

# Chosen abstracts of the II<sup>nd</sup> Middle Eastern and Middle Europe Conference of Nuclear Medicine May, 18-19, 2007 — Cracow, Poland

## CARDIOLOGY

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### DETECTION OF SILENT MYOCARDIAL ISCHEMIA IN CHILDREN WITH FAMILIAL HYPERLIPIDEMIA BY GATED MYOCARDIAL PERFUSION SCINTIGRAPHY

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**Aim:** Familial hyperlipidemia (FHL) is a genetic disease characterized elevated serum levels of total cholesterol and low-density lipoprotein (LDL) which results in a markedly increased incidence of atherosclerosis and coronary artery disease in homozygotes. These changes are seen to a lesser extent in dyslipidemic pediatric patients as well. The purpose of this study was to detect silent myocardial ischemia with Tc-99m MIBI stress gated single-photon emission computed tomography myocardial perfusion scintigraphy (MPS) in patients with FHL and correlate the scan results with clinical variables.

**Material and methods:** Six asymptomatic dyslipidemic (8 to 17 years) and 13 homozygotes FHL (7 to 17 years) patients were evaluated with clinical assessment, blood lipid measurement and stress gated MPS.

**Results:** Five homozygotes FHL patients had abnormal MPS. Ischemia was present in 4 patients and one child had myocardial wall dyskinesia. The coronary angiography of 5 homozygote patients who had an abnormal MPS demonstrated > 50% stenosis in their coronary arteries. Cardiac surgery was then performed in 4 and aggressive repetitive plasma exchange was instituted in 1 patient. The MPS of 6 dyslipidemic patients were normal. The mean ± SD values of total cholesterol and LDL levels in homozygotes with abnormal scans were 626 ± 55 mg/dl and 576 ± 55, respectively. The same measurements were 543 ± 149 mg/dl and 480 ± 158 mg/dl in homozygotes with normal MPS. No significant difference was observed in total cholesterol and LDL levels in patients with or without myocardial ischemia (p = 0.35). However mean total cholesterol (252 ± 44 mg/dl) and LDL (181 ± 46 mg/dl) levels were significantly lower in dyslipidemic patients than homozygote patients with or without myocardial ischemia (p = 0.004 and p = 0.013, respectively).

**Conclusions:** We conclude that in patients with homozygote FHL, stress induced silent myocardial ischemia can occur at a young age and that MPS should be performed early as a screening test which can be used to guide patient management. In our study plasma lipid levels were not diagnostic.

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### EVALUATION OF CARDIAC COMPLICATIONS WITH Tc-99m TETROFOSMIN GATED MYOCARDIAL PERFUSION SCINTIGRAPHY IN PATIENTS WITH THALASSEMIA MAJOR

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**Aim:** Iron overload limits the life expectancy in thalassemic patients by causing cardiac toxicity. Iron also plays a catalytic role in the pathogenesis of atherosclerosis. The aim of this study is to evaluate the role of Tc-99m Tetrofosmin gated myocardial perfusion study (GMPS) to detect cardiac dysfunction in patients with thalassemia major.

**Material and methods:** 42 patients with homozygous beta-thalassemia were enrolled to the study. Myocardial perfusion and wall motion were analysed in all patients aged 17 ± 5.28 and 34 age-matched controls with GMPS. Clinical data, liver function tests, hemoglobin, ferritin, (low density lipoprotein) LDL and cholesterol levels, total transfusion number and frequency were collected from the charts of the patients.

**Results:** 97.6% and 78.5% of patients had normal myocardial perfusion and wall motion respectively. 9 of 42 thalassemic patients had abnormal left ventricular wall motion. Half of those had septal hypokinesia. No significant correlation was found between total transfusion number, serum ferritin levels, liver function test and left ventricular function (Table 1). Echocardiography revealed systolic dysfunction in 5 of 9 patients with wall motion abnormality. In all patients LDL and cholesterol levels were within normal limits.

**Conclusions:** Regional wall motion abnormalities can be seen in patients with thalassemia major. This early damage is frequently located in the septum and can be detected by GMPS. Serum ferritin level, number of blood transfusions are inadequate as predictors of myocardial dysfunction.

Table 1. Distribution of thalassemic patients with and without wall motion abnormality

Parameter	Wall motion abnormality (n = 9)	Normal wall motion (n = 33)	p
Age (mean)	19.7	17.1	0.077
Sex, M/F	8/1	17/16	0.022
Ferritin < 2000/ ≥ 2000 ng/ml	5/4	17/16	1.00
Total transfusions < 200/ ≥ 200	2/7	14/19	0.44
ALT < 40/ ≥ 40 U/L	5/4	22/11	0.698
AST < 33/ ≥ 33U/L	5/4	20/13	1.00

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### NUCLEAR CARDIOLOGY (Tc-99m-MIBI GSPECT) IN ACUTE MYOCARDIAL INFARCTION

