VIA MEDICA

Nuclear Medicine Review 2004
Vol. 7, No. 2, 2004, pp. 219–222

ISSN 1506–9680

Chosen abstracts of XLI Days of Nuclear Medicine of Czech Society of Nuclear Medicine

CARDIOLOGY

1

COMPARISON OF EJECTION FRACTION BETWEEN EQUILIBRIUM GATED RADIONUCLIDE AND X-RAY VENTRICULOGRAPHY IN PATIENTS WITH CORONARY ARTERY DISEASE

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Introduction: Before the start of the grant „MRI with gadolinium contrast versus Thallium myocardial perfusion SPECT in detection of viable left ventricle myocardium before coronary artery bypass graft (CABG) the reproducibility of equilibrium gated radionuclide ventriculography was evaluated.
Since all patients in this study underwent coronarography with X-ray ventriculography we could perform a comparison of left ventricle ejection fraction between radionuclide and X-ray ventriculography.
Material: Fourteen patients (12 men, 2 women, aged 42–74, mean 57 years) with coronary artery disease underwent this investigation. All patients was indicated to CABG.
Method: In all patients we performed coronarography with X-ray ventriculography. After a few weeks patients underwent rest radionuclide ventriculography (500 cycles, matrix 64 x 64, 24 frame per cycle, low-energy all purpose collimator). *In vivo* labelling of red blood cells was used by means of ^{99m}Tc-pertechnetate (750 MBq). Data acquisition was made twice.
Results: We perform comparison between ejection fraction from radionuclide ventriculography first and second data acquisition and X-ray ventriculography. Pearson correlation coefficient was 0.633 (first) and 0.681 (second). Ideal value is 1. Average difference was 8% ± 6% (first) and 8% ± 7% (second). Value of Pearson correlation coefficient was low and it displayed poor match between both of methods.
The question is: which method for assessment of ejection fraction is true? Volumetric method (radionuclide ventriculography) are mild faithfuler than geometric method (X-ray ventriculography) because radioactivity over left ventricle has direct proportion to volume by course of literature.

2

NUCLEAR CARDIOLOGY 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 19,261 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 (39% 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 no increase 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.

NEUROLOGY

3

A COMPARISON OF THE CLINICAL DIAGNOSIS AND BRAIN SPECT PERFUSION EXAMINATION IN COGNITIVE DISTURBANCES

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Introduction: Brain perfusion changes were detected in patients with cognitive disorders. Therefore we performed retrospective analysis of brain SPECT perfusion in patients with cognitive disorders evaluated in our department.
Aim: 1) comparison of the clinical diagnosis with the brain perfusion SPECT examination; 2) assesment of the inter- and intraindividual variability of the results; 3) relation of patient laterality to entering SPECT perfusion pattern.
Material and methods: 68 patients (38 females and 30 men) were enrolled in the study — with an average age of 68 years (41–87 y); 33 with clinical diagnosis of Alzheimer's disease, 13 with mild cognitive impairment and 22 with other cerebral diseases. The results were sorted into five groups according to the reassessment of their brain SPECT perfusion images: 1. vascular dementia (17 patients), 2. Alzheimer's dementia (19), 3. mixed dementia (18), other diagnosis (11), normal (3).
Results: 15/33 patients with clinicaly probable Alzheimer's dementia have got typical SPECT images and 14/33 have got the result compatible with mixed dementia (altogether 87%). In 13 patients with mild cognitive impairment, all types of perfusion disorders were found. The interindividual agreement was found in 31 (89%) out of 35 randomly chosen examinations, intraindividual agreement in 75/91 (87%) findings. The right-sided dominance was establised in 25 patients with Alzheimer's dementia and mixed dementia. Of these, a brain perfusion pathology was described on the left side in 15, on the right side in 2 and bilateral involvement in 8 patients on the first examination.
Conclusions: The majority of patients with Alzheimer's dementia have got the first perfusion deficit in the dominant hemisphere. A satisfactory level of intra- and inter-individual agreement of the SPECT descriptions was found. The heterogeneous patterns of brain perfusion correspond to a mixed population with mild cognitive impairment. For the evaluation of their importance, further study is essential.

