NUCLEAR CARDOILOGY IN THE CZECH REPUBLIC IN 2003: A SUBSTANTIAL INCREASE IN UTILIZATION OF MYOCARDIAL PERFUSION SPECT IMAGING

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Introduction: Since 1994 numbers of myocardial perfusion imaging (MPI) studies have grown at a rate of about 5% per year in Europe and 11% per year in the USA. The second survey of nuclear cardiology in the Czech Republic has been conducted to ascertain whether the activity had increased similarly. Also we wanted to identify new trends in clinical practice.

Method: Likewise in the first survey in 2001, a questionnaire concerning nuclear cardiology practice in 2003 was sent to all departments of nuclear medicine in the Czech Republic; all 46 departments responded.

Results: There were 66 SPECT cameras in 2003 in comparison with 54 in 2001. Out of the 46 centres, 39 provided nuclear cardiology service. The total number of cardiological studies was 19,281 in 2003 (i.e. 1.9 studies/1,000 population); MPI SPECT studies accounted for 91.3% of total nuclear cardiology. In 2001–2003, the utilization rate of MPI increased annually by 10%, 13% and 21%, respectively. Twenty-six (67%) departments reported the increase of MPI activity. The expansion of gated SPECT method was a very positive trend (93% of all MPI studies in 2001 and 61% in 2003). Twenty-five departments reported that they have the possibility of using nuclear cardiology quantitative software (including normal database). We observed a rise in utilization of attenuation correction (3 centres in 2003 in comparison with 5 centres in 2001). Despite new PET capacity in the Czech Republic, the total number of FDG cardiology studies was somewhat lower in 2003 than in 2001 (155 versus 163 studies).

Conclusion: Our data documented substantial growing number of MPI examinations in 2001–2003. However, the Czech Republic nuclear cardiology activity remained still below the European average (2.2 studies/1,000 population in 1994); further increase in MPI activity is necessary to support the adequate needs of the cardiac patients.

THE NURSE’S WORK IN THE DETECTION OF THE BRAIN DEATH IN THE DEPARTMENT OF NUCLEAR MEDICINE IN THE UNIVERSITY HOSPITAL IN OSTRAVA

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Aim: To present our experience with scintigraphic demonstration of the brain death.

Method: We do this scintigraphy on two-headed SPECT camera after i.v. application of 740 MBq of 99mTc-HMPAO. We do dynamic and static scintigraphy of the head and neck. The nurse’s work consists in the preparation of the gamma camera, the preparation of the acquisition of the dynamic and static studies, the assistance to the physician during the application of radiopharmaceutical. The nurse immobilizes the patient’s head in the due position and checks the patient during the whole examination.

Results: From 2003 in our department we have done the examination in 22 patients. Four possible organ donors. In all of them the brain death was confirmed.

In the case report we show dynamic and static scintigrams in a child with a diagnosis of spontaneous intracerebral bleeding and in one adult after a craniostrauma. The nurse immobilizes the patient’s head in the due position and checks the patient during the whole examination.

Conclusion: The scintigraphy for the confirmation of the brain aperfusion is the most contributing especially in patients after craniostrauma. It is done in the time when they have already undergone several examinations which confirmed a suspicion of the brain death. Thus our department is mostly the last workplace where the brain death is confirmed or excluded.
ONCOLOGY

PREDICTIVE VALUE OF TECHNETIUM-99M-MIBI SCINTIGRAPHY AND MRI IN THE DIAGNOSIS AND THERAPY OF MULTIPLE MYELOMA

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Aim: To evaluate the validity of 99mTc-MIBI scintigraphy and MRI in the diagnosis and prediction of therapy effect in patients with multiple myeloma (MM) and monoclonal gammopathy of unknown significance (MGUS), in whom both examinations were performed within 14 days.

Material and methods: Fifty-two consecutive patients (34 men, 17 women, median age — 61 years) with MM or MGUS were enrolled in the study. Fifteen patients were examined before and after therapy. Anterior and posterior whole-body scans were obtained 10 min after administration of 800 MBq 99mTc-MIBI. The scans were classified as showing normal (N), diffuse (D), focal (F) and combined (F + D) 99mTc-MIBI uptake patterns. MRI of Th and LS spine, T1 w.i. and STIR in sagittal plane were performed, selected vertebrae T1 w.i. in transversal plane, T2 w.i. and opposed phase GRE were performed when needed. Main pathological signs were T1 hypointensity (focal or diffuse) and STIR hyperintensity.

