

different (functional and morphological) methods seem to be suitable for setting up the precise diagnoses in a short time thus playing an important role in the modification of patient's further therapy.

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FUTURE LIVER REMNANT FUNCTION MEASURED WITH ^{99m}Tc-MEBROFENIN SPECT/CT BEFORE AND AFTER PORTAL VEIN OCCLUSION

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Background: Insufficient volume and function of future liver remnant (FLR) is the main cause of posthepatectomy liver failure (PHLF). Those patients who need extended liver resection could not be operated earlier because according to CT volumetry the operation would result in insufficient liver volume (healthy liver < 30%, cirrhotic liver < 40%). Portal vein occlusion techniques [embolisation (PVE), ligation (PVL)] cause the hypertrophy of non-embolised/non-ligated and the atrophy of embolised/ligated liver lobe. With CT volumetry only the FLR volume (FLRct) can be measured, but the function not. The latter one can be measured with ^{99m}Tc-mebrofenin SPECT/CT. Our aim was to compare the percentage results of ^{99m}Tc-mebrofenin SPECT/CT and CT volumetry before and after portal vein occlusion techniques prior to extended liver resections.

Material and methods: Between March 2011 and October 2012 forty patients presenting with primary or secondary liver tumors were included. Among these patients the future liver remnant volume (FLRct) measured with CT volumetry before planned extended hepatectomy was less than 30% (normal liver) or 40% (cirrhosis). To increase the FLRct portal vein occlusion techniques (26 PVE, 9 PVL) were performed. In five cases none of the techniques were performed. Eight weeks after portal occlusion CT-volumetry and ^{99m}Tc-mebrofenin SPECT/CT were performed, and both percentage values (fFLR% vs FLRct%) were compared. Among seventeen patients fFLR before occlusion was also measured. Postoperative complications rates (using the Clavien criteria) were also observed. Patients with "borderline" FLRct (healthy liver: 25–30%, cirrhotic liver: 35–40%) were evaluated with special interest.

Results: Eight weeks after portal vein occlusion, fFLR was significantly higher than FLRct (mean fFLR: 39.0 ± 10.5% vs FLRct: 30.7 ± 7.8%; $p < 0.05$). In patients with "borderline" FLRct ($n = 14$) these results were even more convincing (mean fFLR: 35.0 ± 9.9% vs FLRct: 28.0 ± 1.9%; $p < 0.05$). The functional and volumetric percentage values were also compared before and after occlusion, and fFLR growth rate was higher than FLRct growth rate (mean fFLR: 12.6% vs mean FLRct: 7.6%). 33 patients were operated. Among those who had minimum 5% difference between fFLR and FLRct postoperative complications rates were significantly lower, than among those who had similar values.

Conclusion: ^{99m}Tc-Mebrofenin SPECT/CT can be useful in the measurement of future liver remnant function after portal vein occlusions. This can make surgeons decision easier than CT volumetry in planning extended hepatectomies.

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A NEW COMPLEX DIAGNOSTIC PROTOCOL FOR THE DIAGNOSIS OF NASOLACRIMAL DUCT OBSTRUCTION: SIMULTANEOUS DACRYOCYSTOGRAPHY AND DACRYOSCINTIGRAPHY USING SPECT/CT

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Epiphora, an abnormal overflow of tears, is commonly caused by tear drainage system anomalies including nasolacrimal duct obstruction (NLDO). To assess morphological abnormalities dacryocystography by computed tomography (CT-DCG) is used when CT contrast material is syringed into the lacrimal drainage system. To evaluate the function of the system dacryoscintigraphy (DSCI) is the most readily available non-invasive method.

21 patients with clinically suspected obstruction of nasolacrimal duct were recruited into this study. 5 MBq ^{99m}Tc sodium pertechnetate was instilled with a micropipette into the lacrimal lake of both eyes and simultaneously 90 × 10 sec dynamic images was acquired in 256 × 256 matrix with a high resolution gamma-camera (NuclineTh/22, Mediso). The drainage was characterized based on the time-activity curve generated on the ROIs for the left and right eyes and nasolacrimal ducts. (InterviewXP, Mediso) If obstruction was confirmed SPECT/CT (Anyscan SC, Mediso) images (20 sec/64 frame, 360° degree, 128 × 128 matrix SPECT and 50 mAs, 120 kV CT) was performed to localize the site of obstruction before and after syringing with contrast material (ioversol, Optiray 350, Covidien) of the nasolacrimal tear drainage system.

Using DSCI the tear could be detected mostly in the upper part of the nasolacrimal drainage system, but with CT-DCG the contrast material could be forced to get to the Hasner's valve. DCG can provide anatomical details of the nasolacrimal drainage system. The result of a DCG can be totally different from that of a DSCI because of the fact that during DCG high pressure contrast injections are administered resulting in diverse viscosity and surface tension.

SPECT/CT camera offers the opportunity to perform these two sensitive investigations simultaneously enabling us to localize anatomically the exact position of the radiolabelled tear, to identify any blockade and to propose surgical intervention.

