

**Results:** In this model of lung metastasis, tumor cells rapidly accumulate in the lungs and do not seed in other organs. After tumor cell inoculation the activity per ROI peaked within 2-5 minutes, followed by a gradual down slope. Statistical analysis using a linear mixed model revealed a significantly accelerated decrease of lung time activity in sham controls compared to NK depleted animal (coefficient of slope: -0.66 vs -0.54).

**Conclusions:** For the first time we provide direct evidence for a very rapid NK cell mediated lysis of tumor targets in vivo and in an individual organ, we conclude that a functional in vivo monitoring of FDG-labeled tumor cells represents a promising approach to gain more insight into the kinetics of the mechanisms of metastasis formation and related cellular host defense processes.

1027

POSTER

### Evaluation of pulmonary lesions using $^{99m}\text{Tc}$ -depreotide and $^{201}\text{Tl}$ -chloride. Preliminary results

D. Boundas<sup>1</sup>, N. Karatzas<sup>1</sup>, K. Pisteovou-Gompaki<sup>2</sup>, G. Sarikos<sup>3</sup>, Z. Kalaitzi<sup>2</sup>, D. Papanicolaou<sup>4</sup>, D. Ekonomidis<sup>4</sup>, <sup>1</sup> Aristotle University Medical School, Hippokraton Hospital, Nuclear Medicine Department, Thessaloniki, Greece; <sup>2</sup> Aristotle University Medical School, AHEPA Hospital, Department of Radiotherapy-Oncology, Thessaloniki, Greece; <sup>3</sup> Theagenio Anticancer Hospital, Department of Pneumology-Oncology, Thessaloniki, Greece; <sup>4</sup> Aristotle University Medical School, Hippokraton Hospital, Second Department of Internal Medicine, Thessaloniki, Greece

**Background:** Recent reports have indicated the value of  $^{99m}\text{Tc}$ -depreotide, a labelled somatostatin analogue, in the evaluation of pulmonary nodules.  $^{201}\text{Tl}$ -chloride has been for long and applied in the diagnosis of lung cancer. The purpose of this study is to compare the diagnostic potential of  $^{99m}\text{Tc}$ -depreotide and  $^{201}\text{Tl}$ -chloride in the evaluation of pulmonary lesions.

**Material and Methods:** Eighteen patients (mean age 62.3±9.4 yrs, 5 female) with 28 pulmonary lesions suspect for malignancy were submitted, on separate days, to  $^{99m}\text{Tc}$ -depreotide and  $^{201}\text{Tl}$ -chloride SPECT. Early (15 min) and delayed (3 hours) scans were acquired for each radiopharmaceutical. Tumor-to-contralateral normal lung activity ratio for both early (early ratio, ER) and delayed (delayed ratio, DR) scans were calculated and the retention index [RI = ((DR-ER)/ER)\*100] was derived. Lesions were characterized as benign (9/28) or malignant (19/28) on the basis of histological examination, and/or clinical and radiological follow-up. Differences between benign and malignant lesions characteristics were examined by means of non-parametric Mann-Whitney statistics and linear regression analysis was used for correlations between radiopharmaceuticals.

**Results:** All malignant lesions accumulated both tracers. Six out of nine benign lesions were  $^{201}\text{Tl}$ -negative. Four out of nine of them were also  $^{99m}\text{Tc}$ -depreotide-negative, the rest showing minor accumulation of tracer. However, ER and DR of both agents were significantly different between benign and malignant lesions ( $^{99m}\text{Tc}$ -depreotide ER, 1.27±0.37 vs 2.81±0.60, p<0.001;  $^{99m}\text{Tc}$ -depreotide DR, 1.40±0.45 vs 3.58±0.83, p<0.001;  $^{201}\text{Tl}$  ER, 1.12±0.29 vs 2.57±0.66, p<0.001;  $^{201}\text{Tl}$  DR, 1.06±0.15 vs 2.48±0.57, p<0.001). For each radiopharmaceutical ER was well correlated to DR (r=0.88 for  $^{201}\text{Tl}$  and r=0.86 for  $^{99m}\text{Tc}$ -depreotide). Inter-agent correlation was fair for both scan phases (r=0.65 for ER and r=0.64 for DR). Interestingly, RI of both agents did not show any statistically significant difference between benign and malignant lesions or any inter-agent correlation.