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**Background:** ACC/AHA/ASNC Guidelines for the Clinical Use of Cardiac Radionuclide Imaging (2003), in Acute Coronary Syndromes (ACS), consider rest myocardial GSPECT as a procedure of highest indication (class I) for: assessment of myocardial risk in suspected ACS (to identify high risk pts with perfusion defects, who should be admitted), and for prognosis and assessment of therapy after STEMI (myocardial infarction, MI, with ST elevation) and after NSTEMI or unstable angina. Rest Tc-99m-MIBI myocardial perfusion imaging in the research use, takes advantage of specific characteristics of the radiopharmaceutical: because of prompt mitochondrial binding of MIBI and its minimal redistribution over time, imaging can be delayed for a few hours after the injection and still provide accurate information about perfusion at the time of injection, regardless of coronary interventions between injection and imaging. Primary percutaneous coronary intervention (pPCI) is a treatment of choice for acute STEMI. Standard pPCI is performed by stenting the infarct-related artery (IRA). In patients with recognised STEMI, lack of perfusion in acute phase reflects the myocardium (myoc) at risk (RISK area); lack of MIBI accumulation in ischemic myoc is caused by unpatent IRA, with mitochondrial membranes disrupted or not. Lack of perfusion after successful pPCI reflects the myoc with final scar (SCAR area); lack of MIBI accumulation is caused by mitochondrial membranes disruption. The aim of using serial rest Tc-99m-MIBI GSPECT imaging in AMI can be the assessment of the tissue efficacy of pPCI and the evaluation of the time-evolution of post-pPCI results. This is a tool dedicated to comparisons of different methods of pPCI in randomized studies.

**The methodology used at NIC:** After contrast angiography, before pPCI, pts are injected with 30 mCi of Tc-99m-MIBI. GSPECT-0 registration is performed 90-360 min later, after pPCI and patient's stabilisation. GSPECT-I is performed 2-9 days later, GSPECT-II - after 6 mo. Perfusion is assessed in 17 segments of LV by using 5-grade defect scale (0-normal, 4-lack of uptake); summary defect score (SDS) is calculated. In GSPECT-0, RISK area is calculated as a number of segments with uptake = 4 in VISUAL METHOD, and, alternatively, as the % of myoc with uptake < 50% of maximum on a bulls-eye map in THRESHOLD METHOD. In GSPECT-I and -II, by the same methods, the SCAR area is calculated; SALVAGE area = RISK-SCAR; salvage index SI = SALVAGE/RISK. EF, EDV and ESV are calculated by QGS software from all the GSPECT studies. Patients with first STEMI within 12 hrs from pain onset and TIMI flow < 3 are qualified.

**Example 1. Early and late assessment of efficacy of standard pPCI after angiographically successful pPCI.**

**Results:** pPCI in pts with STEMI caused improved tissue perfusion in 84% of pts in early evaluation and in 100% in 6-mo evaluation. The values of SALVAGE area and SI improved early after pPCI and further improved during next 6 mo. Temporary, early improvement in EF was observed; the values of EDV and ESV did not change after pPCI.

**Conclusion:** After pPCI there are dynamic changes in left ventricular perfusion, salvage and function parameters.

**Example 2. Comparison of efficacy of standard pPCI versus thrombectomy followed by stenting (thrombe-pPCI). Randomized study.**

**Results:** In GSPECT-I, SDS improvement, SALVAGE, SI, and EF improvement was not significantly different between pPCI vs. thrombe-pPCI.

**Conclusion:** Coronary thrombectomy may not add benefits as adjunctive therapy to standard pPCI in STEMI.

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## ENDOCRINOLOGY

### THE ROLE OF THYROID SCINTIGRAPHY IN HASHIMOTO THYROIDITIS: COMPARISON WITH CLINICAL AND ULTRASONOGRAPHIC FINDINGS

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**Aim:** To evaluate various stages of Hashimoto thyroiditis (HT) with ultrasonographic and scintigraphic findings.

**Material and methods:** Eighty-six patients (14 M/72 F) with HT were included in the study. The mean age of the patients was 39 yr (range, 14-73 yr). Thyroid scintigraphy was performed with Tc-99m pertechnetate and serum TSH, free T4, free T3, thyroid peroxidase antibody (TPO Abs), TSH receptor antibody levels were obtained in all patients. Ultrasonography was available in 41 patients (48%).

**Results:** Thyroid TPOAbs were elevated in 86 (100%) and TSH receptor antibodies were elevated in 29 (33%) patients. USG revealed diffuse hyperplasia, multinodular goiter and solitary nodule in 16 (39%), 21 (51%) and 4 (10%) patients respectively. In Hashimoto disease, variable scintigraphic appearances were also seen. 9%, 35%, 42%, 5% and 9% of patients had normal scan, diffuse hyperplasia, multinodular gland, solitary nodule, and suppressed glands respectively. Scintigraphic findings were not correlated with TPOAb levels (p > 0.05). A significantly higher prevalence of hyperthyroidism was observed in patients with diffuse goiter in comparison with those with multinodular gland (63% vs. 22%). The relation between scan findings and clinical presentation is shown on Table 1.

**Conclusions:** The scintigraphic findings in HT are highly variable and can mimic a wide range of thyroid disorders. Our data suggest that diffuse radiopharmaceutical uptake among hyperthyroid patients is suggestive of Graves disease or Hashitoxicosis. In early stage Hashimoto disease TSH stimulation results in increased radioiodine activity throughout the thyroid. Consequently, as more thyroid parenchyma is replaced by fibrous tissue, a multinodular goiter develops.

Table 1. Correlation between scan and clinical findings

Clinical presentation	Multinodular or solitary nodules	Diffuse hyperplasia	Suppressed gland	Normal
Euthyroid	16 (19%)	6 (7%)	1 (1%)	3 (3%)
Hyperthyroid	19 (22%)	21 (25%)	5 (6%)	5 (6%)
Hypothyroid	5 (6%)	3 (3%)	2 (2%)	-
Total	40 (47%)	30 (35%)	8 (9%)	8 (9%)

## ONCOLOGY

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**SUCCESS RATE OF SINGLE DOSE RADIOIODINE-131 THERAPY FOLLOWING FIXED OR CALCULATED DOSE APPROACH IN PATIENTS WITH GRAVES' DISEASE**

