1003 POSTER

The use of molecular imaging to help predict response and disease-free survival following pre-operative chemoradiation in patients with adenocarcinoma of the rectum

A. Konski[1], M. Slifker[1], E. Sigurdson[2], A.T. Shivnani[3], J.Q. Yu[4], W. Small Jr.[3], G. Freedman[1], N. Joseph[2], A. Wahl[3], N. Meropol[5]. *[1]Fox Chase Cancer Center, Radiation Oncology, Philadelphia PA, USA; [2]Fox Chase Cancer Center, Surgery, Philadelphia PA, USA; [3]Northwestern University, Radiation Oncology, Chicago IL, USA; [4]Fox Chase Cancer Center, Nuclear Medicine, Philadelphia PA, USA; [5]Fox Chase Cancer Center, Medical Oncology, Philadelphia PA, USA*

Purpose: Correlation of changes in ^{18}FDG-PET uptake with response and disease-free survival after combined modality neoadjuvant therapy in patients with locally advanced rectal cancer.
Methods: Charts were reviewed for consecutive patients with uT3−4Nx or uTxN1 rectal adenocarcinoma planned for pre-operative chemoradiation at Fox Chase Cancer Center (FCCC) and Northwestern Memorial Hospital (NMH) underwent ^{18}FDG-PET scanning before and after combined-modality neoadjuvant 5-FU based chemoradiation. The maximum Standardized Uptake Value (SUV) was measured from the tumor before and 3−4 weeks after completion of chemoradiation prior to surgery. Two-sided Wilcoxon test was used to test for differences in median pre-treatment SUV, post-treatment SUV and % SUV decrease between patients with uT3 and uT4 tumors. Spearman's rank correlation was used to assess associations between post-treatment SUV or %SUV decrease with RT dose and days from RT to PET. This method was also used to examine associations of pCR with post-treatment SUV, %SUV decrease and days from RT to surgery. Logistic regression was used to model the probability of pCR adjusting for clinical factors such as dose, days from RT to surgery, pre and post SUV, and the % change of SUV. Proportional hazard Cox models were used to analyze overall and disease-free survivals.
Results: Sixty-patients, (FCCC n = 48, NMH n = 12), underwent pre and post chemoradiation PET scans between September 2000 and January 2007. Staging by endoscopic ultrasound (EUS) included T2/T3/T4 (1/53/4) with 2 patients unable to undergo EUS because of near-obstructing tumor. The median radiation dose was 5040 cGy (range: 4500–5500). The mean pre-treatment SUV, post-treatment SUV, and %SUV decrease were 9.8 (3.1−37), 3.7 (.5−12.7) and 62% (0−95.5%) respectively. The pCR rate was 29%. Univariate analysis found days from RT to surgery ($p = 0.005$), post-treatment SUV ($p = 0.02$) and % SUV ($p = 0.06$) were associated with pCR. The MVA with stepwise selection showed a trend between post-treatment SUV and pCR ($p = 0.07$) None of the investigated variables were predictive of disease-free survival.
Conclusions: In this retrospective study, post-treatment SUV showed a trend for predicting pCR in patients with rectal cancer treated with pre-operative chemoradiation. Further prospective study with a larger sample size is warranted to better characterize the role of 18 FDG-PET for response prediction in patients with rectal cancer.

1004 POSTER

In vivo imaging of apoptosis by Annexin V scintigraphy: predictive value for treatment outcome

M. Verheij[1], M. Kartachova[2], R.L.M. Haas[3], N. Van Zandwijk[4], S. Burgers[4], H. Van Tinteren[5], F.J.P. Hoebers[3], R.A. Valdes Olmos[2]. *[1]The Netherlands Cancer Institute, Radiation Oncology – Division of Cellular Biochemistry, Amsterdam, The Netherlands; [2]The Netherlands Cancer Institute, Department of Nuclear Medicine, Amsterdam, The Netherlands; [3]The Netherlands Cancer Institute, Department of Radiation Oncology, Amsterdam, The Netherlands; [4]The Netherlands Cancer Institute, Department of Pulmonology, Amsterdam, The Netherlands; [5]The Netherlands Cancer Institute, Department of Biometrics, Amsterdam, The Netherlands*