**Conclusion:** These preliminary results show that  $^{99m}\text{Tc}$ -depreotide may recognize malignant lung lesions as effectively as  $^{201}\text{Tl}$ , having the advantages of improved image quality and favourable dosimetry. Semiquantitative analysis may be helpful in discrimination between benign and malignant lesions.

1028

POSTER

### Contrast-specific ultrasound (CS-US) in staging and follow-up of splenic lymphomas

R. Lo Bianco<sup>1</sup>, S. Tafuto<sup>2</sup>, O. Catalano<sup>1</sup>, M.L. Lentini Graziano<sup>2</sup>, A. Siani<sup>1</sup>, S. Quattrin<sup>2</sup>, <sup>1</sup> S. Maria delle Grazie H., Diagnostica per immagini e Radiologia Interventiva, Pozzuoli (NA), Italy; <sup>2</sup> S. Maria delle Grazie H., Oncematology, Pozzuoli (NA), Italy

**Aims:** To illustrate our experience in the evaluation of splenic hematological malignancies with a real-time, CS-US mode.

**Material and methods:** January to December 2002 we studied 25 patients (10 with Hodgkin disease and 15 with non-Hodgkin lymphoma): 14 M and 11 F aged 28-79 years. After a baseline US study we rapidly injected 2.4-

4.8 mL of the second-generation microbubble agent SonoVue® (Bracco). Contrast-enhanced studies were carried out with a contrast-specific software (CnTI - Contrast Tuned Imaging, Esaote) using a continuous-mode, harmonic acquisition and a low acoustic pressure. US studies outcome was retrospectively correlated with the results of standard tools, including CT (13 cases), MRI (1), US follow-up (10), and FNAB (4).

**Results:** Among 16 cases with focal involvement contrast-enhanced US detected 47/52 lesions demonstrated altogether by reference tools. Conventional US recognized 35/52 lesions. Lesion extent defined by CS-US correlated with standard tools, being similar (81% of cases), underestimated (13%), and overestimated (6%). Baseline US defined the lesion size correctly in 56% of cases, underestimating in 31% and overestimating in 13%. Lesion-to-parenchyma contrast of CS-US resulted low (11% of cases), intermediate (62%), and high (27%). Conspicuity at conventional US was low (52% of cases), intermediate (33%), and high (15%). Lesions appeared as constantly hypoechoic (hypovascular), better definable during intermediate-delayed phase of enhancement than on early phase. Arteries were visible around the lesion and perpendicularly entering along intralesional septa. A clear intralesional microcirculation was visible. Among 9 subjects studied after chemotherapy, loss of microcirculation and marked lesion hypoechogenicity were visible in case of response. Hence, the disease activity could be assessed. In 9 patients with diffuse disease we recognized a slightly less intense and persistent parenchymal opacification, suggesting the need for a full, 4.8 mL contrast medium dose.

**Conclusion:** The spleen is an optimal target CS-US, being superficial, highly vascularized, relatively small, and homogeneous. Contrast-enhanced, gray-scale US is a simple and poorly-invasive tool in morphological and functional imaging of lymphomatous disease.

