer disease (AD)
Material and methods: 24 patients were investigated, with 48 examinations. 10 healthy controls, 5 with unipolar, 5 with bipolar D, and 4 with AD. First we have made the 99mTcHMPAO dynamic, quantitative SPECT and later the Acetazolamide-sensitised quantitative brain perfusion SPECT done for CVRC calculation. Data acquisition and analysis: using the acquisited data of large field of view gamma camera from aortic arch and brain hemispheric areas, time activity curves, and reconstructed coronal SPECT slices of them in a cylinder surface-like model, was used to measure the rest global hemispheric regional blood flow and later the CVRC (The normal rest value: 53 ml/perc/100 g brain tissue is).
Results: in rest a serious global decrease in blood flow is observed at D and AD patients. After Acetazolamide a smaller CVRC values have been observed at patients compared with normal. At pts with unipolar D the frontal region is relatively better perfused, compared with bipolar D, in which the whole gray matter is seriously underperfused. At AD pts the global perfusional loss of brain, and in parieto-temporal areas a characteristic regional hypoperfusion is observed with low CVRC.
Conclusions: comparing with normals, there is a significant decrease of global rest hemispherical blood perfusion at unipolar and bipolar D pts.The unipolar and bipolar D may be separated, because in later case the frontal region is also involved is global cerebral hypoperfusion. At unipolar D the higher blood flow values have been measured in parieto-temporal regions than in AD. At bipolar D these values are near to the values measured in AD. The CVRC is observable in all pts groups, but at the lower level than at normals.

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DOPAMINE TRANSPORTER EXAMINATIONS IN MOVEMENT DISORDERS: SUMMARY OF 4 YEARS (176 EXAMINATIONS)

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Aim: We investigated the role of TRODAT SPECT in differential diagnosis in movement disorders (i.e. Parkinson's disease PD; Parkinsonian syndrome PS, essential tremor ET).
Material and methods: During a 4-year-study 176 patients with parkinsonian features were investigated with ^{99m}Tc-TRODAT SPECT. The different patient groups (PD, PS, ET) and subgroups were compared with each other and with healthy volunteers. As a specific binging region the striatum, the caudate nucleus and putamen, as a reference region the occipital cortex was marked. For statistics linear regression and ANOVA were performed.
Results: In PD patients a linear correlation was found between specific TRODAT uptake values and motor handicap ($p < 0.05$), as well as -based on the different uptake of striatum-^{99m}Tc-TRODAT SPECT differentiated subtypes of PD ($p < 0.05$). During differential diagnostic study-based on the different putaminal involvement-PD and PS groups separated each other ($p < 0.05$).
Conclusion: ^{99m}Tc-TRODAT SPECT investigation is useful by itself in the diagnosis in patients with movement disorders.

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CORRELATION OF DOPAMINE TRANSPORTER IMAGING (TRODAT SPECT) AND PARKINSONIAN MOTOR HANDICAP

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Background: The selective dopamine transporter ligand TRODAT SPECT is useful in the diagnosis of Parkinson's disease.
Aim of the study was the examination of the theoretical correlation between the clinical motor symptoms and ^{99m}Tc-TRODAT uptake values.
Material and methods: The investigated population included 72 patients with Parkinson's disease (30 men, 42 women; mean yr ± SD: 61.4 ± 11.5; disease duration 4.4 ± 4.7 yr; Hoehn-Yahr [H-Y]: 1.9 ± 0.7; UPDRS total [U]: 26.6 ± 17.6; UPDRS III [III]: 16.1 ± 11.3). During semiquantitative assessment, as a specific binding region the striatum (str), as a reference region the occipital cortex (occ) was marked. The specific uptake of TRODAT was compared with the values of clinical rating scales. For statistic linear regression was performed.
Results: The TRODAT uptake of the striatum correlated well with the values of Hoehn-Yahr scale (str/occ ratio = 1.62–0.01*H-Y, $p < 0.01$), of UPDRS scale (str/occ ratio = 1.53–0.003*U; $p = 0.02$) and of UPDRS III scale (str/occ ratio = 1.52–0.005*III, $p < 0.01$).
Conclusion: ^{99m}Tc-TRODAT SPECT not only useful in the diagnosis of Parkinson's disease but it's also suitable to visualization of the severity of the disease.

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CHANGES IN THE CEREBRAL BLOOD FLOW IN DIABETES MELLITUS

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Background: in Type 2 diabetic (T2DM) patients, about 80% die of a macrovascular complication.
Aims: To measure the functional capacity of the brain arteries of T1DM and T2DM patients, and to compare these results to various vascular haematological parameters like CRP, fibrinogen level and myeloperoxidase activity.
Material and methods: 64 patients were involved (18 T1DM and 46 T2DM). Cerebral blood flow was examined by a two day protocol. Basal and subsequently Diamox-stimulated cerebral blood flow was measured on two different occasions. Reserve capacity was calculated on the basis of the difference between stimulated and basal blood flow. CRP and fibrinogen level along with the myeloperoxidase activity of the neutrophil cells were also measured.
Results: Both basal and the Diamox stimulated cerebral blood flow was significantly lower in T2DM, the reserve capacity, however, was the same in both groups (T1DM: basal: 56.33 ± 8.87 ml/min, stimulated: 62.88 ± 10.41 ml/min; T2DM: basal: 48.5 ±6.23 ml/min, stimulated: 52.76 ± 7.68 ml/min). Cerebral blood flow was declining by age. After correcting for this age-dependent phenomenon cerebral blood flow of T2DM patients still remained lower when compered to that of the T1DM, although the difference was not significant. In T2DM significantly higher CRP and fibrinogen level and increased myeloperoxidase activity was measured in comparison to the T1DM group.
Conclusion: Decreased cerebral blood flow of T2DM patients compared to T1DM might represent a more pronounced vascular injury and significantly elevated CRP, fibrinogen levels and myeloperoxidase activity seem to have a possible role in the pathogenesis.

ENDOCRINOLOGY

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SOME AUTONOMOUSLY FUNCTIONING THYROID NODULES RESIST THE SUBACUTE THYROIDITIS

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Aim: In subacute thyroiditis the iodine (technetium) uptake of the thyroid is very low, the gland is hardly seen on the scan. In several patients "hot" spot was present on the thyroid image obtained during the thyroiditis. To evaluate the frequency of this finding we reviewed the scans made in the last 8 years.
Material and methods: Subacute thyroiditis was found in 102 patients, the diagnosis was based on clinical signs, elevated sedimentation rate and low technetium uptake. Serum TSH, FT4 and FT3 were measured in all subjects, Tg, aTg and aTPO were also assessed in special cases.
Results: On 18/102 scans registered during the subacute thyroiditis a single "hot" spot 4-10 mm in diameter was shown. The serum TSH measured at the time of thyroid imaging was suppressed in 15/18 patients (< 0.1 mIU/L), the FT4 was increased in 14/18 (24, 38–56.9 pmol/l). In 12 patients a control scan was performed after recovering from the subacute thyroiditis. On this second scan the regions formerly inflamed or suppressed showed normal uptake again, however the "hot" spot remained visible further on.
Conclusion: The "hot" nodules found in the thyroid during subacute thyroiditis are autonomous in function because they are able to accumulate technetium in spite of suppressed serum TSH. It would appear that, the functional autonomy of the nodules and the ability to resist subacute thyroiditis have common pathogenesis.

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PARATHYROID SCINTIGRAPHY AND ULTRASONOGRAPHY IN PRIMARY HYPERPARATHYREOIDISM

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Aim: According to recent surgical protocols primary localisation investigation is required in primary hyperparathyroidism (PHP). We assessed retrospectively the diagnostic efficacy of parathyroid scintigraphy (PTS) and ultrasonography (US) in case of PHP.
Material and methods: The cause of PHP could be proven by surgery and histology in 30 patients (age: 10–83 years; 25 females, 5 males) investigated during 2003 and 2004 at our institution. PTS was performed following the iv. application of 700 MBq Tc-99m labelled sestamibi and we obtained planar sequential images at least 2 hours long and SPECT investigation. In 11 cases we performed additional thyroid- and subtracted images following the iv. application of 100 MBq Tc-99m pertechnetate. US investigations were performed by several investigators of 10 different institutions. In 9 cases when the original US were negative we made control US (CUS) in the knowledge of PTS results.
Results: 35 lesions were resected (25 adenoma, 10 hyperplasia; 34 in the neck, 1 in mediastinum). The sensitivities of PTS, US and CUS were 86, 13 and 89%, respectively. PTS had 2 false positive findings while positive US findings were always correct.
Conclusions: In case of PHP the sensitivity of US was extremely low, significantly lower than reported in the literature. Based on our CUS investigations this is not the result of objective undetectability by ultrasound. PTS is an excellent method for localising parathyroid tissue with increased functional activity. In case of positive US finding the necessity of PTS is questionable.

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THE CASE FOR TSH IN ELDERLY

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Heves Megyei Önkormányzat Markhot Ferenc Kórház-R.I. Izotópdiagnosztikai Osztály, Eger Approximately 17,000 super sensitive TSH tests are performed annually in our laboratory.

Because of our aging population, 20% of the samples are from patients above 65 years. Our principal observations are the following:
1. 12% of the samples are in the normal range (0, 3–3,5 mU/ml) — 80% of these are male patients.
2. 25% of the patients are hyperthyroid — without difference in gender.
3. The rest of the patients — approximately 60% — are hyperthyroid with a 95% female dominance. Three possible reasons can explain the this difference:
a) due to the decreased metabolic rate, the elderly patient responds with increased amount of TSH as a compensation mechanism, b) this is because the effect of the high incidence of autoimmune thyroid diseases observed in our region,
c) alpha-chains reaching a high serum concentration in menopausal women are associated with false-positive results. In the first situation, feedback mechanism can be suspected; for the examination of the second and the third reason, we performed anti-TPO (RIA-CT) measurements to exclude autoimmune disease. Sexual hormones' role as a principal cause of high concentration of TSH has been confirmed with FSH-LH (IRMA-CT) measurements. Summarizing our results we can conclude, that it would be useful to establish a higher cut off limit — at least 7.5 mU/ml — when we define normal values for TSH.

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INTRAOPERATIVE PARATHYROID ADENOMA LOCALIZATION BY GAMMA PROBE

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Aim: Unsuccessful cases of the conventional parathyroidectomy are around 5% to 10%. Follow up procedure has been performed in order to investigate the improvement of the efficiency of intraoperative radio-guided localization for parathyroid adenomas by applying gamma probe.
Material and Methods: Intraoperative sestamibi scanning was carried out to localize the adenoma by gamma probe in case of 115 parathyroiectomy patients with primery hyperparathyroidism diagnose between February 2000 and December 2004. 700 MBq 99mTc-MIBI have been injected intravenously 1.5–2 hours before the nuclear-guided pararhyroid surgical procedure. The radio-pharmaceutical distribution was measured by Europrobe with dedicated detector head for 99mTc. Counts/ /seconds (cps) were recorded on each particular points.
Results: The activity distribution was measured before the operation percutaneously on the neck. Only 37 cases (32.2 %) were obtained relevant information about the location of parathyroid adenoma. In turn, the localization during the operation directly at explored paratheroid regions improved to 75 cases (65.2%). Finally the removed specimens were *ex-vivo* scanned, which provided the best results. Parathyroid adenoma was proved by 98% reproducibility in case of resected parathyroid glands *ex vivo* tests.
Conclusion: The combination of intraoperative way with the intact PTH determination in parathyroidectomy may reduce the surgical time and risk as well as minimizes the application of invasive surgical action.

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OUR EXPERIENCES WITH SHORT, 5-DAY LITHIUM — ADJUVANT ADMINISTRATION ALONG WITH RADIOIOD TREATMENT OF HYPERTHYREODISM

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Aim: To further increase the effectiveness of radioiod treatment with short Lithium adjuvant therapy.
Material and methods: Lithium increases the intrathyreoidal iodine content. The effective half-lifetime decreases the transient elevation of thyroid hormone concentration after radioiod therapy. The disadvantage of this is toxicity. To avoid its toxicity we used short 5-day Lithium therapy started right after to the radioiod administration with 16 patients where the I131 theraphy was formerly unsuccessful or where we wanted to avoid the increase of FT4 after radioiod administration of the patients.
Results: We found that the favourable effect of Lithium was satisfactory when used this way. Hyperthyreosis disappeared in 15 cases, only diminished in 1 case. There were no side effects.
Conclusion: A 5-day Lithium therapy after radioiod administration may increase its effectiveness without toxic side effects.

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SOMATOSTATIN SCINTIGRAPHY (OCTREOSCAN) IN CLINICAL PRACTICE

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Aim: To establish the value of somatostatin scintigraphy in clinical practice.
Material and methods: The study included 29 patients: 25 patients was observed with identified carcinoid or neuroendocrine tumor, for staging; 3 because of suspicion of carcinoid; and 1 because of suspicion insulinoma. Anterior and posterior abdominal and thoracic static imaging and SPECT study (Siemens, Multispect 2) were performed 24 and 48 hours after i.v. injection of 120 MBq 111-In-Octreoscan.
Results: Only 1 false negative somatostatin scintigraphy was found in the identified carcinoid. In 8 cases the pathological accumulation were only on the SPECT study visible, static scans were negative. In 15 cases we established multifocal accumulation and the most part of spots were proved with other imaging techniques (UH, CT and/or MR) too, but in 8 case only later. At 7 petients the other techniques could not establish any abnormality yet, the examinations are in process.
Conclusion: Somatostatin scintigraphy especially with SPECT images is a sensitive and useful method in the staging and identifying carcinoid and neuroendocrine tumors and in the planning of therapy.