Results: Pathological changes in bone marrow were detected in 99% of scintigraphic examination and in 94% of MRI. All 5 MGUS patients had negative both 99mTc-MIBI scan and MRI. Six MM pts in initial stage (not requiring therapy) had negative scintigraphy and STIR while T1 w.i. was positive. Among 32 MM patients with active disease 18 showed D-pattern of 99mTc-MIBI uptake. 6 F and 11 D + F pattern while all 32 patients exhibited focal lesions in MRI. 4 D + F finding, 6 epidural mass and 18 vertebral compression. After therapy, normal scintigraphy was in agreement with the clinical status in 89% while MRI findings in 22% only. Out of 15 patients in remission (within 2 months), 11 had no pathological uptake of radiotracer and 4 presented both focal and diffuse pattern of 99mTc-MIBI uptake, 10 patients exhibited 10 focal lesions and 5 partial conversions in MRI.

Conclusion: Both 99mTc-MIBI scintigraphy and MRI are methods of equal sensitivity in detecting active MM and complement each other. The advantage of 99mTc-MIBI scintigraphy is whole body examination and faster response to therapy while the advantage of MRI is detection of epidural masses and vertebral compressions influencing the therapeutical strategy.

EXAMINATION OF THE SENTINEL LYMPH NODE IN PROSTATE CANCER AND CERVICAL CANCER

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Aim: To acquaint with the way of the detection of the sentinel lymph nodes (SLN) in patients with prostate cancer and cervical cancer.

Method: The prostate cancer: The urologist applies transrectal with the help of ultrasound 100 MBq of colloid in the volume of 0.5–1 ml with the help of ultrasonography to the both lobes of the prostate. About 30 minutes after it we do the static scintigraphy in the anterior and the posterior projections for 5 minutes with the marking of the SLN on the skin. Then the prostalectomy and biopsy of SLN follow with the help of surgical gamma probe (1 day protocol).

The cervical cancer: In the department of gynaecology it is applicated 100 MBq of colloid in the volume 1 ml to the four quadrants of the cervix around the tumor. Approximately after 1 hour (one day protocol) or after 14–16 hrs (two day protocol) we do the static scintigraphy in the anterior and posterior projections with the marking of the SLN on the skin. Then the surgery follows with the help of the blue dye and the surgical gamma probe — the removal of the tumor and the SLN.

Results: We have examined 13 patients with the prostate cancer and 25 patients with the cervical cancer. We show the results of the detection of SLN in both diagnoses, occurrence of metastases in the SLN. In prostate cancer the SLN is detected in the usual location in fossa obturatoria and also elsewhere paraaortal, around iliac blood vessels, in cervical cancer the SLNs are especially in parametrium and pelvis.

Conclusion: In addition to polished procedure of the SLN detection in melanoma and breast cancer this method is successfully used also in other malignant tumors. We show it in the case of prostate cancer and cancer of cervix.

UPTAKE OF THE BONE-SEEKING RADIOPHARMACEUTICAL IN METASTASES OF THE PANCREATIC CARCINOMA — SIDE FINDING OF BONE SCINTIGRAPHY

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Aim: A number of common soft tissue neoplasm exhibit variable degrees of bone-seeking tracer uptake in the both primary and soft tissue metastases. The mechanism of localization is not well understood but its target to be a combination of tumor calcification and binding to macromolecules.

Material: 53-years old patient with diagnosis adenocarcinoma of the pancreas and biopsy verified liver metastases. Bone scintigraphy was indicated to eliminate bioptically verified liver metastases. Bone scintigraphy was indicated to eliminate bioptically verified liver metastases. Bone scintigraphy was indicated to eliminate bioptically verified liver metastases. Bone scintigraphy was indicated to eliminate bioptically verified liver metastases.

Method: 99mTc-methylene diphosphonate (700 MBq) was administered intravenously. Whole body scintigraphy and liver emission tomography (SPECT) were performed 3 hours after injection.

Results: The whole body bone scan shows bone lesions in the spine, sternum, scapula and left sacro-iliac junction. It presents multiple bone metastases. Planar scan and corresponding SPECT study note also abnormal interconneced focal lesions of the transverse in the liver.

Conclusion: Bone scan imaged metastases of pancreatic carcinoma in skeleton and in liver too. Uptake of the bone radiotracer in hepatic metastases is atypical. CT of the liver detected multiple metastases but it didn’t proved necrosis. Liver biopsy proved partial necrotic transformation of metastatic cells.