4

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 — brain aperfusion.
Method: We do this scintigraphy on two-headed SPECT camera after i.v. application of the bolus of 700 MBq of ^{99m}Tc 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 — 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 craniotrauma. In both patients the brain death was confirmed. For the comparison we also show static scintigrams of a patient after a transient ischemic brain attack. In our paper we also engage in a psychological stress of a medical staff working with these patients with a bad prognosis.
Conclusion: The scintigraphy for the confirmation of the brain aperfusion is the most contributing especially in patients after craniotrauma. 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

5

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 od 99mTc-MIBI scintigraphy and MRI in the diagnosis and prediction of therapy effect in patiens 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 patiens (34 men, 17 women, median age — 61 years) with MM or MGUS were enrolled in the study. Fifteen patiens 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 sagital 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 95% of scintigraphic examination and in 94% of MRI. All 5 MGUS patiens 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 patiens with active disease 18 showed D-pattern of 99mTc-MIBI uptake, 6 F and 8 D + F pattern while all 32 patiens exhibited focal lesions in MRI, 4 D + F finding, 5 epidural mass and 18 vertebrae compression. After therapy, normal scintigraphy was in agreement with the clinical status in 89% while MRI findings in 22% only. Out of 15 patiens 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 patiens exhibited 10 focal lesions and 5 partial conversions in MRI.
Conclusion: Technetium-99m-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.

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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 applicates transrectal with the help of ultrasonography 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 30minutes after it we do the static scintigraphy in the anterior and the posteror projections for 5 minutes with the marking of the SLN on the skin. Then the prostatectomy 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.

7

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 bioptically verified liver metastases. Bone scintigraphy was indicated to eliminate bone metastases.
Method: ^{99m}Tc-methylenediphosphonate (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, sacrum and left sacro-iliac junction. It presents multiple bone metastases. Planar scan and corresponding SPECT study note also abnormal interconnected focal lesions of the intense uptake in the liver.
Conclusions: 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.

8

SCINTIGRAPHY OF TUMORS WITH ^{99M}TC-DEPREOTIDE — 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 ^{99m}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 ^{99m}Tc-depreotide 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%). Radiopharmaceutical is not reliable enough in the abdomen region for the high hepatobiliary excretion.
Material: In total 12 patients were examined with ^{99m}Tc-depreotide, 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 ^{99m}Tc-depreotide. 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.
Conclusions: Our first experiences show that scintigraphy with ^{99m}Tc-depreotide is useful non-invasive method for imaging SSTR-expressing tumors and also for staging of lung cancers, both with very high sensitivity and specificity.

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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: NANOCIS, SENTI-SCINT, NANOCOLL. Peroperative use of blue dye (Patent blau 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, 22 hrs after inj.). The application of RF: in both tumours 80–100 MBq, in the melanoma 4 sub- or intradermal injections, in the breast cancer 4 peritumoral and 1 subdermal injections. Histopathologic examinations including immunohistopathologic examinations.
Results:
The melanoma: The SLN detection by scintigraphy in 94.2% (Nanocis 93.2%, Nanocoll 98.2%, Sentiscint 92.3%), by probe in 91.6% (Nanocis 88.5%, Nanocoll 98.1%, Sentiscint 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% (Nanocis 92,6%, Nanocoll 90.9%, Sentiscint 88.6%), by probe in 88.1% (Nanocis 92.1%, Nanocoll 90.6%, Sentiscint 76.7%), by blue dye in 86.4%. The combination of three methods detected the SLN in 99%.
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.
Conclusions: 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 great difference among used RF. In breast cancer there is the better detection of the SLN in 2-day protocols; in peritumoral injections there is the high detection of non-axillary SLN.

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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 (^{90}Y). The treatment by ibritumomab tiuxetanem is advisable for patients with relapsed or refractory CD 20(+), follicular B-cell, non-Hodgkin's lymfoma (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 had relapse and intraspinal 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/m^2. Next dose of rituximab was administered after 1 week. Immediately after than the patient got short (ten minutes) intravenous infusion of ibritumomab tiuxetan (825 MBq ^{90}Y). Because platelets level was only 14.7×10^9/dL therefore applied activity was reduced to 11 MBq/kg. Dosing pump was shielded by plexiglass and dose rate was 120 nSv/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 bremsstrahlung detection. Two acquisition 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, window 50%, collimator for middle energy and velocity 10 cm/min. We preferred setting-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.