1029

POSTER

### Quantification of microvasculature in cervix carcinoma with functional CT imaging

I. Yeung<sup>1,5</sup>, J. Darko<sup>2</sup>, M. Haider<sup>3</sup>, M. Milosevic<sup>4,5</sup>, A. Fyles<sup>4,5</sup>, <sup>1</sup> Princess Margaret Hospital, Radiation Physics, Toronto, Canada; <sup>2</sup> Kingston Regional Cancer Centre, Medical Physics, Kingston, Canada; <sup>3</sup> Princess Margaret Hospital, Diagnostic Imaging, Toronto, Canada; <sup>4</sup> Princess Margaret Hospital, Radiation Oncology, Toronto, Canada; <sup>5</sup> University of Toronto, Radiation Oncology, Toronto, Canada

**Background:** Functional CT (fCT) imaging has been commonly accepted for clinical practice in a few selected anatomic sites such as the brain. The fCT method is based on dynamic CT scanning on the volume of interest post intravenous injection of X-ray dye. The arterial and tissue uptake curves of dye can be obtained from the dynamic CT images and they are applied to tracer kinetics models based on which physiologic parameters are determined. This pilot study is to demonstrate the feasibility of fCT on cervix carcinoma applied to the "distributed capillary adiabatic tissue homogeneity" (DCATH) model we previously proposed [1]. The fCT parameters were also compared to oxygenation (PO2) and interstitial fluid pressure (IFP) measurement.

**Material and Methods:** A group of 20 patients with cervix carcinoma took part in a pilot study of fCT at time of disease staging prior to radiation therapy. They were scanned with a GE Light Speed CT scanner and cine technique factors of 120 kVp, 100 mA, 1s rotation for 120 s. The data were downloaded to a SUN BLADE 1000 workstation for analysis with a nonlinear deconvolution method using the quasi-Newton algorithm. The DCATH model calculated 5 fCT parameters; namely, blood flow (BF), capillary permeability surface area product (PS), blood volume (BV), mean transit time (MTT) and transit time spread (TTS). The advantage of this model is that TTS measures the architecture complexity of microvasculature in the tissue. Seventeen patients also received IFP measurement by a sick-in needle technique while 15 patients had PO2 measured with the Eppendorf probe. The fCT parameters were tested against IFP and PO2 for correlation.

**Results:** The average fCT parameter estimates for tumor are: BF = 62.7±21.3 mL/min/100g, PS = 25.2±11.1 mL/min/100g, BV = 11.5±4.0 mL/100g, MTT=12.1±3.5s and TTS=5.3±1.3s. The average measured IFP and PO2 are 18.2±8.9 mmHg and 17.3±18.2 mmHg respectively. None of the fCT parameters indicated strong correlation with IFP or PO2 and the only significant correlation is between BF and mean PO2 (r=0.46). However, BF was found to strongly correlate with the slope of tissue uptake curve (r=0.85).

**Conclusions:** The feasibility of the fCT method was demonstrated and average values of the fCT parameters were obtained in this group of patients with cervix carcinoma. The initial slope of the tissue uptake curve may be a good relative measure of BF because of their strong correlation. The weak correlation between BF and PO2 suggests that tissue oxygenation is somewhat dependent on supply via blood flow into the tissue but perhaps

also determined by other contributing factors such as oxygen consumption in tissue.

# Reference

- [1] Koh, T.S. et al. *Phys. Med. Biol.*, 46: 1519-1538, 2001.

1030

POSTER

## CT scans versus 111 In-pentetreotide SPECT imaging in tumour response assessment

G. Gnanasegaran<sup>1</sup>, G. Gopinath<sup>1</sup>, J.R. Buscombe<sup>1</sup>, M.E. Caplin<sup>2</sup>, A.J.W. Hilson<sup>1</sup>. <sup>1</sup> Royal Free Hospital, Nuclear Medicine, London, United Kingdom; <sup>2</sup> Royal Free Hospital, Neuroendocrine Tumour Clinic, London, United Kingdom

**Objectives:** Therapeutic strategy of neuroendocrine tumours is complex, due to their heterogeneity. There are various treatment options available for the management of the carcinoid tumours. Quantification of tumour volume is essential for assessment of therapy-induced changes. Traditional methods of assessing response of neuroendocrine tumours using radiology have been poor at predicting response. The aim of this study was to establish if it was possible to identify a method using Nuclear Medicine SPECT functional volumes to predict the response of tumour to various therapies.