Background and Purpose: Apoptosis has been recognized as an attractive target for anti-cancer therapy. Indeed, many therapeutic strategies have been designed to enhance apoptosis and increase the tumor response to radiation and/or chemotherapy. 99mTc-Annexin V scintigtaphy (TAVS) is a non-invasive imaging technique that allows the in vivo visualization and quantification of apoptosis. Purpose of this study was to correlate early treatment-induced apoptosis as measured by TAVS, with outcome after radiotherapy, chemotherapy or the combination.
Material and Methods: Sixty-one patients (NHL n = 27; HNSCC n = 16; NSCLC n = 16; SCLC n = 1; sarcoma n = 1) underwent a TAVS before and within 24−48 hr after the start of treatment. Therapy consisted of low dose (2×2 Gy) radiotherapy (n = 27), cisplatin-based concurrent chemoradiotherapy (n = 16) or cisplatin-based chemotherapy (n = 18). The difference between the TAV tumor uptake before and after start of treatment (delta U), calculated as maximum count per pixel and expressed as percentage to baseline value, was correlated to response according to RECIST criteria.
Results: A significant correlation (linear regression analysis; $p < 0.001$) was found between delta U and treatment outcome. All patients with notably increased TAV tumor uptake showed complete or partial response. Less prominently increased or decreased uptake correlated with stable or progressive disease.
Conclusion: A significant correlation was established between tumor TAVS uptake and treatment outcome in a variety of tumor types. The predictive value of this test might help to design novel (apoptosis-modulating) strategies and evaluate treatment effects at an early stage.

1005 POSTER

The sensitivity, specificity and predictive values of PET-CT, MRI and neck US in the detection of residual neck disease after definitive radio-chemotherapy in locally-advanced head and neck cancer: preliminary report of a prospective study

L. Marucci[1], G. Giovinazzo[1], A. Di Marzo[1], V. Manciocco[2], R. Pellini[2], A. Vidiri[3], G. Meduri[4], G. Spriano[2], G. Arcangeli[1]. *[1]Regina Elena National Cancer Institute, Radiation Oncology, Rome, Italy; [2]Regina Elena National Cancer Institute, Otolaryngology Head and Neck Surgery, Rome, Italy; [3]Regina Elena National Cancer Institute, Diagnostic imaging, Rome, Italy; [4]Policlinico Gemelli, Nuclear Medicine, Rome, Italy*

Purpose: The role of neck dissection after radio-chemotherapy for locally advanced head and neck cancer is evolving. Recent data suggest neck dissection may be withheld after a complete response. The purpose of this study was to determine the sensitivity, specificity and predictive values of different imaging techniques (Neck US, MRI, PET-CT) in detecting residual cervical metastasis.
Materials and Methods: 25 patients with clinical neck disease staged cN2b-c or N3 have been enrolled in the study. All the patients were treated with radical radio-chemotherapy, 70 Gy were administered to the primary and neck disease. After 12 weeks all patients were evaluated with PET-CT, MRI and neck US. Planned neck dissections were performed immediately afterwards in 14 patients, the remaining patients are currently waiting for the completion of the imaging evaluation or for pathologic examination and are not included in this preliminary report.
Results: 14 PET-CT, 11 MRI and 11 neck US were performed and the reports were compared with the histological results. PET-CT reports were: 2 true positive, 9 true negative and 3 false negative. Eleven MRI reports were: 2 true positive, 2 false positive, 6 true negative and 1 false negative. Neck US reports were: 4 true positive, 3 false positive, 3 true negative and 1 false negative.

	Sensitivity	Specificity	Positive predictive value	Negative predictive value
PET-CT	40%	100%	100%	75%
MRI	66%	75%	50%	85%
NECK US	80%	50%	57%	75%

Conclusion: The preliminary report of the study indicates that PET-CT, performed after 12 weeks, has the highest specificity and positive predictive value in the detection of residual disease after radio-chemotherapy. MRI has the best negative predictive value. Neck US has the highest sensitivity but a low specificity. A bigger sample of patients is needed to increase the significance of the results.

1006 POSTER

Correlation of CT-guided core needle biopsy demonstrating epidermal growth factor receptor mutations to the responses of gefitinib therapy in patients with lung adenocarcinoma who failed chemotherapy: preliminary report

Y. Cheung[1], J.W.C. Chang[2], G. Lin[3], J.J. Hsieh[2], T. Hsu[4], K.W. Lui[5]. *[1]Chang Gung Memorial Hospital, Medical Imaging and Intervention, Taoyuan, Taiwan; [2]Chang Gung Memorial Hospital, Haematology & Oncology, Taoyuan, Taiwan; [3]Chang Gung Memorial Hospital, Imaging & Intervention, Taoyuan, Taiwan; [4]National Taiwan Ocean University, Institute of Bioscience and Biotechnology, Keelung, Taiwan; [5]Chang Gung Memorial Hospital, Medical Imaging & Intervention, Taoyuan, Taiwan*