SCINTIGRAPHY OF TUMORS WITH 111−TC-DEPOTIDE — THE FIRST EXPERIENCE

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Aim: Depreotide is the small synthetic peptide, which binds to somatostatin receptors (SSTR) on the cell membranes, specifically SSTR subtypes 2, 3 and 5. These receptors are over-expressed in lung cancers (NSCLC and SCLC), breast cancers, malignant melanomas, carcinoids, pheochromocytomas, intestinal adenocarcinomas, etc. Depreotide (NeoSpect — Amersham Health) is applicable in scintigraphic imaging after radiolabeling with 111−Tc. The main indication of this radiopharmaceutical in Europe is differential diagnostics of solitary pulmonary nodules detected with chest X-ray or CT scan. Scintigraphy with 111−Tc-depotide can separate malignant and benign lesions with high sensitivity and specificity (foreign clinical trials show sensitivity in this indication up to 97% and specificity around 73%). Radio-pharmaceutical is not reliable enough in the abdomen region for the high hepatobiliary excretion.

Material: In total 12 patients were examined with 111−Tc-depotide, 9 patients with solitary pulmonary nodules suspected of lung cancer, one patient with suspected of the recurrence of lung cancer, and two pts. with suspicion of bronchial carcinoid.

Method: Whole body scan and SPECT of chest was performed 2–4 hours after the intravenous administration of 600–800 MBq of 111−Tc-depotide. In a few cases additional planar scans were obtained after 24 hours. All results were compared with X-ray, CT, surgery, histology and course of the disease.

Results: In eight patients lung carcinoma was correctly detected (6 × NSCLC, 2 × SCLC) and in five of them hilar or mediastinal metastases too. In two patients the results were true negative (granulomas). In two patients with suspicion of bronchial carcinoid the exams were true negative, but in one patient small carcinoid in duodenum was discovered. No side effects were observed.

Conclusion: Our first experiences show that scintigraphy with 111−Tc-depotide is useful non-invasive method for imaging SSTR-expressing tumors and also for stag- ing of lung cancers, both with very high sensitivity and specificity.
The sentinel lymph node, the influence of some factors on the detection success

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The aim: The comparison of the detection of the sentinel lymph node (SLN) in patients with breast cancers and malignant melanomas using the scintigraphy, patent blue dye, surgical gamma probe and the combination of these three methods. The comparison of success rate of three radiopharmaceuticals (RF). In breast cancers patients the comparison of 1-day and 2-day protocols, the detection of the axillary and non-axillary SLN, the determination of a false negativity of the SLN.

Methods: We have examined 194 patients with breast cancers and 275 patients with malignant melanomas. In presurgical lymphoscintigraphy and surgical gamma probe procedure we use one of these three RF: NANOcoll, SENTI-SOMB, NANOcoll. Peroperative use of blue dye (Patent blue V). In the melanoma patients 1-day protocol, in breast cancer patients 1-day protocol (scintigraphy 1 and 2 hrs after injection) or 2-day protocol (1, 2, 23 hrs after inj.). The application of RF: in both tumours 90–100 MBq, in the melanoma 4 sub- or intradermal injections, in the breast cancer 4 peri-tumoral and 1 subdermal injections. Histopathologic examinations including immunohisto-pathologic examinations.

Results:

The melanoma: The SLN detection by scintigraphy in 94.2% (Nanocoll 93.2%, Nanocoll 98.2%, Sentinel 92.3%), by probe in 91.6% (Nanocoll 88.5%, Nanocoll 98.1%, Sentinel 91.9%), by blue dye in 81.6%. The combination of three methods detected the SLN in 99.5%.

The breast cancer: The SLN detection by scintigraphy in 91.2% (Nanocoll 92.6%, Nanocoll 90.9%, Sentinel 88.6%), by probe in 88.1% (Nanocoll 92%, Nanocoll 90.6%, Sentinel 76.7%), by blue dye in 86.4%. The combination of three methods detected the SLN in 89%. 1 and 2-day protocols: 1-day protocol in 24 patients — in 6 patients without detection, 2-day protocol in 170 patients — in 12 pts without detection. False negativity of SLN in 5.7%. The detection of non-axillary SLN in 31% of patients.

Conclusion: The best results of SLN detection have been by simultaneous use of all three methods, the highest detection has had the scintigraphy, the lowest one has had the blue dye. We have not found out a good difference among used RF. In breast cancer there is the better detection of the SLN in 2-day protocols, in peri-tumoral injections there is the high detection of non-axillary SLN.