ONCOLOGY

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USE OF PREOPERATIVE CARCINOEMBRYONIC ANTIGEN VALUES IN PROGNOSIS OF COLORECTAL CANCER

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The aim of this work was to compare various CEA level and to investigate relationship between marker values and tumor stage in estimation of disease prognosis. Determination of CEA in blood were performed by IRMA in 146 patients before radical tumor resection. Survival curves were computed using Kaplan-Meier method and difference between groups was tested using log-rank test. Predictive values were estimated from survival curves. Based on achieved results and Dukes stage patients were divided in groups with normal (< 10 ng/ml) and elevated (> 10 ng/ml) level. The mean survival time was 40.7 ± 1.94 (SEM) months, 5-year survival prediction rate was 47.4% ± 5.3%.No significant difference was found in survival regarding tumor localization ($p = 0.8187$). The mean survival of patients with normal and elevated CEA values were 49.3 ± 2.46 months and 27.4 ± 2.44, respectively. The difference was highly significant ($p < 0.0001$). Prognosis of Dukes A group is more favourable than B and C ($p = 0.0029$). Furthermore, the difference between survival curves in groups with normal and elevated CEA values of Dukes B and C stage are significant ($p = 0.0010$ and $p = 0.0371$, respectively).The results suggest, that prognosis of CEA negative and positive tumors is considerably different. In conclusion, regardless of tumor stage, prognosis of colorectal tumors associated with elevated CEA is poorer than CEA negative tumors. The marker level is a prognostic factor and could be taken into consideration in monitoring of patients

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TC-99M-SESTAMIBI SCINTIGRAPY IN PATIENTS WITH MULTIPLE MYELOMA

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Aim: To assess the diagnostic value of Tc-99m-sestamibi scintigraphy (MIBI) in patients with multiple myeloma (MM) in differentiating between active stage of disease and remission to evaluate therapeutic response.
Material and methods: In a total 32 whole body scintigraphy after 15 minutes of i.v. injection of 740 MBq MIBI in 24 patients (11 male, 13 female, median age: 62.7 years) with MM were performed. 16 out of 32 cases had clinically active disease, 16 cases were in remission. 8 patients had two MIBI scintigraphies: before and one month after appropriate cytostatic treatment. Clinical activity was based on serum LDH, electrophoresis and plasma cell content of the bone marrow.
Results: In clinically active MM 14/16 patients had abnormal MIBI scintigraphy: diffuse intensive uptake with expanded bone marrow in the peripheral long bones. Two out of 14 patients had extramedullary uptake as well. In 2 out of 16 patients with remission increased MIBI uptake was found. Both patients were one month after therapy. 14 patients had normal MIBI scintigraphy.
Conclusions: MIBI scintigraphy has high sensitivity and specificity (87.5%) in differentiating between clinically active disease and remission in patients with MM but is not reliable in early evaluation of therapeutic response.

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TC99M-DEPREOTIDE SCINTIGRAPHY IN THE DIFFERENTIAL DIAGNOSIS OF PULMONARY DISEASES

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Aim: Of our study was to find a semiquantitative parameter on the Tc-99m-depreotide scintigraphic (TcD) images to differentiate between malignant and benign depreotide accumulating pulmonary lesions.
Material and methods: in a total 40 focal pulmonary lesions of 25 patients (14 male, 11 female, median age: 50 ± 12.6 years) were studied. 20 patients had histologic diagnosis of pulmonary malignancies, 5 patients had benign inflammatory lesions. Anterior and posterior images of the thorax were taken 2 and 4 hours after i.v. injection of 740 MBq TcD. Counts/pixel values of the lesions (L), background (B) and contralateral tissue (C) were determined by ROI technique using geometric mean calculation. L/B and L/C ratios were calculated on the 2-hours and 4-hours images as well. Statistical and ROC (area under the curve) analysis were performed.
Results: L/B and L/C ratios on the 4-hours images were significantly higher than on the 2-hours images for malignant and benign lesions as well. No significant difference of the L/C ratios was found between malignant and benign processes. 4-hours L/B ratio was significantly higher (1.62 ± 0.32) in malignant lesions than in inflammatory diseases. This ratio had the highest discriminating value by ROC analysis as well. In our patients L/B ratio over 1.7 suggests malignant disease.
Conclusion: calculation of the L/B ratio at 4 hours images of the TcD scintigraphy is helpful in differentiating malignant and benign pulmonary diseases.

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COMPARATIVE EVALUATION OF TC-99M-SESTAMIBI AND TC-99m-ANTIGRANULOCYTE-ANTIBODY IMMUNOSCINTIGRAPHY IN MULTIPLE MYELOMA

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Aim: To compare diagnostic value of the Tc-99m-sestamibi (MIBI) and the Tc-99m--antigranulocyte antibody bone marrow (BM) scintigraphy in patients with multiple myeloma (MM). Correlation between scintigraphic findings and clinical activity of the disease was studied.
Material and methods: 16 patients (9 male, 7 female, median age: 60.5 years) were enrolled in the study. Whole-body scintigraphy 15 minutes after i.v. injection of 740 MBq MIBI and — within one week — 4 hours after i.v. injection of 600 MBq Tc--99m-antigranulocyte monoclonal antibody (BM). 7 patients had clinically active disease, 7 patients were in remission. Clinical activity was determined by serum LDH, electrophoresis and plasma cell content of the bone marrow.
Results: Diffuse intensive activity uptake with peripheral extension of the bone marrow was found on MIBI scintigraphy in each of the 7 clinically active patients. On BM scintigraphy 5 patients had focal bone marrow defects, 2 of them had bone marrow expansion as well. 2 patients had normal scintigram. In 9 patients with remission MIBI was normal in 7 cases, 2 patients had intensive bone marrow uptake with expansion. BM Scintigraphy was normal only in 2 cases. 6 patiens had bone marrow expansion, 3 patients had focal bone marrow defects.
Conclusions: MIBI is sensitive and specific, BM scintigraphy is sensitive but not specific to detect clinical activity of MM.

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DISCOVER OF A GLUTEAL METASTASIS OF A COLORECTAL ADENO-CARCINOMA BY BONE SCINTIGRAPHY — AN INTERESTING, RARE CASE

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Background: It is well known that distant metastasis of colorectal carcinoma primarily occurs in the liver and lung. The sceletal muscle is undoubtedly the most unusual site of distant metastasis from any cancer, despite the fact that sceletal muscle comprises nearly 50% of the total body mass. Metastases to sceletal muscle from colorectal carcinomas are extremly rare, to our knowledge, only 15 cases have been reported in the world literature.
Case report: A 63-year-old women was examinated by bone scintigraphy 4 years after surgical treatment of colorectal carcinoma. Bone scintigraphy shows an extraosseal MDP-accumulation of the left gluteal region.
Based on this aspecific finding advised CT-scan and fine-needle biopsy reveal a metastasis of the colorectal adenocarcinoma.
Discussion: The results of additional examinations, which was made by the basis of incidental finding of bone scintigraphy, indicated a complete change in the plan of therapy.

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DIFFICULTIES IN MANAGING OF DIFFERENTIATED THYROID CANCER IN RELATION WITH THE CONSENSUS PROTOCOL

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Diagnosis and treatment of differentiated thyroid cancer /DTC/ is well documented.1o4 patients have been treated with radioiodine since l997 in 17o occasions.This period was a continuous adjustment to the international protocol the difficulties of which were considered in this report.
1. Incomplete thyroid resection:volume of remnant was larger than 2 gr in 52% and 131-I-uptake more than 10%:25,4%.
2. TSH-induction: today thyroxine withdrawal is the only option but recombinant hTSH is generally recommended.We administered rhTSH only to 3 patients.
3. Serum-thyroglobulin (hTg) determinations with IRMA/ILMA are reliable methods but one should often wait for the result for several days/weeks.
4. Whole Body Scan (WBS): thick crystals and high energy collimators are necessary and not always available.We had only two WBS-positive cases.
5. Ultrasound: an operator having day-to-day experience in evaluating thyroid cancer patients is needed.Solving of this problem is in progress.
6. PET: useful method for investigation of WBS-negative and hTg-positive patients but not exclusively.
One should overcome the difficulties to go on.

ONCOLOGY — SENTINEL NODE

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DIAGNOSTIC VALUE OF 99mTC-NEOSPECT EXAMINATION IN DIFFERENT PULMONARY DISEASES

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Aim: The 99mTc-Neospect binding to the somatostatin receptors has a crucial role in the differential diagnosis of the solitary pulmonary nodules. The aim of this study was the establishment of the diagnostic value of the method.
Material and methods: 27 patient (10 men, 17 women) were examined. Whole-body scan and SPECT examination about the chest were performed in every patients by Multispect II double-head Siemens equipment. At the patients preliminary chest x-ray, CT, MRI examinations were made and in 13 patients PET examination was performed, too. The histological diagnoses were adenocarcinoma in 9, bronchoalveolar carcinoma in 1, planocellular carcinoma in 3, carcinoid in 6, neuroendocrine tumor in 1, sarcoidosis in 2 cases and 5 benign or non-verificated cases were found.
Results: On the base of the histological diagnosis and the operation the results of the Neospect examination of 20 patients were true-positive. Negative results were found in 4 patients, one of them a positive PET examination was performed, it was adenocarcinoma. PET study was made in 12 from the 23 positive-results patients, the results were concordant in 10 cases. In 2 patients negative PET results were found, but one of them had recidive carcinoid, the other had bronchoalveolar carcinoma. False-positive Neospect eaxmination were obtained in 2 cases of sarcoidosis. Both the Neospect and the PET examination was false-positive in 1 patient with a scar in the chest. On the base of our results the sensitivity was 95% and the positive predictive value was 86%. The specificity was lower, only 50%, the negative predictive value was 75%. (few negative cases were eaxmined.)
Conclusion: The 99mTc-Neospect eaxmination is a very suitable and sensitive method in the diagnosis of the histologically different pulmonary diseses and also plays an important role in the planning of the therapy. But the comparison with the other imaging studies is very important because of the low specificity.

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AXILLARY RECURRENCE IN BREAST CANCER FOLLOWING SELECTIVE AXILLARY LYMPH NODE DISSECTION BASED ON SENTINEL NODE BIOPSY

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Aim: 1. To evaluate the rate of axillary recurrence in patients with clinically T1-2N0 breast cancer omitted axillary lymph node dissection (ALND) based on negative result of sentinel node biopsy (SNB).
2. A retrospective judgement of our SNB method.
Material and methods: Between October 2000 and June 2005 selective ALND was performed in 329 breast cancer patients, i.e. ALND was omitted in patients with negative sentinel node(s). Combined labelling method was used (Tc^{99m} labelled nanocolloid was injected peritumorally on the day before the operation + blue dye was injected peritumorally just before the operation). Hot and blue lymph node(s) only were declared as sentinel node(s) during surgery. ALND was omitted in 192 patients on the basis of negative result of intraoperative imprint cytology of sentinel node(s). Clinical and axillary US follow-up was carried out six-monthly in 176/192 patients. The mean of follow-up time was 22.2 months (range 6–48 months).
Results: Suspicion of axillary recurrence was raised in 3/176 patients (US 3, palpation 2 patients), but none of them proved to have malignancy by histology In consequence, during around 2 years follow-up in none of 176 patients omitted ALND (based on negative result of sentinel node biopsy) developed axillary recurrence.
Conclusions: Our results suggest that 1. using strict patient enrollment 2. using combined radiocolloid and blue dye labelling technique 3. with the collaboration of a properly trained team (nuclear medicine, surgery, pathology) selective ALND based on SNB is a safe and appropriate method in early breast cancer.

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PROGNOSTIC VALUE OF SENTINEL NODE TUMOUR INFILTRATION IN MELANOMA MALIGNUM — A THREE-YEARS FOLLOW-UP

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Aim: The prognostic value of malignant involvement of sentinel node (SN) was analysed in melanoma malignum (MM) patients.
Material and methods: SN localisation was performed in 110 MM patients with 99mTc-nanocolloids (SENTI-SCINT) preoperatively by gamma-camera technique, and intaoperatively using gamma-probe method. The prognostic role of MM involvement of the SN was analysed by comparison with the 3-years MM associated mortality.
Results: Intaoperatively SN was found in all patients; 137 SN in concerning to 122 regions. In 74 cases (67%) SN has been proven to be MM free. In 36 patients (33%) SN was MM positive. In 29 of these patients block-dissection was performed. In 16 cases (55%), the block lymph nodes were MM free. In 13 patients (45%) block nodes showed MM involvement.
In SN negative patients the 3-years MM associated mortality was 7% (5/74), and in MM positive SN cases 19% (7/36). The MM involvement of block lymph nodes has not been proven to be a bad prognostic sign: the MM associated mortality in block negative cases was 31% (8/16), and in block positive patients 15% (2/13).
Conclusions: In MM patients the malignant involvement of SN is a bad prognostic sign in concerning to the 3-years mortality. In this group of patients, the MM involvement of block lymph nodes was not found to be a bad prognostic marker.

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RADIOGIUDED SENTINEL LYMPH NODE BIOPSY AND SIMULTANEOUS OCCULT LESION LOCALIZATION IN BREAST CANCER PATIENTS

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Aim: To investigate the usefulness of radioguided sentinel lymph node (SN) biopsy in breast cancer patients and the simultaneously performed radioguided occult lesion localization (ROLL) in patients with non-palpable breast tumour.
Material and methods: 150 non-palpable tumour (128 US, 22 X-ray guided) and simultaneous SN localization were performed in 147 patients administering the radiopharmaceutical (99mTc-Senti-Scint) intratumourally (group A). SN localization and biopsy were performed in 67 patients with palpable breast tumour (group B) applying peritumoural administration. Afterwards all patients underwent open surgical tumour excision and axillary SN biopsy with the use of a gamma probe and Patentblau staining. In most of the cases radiographic specimen control and later histopathological analysis were made is every case.
Results: According to the radiographic specimen control all of the earlier visualised tumours were removed. In group "A" all the histopathologically detectable tumour tissue was successfully removed in 130 (87%) of the cases (9 reexcision and 11 mastectomy were necessary). The tumours were benign in 28 cases. Sns were positive in 37 cases and in 7 cases the complementary axillary dissection showed further lymph node positivity. In 12 cases (8%) the SN detection was not successful. In group "B" posterior mastectomy was necessary in 8 cases. In 19 cases histopathologically positive SN(s) and out of them further lymph node positivity was found in the axillary block in 9 cases. Two tumours were benign. SN localization was not successful in 3 cases (4%).
Conclusion: The method we used is suitable for the detection of SN (both by peritumoural and by intratumoural radiocolloid administration) and for the simultaneous localization of non-palpable breast tumours.