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**Aim:** The aim of this study was to evaluate the effectiveness of single dose radioiodine-131 therapy and results of follow-up in patients with Graves' disease.**Material and methods:** Therapeutic effectiveness and follow-up results of 139 patients (31 male and 108 female, mean age:  $45 \pm 14$  years) treated with radioiodine-131 for Graves' disease between the years of 2000 and 2006 were evaluated retrospectively. Mean follow-up period after therapy were  $18 \pm 16$  months. Radioiodine-131 therapy was given orally using calculated dose ( $80\text{--}120 \mu\text{Ci}/\text{gr}$ ) or fixed dose approaches in 17 and 122 patients, respectively. The criteria for successful therapy was defined as euthyroidism or hypothyroidism after radioiodine therapy and, the existence of hyperthyroidism six months after therapy was considered as unsuccessful therapy. Twenty two patients were excluded from the study because of failure in follow-up. The success rates for both calculated and fixed dose groups were determined.**Results:** Mean doses were  $8 \pm 4 \text{ mCi}$  and  $10 \pm 3 \text{ mCi}$  in calculated and fixed doses groups, respectively, and did not differ significantly ( $p > 0.05$ ). Single dose success rates were 38% in calculated dose group and 59% in fixed dose group. The incidence of hypothyroidism after therapy was higher in fixed dose group compared to calculated group (55% vs. 23%). There were no therapeutic complications in the groups due to radioiodine.**Conclusions:** Our results suggested that radioiodine-131 provides a safe and effective treatment for Graves' disease. Although the incidence of hypothyroidism was higher, fixed dose approach was more effective and practical than calculated dose approach.

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**PRIMARY HYPERPARATHYROIDISM WITH MULTIPLE BROWN TUMORS — UNUSUAL CLINICAL PRESENTATION WITH RADIONUCLIDE LOCALIZATION OF PARATHYROID ADENOMA — CASE REPORT**B.E. Chrapko<sup>1</sup>, A. Nocuń<sup>1</sup>, J. Malicka<sup>2</sup>, A. Nowakowski<sup>2</sup>, M. Sawicki<sup>3</sup>, W. Cholewiński<sup>1</sup><sup>1</sup>Department of Nuclear Medicine 2Clinic of Endocrinology, Medical University of Lublin, Poland<sup>3</sup>Clinic of Thoracosurgery, Medical University of Lublin, Poland

We present a case of a 40 years old man, admitted to the hospital with acute symptoms of headache and diplopia with a history of nephrolithiasis and peptic ulcer. He also complained of polydipsia, and polyuria. Thirteen years ago he underwent subtotal thyroidectomy but his thyroid function was within normal limits. CT and MRI were performed and revealed tumour of the sella turcica with infiltration of the sinus cavernosus. The patient underwent sublabial transeptal transsphenoidal tumour resection with subsequent histological tissue assessment. It showed gigantocellular tumour and a brown tumor.

Because the patient complained of multifocal bone pain, bone scan with <sup>99m</sup>Tc-MDP was performed. The images showed multiple foci of very intense tracer uptake, localized mainly in the long bones. In addition, whole body MIBI scan was done.Since the level of parathormon was 1900.0 pg/ml, the parathyroid scintigraphy with <sup>99m</sup>Tc-MIBI/ NaTcO<sub>4</sub> was scheduled. The images were acquired with planar and SPECT technique and interpreted with subtraction and clearance methods. There was a very mild uptake medially to the right thyroid lobe, just above the isthmus, however the scan was reported as inconclusive because not all scintigraphic criteria for positive scan were fulfilled. Patient underwent right lobe strumectomy with right parathyroidectomy. Because PTH levels remained very high, a repeat parathyroid scan was performed with additional image fusion on CT images. The scan showed a very well circumscribed area of high MIBI uptake within the right medial part of the neck, which fused with a small focus on the CT scan. Repeat surgery was performed but this time with intra-operative gamma probe after IV injection of 740MBq of <sup>99m</sup>Tc-MIBI. The parathyroid adenoma was detected in the para-tracheal region and was successfully removed. After surgical resection the PTH level returned to normal values (41 pg/ml).

The wide range of symptoms found in primary parathyroidism frequently may lead to the misdiagnosis. In the above case, the advantages of radionuclide methods and close collaboration of various medical disciplines managed to overcome prospected difficulties.

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**TC-99M MDP BONE SCINTIGRAPHY IN DETECTION OF DISTANT METASTASES FROM LUNG CANCER**

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**Background:** Lung cancer is known to favour haematogenic dissemination raising the possibility of distant metastases. The probability of a solitary bone lesion to be malignant, is of considerable clinical interest.**Aim:** To determine the incidence of abnormal bone scintigraphy (BS) scans and to review the pattern of BS findings in lung cancer patients.**Material and methods:** We retrospectively analyzed one hundred of patients (78 males and 22 females) mean age of 63.3 years with diagnosis of lung cancer, who underwent BS during the three year's period (2003–2005). Scintiscans were classified as positive; negative and suspicious for bone metastases.**Results:** The incidence of positive findings was 57%, negative findings 33% while the image suspicious for bone metastases was obtained in 10% of patients. Out of 57 patients with bone metastases 51 scans showed multiple asymmetric foci of increased tracer activity localized in ribs, spine, extremities, pelvis, sternum, scapula and skull in 80%, 61%, 55%, 48%, 14%, 10% and 6% of scans respectively. BS revealed solitary metastases in 6 patients. Lesions were located in lower limbs in three patients and in upper limb, pelvis and sternum in remaining three patients.**Conclusion:** our results suggest that systematic inclusion of limbs in BS acquisition should be necessary for accurate staging of lung cancer patients.