The first experience in radioimmunotherapy with ibritumomab tiuxetan (Zevalin®)

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Introduction: Ibritumomab tiuxetan (Zevalin®) is a drug for radioimmunotherapy, its base is a murine IgG monoclonal antibody (MoAb) targets on the CD-20 antigen. This MoAb is joined with yttrium-90 (90Y). The treatment by ibritumomab tiuxetanem is advisable for patients with relapsed or refractory CD 20(+) follicular B-cell, non-Hodgkin’s lymphoma (NHL).

Material and method: We performed the first application of ibritumomab tiuxetan (Zevalin®) on march 2004 in 59-years-old man with follicular B-cell NHL, initial stage IV A (abdominal paraaortal lymphnodes + bone marrow). NHL was diagnosed in 1996. Patient underwent chemotherapy + external actinotherapy and therapy with interferon-alpha has been started. After six years patient got relapse and intraspi- nal infiltration (Th 5–7) and affection of vertebrae Th 3-10 with paraparesis lower limbs. Paraparesis regressed after high-dose chemotherapy with transplantation peripheral stem cells. Back pain found again in January 2004. MRI detected tumor infiltration in front of vertebrae Th 7-10, thickness 4 cm, no infiltration was intraspinal and in bodies of vertebrae. We decided to administer radioimmunotherapy with ibritumomab tiuxetan. Rituximab (MabThera® — cold MoAb targets on the CD 20 antigen) was applied intravenously in dose 250 mg/m². Next dose of rituximab was administered after 1 week. Immediately after the patient got short (ten minutes) intravenous infustion of ibritumomab tiuxetan (805 MBq 90Y). Because platelets level was only 14.7 × 10⁹/dL therefore applied activity was reduced to 11 MBq/kg. Dosing pump was shielded by Plexiglas and dose rate was 120 mSv/hour from 1 meter. One hour after injection dose rate in 1 meter from patient was 2.5 mSv/hour and 24 hours after injection was 0.95 mSv/hour. Whole-body scintigraphy 24 and 90 hours after injection was performed by means of the beamstrahlung detection. Two acquisi- tion-setting-up were used — a) photopeak 140 keV, window 50%, low-energy high resolution collimator and velocity 14 cm/min and b) photopeak 200 keV, win- dow 50%, collar in 128 energy and velocity 10 cm/min. We preferred set- tling-up with photopeak 200 keV for lower scatter.

Results: During intravenous ibritumomab tiuxetan application the patient was in good condition and no allergic state and cardiopulmonary instability were detected. Four months after ibritumomab tiuxetan administration the tumor infiltration is reduced, it is only in front of vertebrae Th 10–11, thickness only 18 mm by MRI.
RADIOSYNOVIOARTHESIS FROM THE POINT OF VIEW
OF THE ORTHOPAEDIST
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Aim: To acquaint with the inclusion of the radiosynoviorthesis in the algorithm of the intrarticular treatment of the synovitis.

Method: The radiosynoviorthesis (RSO) is intraarticular treatment with beta emitters. For the correct indication one should accomplish before RSO the ultrasonography, X-ray; it is suitable three-phase bone scintigraphy. The treatment effect is possible to expect only when the synovitis is proved by these procedures. The treatment effect is evaluated by the clinical examination, the ultrasonography and the three-phase bone scintigraphy.

Results: From 1986 to XI/2004 we have done RSO of 1243 knees, from VI/2002 to IX/2004 25 RSO of medium joints — 8 elbows, 7 ATC, 3 shoulders, one hip, 6 RC and RSO of 8 small joints in two patients. The evaluation of the treatment effect by patients in 294 RSO (the effect on the pain and the formation of the fluid): in 10.9% no effect, in 42.2% the substantial and long-term effect, in 46.9% the partial effect. The clinical evaluation (by the orthopaedist) of 180 patients after RSO: after 6 months in 77% a reduction of a filling and a swelling and in 86% a reduction of pain, after one year in 53% a reduction of a filling and a swelling and in 62% a reduction of pain, after two years in 28% a reduction of a filling and a swelling and in 48% a reduction of pain. In RSO of small joints there are very good treatment effects especially in haemophilic patients.

Conclusion: RSO is effective, simple, for patients non troublesome treatment procedure with a low incidence of undesirable effects. It is necessary to have a team co-operation in indications, doing and an evaluation of the treatment effect.