PET

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DEVELOPMENT OF ^{11}C ISOTOPE LABELLED A_{2A} ADENOSINE RECEPTOR LIGAND FOR PET STUDY

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The purpose of the work was to synthesized ^{11}C isotope labeled selective adenosine A_{2A} receptor ligand (E)-8-(3-iodostyryl)-1,3,7-trimethylxantine (ISC), with high specific activity.We prepared the inactive ISC from 3-amino-cinnamic acid, the intermediate product was 3-iodo-cinnamic acid and (E)-8-(3- iodostyryl)-1,3-dimethylxantine (ISX). We identified the final and intermediate product with thin layer chromatography and melting point measurement. We made HPLC and NMR analysis of precursor of ISC (ISX) and ISC. We used $[^{11}C]CH_3I$ as labeling agent reacted with (E)-8-(3-iodostyryl)-1,3-dimethylxantine than we obtained $[^{11}C]$ISC. The product was separated from the reaction mixture with semipreparative HPLC procedure. The final product was analyzed with analytical HPLC. Using this procedure the adenosine receptor ligand were synthesized with radiochemical purity of 98% and specific activity of 250–350 GBq/μmol (n = 10). Analyzing the final product in the water solution we detected E-Z isomerism. Previous experiments showed 16% of E-isomer transformation to Z-isomer on exposure for 2 hours to 20 W source of light. The A_{2A} specificity and selectivity was proven by pharmacological.
This work was supported by OTKA T-038270 grant.

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DIAGNOSTIC ADVANTAGES OF PET/CT COMPARED TO PET IN ONCOLOGIC PATIENTS

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Aim: To evaluate diagnostic advantages of PET/CT compared to PET in 100 oncologic patients with FDG-PET/CT examination.
Material and methods: PET/CT examinations of 100 consecutive patients with various oncological diseases were studied. FDG PET was indicated using 1a and 1b categories of the German Consensus Conference. 370–700 MBq F-18-FDG was injected. PET/CT examination was performed using a state-of-art machine (two--slices spiral CT, dedicated LSO-PET, 3D aquisition). First the attenuation-corrected PET images were evaluated without CT findings. Next day integrated evaluation of the FDG distribution was performed using diagnostic CT data. Comparison of the two evaluations was made on the transversal slices by lesion-to-lesion. Number of false positive and false negative interpretation of FDG accumulation was determined in all regions. Possibility of accurate anatomical localization of FDG accumulating lesions was studied.
Results: False positive interpretation of FDG accumulating foci was significantly decreased in the neck region, in the location of gastrointestinal sphincters, in the bowel and urinary bladder regions. Metal in the dental region frequently results in false positive lesions on the attenuation-corrected PET images of the neck. Accurate anatomical localization of cervical, mediastinal and abdominal lymph nodes were possible by using integrated evaluation only. Localization of hepatic lesions were accurate without CT in majority of the cases.
Conclusions: Integrated evaluation of metabolic and anatomic imaging increases diagnostic accuracy of FDG-PET in oncological patients by decreasing false positive interpretation of FDG distribution and by accurate localization of abnormal lymph nodes.

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DIAGNOSTIC ADVANTAGES OF PET/CT COMPARED TO PET IN ONCOLOGIC PATIENTS

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Aim: To evaluate diagnostic advantages of integrated morphometabolic interpretation of PET/CT compared to PET in the first 100 oncologic FDG-PET/CT examinations.
Material and methods: PET/CT examinations of 100 consecutive patients with various oncological diseases were studied. FDG PET was indicated using 1a and 1b categories of the German Consensus Conference. 370–700 MBq F-18-FDG were injected. Simultaneous PET and diagnostic CT examinations were performed using a PET/CT with two-slices CT and LSO-PET in 3D aquisition mode. On the first day attenuation-corrected and uncorrected PET images were evaluated without the CT findings by two NM physicians (I.Sz., Z.N.) unexperienced in reading PET/CT. Next day FDG distribution was evaluated by using diagnostic CT data too. Comparison of the two evaluations was made by lesions-to-lesions. Number of false positive and negative interpretations of FDG accumulation were determined in all regions. Reliability of accurate anatomical localization of FDG accumulating lesions was studied.
Results: False positive interpretation of FDG accumulating foci was significantly decreased by simultaneous evaluation of CT in the regions of neck, gastrointestinal sphincters, and in the bowel and urinary bladder regions. Artifacts were frequently (79/100) seen as false positive lesions on the attenuation-corrected PET images of the oral region. Accurate anatomical localization of cervical, mediastinal and abdominal lymph nodes were significantly improved by using integrated evaluation (in 86%, 72% and 76% respectively). Localization of hepatic and splenic lesions were accurate without CT in majority of the cases.
Conclusions: Integrated evaluation of metabolic and anatomic imaging increases diagnostic accuracy of FDG-PET in oncological patients by decreasing false positive interpretation of FDG distribution and by accurate localization of abnormal lymph nodes.
This study was supported by IAEA (C6/HUN/03008), and kindly supervised by P. Lind, LKH Klagenfurt, Department of Nuclear Medicine and Endocrinology.

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THE DIAGNOSTICAL AND DIFFERENTIALDIAGNOSTICAL VALUE OF F18- FDG-PET IN VACULITIS

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Aim: The diagnostical and differentialdiagnostical value of FDG-PET in various types of vaculitis was examined.
Material and methods: We examined 25 patients with verified vasculitis using the ARA-Criteria wit F18-FDG-PET. In 14 patients brain and whole-body scans were performed, and in 11 patients only a whole-body scan was aquired. The patients were retrospectively classified as vasculitis of the large vessels (13 cases) and vasculitis of the middle- and small vessels (12 cases).
Results: All patients with vasculitis of the large vessels (n = 13) showed at least in one location of the large vessels increased FDG Uptake, but only two patients of 7 (29%) showed typical changes of vasculitis in the brain. Of the 12 patients with vasculitis of the middle- and small vessels 2 showed (17%) pathological changes in large vessel locations and 6 from 7 (86%) showed typical changes of vasculitis in the brain.
Conclusion: The brain and the whole-body F18-FDG examination benefitial in diagnosis and differentialdiagnosis of various types of vaculitis.

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EVALUATION OF A PET-ISOTOPE LABELLED A_{2A} ADENOSINE RECEPTOR LIGAND

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We report on the biological evaluation of an A_{2A} specific adenosine receptor antagonist developed in our laboratory.
The (E)-8-(3-jódsztiril)-1,3,7-trimetilxantin (ISC) receptor ligand was labeled with ^{11}C isotope. Results of contractility and relaxation studies also supported the high specificity and selectivity of this **A_{2A}** receptor ligand. The A_{2A}/A_{2B} and A_{2A}/A_1 selectivity was found to be 15 and > 200, respectively. Specific binding of [^{11}C]ISC to adenosine receptors was investigated on DDT1 MF-2 cells and competition between labeled and unlabelled ISC was documented. [^{11}C]ISC-receptor binding was effectively blocked by CSC (an A_{2A} antagonist) while DCPCX (A_1-type antagonist) did not affect the ISC-receptor interaction. Tissue accumulation of [^{11}C]ISC was followed ex vivo in Balb C mice. Remarkably high accumulation was found in the intestine, stomach, heart and kidneys. Dynamic PET scans were carried out on rabbits to elaborate detailed accumulation kinetics of [C^{11}]ISC in heart, lung, liver, kidney, spleen and brain. The labeled ligand can serve as a useful tool in in vivo studies of adenosine receptor regulation.
This work was supported by the OTKA T-038270 grant.

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EFFECTS OF NA^+/CA^{2+} EXCHANGE ON THE ACCUMULATION OF TUMORDIAGNOSTIC PET TRACERS IN CANCER CELLS

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The Na^+/Ca^{2+} exchanger (NCX) plays crucial role in the calcium homeostasis of cells. In the present paper we describe the effects of NCX blockers on the ^{18}FDG and ^{11}C-choline accumulation in different cancer cells. We demonstrated that the NCX is expressed at a remarkable level in the cytoplasmic membrane of the examined cells. Incubation of the cells with NCX blockers (bepridil, KB-R7943, 3´,4´-dichlorobenzamil hydrochloride) resulted in an increase of the intracellular Ca^{2+} with a simultaneous decrease of the intracellular Na^+ concentration. In addition the treatment with the blockers increased the energy consumption of the tumour cells by 30–80%. The increased energy demand is explained by the higher activity of the sarco-endoplasmic reticulum Ca^{2+}-ATPase. Preincubation in sodium free environment or thapsigargin (an effective blocker of the Ca^{2+}-ATPase) pretreatment abolished the increased FDG accumulation of the cells. The applied NCX blockers decreased the ^{11}C-choline accumulation by 40–80% relative to the control. Our results indicate that NCX medication protocols have to be taken also into account while interpreting tumour tracer accumulations.
This work was supported by the OTKA T-038270 grant.

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DEVELOPMENT OF A CALIBRATION SOFTWARE TO STUDY SMALL ANIMAL -PET DETECTOR MODULES

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Background: We have developed a PET camera for small animal studies at the PET Center of the University of Debrecen. We apply LSO scintillation crystals in the detectors that are arranged in 8x8 matrices in each module, and use a position sensitive photomultiplier tube with an appropriate optical connection.
The corner signals of PMT contain the crystal position and energy data of the events. We constructed four such detector-blocks and rotating them we will achieve tomographical PET projection.
Material and methods: The aim of our work is to develop special software in order to determine the detector parameters (such as energy discrimination levels, pin-crystal positions, etc.). The software will be capable of visualizing the calculated detector properties and restore them for a data acquisition software unit. The development has been assisted using a MATLAB software package because it contains a lot of useful predefined methods, such as segmentation, high-level optimization algorithms, 2D and 3D visualization tools needed to achieve our goals.
Results: During data processing, the deviation of parameters of individual crystal elements turned out to be considerably high, so it was essential to perform the appropriate normalization prior to starting small animal studies.

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THE ROLE OF FDG PET IN ACCURATE DIAGNOSIS OF VASCULAR GRAFT INFECTION

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Background: The diagnosis of vascular graft infection relies on a combination of clinical symptoms and imaging findings. Labeled leukocyte scan are the most used diagnostic tool. The usefulness of FDG PET is not yet evaluated. We report two cases of vascular graft suppuration where the patients were examined by leukocyte scan and FDG PET.
Material and methods: The first patient underwent a femoro-popliteal bypass in 1997 (Case No. 1). By the other patient aorto-bifemoral bypass had been carried out previously (Case No. 2). 99m-technetium labeled leukocyte scintigraphy was performed. Planar images were obtained. PET images were obtained 40 min after the intravenous administration of 0.15 mCi $\times$ kg^{-1} of FDG. There was no correction to tissue attenuation.
Results: The grafts were found to be infected in both cases during surgical revision. PET imaging gave the correct diagnosis in both cases as it demonstrated abnormal FDG uptake in areas corresponding with the vascular graft. In contrast with PET, white blood cell scan gave false negative result in Case No. 2. where retroperitoneal graft infection was suspected. The leukocyte scan demonstrated abnormal uptake in the left thigh corresponding with the graft in Case No. 1.
Conclusion: There are only few articles that describe the use of FDG PET in diagnosis of vascular graft infection. We recognize that FDG PET was 100% accurate in diagnosing both the fact of the graft infection and its extent. Further evaluation in a large group of patients is indicated to assess whether FDG PET could become the imaging of choice when graft infection is suspected and other means of imaging result in ambiguous diagnosis.

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NEURAL CORRELATES OF SPATIAL NAVIGATION: A VIRTUAL REALITY PET STUDY

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The neural basis of navigation by humans was investigated with functional neuroimaging of brain activity during navigation in complex virtual reality environment. We used positron emission tomography (PET) to scan six healthy male subjects while they navigated to locations in a familiar virtual reality town build up during a period of exploration immediately before scanning. Navigation was compared with a task in which subjects moved trough another town following a trail of arrows, thus not need to refer to an internal topographical representation of the town. The results revealed significant activation of left superior occipital lobe (Br. 19), right parietal lobe, precuneus (Br. 39), right temporal lobe, fusiform gyrus (Br. 37, 20), bilateral parahippocampal gyrus (Br. 19), bilateral posterior cyngulum (Br. 23, 30) and left middle frontal gyrus (Br. 6, 8) in navigation task in comparation with the baseline. The results are consistent with previous neuropsychological and functional neuroimaging findings of the involvement of the temporal (mediotemporal) and parietal regions, especially of the right side, in topographical memory.

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LOCALIZATION OF LANGUAGE-RELATED BRAIN AREAS WITH 15O-LABELED WATER PET IN PATIENTS WITH UNILATERAL TEMPORAL LOBE EPILEPSY

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Since introduction of 15O-labeled water PET as a method for measuring regional blood flow changes under different activation tasks, many functional brain mapping experiments have been designed to investigate human language functions. It was shown that tasks involving semantic analysis were best suited to detecting left-right differences in the activation pattern. We focused on the question of whether PET during speech activation is an appropriate method for noninvasive determination of language-related brain areas in epileptic patients with unilateral temporal lobe pathology. Twelve right-handed TLE patients were examined (7 with pathology on the right side, 5 on the left) in a verb generation task paradigm (finding a semantically matching verb for each noun read aloud) compared with the baseline resting condition (dark room, eyes closed). The results shown that in the left sided group highly significant activated regions were the superior temporal gyrus bilaterally (Br. 41, 22) left middle and inferior frontal gyrus (Br.6, 46) and right cerebellum. In the right group significant activations were the left superior temporal gyrus (Br. 22), left inferior frontal gyrus (Br 45), left middle and medial frontal gyrus (Br. 6,8) and cerebellum bilaterally. In a comparison between two groups we found significant activations of right superior temporal gyrus (Br. 22) in left group and right medial frontal gyrus in patients with pathology in the right side. In conclusion, the presence of structural pathology in the left (verbally dominant) temporal lobe caused a more bilaterally distribution of language processing and the measurement of CBF changes during verb generation task seems to be useful method in identification of language-related areas in epileptic patients with unilateral temporal pathology.