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**NORMAL ADRENAL UPTAKE OF THE SOMATOSTATIN ANALOGUE, VISUALIZED IN SPECT EXAMINATION WITH <sup>99m</sup>Tc-EDDA/HYNIC-TOC**

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**Background:** Interpretation of any radionuclide examination requires a knowledge of the normal radiotracer distribution and its variants. As usually reported, the biodistribution of the somatostatin analogues includes the uptake in the liver, gallbladder, spleen, kidneys, colon, pituitary gland, salivary gland and breast (variable). Although adrenal medulla expresses type 2 somatostatin receptors, only few papers describe visualization of the normal adrenals in SPECT examination with radiolabeled somatostatin analogues. In this paper we report how often the normal adrenals can be seen in the scintigraphy performed with <sup>99m</sup>Tc-EDDA/HYNIC-TOC.**Material and methods:** The studied group comprised 48 patients (27 females and 21 males), the mean age of the group was 58 years (range: 28-79 years). The patients were diagnosed with neuroendocrine tumors (40 pts) or pulmonary carcinoma (8 pts) and referred to the Department of Nuclear Medicine of Medical University of Lublin for staging before a treatment by means of the somatostatin receptor scintigraphy. In all the cases adrenal glands were reported as normal in CT examination, performed before the scintigraphy.**Imaging protocol:** administered dose of <sup>99m</sup>Tc-EDDA/HYNIC-TOC (<sup>99m</sup>Tc-Tektrotyd, POLATOM, Łódź, Poland) was 740 MBq. SPECT acquisition was performed two hours after IV injection of the radiotracer, using a dual-head gamma-camera Varicam Elscint. High-resolution collimators and a matrix of  $128 \times 128$  pixels were applied. One hundred and twenty projections were acquired, each of 30 s duration. Filtered back projection with a Butterworth filter was used for reconstruction. Visual analysis of the images was made by two specialists in nuclear medicine.**Results:** Radiotracer activity in the area corresponding to the left adrenal gland ("hot" spot close to the upper pole of the left kidney) was observed in 15 (31.2%) patients (7 females and 8 males). In 4 (8.3%) patients (1 female and 3 males) adrenal activity was seen bilaterally (Table 1).**Conclusion:** The normal distribution of <sup>99m</sup>Tc-EDDA/HYNIC-TOC, evaluated by SPECT, in some adult patients may include adrenal uptake on one or both sides.**Table 1.** Adrenal uptake of <sup>99m</sup>Tc-EDDA/HYNIC-TOC in 48 SPECT examinations

Uptake visible in SPECT	Number of patients
Right adrenal only	0 (0%)
Left adrenal only	15 (31.2%)
Both adrenals	4 (8.3%)
Total	19 (39.5%)

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#### COMPARISON OF SERUM THYROGLOBULIN, I-131 AND TC-99M THYROID SCINTIGRAPHY, THYROID I-131 UPTAKE AND ULTRASONOGRAPHY IN THE EVALUATION OF PATIENTS WITH THYROID CANCER AFTER SURGERY

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**Aim:** The extent of remnant thyroid tissue after surgery influences the outcome of radioiodine ablation in patients with thyroid cancer. **AIM:** To evaluate the use of neck ultrasonography (USG), Tc-99m thyroid scintigraphy (TS), iodine-I-131 scintigraphy (IS), thyroid I-131 uptake (IU) and serum thyroglobulin (Tg) levels in the evaluation residual thyroid remnants after surgery.

**Material and methods:** We prospectively studied 30 patients with a median age of 44 years (range, 21–68 years) with differentiated thyroid carcinoma treated with total or near total thyroidectomy. Among them there were 22 patients with papillary and 8 with follicular tumors. Patients with metastases and anti-Tg antibodies were excluded. After optimal endogenous thyroid-stimulating hormone stimulation (> 30 mIU/ml), 30 pairs of IS and TS and IU studies were performed one month after thyroid surgery. Concomitant serum thyroglobulin levels were available for all patients. The presence or absence of thyroid tissue on scintigraphy was correlated with USG and post-treatment whole body I-131 scintigraphy (WBS).

**Results:** None of our patients had extrathyroidal uptake on the post-treatment WBS. Tg values 1 month after surgery were in the range of 0.2–21.0 ng/ml (median: 2.85 ng/ml). I-131 uptake in the thyroid bed varied between 0.1 to 8.7% (median: 1%). Tg levels positively correlated with thyroid bed iodine uptake ( $r = 0.726$ ,  $p < 0.0001$ ). IS and TS detected residual tissue in the neck in 21 (70%) and 15 patients (50%) respectively. The agreement (kappa value) between IS and TS was 0.6%, ( $p < 0.0001$ ). When IU values were > 1.5%, all patients had tracer uptake in the thyroid bed both on IS and TS. IS and TS were able to show remnant tissue in 55% and 25% of patients who had  $\leq 1.5\%$  IU, respectively. TS was found to be significantly better ( $p < 0.005$ ) than USG for the detection of remnant thyroid tissue.

**Conclusions:** For the postoperative evaluation of patients with well differentiated thyroid cancer without metastasis and anti-Tg antibodies, 1) IS is superior to TS for the detection of residual thyroid tissue in patients with  $\leq 1.5\%$  iodine uptake, 2) detectable Tg levels correlate with tissue remnants and 3) postoperative measurement of cervical I-131 uptake could be a guide in deciding the ablative dose of I-131.

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## THErapy

#### RADIOIMMUNOTHERAPY IN FOLLICULAR LYMPHOMAS: A RETROSPECTIVE ANALYSIS OF PLRG EXPERIENCE

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The paper summarizes the result of 21 follicular lymphoma patients subjected to radioimmunotherapy in PLRG centers. Ibritumomab (Zevalin) is the only radioimmunoconjugate currently available in Europe registered for treatment of follicular lymphoma relapsing or refractory after Rituximab. It combines the specificity of an anti CD20 monoclonal antibody with the power of beta emitting <sup>90</sup>Y, being particularly efficient in a fibrosed, poorly vascularised lymph nodes.