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YTTRIUM-90 COLLOID IN THE TREATMENT OF CYSTIC CRANIOPHARYNGIOMA

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Aim: Long-term follow up the patients after intracavitary irradiation for cystic craniopharyngioma. These tumours are benign but difficulty in curing them can lead to serious morbidity or death. No primary medical therapy exists for these tumours.
Material and method: For retrospective analysis 17 patients were selected in age range 2–67 years. The volume of the cyst was determined by CT or repeated MRI. The cumulative dose to the inner surface of the cyst wall was 250 Gy. Modification of Backlund's formula for dosimetry was used. The formula can be used for spheroid cysts if the mixing of the injected colloid and the cyst fluid is complete and homogenous. Administered activity were in range 40–222 MBq. ^{90}Yttrium silicate colloid was administered directly stereotactically (CT guided surgery) or through Ommaya drainage system. Control scintigraphy 2–3 hours after ^{90}Y injection to detect possible leakage of the radioisotope was performed. None of our patients showed evidence of this. The patients were checked daily to pay attention to visual function, neurological condition and possible meningeal irritation. During the study two patients died, one due to pulmonary embolism and the second from complications related to a solid/cystic recurrence.
Results: For monitoring cyst volume repeated CT examinations were used. To simplify representation, the original cyst volume was normalized to 100% in all cases. Decrease in volume during 4 month was in 48% of cysts. Shrinkage of the initial cyst volume was 75% after 1 year. The cyst disappeared nearly totally in 5 patients. No patients developed a visual field defect or evidence of hypothalamic dysfunction after the treatment. Worsening of neuroophtalmological symptoms was one of the typical signs for recurrence.
Conclusion: From our results ^{90}Y intracavitary therapy is minimally invasive and very effective method, but careful patient selection is necessary. The best result can be expected by solitary cyst because the effect is limited to the cystic part of the tumour. This method plays important role in multi-modality treatment of cystic craniopharyngioma. The treatment is not recommended in cases with predominantly solid tumours, mixed tumours with small cysts, or mainly intrasellar tumours.

SYNOVIORTHESIS

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RADIOSYNOVIORTHESIS FROM THE POINT OF VIEW OF THE NUCLEAR MEDICINE

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Aim: To acquaint with the indications, doing, treatment results of the radiosynoviorthesis (RSO) of great, medium and small joints.
Method: The 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.
To the knees we applicate 200 MBq of yttrium citrate. The orthopaedist applicates rhenium sulfide to the medium joints (70–110 MBq) and erbium citrate (20–40 MBq) to the small joints under ultrasonographic control. After RSO the joint is immobilized for 2–3 days. After RSO it is possible to do the scintigraphy when we obtain an information about the radiopharmaceutical distribution in the joint.
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 orthopadist) 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.

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RADIOSYNOVIORTHESIS 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: An etiopathogenesis of the synovitis is critical for the choice of the treatment strategy. The conservative treatment involves total medical and rehabilitation therapy, the intraarticular application of corticosteroids and the radiosynoviorthesis. The surgical procedure offers the arthroscopic synovectomy especially in the early stages of the disease. In the chronic form and more marked finding it is necessary to use the wide arthrotomy. The usable algorithm of the synovitis treatment of adults: the intraarticular application of corticosteroids — the radiosynoviorthesis — the arthroscopy with the synovectomy — the open synovectomy.
Conclusion: The radiosynoviorthesis is in the early stage of the synovitis (affected only stratum synoviale) nearly comparable method with the surgery, but only with reduce risks and with the minimal requirements of the after-treatment.
In the chronic disease stages (affected also stratum fibrosum) it is possible to combine the radiosynoviorthesis with the surgical methods. It is dependent on the disease activity. Generally it is possible to say that the radiosynoviorthesis postpones the radical surgical procedure.