SENTINEL NODE

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MAPPING OF GLUCOSE METABOLISM IN PATIENTS WITH HUNTINGTON'S DISEASE

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Background: Huntington's disease (HD) is an autosomal dominantly inherited neurodegenerative disorder characterized by worsening abnormalities of movement and cognition. Genetically screened gene mutation carriers and symptomatic patients were examined regarding the affection of the basal ganglia, and the possible metabolic changes of the cortex.
Material and methods: 19 patients (13 presymptomatic gene carrier and 6 symptomatic) and 6 healthy volunteers were included in the study. All patients had HD in familial history and all had CAG repeat above the normal limit (> 37). The presymptomatic group was devided into 2 subgroups based on the CAG repeat number. Dynamic brain FDG-PET investigations were performed in all subjects. A 3-compartmental model was applied for the kinetic analysis. All individual PET images were transformed into the MNI space. SPM analyses were carried out to ascertain statistical differences in the striatal and cortical metabolism between patient groups and healthy subjects. The regional rate of glucose consumption was also determined in all cases with defining different VOIs on the standardized MRI images. The obtained values were ratio-normalized (nGMR) to unit global metabolic rate. The results were compared to those of the control group.
Results: Severe bilateral hypometabolism was detected in the caudate nuclei and the striatal region in the 6 symptomatic patients. 10 presymptomatic patients had different degree of reduced metabolism of the basal ganglia. The remaining 3 with CAG repeat less than 40 had normal scans. Statistical differences were found with SPM analysis between the patient groups and healthy subjects in the severity of the striatal hypometabolism. Compared to the control group, reduced metabolism was observed in the medial frontal gyrus in the symptomatic patients. On the other hand, there was non-significant hypermetabolism in the right superior frontal and left medial and middle frontal gyrus in this group. In addition, metabolism was elevated in the left inferior and superior temporal and in the left medial frontal gyrus in the presymptomatic patients with intermediately reduced glucose uptake.

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LYMPHOSCINTIGRAPHY IN CERVICAL CANCER PATIENTS; DEEP VS. SUB-EPITHELIAL INJECTION TECHNIQUE

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Background and aim: Regional lymph node surgical management is an integral part of cervical cancer therapy. In gynaecological oncology, recent studies have confirmed the utility of the sentinel node concept in vulvar and cervical cancer. The method of marker's administration is considered to play an important role in sentinel node detection. The aim of the study was to assess the sensitivity of sentinel node detection by the use of pre- and intra-operative radiodetection versus blue-dye method in patients with cervical cancer, as well as the influence of sub-epithelial versus deep way of tracer administration.
Material and methods: We studied 60 patients with cervical cancer (stage IB-IIA) using a blue dye injection technique and radionuclide studies with a pre-operative scintigraphy utilising a nanocolloid tracer/dual-head gammacamera and intra-operative gamma-probe technique during radical abdominal hysterectomy. In 30 randomly chosen patients the tracer was administered using deep (0.5–1.0 cm) injection technique; in 30 by sub-epithelial injection.
Results: All sentinel nodes visible in pre-operative scanning were also detected by intra-operative gamma probe. After deep injection sentinel nodes were showed in 27 patients (90%) on both sides, in 3 pts. on one side; only 40% of sentinel nodes were detected using blue dye technique. Following sub-epithelial injection of radioisotope sentinel nodes were found in all 30 patients (100%), after blue dye injection in 28 patients (93%).
Conclusions: Radionuclide sentinel node detection seems to be slightly superior as compared to blue dye technique. Sub-epithelial administration provides better sensitivity of sentinel node detection, probably due to differences in lymphatic vessels architecture.

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CLINICAL VALUE OF LYMPHOSCINTIGRAPHY IN CHILDREN WITH LYMPHEDEMA OF THE LOWER LIMB

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Aim: To evaluate clinical relevance of lymphoscintigraphy (LS) in the diagnosis and postoperative follow-up of pediatric patients with lymphedema (LE) of the lower limbs.
Material and methods: 47 patients (21 boys and 26 girls) with long-standing edema of non-venous origin of the lower limbs were studied, median age of 9.6 years (2–26). 43 patients had edema on one limb, 4 patients on both limbs. 5 patients underwent microsurgery of the lymphatic vessels before the study. 20–40 MBq Tc-99m-nanocolloids were injected subcutaneously on both legs. A 30 minutes dynamic study and whole-body scintigraphy at 1, 4 and 24 hours were performed. Dynamics of lymph flow, visualization of the lymphatic vessels, the lymph nodes and the liver were evaluated by a score-system. Local retention of radiopharmaceutical was also measured expressed in per cent of the injected activity.
Results: In 9 patients LE was excluded by normal LS. Hypoplasia of the lymphatic system was diagnosed in 26 patients (in 4 children on both limbs), 12 patients had lymphatic aplasia of one lower limb. Significant negative correlation was found between severity of the LE and score values of flow, visualization of lymphatic vessels and nodes and liver respectively. Local retention was related to LE. Improved score values were found after lymphatic vessel implantation.
Conclusions: LS is a clinically useful method to diagnose LE of the lower limb in pediatric patients, it contributes to better understanding of pathomechanism of the LE. LS has therapeutic impact and is helpful in the postoperative follow-up.

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THE PROGNOSTIC IMPORTANCE OF THE SENTINEL LYMPH NODE EXAMINATION IN BREAST CANCER

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Aim: We evaluated in breast cancer using sentinel lymph node biopsy (SLNB) followed by full axillary resection: 1. the removed sentinel lymph node(s) (SLN) positivity with conventional and serial sectioning and immunhistochemical staining 2. the number of cases with false positive SLN 3. the frequency of loco-regional and distant spread of the tumor during 3 years follow-up period
Material and methods: SLNB were performed in Uzsoki Hospital between 1999 and 2004 in 381 cases. In this study we evaluated the results of histological examinations of SLN, and bone scintigraphy, abdominal and axillary ultrasonography, chest X-ray examination repeated every year in the cases of breast cancer with < 25 mm tumor, clinical NO stage. The mean follow-up period was 3 years. The number of pts was 98, mean age 52 year (35–82 years). In breast cancer (verified by mammography, ultrasonography and cytology examinations) we injected 150 MBq Tc-99m-SentiScint intradermally-peritumorally or intratumorally in the cases with non or poorly palpable tumor. After 3, 24 hours we performed static scintigram with gamma camera. We removed the SLN intraoperative, looking for node(s) with gamma probe, NAVIGATOR. We analysed the removed SLN by histological method (conventionally and immunhistochemically). The oncological treatment was modified by the histological result of SLN.
Results: We could find positive SLN in 29/98 (29%) patients, the SLN were false negative in 4/98 (4%) patients. During 3 years follow-up period we could not detect local metastases, in 1 case the metastases were found in axilla, in 3 cases distant metastases could be detected.
Conclusions: Our results proved to be almost the same as in the literature in the cases with clinicaly NO stage of breast cancer — showing positive SLN in 28% of patients, the low number of pts with regional and distant metastases. Using the SLNB the staging of the breast cancer can be more accurate, therefore the oncological therapy can be more adequate as well.

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SENTINEL NODE DETECTION IN BREAST CANCER: PERITUMORAL VS. PERIAREOLAR TRACER ADMINISTRATION TECHNIQUE

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Background and aim: Regional lymphatic node resection is a standard management in surgical treatment of breast cancer. Sentinel node determination is an important part of it. The aim of the study was to compare the radionuclide and blue dye techniques of as well as the influence of the way of tracer administration on the sensitivity of sentinel node determination.
Material and methods: We studied 195 patients with breast carcinoma divided into three groups: group I (51 patients) with radionuclide/blue dye peritumoral administration, group II (72 patients), with sentinel node determined with blue dye technique only, group III (72 patients), where radionuclide and blue dye were injected intradermal and peri-areolar way. 99Tc-nanocolloid tracer and a single head gamma-camera Diacam (Siemens, Germany) were applied; intra-operation sentinel node determination was done using a hand-held NeoProbe device.
Results: Sensitivity, specificity, positive and negative predictive ratios were respectively in group I: 92%, 100%, 100% i 96%; in group II: 72%, 100%, 100% i 81%, in group III 91%, 100%, 100%, 95%. Multivariant analysis showed that efficacy of sentinel node determination depended on body mass index and surgeon's experience, did not on age of patient, the size of the tumour and it's pathologic type.
Conclusions: Dual radionuclide/blue dye sentinel node determination technique is superior to blue dye only technique, with no major impact of the way of administration.

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LYMPHATIC RECURRENCE IN MALIGNANT MELANOMA FOLLOWING SELECTIVE LYMPH NODE DISSECTION BASED ON SENTINEL NODE BIOPSY

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Aim: To evaluate the occurence of lymphatic region recurrence during postoperative follow-up in patients with 1-4 mm thick malignant melanoma (MM) and without palpable regional lymph node, omitted regional block dissection (RBD) based on negative result of sentinel node biopsy (SNB).
Material and methods: Between April 2001 and November 2003 selective RBD was performed in 47 MM patients, i.e. RBD was omitted in patients with negative sentinel node(s) (SN). Combined method was used (Tc^{99m} labelled nanocolloid was injected peritumorally or round the scar on the day before the operation + blue dye was injected peritumorally or round the scar directly before the operation). Hot and blue lymph nodes only were identified as sentinel nodes. In 28/47 patients RBD was omitted based on negative results of SN histology completed after the operation. In 28 patients physical examination, lymph node region as well as abdominal ultrasound (US), chest X-ray, bone scan and S-100 protein measurement were performed during the follow-up. The mean of duration of follow-up was 24 months (range, 10–41 months).
Results: Suspicion of lymph node region recurrence was raised in 4/28 patients according to physical examination and lymph node region US. The cytology was negative in 3/4 patients (histiocytosis, non malignant disease) and lymph node metastasis in 1/4 patient. In the latter case lymphatic region recurrence as well as scar recurrence was revealed at the same time therefore it is impossible to hold an opinion about the possibility of a false negative SNB.
Conclusions: Our results support that: 1. Using strict patient enrollment, 2. Using combined radiocolloid and blue dye labelling technique, 3. With properly trained team, selective RNB based on SNB is a safe and appropriate method in early MM.

GASTROENTEROLOGY

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HEPATOBILIARY SCINTIGRAPHY COMBINED WITH DRINKING OF MILK IN PATIENTS WITH "POSTCHOLECYSTECTOMY SYNDROME"

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Aim: After cholecystectomy a compensating dilatation of the bile ducts may occur. The obstruction of the bile flow also results in dilatation of the bile ducts. Hepatocholescintigraphy combined with drinking of milk was used to differentiate between the to possibilities.
Material and methods: 48 patients with „postcholecystectomy" complaints were enrolled into the study. 100 MBq 99m-Tc-EHIDA was injected i.v, 90 frames (1 min each) were registered 250 ml milk was given at the moment when the activity in the common bile duct started to decrease. The time from the injection to the arrival into the duodenum was measured, more than 25 minutes was regarded as a delay. The half time of ejection after milk was also determined in the common bile duct. The ejection showed a fast and a slow component. The upper normal value of the fast component half time is 10 min, and that is 20 min for the slow component.
Results: In 28 subjects all the three parameters of the bile flow were in the normal range. In 6 patients all were delayed and in these patients partial obstruction of bile flow was diagnosed. In 6 patients the delayed arrival of isotope was combined with normal ejection after milk, these data together were not regarded as an obstruction. The fourth type of the results was the arrival in time with delayed ejection The slow ejection was the sign of partial obstruction (8 patients).
Conclusion: The measuring of the arrival of the isotope into the duodenum combined with the determination of the ejection rate after drinking milk makes the biliary scintigraphy suitable to differentiate obstruction from biliary tract dilatation observed following cholecystectomy.

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RADIONUCLIDE GASTRIC EMTYING STUDIES IN DIABETES MELLITUS

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Aim: The diagnostic role of radionuclide gastric emptying study was investigated in long duration type 1 and type 2 diabetes mellitus (DM) patients for the determination of diabetic neuropathy.
Material and methods: Twenty-two patients has type 1 DM and 13 patients suffered from type 2 DM. The duration of disease was similar in two group of patients (type 1: 23.5 ± 1.8 years, type 2: 19.6 ± 2.5 years, $p > 0.5$). The dynamic of gastric emptying was investigated after eating of two 99mTc-labelled boiled eggs, one roll of bred, and 200 ml of water. The gastric emptying was characterised by the half time of the gastric time/activity curve. The gastric half time was compared with the results of cardiovascular reflex tests (AN score).
Results: The gastric half time was increased in both groups (type 1: 95 ± 9.9, *vs.* 49.6 ± 5.5 min, $p < 0.05$, type 2: 82.4 ± 8.8 *vs.* 49.6 ± 5.5 min, $p < 0.05$). The AN score revealed more severe neuropathy in the type 2 DM (type-1: 4.3 ± 0.6, type 2 7.1 ± 0.5, $p < 0.01$). A significant positive correlation was found between the gastric emptying and the AN score in the type-1 DM ($r = 0.57$, $p < 0.01$). No correlation was detected between the gastric emptying and the AN score in the type 2 DM patients.
Conclusions: The gastric emptying was prolonged in both groups of DM patients. In type 1 DM the AN is suggested to be the initial factor of gastoparesis. In the type 2, the ethiology of gastroparesis is more complex.