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TEAR-CLEARANCE MEASUREMENT WITH NUCLEAR MEDICINE METHOD

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The tear has two phases (watery and lipid) and it has 3 layers (lipid, watery and mucin). In case of missing lipid phase, which produced by Meibomian glands, the tear layer easily split up. The patients can feel dry eye sensation, which means a constantly stimulus to twinkle. Moreover the evaporation of tear is increase, because of that the tear-clearance is increase accordingly. The basis of our examination is that 10 MBq/ml sterile ^{99m}TcO₄ was dropped into both of eyes and after all we started a dynamic acquisition protocol (90 × 10 sec, 256 × 256) on planar gamma

camera, with good spatial resolution (Nucline Th22, MEDISO). Finally a ROI was created on the image to get a time-activity curve, and the half-life time was characterized (Interview XP, MEDISO).

We made 32 examinations (64 eyes) that consist of 8 healthy and 24 MGD patient. The control group was selected based on previous ophthalmological monitoring excluded all types of keratoconjunctivitis sicca, as well as surgical intervention was excluded. On the other hand, the MGD was proven previously in case of patient's group. The mean of T1/2 value of tear-clearance of healthy people was 6.26 min, median is 6.19 min, in contrast of patients the mean was 29.908 min, the median is 30.26 min. Mann-Whitney Test was performed, the results suggest significant difference ($p < 0.0001$).

As a summary we can conclude that, the tear scintigraphy is able to quantify the dry-level of eye. Practically it is reproducible, a cheap and easy to perform method. Of course it does not replace the MGD examinations, but it contains a meaningful add in information.

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ACCURACY OF THE SCINTIGRAPHIC ESTIMATION OF SPLIT RENAL FUNCTION

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Background: Urologists or surgeons often make their decision about keeping or removing a kidney based upon the split function, so it is important to know how accurately we can estimate it by different scintigraphic methods. Usually we calculate the ratio of kidney functions from the geometric mean of count rates measured from posterior and anterior views, since for point sources in a homogeneous medium it is theoretically independent of the source position. In our present work we investigated the extent of inaccuracy obtained by the geometric mean method, when varying the kidney size and position (depth) in a phantom experiment.

Material and methods: We inserted a simple kidney phantom in a rectangular water tank (thickness: 35 cm). We varied the volume of the "kidney" (point-like, 50, 100, 150, 200, 250 mL), activity concentration in the scattering medium (0, 33 or 65% of the concentration inside the "kidney"), and the position (in one centimeter steps from 4 to 31 cm). We acquired images simultaneously by two detector heads positioned on opposite sides of the tank, and analyzed the changes in the geometric mean of the two count rates. We processed clinical studies in the same way, and compared the obtained ratios with those estimated by the routinely used methods provided by the clinical program package.

Results: We obtained almost identical geometric mean values, independent of the position, volume, and also of the background concentration when applying a suitable background correction method. For the low-background patient studies with DMSA ($n = 30$), the routine processing method gave similar results to the "optimized" one. When utilizing dual detector acquisition for the clinical studies with higher background, the deviations from the target values were small in most cases, rarely occurred higher differences. However, estimations based on only posterior images resulted in quite high errors in some cases because of the unknown differences between kidney depths.

Conclusion: DTPA studies with traditional posterior acquisition are not suitable for the accurate estimation of split renal function. Quite good estimation can be obtained when applying dual-detector acquisition and a suitable background correction based on background ROIs surrounding both kidneys.

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RADIOLABELED RHTSH PEPTIDE ANALOG FOR CANCER IMAGING IN SPONTANEOUS DISEASED ANIMAL MODELS

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Background: Nowadays the targeted imaging and therapy of cancer with radiolabeled antibodies and peptides is a very important part of oncological researches. Spontaneous tumours in dogs and cats share a wide variety of epidemiological, biological, and clinical features with human cancer. High degree of homology can be detected in tumour gene expression patterns, expression of cell surface antigens and in the case of various signal transduction pathways. These are the factors that contribute to the advantages of the companion animals as a model for human neoplastic diseases.

Material and methods: In our whole body 3D SPECT/CT examinations we used altogether 4 referred dog and 2 cat patients: 3 dog patients with thyroid cancer, 2 cats and 1 dog having other type of head and neck cancers. We labelled one aliquot of rhTSH (recombinant human Thyroid-stimulating hormone) with 925 MBq ^{99m}TcO₄ in tricine buffer. To avoid the unnecessary degradation of image quality caused by unbound pertechnetate we performed purification with a PD 10 gel chromatography column. Labelling efficiency was determined with Instant Thin Layer Chromatography-Silica Gel (ITLC-SG) in 0.9% NaCl solution mobile phase.

Results: The rhTSH analog showed high specific uptake in two dogs with thyroid carcinomas but in another dog which had tumour resection before the examination we saw inhomogeneous uptake. The cervical region of the operated area 2.4 × 3.2 cm diameter primary thyroid tumour residuum displayed correctly. We saw 4 cervical and 1 mediastinal lymph node metastases and in the lungs several tumor metastasis (2–4 mm in a diameter) were found. Only low, non-specific uptake was detected in the two cat and one dog patients with other head and neck cancers. The tumorous animals tolerated well the radiopharmaceutical applications; neither acute nor chronic side-effects were detected.

Conclusion: ^{99m}Tc-rhTSH analog seems promising probes for molecular imaging of tumours which are overexpressing TSH receptors. Our preliminary results in companion animals with different spontaneously occurring tumours proved to be useful in radiopharmaceutical research because of the high degree of similarity with human oncological diseases.

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