**Methods:** 34 patients (18 males and 16 females) with tumours in the liver were treated with chemo-embolization, chemotherapy and <sup>90</sup>Yttrium labelled Somatostatin analogues. All the patients had <sup>111</sup>In- pentetreotide SPECT imaging (Nuclear Medicine scan to image Somatostatin receptor positive neuroendocrine tumours) and CT scan pre and post treatment. Tumour uptake volume, a measure of metabolically active tumour tissue, was calculated from the SPECT images (transverse slices) using 10 point colour display and drawing a region of interest around 50% of maximum tumour activity slice by slice and then multiplying by the slice thickness (9.3mm). Normal structures were avoided. Any difference in function volume was compared with CT response and clinical outcome. Clinical improvement was based on reduction in diarrhoea, reduced flushing, reduced painkillers, increased ability to work and perform other activities of daily living.

**Results:** At 6 months post treatment 19 patients had good clinical response and the volume of the tumour in these patients dropped by a mean of 27%(range-15-80%). Of those who worsened clinically (10 patients), the functional volumes increased by a mean of 77%(range-20-254%). 5 patients had stable disease. Using a >10% change as significant, SPECT predicted 79.4% of clinical outcome correctly but CT only predicted 47% correctly.

**Conclusions:** The assessment of functional volume by SPECT quantification is more useful in monitoring the tumour response after treatment than CT. The changes in functional volumes after therapy correlate well with clinical response.

1031

POSTER

## 99mTc-MIBI myocardial perfusion scintigraphy for assessment of radiation induced cardiac damage - preliminary results

A. Tzonevska<sup>1</sup>, V. Parvanova<sup>2</sup>, E. Piperkova<sup>3</sup>, D. Dimitrova<sup>4</sup>. <sup>1</sup> National Oncology Hospital, Department of Nuclear Medicine, Sofia, Bulgaria; <sup>2</sup> National Oncology Hospital, Department of Radiotherapy, Sofia, Bulgaria; <sup>3</sup> National Oncology Hospital, Department of Nuclear Medicine, Sofia, Bulgaria; <sup>4</sup> National Oncology Hospital, Department of Nuclear Medicine, Sofia, Bulgaria

In radiation therapy to the thorax, cardiac injuries may be induced involving the myocardial capillaries and causing myocardial fibrosis. The injuries have a less dramatic clinical expression with slow functional impairment. Early detection of subclinical myocardial damage is of important use for these patients in order to compare their magnitude in relation to the different treatment schedule. The aim of the study is to assess the role of 99mTc-MIBI myocardial perfusion scintigraphy (MPS) for mapping the radiation-induced cardiac injuries. The study involves 15 patients with early left-sided breast cancer after breast-conserving surgery received postoperative radiotherapy with dose level 50 Gy in 25 fractions to the residual breast including underlying chest wall without boost and no anthracycline chemotherapy. In these cases the anterior wall of the myocardium often is included in target field. All of the patients are asymptomatic. Ejection Fraction (EF) of the left ventricle measured echocardiographically and 99mTc-MIBI SPECT MPS were performed 6-9 months after treatment. 99mTc-MIBI SPECT was performed at rest using Diacam (Siemens) gamma-camera. Tracer activity

of 555 MBq was injected in each occasion. SPECT imaging was performed 60 min. after injection and the images were analyzed dividing the left ventricle into 17 segments on the three short axes slices and one vertical long axis slices and each segment was graded according to perfusion using a semiquantitative four-point system. All of the patients had normal EF. MPS was normal in 11 patients. In 4 of the patients MPS established moderately reduced perfusion: two of the patients had hypoperfusion of the anterior wall segments, two patients had hypoperfused septum and apex. These patients had EF at lower limit (56%-59%). Despite modern treatment planning techniques, cardiac effect after irradiation occur and their early detection may minimize the severe cardiac damage. MPS may be feasible method to that purpose.