All 21 patients were heavily pretreated, after failing 2–6 lines of previous therapy. In the whole group median event free survival exceeded 15 month, and overall survival was not yet reached at 45 months of follow-up. Subgroup analysis and literature review are included, to identify patients which could merit most of RIT.

**Key words:** radioimmunotherapy, Zevalin, Ibritumomab, follicular lymphoma

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#### TREATMENT OF SMALL AND MEDIUM JOINTS BY MEANS OF RADIOSYNOVIORTHESIS

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**Aim:** To familiarize with the indications, doing, treatment results of the radiosynoviorthesis (RSO) of medium and small joints in patients with rheumatoid arthritis (RA).

**Material and methods:** The RSO is intraarticular treatment with beta emitters. For correct indication one should accomplish before RSO clinical examination (presence of a pain, swelling, joint motion), ultrasonography (US) (filling and synovial reaction), X-ray (Larsen's classification); it is suitable three-phase bone scintigraphy. Treatment effect is possible to expect only when synovitis is proved by these procedures. Control clinical and US examinations are done after 6 and 12 months. Orthopaedist applies rhenium sulfide to medium joints (70–110 MBq) and erbium citrate (20–40 MBq) to small joints under US control in sterile conditions after application 1% Mesocain, i.a. After RSO the joint is immobilized for 2–3 days.

**Results:** From VI/2002 to IX/2005 we have done 45 RSO of medium joints in 36 patients — 4 elbows, 11 ATC, 5 shoulders, 25 RC and RSO of 45 small joints in 17 patients — MCP and PIP of hands. Evaluation of treatment effect after RSO of medium joints: by patients (effect on pain and formation of fluid) and clinical evaluation (by orthopaedist): shoulders: in 100% reduction of pain and swelling, in 60% improvement of motion, in 100% reduction of synovial reaction; elbow: in 100% reduction of pain, in 75% reduction of swelling, in 75% identical motion, in 50% US improvement, 1 × post-radiation synovitis treated conservatively; RC: in 68% reduction of pain and swelling, in 28% improvement of motion, in 64% US improvement, 1 × re-RSO after one year; TC: in 72% reduction of pain, in 72% identical swelling and motion, in 18% US improvement, in 2 pts repeated RSO after one year. Small joints: in 72% reduction of pain, in 56% reduction of swelling, in 11% motion improvement, in 50% US improvement, 1 × re-RSO of MCP after one year.

**Conclusions:** RSO of medium and small joints reduces volume and activity of synovial tissue and volume of produced fluid. It decreases intra-cavitary pressure, pain and secondary destruction of articular structures and postpones surgical invasive therapy. It reduces possible risks from surgical therapy and costs of further treatment. RSO advantages: semi-invasive method with good effect. It can be repeated in sever part of treatment series. It is possible to use RSO as separate therapeutic intervention or as supplement of surgical therapy.

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## GASTROINTESTINAL TRACT AND KIDNEYS

#### OUR FIRST EXPERIENCES WITH <sup>99m</sup>Tc-HMPAO LABELLED WHITE CELL (LEUCOSCINT) IN EVALUATION PATIENTS WITH INFLAMMATORY BOWEL DISEASES

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The aim of the study was to verify the effectiveness of lyophilized <sup>99m</sup>Tc-HMPAO labeled white cells in the detection of inflammatory foci in patients with bowel diseases.

A total number of 9 patients with clinical suspicion of bowel inflammation were investigated. Additional data were provided using clinical finding, ultrasonography, computer tomography and magnetic resonance imaging, colonoscopy and laboratory analysis for confirmation of bowel inflammation. The white cells were reconstituted with <sup>99m</sup>Tc-HMPAO (Leuco-Scint, Medi-Radiopharma, Hungary) expecting at least 80% of lipophilic label complexes. After reconstitution <sup>99m</sup>Tc-HMPAO labeled white cells were intravenously reinjected in dose 55–740 MBq. Serial imaging at 5 min, 1, 2 and 3 hours were performed in whole body static planar modality (anterior and posterior view abdomen and pelvis). When needed, additional scintigrams were acquired after 24 h. In 4 patients with equivocal findings on planar scintigraphy, emission computed tomography was performed. There were positive findings in all evaluated patients with bowel inflammation (four due to Crohns disease, three to ulcerative colitis and two to inflammatory enterocolitis). Increased white cells accumulation was found to be located in different parts of bowel. In 5 patients (55%), was registered more than one focal site of intensive white cells distribution. The rate of appearance of positive uptake was concordant with clinically manifested intensity of bowel inflammation. According to our results scintigraphy with <sup>99m</sup>Tc-HMPAO labeled white cells is a useful method for detection, assessment of exact localization and rate of intensity of inflammatory foci in bowel diseases.

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**INTER AND INTRA VARIABILITY OF Tc-99m DMSA RENAL SCINTIGRAPHY IN CHILDREN: IMPACT OF OBLIQUE VIEWS**Meltem Tuncali<sup>1</sup>, Pinar Kiratli<sup>1</sup>, Erdem Karabulut<sup>2</sup><sup>1</sup>Nuclear Medicine, Hacettepe University Medical Faculty, Ankara, Turkey  
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**Aim:** Technetium-99m-dimercaptosuccinic acid (DMSA) renal scintigraphy is frequently used to assess the presence and severity of kidney damage. This work was undertaken to evaluate the level of inter and intra-observer variability of Tc-99m DMSA scintigraphy and to identify the impact of posterior oblique views on scan interpretation in the pediatric population.