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SPECT STUDIES IN FOCAL NODULAR HYPERPLASIA

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The focal nodular hyperplasia (FNH) is the second most common benign hepatic tumor, which contains variable quantities of normal hepatic cellular elements: Kupffer cells, hepatocytes, bile ducts and blood vessels. Nuclear medicine has an important role in the diagnostic of FNH. The caracterictic signes are increased perfusion, normal or moderately increased blood pool and increased accumulation of 99mTc--HIDA. The colloid uptake is in approximately 75% of cases normal, in 25% decreased, and in 5% increased, reflecting the variable quantity of Kupffer cells.
Two patients with suspicion of FNH were investigated by colloidal-, blood pool- and hepatobiliary scintigraphy. Static and SPECT study were performed in all cases. Diagnosis was confirmed by histology. In our experience the SPECT study is an useful completion of static study aspecially in small tumors, in the exact appreciation of activity.

KIDNEYS

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COMPARISON OF VARIOUS MEASURES AND INDICES OF KIDNEY FUNCTION

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Aim: Various indices of the kidney function have been developed and used in the clinical practice. Our aim was to compare nine of these methods in order to find those of choice for the everyday routine.
Material and methods: 31 patients in states ranging from normal to serious renal insufficiency were studied. Tc-99m DTPA clearance from two blood samples (*DTPA--GFR*) was used as reference. Gamma camera-based techniques included Gates', Inoue's and Patlak analysis. Non-radioactive measurements of creatinine clearance (without and with normalization), Cystatine-C, and indices using the *MDRD* and Cockroft-Gault (*CG*) formulas were also calculated. Regression analysis and Altman-Bland plot were used to characterize the relationship with the reference method. From among the split renal function estimators the one based on the Patlak plot was used as reference.
Results: All studied methods correlated significantly with DTPA-GFR. MDRD (0.88), Cystatine-C (0.78) and CG (0.75) showed the highest correlation coefficients. From among the camera-based methods Inoue's performed the best ($r = 0.69$), while Gates' the poorest ($r = 0.54$). All parameters but CG and Inoue's method were significantly biased proportional to GFR; e.g. MDRD tends to overestimate values below 60, while underestimate those above 60 ml/min/1.73 m^2. Gates' method for split renal function tends to overestimate the side of worse function, although not significantly.
Conclusion: From among the laboratory parameters tested the *MDRD* formula provided the best estimate of GFR. From the present gamma camera-based techniques *Inoue's* is the method of choice.

INFECTION AND INFLAMMATION

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THE ROLE OF LEUKOCYTE SCINTIGRAPHY IN THE DIAGNOSIS OF VASCULAR GRAFT INFECTION

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Aim: The diagnosis of vascular graft infection is not always easy. While the graft infection indicates hazardous reoperation, the correct diagnosis is essential. In this study, the diagnostic value of 99mTc-HMPAO leukocyte scintigraphy (LS) was analysed in cases with graft infection.
Material and methods: Ten patients (11 grafts: 6 aorto-bifemorale, 3 femoro-popliteal, 2 ilio-femorale) were investigated. Images were taken 2, 4 and 24 hours following the reinjection of in vitro labelled leukocytes. The results of LS was compared with the surgical and bacteriological findings.
Results: LS revealed infection in 9 of the 10 patients, in concerning to 10 grafts. The reoperation and bacteriology verified infection in 8 patients (9 grafts). In one case, LS was false positive: during the reoperation scar tissue was found without infection. In another patient LS was false negative. In true positive cases, LS correctly localised the site of infection.
Conclusions: LS is a sensitive method for the verification and localisation of vascular graft infection. Further investigations are necessary to confirm the specificity of LS in graft infection.

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PREPARATION AND STUDY OF 99M-TC-LABELLED COMPLEXES FOR INFLAMMATION AND INFECTION IMAGING

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According to the report of WHO, 25% of all deaths world wide are caused by infectious deseases. The aim of IAEA supported Coordinated Research Programme developing specific radiopharmaceuticals in the field inflammation and infection imaging. We tested the following agents: Human Neutrophil Elastase 2 (HNE2), Ubiquicidin (UBI). We used next chelating agents: diethylen-triamine penta acetic acid (DTPA), 6-hydrazinopyridine-3-carboxylic acid (HYNIC).In ther first step HNE2 and UBI were conjugated with chelating agents. We prepared next conjugates HNE2-DTPA, UBI-DTPA, UBI-HYNIC. After stability studies of conjugated peptides we worked out optimum conditions of labelling procedure with 99m-Tc. We accomplished radioanalitycal and chemical stability examination of radiolabelled conjugates. Radioanalitycal mehods were worked with HRLC, ITLC, paper cromatography. Scintigraphical examination studies were done in inflammation induced rats, and Beagle dogs. All the compounds tested showed labelling efficiency higher than 95% but HNE2-DTPA showed after six hours 94–95%. Scintigraphical examination studies with HNE2-DTPA twenty four hours after injecting higher activity showed inflammation induced field. We can conclude that 99m-Tc-HNE2-DTPA have the potential radiopharmaceutical for inflammation and infection imaging.

BONE AND JOINTS

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RELATIONSHIP BETWEEN THE BONE STRENGTH AND BONE MINERAL CONTENT IN EXPERIMENTALLY INDUCED OSTEOPOROSIS IN RATS

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Main aim of the research work was to investigate the relationship between bone strength and bone mineral content at different skeletal sites in experimentally induced osteoporosis in rats Bone mineral contents (BMC) have been determined by single photon absorptiometry at femoral metaphysic, as well as another physical quantity at the trochanter to be proportional very well to the bone mineral mass was tested by a soft X-ray equipment in case of cirrhotic rats. The exposed X-ray films were digitised and then quantitatively evaluated by OSIRIS 3.6 and microSegams© imaging systems. Next investigations were oriented to determine the maximal mechanical loading forces (Fmax) by a biomechanical test series (Zwick-020) at femoral metaphysis. The obtained results have been compared to normal control groups.
High correlations were found in normal control group between cortical BMC and metaphyseal Fmax ($r = 0.901$, $p < 0.001$) as well as between cancellous (trochanteric) bone mass and metaphyseal Fmax ($r = 0.906$, $p = 0.002$). Strong correlation was obtained also between cortical and cancellous bone mass ($r = 0.809$, $p = 0.015$) at femora of control rats. However, in case of cirrhotic animals only cortical BMC showed relationship to metaphyseal Fmax ($r = 0.769$, $p = 0.003$) while no correlation was found between cortical and trochanteric bone mass.
The obtained results show strong relation between maximal loading force of femoral metaphysic and cortical as well as trabecular bone density for normal control group. In turn, the cortical and trabecular bone loss in cirrhotic animals are not equivalent. Consequently, the maximal loading force of bone metaphyseal cannot be determined by trabecular bone density.

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ACTIVITY DEFECT ON BONE MARROW SCINTIGRAPHY: VERTEBRAL HAEMANGIOMA?

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Aim: Focal decreased activities on bone marrow scintigraphy (BMS) suspicious for bone metastases (BM) can be caused by several benign lesions. Recently vertebral haemangiomas (VH) could be proved in several cases as the cause of focally decreased bone marrow uptake on BMSs performed with the suspicion of BMs. Nevertheless such cases are not reported in the literature. Based on our cases the diagnostic features of VHs will be discussed.
Material and methods: The BMSs performed in 2003–2004 were overviewed. BMS was performed 2–3 hours after the intravenous application of 700 MBq Tc-99m labelled anti-granulocyte antibodies. Whole body- and occasionally SPECT images were obtained. Suspicious metastatic lesions were further investigated radiologically.
Results: We performed 64 BMSs in 2003 and 2004. All patients with BMS had bone scintigraphy (BS) previously. 5 focal decreased bone marrow uptake of 4 patients were caused by VHs as proved by radiology (2 X-ray, 4 CT, 3 MR). 2 additional bone marrow- and 1 bone SPECT were performed. The activity defect caused by VH was depicted in a single vertebral body but BS showed almost normal regional uptake. Our cases demonstrate the more specific radiological features of VHs as well.
Conclusions: We found VH frequently in our patient population. Among focal activity defects on BMS VHs and BMs have similar appearance while degenerative lesions can cause more specific image based on photopenic lesions in two neighbouring vertebral bodies. According to our experiences and literature data BSs are usually normal in the region of VHs but early BMs may also have the same appearance. One or few lesions detected on BMS necessitate further clarifying investigations.

THERAPY

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SAMARIUM-153-MULTIBONE TREATMENT OF METASTATIC BONE PAIN

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Background: Pain caused by bone metastases often significantly affects quality of life of the patients with cancer. In Hungary the isotopic treatment of this type of pain is reimbursed by the national security system for 3 years.
Aim: To follow-up of our patients treated with Sm-153-Multibone and to determine of therapy efficacy and the extent bone marrow damage.
Material and methods: Between 2002–2004 we performed 90 treatments in 74 patients, In most cases primary cancer causing metastasis was breast cancer among women (26 patients) and prostatic cancer (24 patients) in men. 43 patients were already on narcotic drugs, the others received multiple types and doses of analgesics. The bone scintigraphy score before treatment was mean 69 (30–110). The patients received 2500 MBq Sm-153-Multibone intravenously. 10 patients asked for treatment repetition.
Results: The decrease of subjective complaints and reduction in analgesic consumption was the marker of treatment efficacy.The therapy was succesfull in 48 patients (significant pain reduction in 33, moderate pain reduction in 15 patients). Succesfull treatment was achieved mostly in breast and prostatic cancer, while failure was seen mainly in metastases caused by other tumors (colo-rectal, thyroid carcinoma). In one part of our cases the repeated bone scintigraphy showed significant regression. After the treatment 30% of patients had the significant lowering of the white cell and thrombocyte counts. It could be noticed in the 2nd weeks after the treatment and reached critical values in the 4th week. The red blood cell counts and serum creatitine levels did not change.
Conclusion: Based on our results, Samarium-153-Multibone treatment is effective for bone pain palliative therapy, but the reduction of white blood cells requires close follow up of the patients.

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2.5-YEARS RESULTS WITH ^{166}HOLMIUM-PHYTATE TREATMENT OF CHRONIC SYNOVITIS. PHASE I-IIA, RANDOMIZED, INCREASING DOSAGE, SINGLE-BLIND, PLACEBO-CONTROLLED COMPARATIVE STUDY

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Study objectives: Examination of anti-inflammatory effect of 166-Holmium-phytate injection /166-Ho/.
Material and methods: Phases I-II, randomized, simple-blind, placebo-controlled comparative study using increasing dosage. 31 patients suffering from chronic synovitis, rheumatoid arthritis and seronegative spondylarthritis were examined. The protocol commenced with screening. The patients were selected according to inclusion and exclusion criteria. Patients were randomly distributed into four treatment arms: Group I. Holmium phytate injectable suspension marked by 185 MBq ^{166}Ho + 40 mg of 1 ml triamcinolone acetonide/TA/ + 1 ml of 1% lidocaine injection./Lid.inj./ Group II. 555 MBq ^{166}Ho. + 40 mg of 1 ml TA + 1 ml Lid.inj. Group III. 925 MBq ^{166}Ho + 40 mg 1 ml TA + 1 ml of 1% Lid.inj. Group IV. Solely 40 mg of 1 ml TA + 1 ml of 1% Lid.inj. There were 30 month follow-up period after the administration of the isotope. Inflammatory activity of the affected knee-joint was tested prior to treatment, and the 14th and 28th days, and 3, 6, 9, 12, 24 and 30 months after treatment. Testing was done based on the following parameters: Measurement of swelling of knee-joint [cm]; Flexion – heal buttocks distance [cm]; Degree of knee-joint pain. Visual Analogue Scale /VAS-1-100/; Patient's opinion on inflammation of knee-joint /VAS-1-100/; Doctor's opinion on given inflammation of knee-joint /VAS-1-100/.
Results: Even after 3 year period 88.2% of the findings were rated as excellent or good. 86.66% of the patients do not need another punction even after a 3 years period. During the study period, inflammation decreased in the group receiving 555 and 925 MBq.
Conclusion: Ho-166 isotope is an effective radiopharmacy treating synovitis. Effective dosage is 555-925 MBq.

THERAPY — RADIOSYNOVIORTHESIS

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INTRACORONARY RADIONUCLIDE THERAPY WITH LIQUIDE RE-188 TO PREVENT RESTENOSIS

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Aim: To evaluate possible relationship between clinical success of intracoronary radionuclide therapy with liquide Re-188 to prevent restenosis (RS) after percutaneous coronary intervention (PCI) and severity of coronary artery disease (length of stenosis, number of diseased vessels and restenosis after previous PCI).
Material and methods: 19 patients (11 male, 8 female, median age: 64.1 years) were enrolled in the study according to the protocol of an IAEA co-ordinated project. 13 patients had significant coronary stenosis with less than 2 cm of length, 6 patients had stenosis longer than 2 cm. 8 patients had single vessel, 5 patients had two-vessel and 6 patients had three-vessel disease. 5 patient had RT after one, 10 after two and 4 after three previous PCIs. 18–20 mL of Re-188 eluate from a W-188 generator were concentrated to 1–2 mL. Re-188 solution was put — by a special tool with appropriate radiation protection — into a balloon-catheter placed in the dilated vessel. Duration of the irradiation was calculated by an Excel table — based on certain data of the coronary anatomy and radioactive concentration — to deliver 18 Gy to the vessel. Success of the therapy was evaluated after 6 month of follow-up.
Results: 6 patient had RS. RS rate was not related to the length of stenosis. RS occured in patient with two- or three-vessel disease and after 2 or 3 previous restenosis only.
Conclusions: intracoronary radionuclide therapy is not effective in patients with two- or three-vessel disease and repeated restenosis after previous PCI. Supported by IAEA (CRP-IVRNT).