1032

POSTER

## Impact of positron emission tomography in radiation therapy treatment planning

J. Schultze<sup>1</sup>, J. Hayen<sup>1</sup>, N. Czech<sup>2</sup>, B. Kimmig<sup>1</sup>. <sup>1</sup> University of Kiel, Radiotherapy, Kiel, Germany; <sup>2</sup> University of Kiel, Nuclear Medicine, Kiel, Germany

**Background:** Positron emission tomography (PET) as a functional imaging method has gained increasing influence in oncological imaging. This additional information derived from PET has to be included into radiation therapy decisions. The role of PET for radiation therapy treatment planning therefore had to be evaluated.

**Patients/Methods:** In 60 patients referred for radiation therapy an additional PET examination was performed. There were 23 female and 37 male patients, mean age was 51 years ranging from 34 to 90 years of age. Main cancer diagnoses in these patients were cancers of unknown primary (CUP) in the head and neck region (20), ENT tumors (11), breast cancer (9), CUP outside the head and neck region (6), lung cancer (4) and miscellaneous other tumors (10). PET was performed as a whole body scan with 300 MBq 18F-FDG. Retrospectively the impact of PET was assessed with regard to alterations of the radiotherapeutic target volume, the basic oncological treatment strategy and with regard to affirmation of a previously doubtful situation.

**Results:** In 18 of 60 patients (30%) there had been an alteration of the treatment regimen due to the information gained from the PET examination. In 13 of these patients the target volume had to be modified, in 5 patients the entire treatment strategy had to be revised. In further 6 cases (10%) the treatment regimen could be affirmed following the PET findings. In 36 cases (60%) PET did not affect the cancer therapy of our patients.

**Conclusions:** PET has proved to be a useful tool in cancer therapy management. It is cost effective especially in cases of unknown primaries. PET should be performed for radiotherapeutic target volume definition in cases of ENT-tumors and metastatic breast cancer.

1033

POSTER

## Magnetic resonance neuroimaging in breast cancer carcinomatous meningitis

A. Niwinska<sup>1</sup>, H. Rudnicka<sup>1</sup>, D. Wiszniewska-Rawlik<sup>2</sup>, A. Jagiello-Grusfeld<sup>3</sup>, J. Giermek<sup>1</sup>, T. Pienkowski<sup>1</sup>. <sup>1</sup> Maria Skłodowska-Curie Memorial Cancer Centre and Breast Cancer and Reconstructive Surgery Department, Warszawa, Poland; <sup>2</sup> Maria Skłodowska-Curie Memorial Cancer Centre and Institute, Radiology Department, Warszawa, Poland; <sup>3</sup> Regional Cancer Centre - Olsztyn, Chemotherapy Department, Olsztyn, Poland

**Aim:** The aim of the study is the type and frequency of abnormalities on Magnetic Resonance (MRI) in breast cancer patients (pts) with carcinomatous meningitis (CM).

**Material and Methods:** The MRI was abnormal in 32 pts (80%). In those pts sulcal/dural enhancement of craniocervical leptomeninges was observed. The localization of leptomeningeal enhancement was as follow: whole brain and spinal cord in 4 pts, spinal cord in 4 pts, infratentorial in 11 pts, infratentorial and fronto-temporal lobe in 4 pts, infratentorial and spinal cord in 3 pts, supratentorial in 4 pts and frontal lobe in 2 pts. secondary hydrocephalus was detected in 14 pts. In 8 pts (20%) with CM MRI did not revealed any abnormalities typical to CM. Beside of leptomeningeal morbidity, brain metastases were detected in 15 pts.

**Conclusions:** MRI is important and very sensitive method to establish the diagnosis of CM in breast cancer patients and should be performed in all patients who have cancer cells in CSF detected.