**Material and methods:** A total of 100 DMSA renal scans (197 kidneys) were evaluated. Two nuclear medicine physicians independently interpreted the images four times; twice only from the posterior projection views and twice from the posterior and posterior oblique views. For each kidney, the observers had to choose between the following results: normal, abnormal and indeterminate. The indices of variability used were the percentage of agreement, kappa statistic and marginal homogeneity test.

**Results:** Disagreement of DMSA scan interpretation was present in 18% of kidneys within observers and in 21% cases between observers when only posterior images were used. Oblique views changed the interpretation in 14% and 11.5% kidneys for the first and second observer respectively. The intra- and inter-observer reproducibility (kappa values) varied between 0.683 and 0.708 for intra-, between 0.609 and 0.671 for inter-observer variability when only posterior views were used. With the addition of oblique views the kappa values improved slightly (0.725–0.812 and 0.768–0.732 respectively).

**Conclusions:** Oblique views were found useful in approximately 13% of kidneys and had effect on inter- and intra-observer variability. Our results suggest that they should be used routinely in children with a clinical suspicion of UTI to obtain reliable

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**VARIA****MAGNETIC IRON OXIDE LABELLED WITH <sup>54</sup>Mn AS A POSSIBLE DRUG CARRIER**

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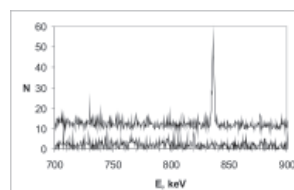
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**Aim:** Magnetic nano- and microparticles of iron(II,III) oxide Fe<sub>3</sub>O<sub>4</sub> are interesting as possible drug carriers whose migration to target tissues can be enhanced by external magnetic fields. The isotope <sup>54</sup>Mn (312.3 d, 100% EC, gamma 834.848 keV 99.976%), a convenient single photon calibration source, is known from preclinical research on the function and movement in the brain [1–3]. Manganese as Mn<sup>+2</sup>, Mn<sup>+3</sup> and Mn<sup>+4</sup> ions is involved in the metabolism of proteins, lipids and carbohydrates. Magnetic field-enhanced in vivo transport of [<sup>54</sup>Mn]Fe<sub>3</sub>O<sub>4</sub> can give more information about metabolism of both metals in target sites. The aim of this work was synthesis of Fe<sub>3</sub>O<sub>4</sub> and its labelling with manganese <sup>54</sup>Mn whose chemical properties are close to those of iron.

**Material and methods:** The label <sup>54</sup>Mn was produced in the <sup>51</sup>V( $\alpha, n$ )<sup>54</sup>Mn reaction by alpha-particle activation of vanadium(V) oxide V<sub>2</sub>O<sub>5</sub> of natural isotopic abundance (99.75% <sup>51</sup>V). <sup>54</sup>Mn was separated from HCl solution on Dowex-50x8 resin in the presence of an internal tracer <sup>48</sup>V, produced in the same cyclotron via <sup>48</sup>Ti(p, xn)<sup>48</sup>V reaction. The micro-component <sup>54</sup>Mn was eluted from the column with 3 M HCl, and the macro-component vanadium with 0.1M HCl/ethanol/H<sub>2</sub>O mixture. Magnetic suspension of Fe<sub>3</sub>O<sub>4</sub> was produced in the 6Fe<sup>3+</sup> + SO<sub>4</sub><sup>2-</sup> + 18NH<sub>4</sub>OH → 2Fe<sub>3</sub>O<sub>4</sub> ↓ + + SO<sub>4</sub><sup>2-</sup> + 18NH<sub>4</sub><sup>+</sup> + 9H<sub>2</sub>O reaction [4] from freshly prepared reagents under heavy stirring and bubbling with Argonne gas at 70°C. The black precipitate was centrifuged and washed with water and with water-ethanol mixture. The labelled Fe<sub>3</sub>O<sub>4</sub> was produced in the same way by co-precipitation with <sup>54</sup>Mn added as <sup>54</sup>MnCl<sub>2</sub>. Radioactive samples were identified by gamma-ray spectrometry, using a 35cm<sup>3</sup> HPGe co-axial detector coupled with a multichannel analyser.

**Results:** The carrier-free <sup>54</sup>Mn was of 99.9% radionuclide purity. The black precipitate of Fe<sub>3</sub>O<sub>4</sub> exhibited well expressed magnetic properties. Labelling with <sup>54</sup>Mn was quantitative (Figure 1). Stability of the precipitate in vitro is still to be checked.

**Conclusions:** Although the long half-life of <sup>54</sup>Mn rules it out as a radiopharmaceutical, its excellent detection properties can help in observation of labelled Fe<sub>3</sub>O<sub>4</sub> in pre-clinical research.



**Figure 1.** Gamma spectrum of the filtrate (bottom) and of the Fe<sub>3</sub>O<sub>4</sub> sediment (top, shifted by  $n = 10$ ).

**References**

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**SYSTEM FOR COMPLEX MATHEMATICAL ANALYSIS AND CLINICAL EVALUATION OF FUNCTIONAL SCINTIGRAPHY ON PC**

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The software for the complex mathematical analyses of scintigraphic examinations performed on the standard PC computers, has been developed in the Nuclear Medicine Department at University Hospital in Ostrava. Besides conventional procedures for the individual (manual) processing of pictures and curves, our software contains a lot of complex programmes for the mathematical analyses of the dynamic scintigraphic examinations (e.g. for gated ventriculographic studies, the first pass radiocardiographic studies, dynamic kidneys and liver studies, myocardial perfusion studies etc.). A lot of original methods and procedures have been applied in these programmes. They give us quick, automatic and exact evaluation with the maximal complexity. Operating these programmes is very easy, time and labour saving for a user. The output of each programme is an entire protocol containing information about patient, scintigraphic and parametric pictures of all important examination phases, time-activity curves of ROI's, numerical values of quantitative parameters as well as the verbal evaluation of whole examination with a short conclusion. It is very easy to use this system on any PC by means of Windows 95-2000 or higher and it is able to evaluate studies taken from various scintillation cameras.