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^{166}HOLMIUM-PHYTATE-RADIOSYNOVIORTHESIS IN RHEUMATOID ARTHRITIS. ONE YEAR RESULTS. PHASE III PROSPECTIV STUDY

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Study objectives: Examination of anti-inflammatory effect of 166-Holmium-phytate injection.
Material and methods: Phases III, prospectiv study. 32 patients suffering from chronic synovitis, rheumatoid arthritis were examined. The protocol commenced with screening. The patients were selected according to inclusion and exclusion criteria. Holmium phytate injectable suspension marked by 600 MBq ^{166}Holmium phytate injectable suspension, and 40 mg of 1 ml triamcinolone acetonide and 1 ml of lidocaine 1% There were 12 month follow-up period after the administration of the isotope. Inflammatory activity of the affected knee-joint was tested prior to treatment, and the 3th and 3, 6, 9 and 12 months after treatment. Evaulation was based on the criteria as described by Müller, Rau and Scütte the score system was developed by the authors.
Results: During the study period, inflammation decreased. In the first one year excellent and good results were recorded in 93.3%. One year after radiosynoviorthesis 93.3% of patients did not need another punction. Administration of Holmium-166 phytate is a safe procedure. We did not detect any symptoms of radiation sickness. We found no deviations in either haematological or chemical parameters during the study period.
Conclusion: Holmium-166 isotope is an effective radiopharmacy treating synovitis. Due its adventageous features it produces less radioactive damage on the organism than the traditionally used isotopes (90-Yttrium, 169-Erbium, 186-Rhenium). Due to its physical parameters it is optimal to treat large joints (knee) and medium size joints (hips, shoulder, elbow, wrist, ankle). Effective dosage is 555–925 MBq.

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THE STRATEGY OF THE DIAGNOSTIC METHODS BEFORE RADIOSYNOVIORTHESIS (WHICH EXAMINATIONS SHOULD WE MAKE, WHICH ARE ENOUGH?)

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Background: The radiosynoviorthesis (RSO) has been used effectively for a long time for the treatment of the painful arthropathy, synovitis. The indication and the isotops for the usage are well-defined. The effectiveness of the RSO depend on the good indication of the treatment. We have to decide before the therapy the diagnosis perfectly and the good distribution of the isotop inside the joint.
Aim: To decide the indication of RSO exactly with the shortest, most accurate diagnostic strategy.
Material and methods: On the basis of clinical status, we examined before treatment of 81 patients, dedicated for knee RSO 52 patients, for hip 25 patients, for ankle 4 patients. In every case we performed X-ray (XR), ultrasonography (US), three phase bone scintigraphy (BSc). In 6/81 cases MR was performed as well.
Results: 1. XR examinations help select the relative contraindicated cases (for example: subluxations).
2. US compared whit BSc detected more exatly the synovitis.
3. We could find good correlation between the severity of pain caused by synovitis and the early phase of BSc.
4. The other intra- or extrajoint illnesses in contrary to synovitis could be detected by US exactly.
5. BSc can differentiate the main cause of pain in the cases of association of synovitis and arthrosis (painful synovitis or painful arthrosis?)
6.US proved to be the only diagnostic method to detect Baker-cysts. On the basis of these 3 examinations in 17/81 cases the RSO were contraindicated or non-indicated.
Conclusions: The XR and US examination are proved to be the first, most important „screening" method before RSO. The BSc should be performed to detect:
1. The severity of the well established synovitis
2. The localisation of the real cause of the pain
3. To decide the sequence of treatment in the case of more than one joints to treat.
The importance of other (MR or something else) examinations is very low.

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ULTRASOUND MONITORING OF THE SYNOVIAL THICKNESS AFTER 166-HOLMIUM-PHYTATE RADIOSYNOVIORTHESIS — 2.5-YEARS RESULTS (COMPARATIVE, RANDOMIZED, SINGLE-BLIND, PLACEBO--CONTROLLED STUDY WITH INCREASING DOSAGE)

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Study objectives: Measure the synovial thickness after 166-Holmium radiosynoviorthesis by sonography.
Material and methods: Phase I-II, randomized, simple-blind, placebo-controlled comparative study using increasing dosage. 31 patients suffering from chronic synovitis, or rheumatoid arthritis /RA/, or seronegative spondylarthritis (SNSA) were examined. The protocol commenced with screening. The patients were selected according to inclusion and exclusion criteria. Patients were randomly distributed into four treatment arms: Group I. 185 MBq ^{166}Holmium phytate injectable suspension and 40 mg of 1 ml triamcinolone acetonide, and 1 ml of lidocaine injection 1% Group II. 555 MBq ^{166}Holmium phytate injectable suspension, and 40 mg of 1 ml triamcinolone acetonide and 1 ml of lidocaine 1% Group III. 925 MBq ^{166}Holmium phytate injectable suspension and 40 mg of 1 ml triamcinolone acetonide and 1 ml of lidocaine 1%. Group IV. Solely 40 mg of 1 ml triamcinolone acetonide and 1 ml of lidocaine injection 1%. There were 30 month follow-up period after the administration of the isotope. We measured the quantity of the synovial fluid and the thickness of the synovia before the treatment, and the 14th, 28th days and 3, 6, 9, 12, 24 and 30 months after the treatment. We measured the synovial thickness the following locations: In the midline, lateral and medial, by the condylus of femur medial and lateral.
Results: The thickness of the synovia decreased significantly in the Group II (555 MBq) and III (925 MBq). After a transient improve (the steroid effect) the thickness of the synovia began to rise in the Group I. (185 MBq) and in the control group. We find a significant correlation between the synovial thickness and the clinical improvenes.
Conclusion: The 166-Holmium-phytate is an effective new radiopharmacon in the treatment of synovitis. We detect the clinical improvement by sonography. The effective dose is 555-925 MBq.

VETERINARY NUCLEAR MEDICINE

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RESULTS OF ONE YEAR FOLLOW-UP — RADIOSYNOVECTOMY IN KNEE AND HIP JOINT

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Aim: One year follow-up results of 65 pts treated with radiosynovectomy were evaluated. In 17/65 cases the hip and in 46/65 cases the knee were treated.
Material and methods: The indication of radiosynovectomy was synovitis in systemic disease (PCP, SNSA, psoriatic arthritis) in 21/65 cases or in early stage of arthrosis in 41/65 cases. Mean age was 49 year (30–82), 51 female, 14 male. Before the treatment X-ray examinations, 3 phase bone scintigraphy and ultrasonography were made in every case. Yttrium-90-colloid was used for radiosynovectomy of hip and Rhenium-186-colloid for radiosynovectomy of knee. Measurement of clinical improvement was performed with HSS (Hospital for Special Surgery) score. 3 phase bone scintigraphy and ultrasonography were repeated after 3–6 months.
Results: On the basis of clinical improvement our cases were divided into 3 groups: 1. best clinical effect (HSS score 80–100), 2. intermediate therapeutical effect (HSS score 60–80), 3. low therapeutical effect (HSS score 40–60). We could register in 52/65 (80%) of patients clinical improvement 1-3. score in HSS score system with improved mobility, pain, inflammation, oedema. Ultrasonography and 3 phase bone scintigraphy had good correlation with the clinical status.
Conclusion: On the basis of objective clinical scoring, and results of diagnostic procedures (3 phase bone scintigraphy and ultrasonography) radiosynovectomy of hip and knee was proved to be a good alternative method for the treatment of synovitis.

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USE OF A TUMOROUS DOG MODEL IN THE EVALUATION OF ^{90}Y AND ^{99M}TC-LABELLED SOMATOSTATIN ANALOGS

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Background: There is a considerable interest about matching pairs of diagnostic and therapeutic radiopharmaceuticals for targeted somatostatin receptor therapies. However, there is a gap in preclinical models between the monoclonal, well-reacting rodent-borne tumors and the real clinical situation, where polyclonal and stroma-containing tumors have to be killed by radionuclide receptor therapy. We aimed at filling this gap with the presentation of a dog insulinoma diagnosis and treatment with radiolabelled somatostatin analogs.
Material and methods: The labelling of the somatostatin analog peptide DOTA--TATE (piChem, Austria) was performed with ^{90}Y for therapeutic goals under mildly acidic conditions and heating. ^{99m}Tc labelling of the peptide HYNIC-TATE (Kantonsspital Basel, Switzerland) was performed by the method described by the supplier. One dog bearing insulinoma received two doses of subsequently 10 and 5 mCi of ^{90}Y-DOTA-TATE. A diagnostic scintigraphy and SPECT was performed in the animal with 500 MBq of ^{99m}Tc-HYNIC-TATE. Size of the tumor was monitored by ultrasound. Blood kinetics of the pharmacons were measured. Serum insulin and glucose as well as a complete biochemistry panel were monitored, too.
Results: Following the first two therapies, the tumor size of originally 1.8 cm in diameter shrinked and after 2 months the tumor became unvisible with ultrasound. Serum insulin levels decreased shortly after therapies, but returned to an elevated level thereafter. The animal was free of symptoms for 1 year following treatment. However, ^{99m}Tc-HYNIC-TATE SPECT has shown a small focus in this period.
Discussion: This case reveals the use of a large animal model in targeted cancer treatment and the effectiveness of somatostatin receptor therapy.

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SENTINEL LYMPH NODE DETECTION IN DOGS AND CATS — RETROSPECTICE ANALYSIS OF CLINICAL CASES

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The aim of this study was to compare the effectivity of detection sentinel lymph nodes by radioactive, non-isotope and a mixed method in spontaneously occurring oncological canine and feline patients and to evaluate the clinical usefulness of a novel method. Altogether 44 dog and 21 cat patients with the history of mammary tumours, skin tumours and different head-, and neck tumours were included in the study. All the referred patients underwent fine needle biopsy, thoracal radiography and haematological examination before the surgical removal and intra-operative sentinel lymph node detection. Gamma camera imaging (Nucline X-ring, Mediso Ltd) and intra-operative gamma probe (Europrobe, Eurorad) with blue stain imaging (Patent blue) was used for localizing the sentinel nodes. Removed tumours and lymph nodes were investigated by pathologist. Forty two percentage of the removed lymph nodes found to be positive by histopathological examination. Only 62% of the lymph nodes were enlarged, palpable before the surgery, and 70% were blue colour painted by the stain. Seventy six % of the nodes were imaged in the preoperative scans and over 96% were to be localized by the combined (99mTc-colloid and blue stain) intra-operative detection. All the 5 lymph nodes that were not detected by any methods but found by the pathologist in the surgical samples were negative for metastases. Only 1 patient with negative sentinel lymph nodes resulted regional recurrance of the tumour and over 50% of the positive sentinel lymph nodes resulted local recurrance in the 2 years follow-up examinations. Intra-operative radioactive guided surgery combined with gamma camera imaging and the blue stain seem to be the superior method for localizing sentinel lymph nodes. The use of sentinel lymph node detection in animals proved to be helpful in the veterinary oncological praxis.

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STUDIES OF LOCAL HYPERTHERMIA'S EFFECTS ON THE UPTAKE OF ^{99M}TC-MDP WITH 3-PHASE BONE SCINTIGRAPHY IN THE HEALTHY BEAGLE DOG

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Background: Application of local hyperthermic protocols is gaining an increased reputation in oncotherapy of head and neck, breast, digestive and gynecological tumors. There is growing interest in combination of radioimmunotherapy and hyperthermia, too.
Material and methods: Heating of the right forelimb was performed with a local microwave applicator (Erbotherm 240, Erbe, Germany) in 3 Beagles and 30 minutes of heat before the start of 3-phase scintigraphy with 300 MBq of ^{99m}Tc-MDP. Another 3 dogs were heated for an additional 30 minutes (Group B-total 60 min. heat) or 1 hour (Group C-total 90 min. heat) after the start of scintigraphy. The regional uptakes compared to the contralateral side were calculated with the ROI-method on the images. Temperature monitoring of 4 points in the right limb was performed with a newly developed fiber optic laser Bragg-grating thermometry system (EC-JRC, Ispra, Italy).
Results: Temperature was constantly 42°C in the center of the heated region and remained normal at the contralateral side. Uptake of MDP was increased by heat in Group A with 50% in the perfusion phase, 20% in the tissue phase and 14% in the bone phase. These values in Group B were 55–42–33%, in Group C: 60–55–75%.
Discussion: Local heating of the dog forearm definitely increases perfusion. A marked increase could be detected in both the tissue and the bone phase as well. The increase in uptake of the bone phase can also be due to a kinetic acceleration of the chemisorption reaction. Based on these results, a significant increase in the local dose will be available with palliative bone-seeking therapeutic radiopharmaceuticals during a combination with local hyperthermia at the site of metastases.

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LEAKAGE STUDIES AFTER INTRAARTICULAR INJECTION OF ^{90}Y AND ^{169}ER RADIOCOLLOIDS IN THE HEALTHY RABBIT KNEE

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Background: Leakage of radioactivity after intra-articular injection into the knee joint has been studied in healthy rabbit knee joints. Three colloidal systems have been studied, ^{90}Y citrate, ^{90}Y silicate and ^{169}Er citrate.
Material and methods: Leakage studies have been performed at various times post injection with 6 male animals per time point for all preparations. Time points ranged from 6h to 5 days for the ^{90}Y preparations and 6h to 19 days for ^{169}Er. Knee joint injection was done with 100–500 μCi of activity in 100 μl volume. Correctness of injection was checked in all animals by gamma camera with the use of ^{99m}Tc-colloids as well. In some studies, leakages of immobilized and non immobilized rabbit knees were also compared. The remaining activities in the knees were determined by measuring bremsstrahlung in a NaI(Tl) scintillation counter. Absorbed radiation dose was calculated using the MIRDOSE 3 software.
Results: Radiocolloids showed a retention of more than 90% from 6 h–2 days, while the time points up to 5 days indicated a leakage of not more than 10%, with an exception of the ^{90}Y silicate with a leakage of 16%. Later time points showed a leakage in the range of 15% for the ^{169}Er colloid. There was no significant difference between the leakage of immobilized and non immobilized rabbit knees.
Discussion: This extensive study has shown that all preparations reside mostly in the knee. The estimated radiation burden to other organs is negligible after intraarticular injection of these radiocolloids. The loss of difference between immobilized and non-immobilized animals can be a characteristic of the chosen rabbit model.