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**EXPERIENCE WITH MPI WITH MYOVIEV IN NUCLEAR MEDICINE DEPARTMENT OF UNIVERSITY HOSPITAL OSTRAVA, CZECH REPUBLIC**

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From 1973 (opening of our department of nuclear medicine) we performed myocardial perfusion planar scintigraphy using <sup>201</sup>Tl chloride. From 1993 we have used SPECT with <sup>99m</sup>Tc tetrofosmin (Myoview GE Healthcare) and <sup>201</sup>Tl chloride, last 11 years SPECT only with <sup>99m</sup>Tc Myoview — non-gated, since April 2003 gated SPECT. 80% of stress studies used bicycle ergometry, 20% pharmacological stress — dipyridamole, rarely dobutamine.

Our equipment: from 1993 and 1994 to 2006 was: two single headed SPECT cameras DIACAM Siemens with HR collimator, from 2003 double headed SPECT camera E.CAM Siemens with LEHR collimator, from 2007 double headed SPECT camera Symbia S Siemens with LEHR collimator. Additional equipments: 12-point ECG, ergometer, defibrillator, laryngoscope, ambuvac, pharmaceuticals for resuscitation. Stress studies are performed only at the presence NM specialist (rarely cardiologist — mainly dobutamine stress) trained in stress test and specialised secondary educated staff. Main indications for MPI are:

- myocardial ischemia — detection, localization, relevancy;
- evaluation of the stenosis detected by coronarography, risk stratification;
- myocardial viability in patients with left ventricle dysfunction in revascularization planning;
- evaluation of revascularization effect (PTCA or bypass-CABG) in patients with symptom recurrence or with positive or nondiagnostic stress EKG;
- acute coronary syndrome.

Relative contra-indications for MPI are: pregnancy (tests are done only in vital indication at limited dose) and lactation.

Applied activity of radiopharmaceutical <sup>99m</sup>Tc tetrofosmin (Myoview) is 600–1000 MBq. When we combine stress and rest studies (pathological finding in stress study), we use only two-day protocol.

**Patient preparation:** It is preferred to have patients empty-bellied (except in diabetic patients), 12 hours before study to drink or eat food and drinks caffeine-free (possibility of pharmacological stress), to withdraw beta blockers for 48 hours. In rest studies for detection of viability a nitroglycerine is administered (except in patients with hypotension) 3–5 minutes prior Myoview application. Intravenous cannula is obligatory. Bicycle ergometry: monitoring of ECG and blood pressure, starting at 25–50 W and gradually individually increasing. Stress should not be shorter than 4 min. with respect to angina pectoris, dyspnoea or strong EKG differences, arrhythm etc. RF is applied at the top of stress at about 85% of max. aerobic capacity (75% in patients after IM or revascularization) and test continues another 1.5 min.

Then myocardial perfusion scintigraphy is done. Using <sup>99m</sup>Tc Myoview acquisition starts 15–30 min. after RF application.

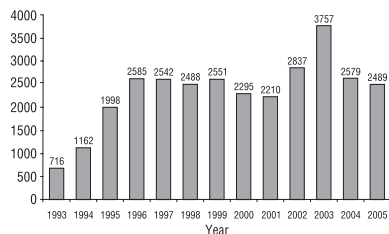
Pharmacological stress with dipyridamole: monitoring of ECG and blood pressure, application dose — i.v. infusion 0.56 mg/kg of Curantyl during 4 min. Physical stress during the test is suitable — elimination of side effects, reduction of splanchnic vascularization. 100–300 mg aminophylline i.v. blockades effect of dipyridamole in case of troubles after test.

Acquisition: gated-SPECT, supine position is basic. In patients with attenuation of posterior (mainly in obese pts) or anterior (in some women) wall, the prone position is appended.

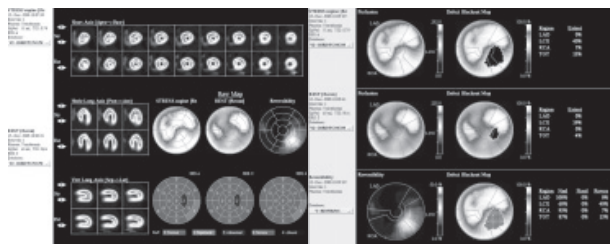
For processing we use programme 4DMSPECT.

**Conclusions:** Scintigrams quality using Myoview is excellent. With radiopharmaceutical Myoview the problems with activity in liver or stomach or bowels are only rare. These cases are easily solvable — to repeat study after drinking some liquids or eating some food or chocolate. Myoview preparation is easy and quick. It is not necessary to boil it.

It is possible to use up to 12 GBq in volume 8 ml from one vial and to examine great number of patients. It is economically very advantageous. Our satisfaction with Myoview is great.



**Figure 1.** Numbers of MPI stress and rest studies in our department.



**Figure 2.** Temporary stress ischaemia in posterolateral segment of left ventricle in 65 years old man with angina pectoris syndrome.

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**SIGNIFICANCE, DETECTION AND BIOPSY OF SENTINEL LYMPH NODES IN SOME TYPES OF MALIGNANT TUMOURS**

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**Background:** Sentinel lymph node biopsy has revolutionized the surgical management of primary malignant melanoma and breast cancer.

The authors conducted a retrospective review of 530 patients treated for malignant melanomas, 505 pts for breast cancers, 85 for cervical cancers, 19 for vulvar cancers, 1 for vaginal cancer, 16 for prostate cancers, 2 for penile cancers, 3 for oral cancers with lymphoscintigraphy, patent blue dye and gamma probe guided sentinel lymph node biopsy since 2000.

**Methods and results:** In all patients with various types of tumours the operation was performed with preoperative technetium <sup>99m</sup>Tc lymphoscintigraphy (with three types of radiocolloids: Nanocis Cis bio International Gif-sur-Yvette Cedex, France, Nanocoll Nycomed Amersham Sorin, Saluggia, Italy and SentiScint FJC National Research Institute for Radiobiology and Radiohygiene, Budapest, Hungary), patent blue dye and gamma probe guided sentinel lymph node biopsy. Sentinel lymph nodes were examined by means of histological and immunohistochemical examinations.

**Melanoma patients:** 530 patients (249 male and 281 female patients, age from 10 to 84 years, average age 56 yrs) were identified. Melanoma thickness according to Breslow in the group of our patients was in a wide range from 0.18 to 14 mm, the tumour invasion across cutaneous zones (Clark's levels) I–V. The primary melanoma sites were the scalp (n = 14), the neck (n = 6), the trunk melanomas (n = 255), the upper extremity (n = 118), the lower extremity (n = 132), the vagina and vulva (n = 5). Lymph node basins (one, two or even three in every patient) were identified in the axilla, in the inguinal region, less common locations - the popliteal, trunkal, neck, sub-mandibular, preauricular and supraclavicular regions. The lymph nodes were affected by metastases in 80 patients (in 16.8% from 476 patients in whom the SLN was removed).

A standard regional dissection of lymph nodes was subsequently carried out in these patients with SLN metastasis.

**Breast cancers patients:** To prove sentinel lymph nodes, we examined 501 women and 4 men with diagnosis of breast cancer (aged 58.5 years on average; tumour size from T1a to T2, in 6 pts T3) in one- or two-day protocol. Lymph node metastasis was detected in 167 patients, i.e. in 33.1% of the operated patients. Out of these 167 patients with metastasis-affected node there were 7 patients with affected axillary lymph node without any affection of the sentinel lymph node, which means that skip metastasis (false negativity of SLN) was proved in 4.2% (7 in 167). In some patients SLN biopsy was combined with axillary lymph node dissection (ALND) and ALND was performed in all patients with SLN metastasis.

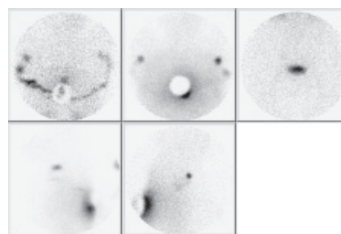
**Patients with other types of tumours:** We examined 2 pts with penile cancer (one of them had SLN metastasis), 16 pts with prostate cancer (6 pts with SLN metastasis), 3 pts with oral cancer (two with SLN metastasis), 19 pts with vulvar cancer (9 with SLN metastasis), 1 with vaginal cancer. 127 pts with cervical cancer were examined in one- or two-day protocol (after exclusion 45 pts with stage FIGO III we included 85 pts — 3 pts had SLN metastasis). After SLN biopsy all women underwent lymph node dissection and hysterectomy according Wertheim-Meigs with radicalism PIVER II, III).

**Conclusions:** In melanoma and breast cancer patients sentinel lymph node biopsy is highly reliable in experienced hands. This study shows the importance of lymphoscintigraphy, the gamma probe and patent blue dye in all lymph node basins but mainly in the axilla and unusual basins.

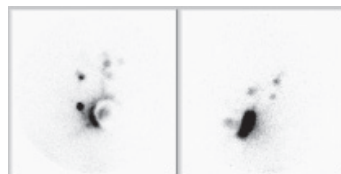
Completion therapeutic lymphadenectomy is recommended after positive biopsy because it is difficult to predict the presence of positive nonsentinel nodes. The method reduced distinctively a number of elective lymphadenectomies much-favoured some years ago.

In all types of tumours the success of localization of SLN was directly related to simultaneous use of scintigraphy, the surgical probe and patent blue dye.

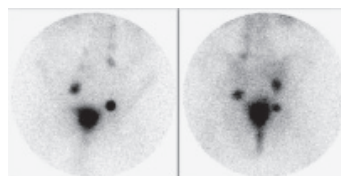
Sentinel lymph node biopsy is very useful in surgical management of primary malignant melanoma and breast cancer. In other types of tumours the role of sentinel lymph node biopsy is also significant and feasible but its results are not as unequivocal and optimistic as in breast cancer and malignant melanoma, and it is still experimental. For scintigraphy and intraoperative gamma probe the differences among three radiopharmaceuticals were not great, however in malignant melanoma patients Nanocoll detected more SLNs on average. It is possible safely avoid axillary dissection in breast cancer in tumours of the size up to 1 centimetre (T1a and T1b) with negative SLN. The SLN identification rate in malignant melanoma and breast cancer and the SLN false-negative rate in breast cancer are comparable with other studies.



**Figure 1.** SLNs in both axilla in 72 yrs old woman with malignant melanoma of the back.



**Figure 2.** Several SLNs in 60 yrs old woman with cancer of the left breast.



**Figure 3.** Several SLNs in 66 yrs old man with prostate cancer.



**Figure 4.** Two SLNs in 63 yrs old woman with cervical cancer.