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SUCCESSFULL TREATMENT OF A CANINE THYROID CARCINOMA WITH THORACAL METASTASES

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Operation combined with high-dose radioactive iodine was used in the treatment of a nine year old, large sized, mixed-breed, male dog with hyperthyroidism resulting from a large unilateral thyroid carcinoma with multiple thoracal metastases. Hyperthyroidism was diagnosed on the basis of clinical signs (lethargy, weight loss, tachycardia, PD/PU) and high basal serum thyroxin (T_4) concentrations, as well as ^{99m}Tc-pertechnetate scintigraphy that showed a high radiotracer uptake into the thyroid tumour and thoracal metastases. The fine needle biopsy and the histopathological examination of the removed primary tumour revealed a compact cell carcinoma originated from the left thyroid lobe. Ten days after removing the primary tumour 4.2 GBq I-131 was applied intravenously. After the high dose radioiodine treatment the dog had been hospitalized for 30 days, T_4, haematology, complete blood chemistry and whole-body scans were made every third day. Radioactivity of blood and urine samples and the external body surface doses were checked in the same time as well. The high dose radioiodine treatment resulted a complete ablation of the contra-lateral healthy thyroid lobe and the thoracal metastases. Six, 12 and 18 month after the treatment control laboratory and scintigraphical examinations were carried out and the dog is considered to be tumour-free with a hypothyroid status, it only needed daily thyroxin substitution. The dog was euthanized on the request of the owner 20 month after completing the therapy and de-compensated cardiac insufficiency with no evidence of tumour abscence was found in necropsy.

RADIOPHARMACY

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PREPARATION OF 99M TC LABELLED RECEPTORSSPECIFIC LIPOSOMES AND LIPOPROTEIN MACROMOLECULES FOR THE SCINTIGRAPHIC DETECTION OF THE PLAQES OF ATHEROSCLEROSIS

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Background: We have used the radiolabelled low density lipoproteins (LDL)and radiolabelled LDL mimic liposomes for the scintigraphyc detection of plaques in animal model.
Material and methods: We have isolated lipoproteins by preparative ultracentrifugation. The identification of the heterogeneity of lipoproteins subfractions were taken for Schlieren analysis. Liposomes were obtained from lipoproteins and from phospholipids and cholesterol with similar features to lipoproteins. Radiolabelling of lipoproteins and liposomes with 99mTc were performed using sodium dithionite as a reducing agent. Radiochemical purity and in vitro stability of radiolabelled components were controlled by paper chromatography. Rabbits fed a diet containing 1% cholesterol for 60 days to develop hyperlipidemia and atheromatous aortic plaques. Gamma scintillation camera imaging of the rabbits were performed for radiolabelled lipoproteins, and liposomes.
Results: The analytical and preparative ultracentrifugation methods proved to be useful to obtain lipoprotein aliquots for radiolabeling. Labelling efficiencies were more than –90% for lipoproteins and liposomes. Mean uptake of 99m Tc-labelled lipoproteins and liposomes in the aorta (mainly in aorta arch) and in caroted arteries were higher in hypercholesterolemic rabbits than in normal rabbit controls (about 3 fold qauntity increased uptake), which were confirmed by pahtological examinations.
Conclusions: Our preliminary results showed that gamma camera in vivo scintigraphy of rabbits revealed visible signal corresponding to atherosclerotic plaques by radiolabelled lipoprotens and liposomes. Liposomes can be made from lipids which closely mimic the metabolic behaviour and receptor binding features of lipoproteins.

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MEASUREMENTS OF COLLOID PARTICLE SIZE IN THERAPEUTICAL RADIOPHARMACEUTICALS

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Background: Localization and pharmacokinetics of therapeutical colloid radiopharmaceuticals mainly depends on their particle sizes. In our experiments we used laser scattering method for determination the sizes of different colloids. Samples tested were ^{90}Y-Citrate, ^{90}Y-Silicate, ^{166}Ho-Fytate and ^{188}Re-(Tin-) colloid.
Material and methods: The analytical instrument used in our experiments named DynaPro is a product of the Proteinsolutions Inc. The sample is illuminated by a semi-conductor laser of ~830 nm wavelength. The DynaPro analyses the time scale of the scattered light intensity fluctuations by a mathematical process. The hydrodynamic radius of the sample is determined using the Stokes-Einstein equation. In our experiments paralelly with the samples calibration standard was measured, it was 160 nm polystyrene standard (Bangs Laboratories Inc., Serial NO: 5692). Radiochemical stability measurements were in different time points by TLC.
Results: The calibration found more than 95% exactness of the standard measurements.Particle fraction of ^{90}Y-Citrate colloid ranged between 1 and 7 μm (mean diameter: 3.5 μm) and in case of ^{90}Y-Silicate colloid particles ranged between 0.1 and 4.5 μm (mean diameter: 1 μm). ^{188}Re-(Tin-)Colloid mean diameter was around 4.5 μm. We also examined the stability of the colloid products. These radiopharmaceuticals showed high particle and radiochemical stability (> 99%) *in vitro* and in synovial fluid.
Conclusion: Because of pharmacokinetics of therapeutical radiocolloids depends on their particle sizes the measurements by laser scattering method can be a very important element of radiopharmaceutical research.

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RADIOLABELLING OF SOMATOSTATIN ANALOGUE PEPTIDES BY ^{90}Y

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Background: In the therapy of somatostatin expessing tumours by therapeutical radiopharmaceutical a somatostatin analogue peptid is radiolabelled by beta-emitter radionuclide. In our experiments it was ^{90}Y.
Material and methods: ^{90}Y radionuclide was as [^{90}Y]Yttriumcloride in aqueous solution (0.04M HCl) with 99.9% radiochemical purity (manufactured by AEA Technology QSA GmbH, Braunschweig, Germany). The labelled peptide product were DOTA--TOC (maufactured by Kantonsspital, Basel and IEO, Milano) and DOTA-TATE (piCHEM, Graz).
Before labelling petide was dissolved in milliQ destillated water and gentisic-acid with sodium-acetate buffer (pH:5) was added into the solution as a free radical scavenger. Incubation was at 90æC for 30 minutes.
For quality control we used several processes paralelly. To separation we used reverse phase chromatographic cloumns (Supelco C-18, Merck RP-18, Sep-Pak Cartridges C-18), thin layer chomatography (TLC — 0.1M sodium-citrate solution; ITLC — 40 mM DTPA solution) and HPLC. To measure sample activity CAPINTEC CRC 15 beta (Capintec Inc., USA) dose calibrator and well-type gamma counter were used. *In vitro* radiochemical stability of labelled compounds was tested with incubaion in saline and sera for different times.
Results: Labelling efficiency of ^{90}Y-peptides was 99%. We showed in the stability measurements that labelled peptide shows high radiochemical stability in saline and also in blood sera. The main concern of labelling is the absence of free metal ions (mostly Fe^{3+} és Zn^{2+}) in the micro reaction space and the exact masurement of small beta activities.
Conclusion: Radiolabelling of somatostatin analogues by beta-emitter radionuclides allows of produce new terapeutical radiopharmaticals.

RADIOPROTECTION

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RADIONUCLIDE RELEASES FROM THE SEMMELWEIS UNIVERSITY CLINIC OF RADIOLOGY AND ONCO-THERAPY TO THE ENVIRONMENT AND THE LIMITS

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During the last years the annually used unsealed radionuclide activities in the Clinic are the following: ^{99m}Tc: 1500 GBq to renal diagnostics and 1500 GBq to bone diagnostics, ^{153}Sm: 35 GBq in bone therapy and ^{131}I: 3 GBq in thyroid therapy. To assess the discharges into the aquatic environment it is assumed that the whole activity applied in renal tests removed by the urine of the patients directly into the waste water, while for the bone tests only the 40%. The amount of discharged ^{153}Sm takes 40% of the total used one and for ^{131}I 20% during the staying of the patients inside the Clinic. The atmospheric releases are assessed by 1% of the total activities of ^{99m}Tc and ^{131}I and 0.1% of ^{153}Sm. Taken into consideration the regulations issued at 6. June, 2001 by the Ministry of Environmental Protection as Authority the assessed releases in 2004 are the following: to the aquatic environment 8% and to the atmospheric pathway 38% of the proper limits. The last one is over the investigation level therefore a more detailed assessment procedure is to be provided and depending on the improved results protection actions have to be introduced. The main contribution to the decision function both in aquatic and atmospheric pathways can be derived from the radionuclide ^{99m}Tc. Probably the uncertainty of the assessment is high mainly due to the short half life of the ^{99m}Tc.

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TRANSMISSION OF BACKGROUND RADIATION DATA TO NATIONAL RADIATION MONITORING SYSTEM (OSJER) VIA INTERNET

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Our Institute joined the OSJER in 1997. During the past years we have purchased 2 high sensitivity proportional gamma detectors, BITT RS/03 (BITT Technology), enabling indications of minor changes in the ambient natural radioactivity level. These gammameters were connected to a personal computer. At an early stage we manually downloaded the measurements data and converted them into Excel file and then we e-mailed this file to the Information Centre (BIK), weekly.
The aim of our work was to automate the measurement, data transfer and visualition by means of a server computer connected to Internet. The parameters of the installed server were: 400 Mhz CPU, 32 MB RAM, 80 GB hdd, Debian GNU Linux operation system, Apache WEB server, MRTG diagram maker, Rsync fast remote file copy program - free softwares. The measurements of the sensor are obtained via serial port by means of a special software. The data are downloaded, stored locally and transported to the BIK by 5 minutes. At the same time diagrams are made in daily, weekly, monthly and yearly splitting. The diagrams are archived daily available on the http://tio.numed.szote.u-szeged.hu/ website. It is possible to get the last measured data from mobile telephone from the http://tio.numed.szote.u-szeged.hu/wap/ site.

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RADIATION SAFETY RELATED TO THE OUTPATIENT RADIOIODINE THERAPY

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Aim: The aim of this study was to investigate the external and internal doses of the husband (45 years) and daughter (15 years) of a woman (38 years) with thyroid autonomy treated with 170 MBq of I-131.
Material and methods: The background dose rate variation was determined using a sensitive proportional counter, the personal doses were measured with electronic dosimeters. The internal doses were estimated via the radioiodine concentration in samples taken with an air sampler equipped with a charcoal cartridge and aerosol filter, using a HPGe detector.
Results: The average natural background dose in the house before treatment was (mean ± SD) 2.2 ± 0.3. After the treatment, the background was 28 microSv for the first 24 hours, which decreased to 3.8 microSv by day 11. The total integrated dose for the 11 days was 170 microSv. The personal dosimeters showed a total of 46 microSv (maximum 6 microSv on day 3) for the husband and 40 microSv (maximum 7 microSv on day 5) for the daughter. The internal doses were estimated as 57 microSv (husband) and 80 microSv (daughter), based on a time-integrated I-131 activity concentration of 130 Bq/m^{3}d.
Conclusion: The total dose of each of the family members was well below the recommended levels of 3 mSv and 1 mSv respectively, and a higher administered I-131 activity would also yield acceptable personal doses. In contrast with our expectations, the personal dosimeters of the family members did not show the highest values on day 1, probably because of a decrease in self-protection against the radiation. This should be mentioned while informing patients.

INSTRUMENTATION

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ROLE OF LOCAL AND REGIONAL MONITORING SYSTEMS IN HEALTH PHYSICS ASSESSMENT OF RADIATION INCIDENTS AND ACCIDENTS

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In April 2003 a severe incident took place at Unit #2 of NPP Paks during the temporary surface cleaning of a group of current fuel bundles that led to the break of fuel bundles and the subsequent radiocontamination of local storage tanks. Members of the operating personnel suffered a dose exposure that was well below the limit of harmful consequences but exceeded the normal operational level. The planning of the compound technological procedure for the removal of the broken fuel bundles should consider the potential increase of dose exposure as well. In order to provide a complete assessment for these situations both local (on-site) and environmental (off-site) monitoring should be performed in addition to personal dose measurements including the measurement of external dose rate and radionuclide emission. We will present the various data categories that can be provided by local and environmental monitoring systems, giving special emphasis to continuous health physics assessment during the process of broken fuel removal and the comparison of sensitivity of appropriate methods of on-site and off-site monitoring.

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ROLE OF THE PACS IN THE MULTI-MODALITY NON-INVASIVE IMAGING DIAGNOSTICS AND RESEARCH

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More and more efficient utilization of the rapidly growing novel results and possibilities to be produced by the non-invasive digital imaging systems in clinical application and the related research and developing works are the serious challenges of nowadays. Technological background is provided by the electronic archival system of digital imaging modalities -PACS- with the communication structures.
Due to the research and developing activities in our department (supported by 3 domestic companies) a PACS system with the communication architecture have been created and then integrated into the daily clinical application as well as the research, development and education. Three modalities — CT, NM, VIDAR X-ray film scanner (mainly for mammography) — are connected to the PACS by on-line DICOM 3.0 communication (PracticeBuilder$_{1.2.3}$® and MEDISA), while the other 2 modalities (RAD-850 film scanner and ACUSON ultrasound) by off-line DICOM way with HUG-Osiris software support. Simultaneous presentation of multi-modality images, tele-conference and the electronic archival play significant role in the routine clinical work. PACS based multi-modality is an essential condition for our following research activities like: digital image processing, small animal experiments, quantitative evaluation of digitized mammography and construction of advisory level database as well as pattern recognition. Fusion between various image modalities is already the main power of the future non-invasive diagnostics.
Due to the MEDISO Ltd. supports our department develops the necessary technological conditions for clinical introduction of a cost-effective image fusion software system -Pmod (Univ. Zürich)-.
The achieved results of our research on PACS field highly contribute to do the non-invasive imaging diagnostics even more efficiently.

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INTERVIEW XP™ IS A WINDOWS®XP BASED GENERAL PURPOSE IMAGE PROCESSING SYSTEM FOR NUCLEAR MEDICINE

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InterView XP™ is a graphical based nuclear medical image processing system for both planar and SPECT studies developed by MEDISO Ltd. The evaluation system was dedicated mainly for the domestic developed and manufactured nuclear medical imaging systems keeping under consideration the connectivity to other equipments and workstations. The evaluation system is Windows®XP based on PC platform (P4 CPU is highly recommended). The minimum requirements for the displaying system are to support the 1280 × 1024 resolution with 16bit depth. The fundamental database format is still DIAG, but DICOM 3.0 based structure is on the test phase already. The compatibility is supported between the two database structures. System management of InterView XP™ is very similar to InterView™. It is graphical, object oriented, interactive and easy to learn due to the well arranged and logical linked objects. The daily routine procedures can be pre-defined by organ specific according to the acquisition techniques. But they are interactively modifiable during the processing procedure when the needs arise. All users can create and save own final result pages and hardcopy document outlines according to the demands. Design and creation of the result pages and documents are supported by pre-defined object set called templates. The results produced by InterView XP™ can be compared and validated by both domestic (Pegasys, microSEGAMSa, DIAG) and international (Pegasys, SEGAMI, HERMES, …) references due to the DICOM 3.0 and Interfile 3.31 communication.

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EXPERIENCE WITH DICOM BASE MULTIMODALITY MEDICAL IMAGE PROCESSING AT THE PET CENTER OF THE UNIVERSITY OF DEBRECEN

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Background: Digital radiology ensures the possibility to process images recorded by different modalities in the same way and transmit them via the internet. This intention is facilitated by DICOM standard whose implementations may be very different.
Material and methods: To overcome the problems arising from this variegation, we decided to supplement the software library developed at our department with a DICOM implementation. This allows for the identical data procession of files from national and international partners alike.
Results: We routinely use CT and MRI data files in daily diagnostics as well as in the spatial standardization of brain activation examinations. Images and contours are transmitted in DICOM format to support the planning of irradiation. After the spring of 2005, all of the Debrecen patients will be given their PET images in DICOM format.
Conclusion: We have been given an opportunity to start methodological development in the field of cardiological image processing through the wider implementation of DICOM standard.

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ADAPTIVE FILTERING PROCEDURE TO EHANCE HIGHER LUMINOSITY OBJECTS IN NUCLEAR MEDICAL IMAGES

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The current image processing work deal with a special nuclear medicine problem, when it is necessary to detect and display within a relatively high activity territory (high luminosity) even higher activity defects (hot nodule) with better and better efficiency i.e. in earlier and earlier phase (e.g. hot nodule metastases in spine or in sacrum). The most often applied noise filtering procedures in routine daily image processing — besides the noise reduction — reduces the image contrast in the sudden changes environment, consequently the enhancement of higher activity i.e. the higher luminosity objects in noisy environment demands edge or contrast preserving filtering method. But this is not optimal within the stationer region, which surrounds the enhancing object. An adaptive convolution filtering procedure (filtering series) for 2D scintigraphy images have been worked out to avoid the above mentioned problem. The filter identifies the local significant changes in the first step and then according to the determined contrast function will be selected the way of filtering with the filter parameters in order to optimize the noise elimination for better enhancement of the target object. The filter properties have been tested by phantom images particularly on the directional and pattern sensitivity, contrast sensitivity, detection limit and the sensitivity of the transition zone. The influence of the different noise level was under consideration too at the tests. The image processing procedure has been applied for various human cases also with promising results. Further refinements are necessary in the current optimization algorithm in order to reduce the image artifacts produced by adaptive filtering.

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CLUSTER BASED PET AND SPECT RECONSTRUCTION SOFTWARE LIBRARY

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Background: Iterative reconstruction methods of the PET and SPECT technique produce high resolution and good signal-noise ratio images. There are a lot of algorithms in the literature, which assume high computational capacity, and they give better quality images than routinely used algorithms do.
Material and methods: We aimed at developing a software library which contains the conventional and new reconstruction methods and is good for data acquisition simulation. Our library is easy to adapt for different topological detector systems.
Results: The available algorithms are the 2D and 3D filtered back projection, MLEM and OSEM based on one pre-generated high precision system matrix. The current version of the software library allows for studying the effects of matrices generated in different ways. The cluster based implementation enables the studies of the parallelization of calculation procedures. The programs based on this library were tested on data acquired by our small animal PET camera.

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EVALUATION OF DNA DAMAGE AND REPAIR IN AUTONOMOUS THYROID NODULES AND PERIPHERAL BLOOD LYMPHOCYTES IN PATIENTS RECEIVING 131-IODINE THERAPY

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Background: Radioiodine treatement of patients with autonomous thyroid nodule leads to cellular DNA damage not only in thyreocytes but also in peripheral blood lymphocytes (PBL). Damage to DNA induces DNA repair systems thus eliminating these damages.
Aim: The purpose of this study was to evaluate DNA breakage and base damage with the use of comet assay in thyreocytes and PBL in patients treated with 131-Iodine.
Material and methods: In all the patients thyroid scintigram showed a single "hot nodule". Damage to DNA was estimated by comet assay in thyreocytes taken from "hot nodule" by fine needle aspiratory biopsy and in PBL. Samples were taken three times: before radioiodine treatment, and 12 and 54 days after.
Results: Preliminary results indicate a high diversity in the level of DNA damage among the patients. In lymphocytes 12 days after 131-I application a significant level of DNA breakage and base damage was still observed. However, after 54 days the level of DNA damage in lymphocytes was even lower than in the control. In contrast, in "hot nodule" cells DNA damage persisted until the 54th day after 131-I treatment. Differences in the type of damage between thyroid cells and lymphocytes were also observed. In lymphocytes there was more base damage while in thyreocytes single strand DNA breaks prevailed.
Conclusion: The comet assay can be a valuable tool for monitoring radioiodine treated patients. The differences in the type and persistence of DNA damage in lymphocytes and thyreocytes might indicate different mechanisms of DNA damage induction and/or differences in DNA repair mechanisms.

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EFFICACY OF RADIOIODINE THERAPY IN ELDERLY PATIENTS WITH DIFFERENT TYPES OF HYPERTHYROIDISM

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Background: The number of elderly patients treated with radioiodine in our centre is increasing. The effectiveness of radioiodine therapy (RIT) in elderly patients with different types of hyperthyroidism (toxic nodular goiter, Graves' disease and toxic adenoma) was the objective of this study.
Material and methods: We analyzed the effect of RIT in 536 patients, aged 60–91 years (mean: 68.7± 8.2; median: 66 years) treated for hyperthyroidism. We studied a group of 451 women (84.1%, age 75.0 ± 12.3 years) and 85 men (15.9%; age 62.8 ± 4.9 years) treated between October 2002 and October 2003. The doses of ^{131}I ranged from 3.0 to 22.0 mCi. The effect of RIT was prospectively studied for one year.
Results: Etiology of hyperthyroidism was as follows: toxic nodular goiter (n = 453; 84.5%), Graves' disease (n = 53, 9.9%), toxic adenoma (n = 21, 3.9%) and iatrogenic thyrotoxicosis in 9 patients (1.7%). Twenty-six (5.0%) of patients had been diagnosed in the last 3 months, 332 (61.9%) in the last 2 years, 81 (15.1%) in the last 5 years, 53 (9.9%) in the last 10 years, and 42 (7.9%) in the last 20 years.
In the studied population, one year after RIT, hypothyroidism occured in 132 patients (24.6%), normal hormonal status was found in 339 patients (63.2%) and hyperthyroidism was observed in 65 patients (12.1%).
In the group of patients with toxic nodular goiter, 116 (25.6%) patients developed hypothyroidism, 278 (61.4%) were euthyroid, and 59 (13.0%) had recurrence of hyperthyroidism. The respective numbers in the group of Graves' disease were: 10 (18.9%), 38 (71.7%) and 5 (9.4%). In the group of patients with toxic adenoma: 3 (14.3%), 18 (85.7%) and 0 (0%) and in the group of iatrogenic thyrotoxicosis (after amiodarone): 3 (33.3%), 5 (55.6%) and 1 (11.1%).
Conclusions: RIT is safe and effective in the treatment of hyperthyroidism in elderly patients. The most common indication for RIT was toxic nodular goiter. The best efficacy of RIT was found in patients with toxic adenoma. The highest incidence of hyperthyroidism recurrence was observed in patients with toxic nodular goiter.

3

THE RISK OF NOT DIAGNOSED MALIGNANCY IN PATIENTS WITH TOXIC MULTINODULAR GOITER WHO HAD BEEN QUALIFIED FOR I-131 TREATMENT

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Background: I-131 treatment of patients with hyperthyroidism is contraindicated in case of thyroid cancer. The objective of the diagnostic work-up before I-131 treatment is to exclude malignant nodules in the thyroid.The most effective test for diagnosis of malignancy is ultrasound-guided fine-needle aspiration cytology (FNAC). FNAC has a specificity and sensitivity of approximating 95%, however the negative result of FNAC cannot exclude malignancy. Thyroid cancer has been revealed in histopathological material in 4 of 200 cases of patients who had been operated on multinodular goiter in ŚCO in 2000, although preoperative complete diagnostic work-up had excluded malignancy.
Aim: The purpose of our study was to evaluate the risk of not diagnosed malignancy in patients with toxic multinodular goiter who had been qualified for I-131 treatment.
Material and methods: The study involved 260 patients with toxic multinodular goiter, treated with I-131 in years 1999–2000. Diagnostic work-up before treatment included thyroid ultrasonography and FNAC of every suspicious of malignancy lesions (hypoechoic, with absence of a periferial halo, irregular margins, micro calcifications or hypervascularisation at Doppler ultrasonography and every clinical thyroid nodules). Thyroid cancer was excluded in every patient before I-131 treatment. After the treatment long-term follow up of patients was performed. Once a year thyroid ultrasonography was performed and also FNAC- in case of any enlargement of the lesion or clinically suspicious tumour. Patients with positive result of FNAC or with progression of tumour (up to 100%) were operated.
Results: Among 260 followed up patients — 26 (10%) — had developed enlargement of thyroid nodule. These patients were submitted to FNAC. Diagnosis of follicular neoplasm was revealed in one patient, and multinodular goiter in 25 patients. Eventually two patients were sent to operation — one with enlargement of the thyroid nodule up to 100%, and the second one with diagnosis of follicular neoplasm. Histopathological examination in both cases did not reveal malignancy. Moreover no patient has developed thyroid cancer during 4-year-follow-up.
Conclusion: Diagnostic work-up protocol employed in ŚCO in case of patients with toxic multinodular goiter qualified for I-131- therapy, allows reducing the risk of not diagnosed malignancy before treatment. Taking into consideration false negative results (4/200) of thyroid cancer in case of patients who underwent operations, nearly the same amount of not diagnose thyroid cancer should be expected among patients treated with I-131 that commands further control of the patients from the viewpoint of cancer detection.

4

EFFICACY OF RADIOIODINE THERAPY OF LARGE MULTINODULAR GOITER

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The efficacy of fractionated radioiodine therapy in patients with multinodular large goiter was assessed in the present study. Therapy was undertaken in patients disqualified from surgery due to high risk or in patient who gave no consent to surgery. Studies were performed in 24 women (age range: 62–82 yrs) with large goiters (II° in WHO classification and goiter volume assessed over 100 ml assessed by ultrasound).
Serum TSH, fT4, antithyroid antibodies (anti-TPO, anti-Tg, TSHR-Ab) levels were estimated in all patients. Radioiodine uptake test (after 5 and 24 hours), 131-I thyroid scintigraphy and fine needle biopsy to exclude neoplasmatic transformation were also performed. No malignant nodules were detected.
During classification to the therapy in 18 patients hyperthyroidism and in 6 patients normal thyroid function was diagnosed. All the tests and subsequent radioiodine therapy were repeated every 3 months. The cumulative dose of 4.44 GBq (120 mCi) was administered over 12 months (30 mCi every 3 months).
Before therapy, the mean thyroid volume was 163 ml (range: 100–370 ml; median 145 ml). It gradually decreased to 123 ml (range: 56–240 ml; median 109 ml) after 6 months and to 110 ml (range: 49–213 ml; median 90 ml) after 12 months. After 12 months: 62% of patients were euthyroid, 8% of patients were hyperthyroid and 30% of patients turned hypothyroid. Anti-TPO and anti-Tg antibodies showed tendency to rise, with significant differences and fluctuations in particular patients (aTPO — median: 30 IU/ml to 58 IU/ml; anti-Tg — median: 31 IU/ml to 44 IU/ml).
The fractionated radioiodine therapy is safe and effective method of treatment of large multinodular toxic goiter. During these observations we found no correlation between the levels of antithyroid antibodies, radioiodine uptake and reduction of goiter volume.

5

GRAVES' OPHTALMOPATHY AFTER RADIOIODINE TREATMENT — REVIEW OF SEVEN YEARS EXPERIENCE

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Background: The relationship between Graves' ophtalmopathy (GO) and radioactive iodine (RAI) treatment of Graves' disease is still a matter of controversy. The aim of the study is to establish the rate of this complication and analyse the factors which may interfere.
Material and methods: A retrospective analysis of patients data emphasising those with Graves' hyperthyroidism receiving RAI from 1998 to October 2004 was done.
Results: The total number of 3459 patients were treated according to Marinelli's formula with RAI. Among them nearly 700 suffered from Graves« disease. After RAI 7 patients developed severe form of GO and were qualified for specific treatment at the department of endocrinology. The patients data are gathered in the Table:

Pt/ No/ Sex	Age (years)	Thyroid Volume before RAI [ml]	Absorbed dose (Gy)	Thyroid function one year after RAI	Time (years) interval between RAI and GO	Ophtalm. Index according to Donaldson	Ophtalm. Index according to Donaldson	I.v pulses of methyl--predni--solone	Rtg-therapy
1. F	70	140	200	Hyperthyroidism	2	1	4	V courses	YES
2. M	69	28	150	Hypothyroidism	4	4	5	I course	NO
3. F	53	35	250	Hypothyroidism	2	2	2	III courses	YES
4. F	53	10	150	Hypothyroidism	4	5	3	VI courses	YES
5. F	63	35	200	Hypothyroidism	1	3	4	IV courses	YES
6. M	57	25	120	Normal	1	0	3	NO	YES
7. F	50	25	120	Hypothyroidism	5/12	3	4	III courses	NO

Conclusions: RAI because of Graves' hyperthyroidism is given to nearly one hundred patients per year at our department but severe GO occurred only at about 1% of treated patients. According to our data GO is not so often encountered complication after RAI. Hypothyroidism after RAI may increase the GO rate.