Background: Lung cancer is the leading cause of death in many countries. Recent advances in molecular targeted therapy such as epidermal growth factor receptor (EGFR) inhibitor hold certain promise for patients

with mutated lung adenocarcinoma. We evaluate the use of computed tomographic guided (CT-guided) core needle biopsy for assessment of EGFR gene mutation in the patients with advanced lung adenocarcinoma who failed the chemotherapy with the correlation to the responses to gefitinib.
Materials and Methods: Between August 2005 and January 2006, 17 patients with histologically proved advanced lung adenocarcinoma who had failed chemotherapy were enrolled in the study. All fresh specimens obtained from the target cancers by CT-guided core needle biopsy were sent frozen for DNA analysis (EGFR mutation) before the treatment of gefitinib (250 mg/day). The mutant and non-mutant groups were correlated to the responses on the basis of RECIST criteria measured by computed tomography (mean interval days on 61 after gefitinib therapy) and clinical assessment (on 194 days after gefitinib therapy). The early response was recorded to positive when the biopsy target cancers were documented to partial response (>30% of tumour size reduction) under the RECIST criteria and the clinical assessment were either based on clinical presentation, chest film or CT.
Results: Nine male and 8 female patients (mean age = 58 years old; age range = 41 to 78) were enrolled in this study. Twelve patients (70%) exhibited EGFR mutations were classified to mutant and 5 were nonmutant. Fifteen patients (12 mutant and 3 nonmutant patients) finally received gefitinib therapy and 2 nonmutant patients refused gefitinib treatment. The overall early responses rates were counted to 73.3% (11/15), with 91.6% (11/12) for mutant group and 0% for nonmutant group. However, the overall clinical assessment of response resulted 80% (12/15), with 100% for mutant group and 0% for nonmutant group. Both responses were statistically significant with p values less than 0.01.
Conclusion: CT-guided core needle biopsy for EGFR mutation analysis is feasible for planning targeted therapy on lung adenocarcinoma. Presence of EGFR mutation is an independent predictor of gefitinib response.

1007 POSTER

Treatment of malignant vena cava syndrome with large self-expandable nitinol stents

S. Heye, G. Maleux. *U.Z. Gasthuisberg, Radiology, Leuven, Belgium*

Background: More than 85% of cases of superior vena cava syndrome (SVCS) and are due to an underlying malignancy. The exact incidence of malignant inferior vena cava syndrome (IVCS) is not known, but both and IVCS and SVCS represent a severe complication of some malignancies. Radiation therapy and chemotherapy are effective but may require 2−4 weeks for relief of symptoms. Endovascular stenting may cause rapid symptom relief and does not interfere with the subsequent application of radiotherapy, chemotherapy or both. In literature most of the stenting procedures are done with either balloon-expanding or self-expanding stainless steel stents or self-expanding stents made of cobalt-chromium alloy, but little data exists on the use of nitinol stents. The goal of our study was to retrospectively evaluate safety, feasibility and outcome of large self-expandable nitinol stents to treat malignant venous stenosis.
Material and Methods: From May 2005 to November 2006, 27 patients (20 men, 7 women) with malignant disease and superior/inferior vena cava syndrome underwent endovascular treatment using Zilverstents (William Cook, Bloomington, IN, USA).
Results: Technical and radiological success was 100%. All patients who underwent SVC stenting (20/20) had immediate relief of symptoms. Five of the 7 patients (71%) with stenting of inferior vena cava/iliac vein stenosis had relief of symptoms within 1 week.
Fifteen patients (56%) died during follow-up (mean: 4.5 months, range: 2 days – 14 months) due to progressive malignant disease.
Early stent thrombosis (within 24h) occurred in 2 patients (7%). One patient died two days later, the other underwent successful fibrinolysis and additional stenting.
Instent stenosis with/without recoil occurred in 6 patients (22%). Therapy consisted of PTA alone in one, additional Zilverstent placement in two and placing a balloon-expandable stent (Express Vascular, Boston Scientific, Nanterre Cedex, France) in the Zilverstent in three patients.
Conclusion: The use of large self-expandable nitinol stents for treatment of malignant venous stenosis is safe and efficacious. Recurrent symptomatic stenosis/occlusion can be treated by additional stenting, preceded by fibrinolysis if necessary.

1008 POSTER

Dynamic contrast-enhanced ultrasonography (DCE-US) with quantification for the early evaluation of metastatic renal cancer treated with tyrosine kinase inhibitors

L. Bouaita[1], N. Lassau[2], S. Koscielny[3], L. Chami[2], A. Plantade[1], C. Massard[1], B. Benatsou[2], J. Pellier[2], A. Roche[2], B. Escudier[1]. *[1]Institut Gustave Roussy, Departement de Médecine, Villejuif, France; [2]Institut Gustave Roussy, Departement d'Imagerie, Villejuif, France; [3]Institut Gustave Roussy, Departement de Biostatistique, Villejuif, France*

Background: To determine the best quantitative parameters of dynamic contrast-enhanced ultrasonography (DCE-US) for predicting the early functional response to tyrosine kinase inhibitors (TKI) in patients with metastatic renal cancer.
Materials and Methods: Twenty-five patients with metastatic renal cancer, treated with (TKI) (sorafenib and sunitinib) were prospectively followed up by DCE-US, with primary objective to predict response to therapy.
DCE-US examinations were performed using contrast agent (Sonovue, Bracco) and perfusion (VRI: Vascular Recognition Imaging) and quantification softwares (CHI-Q: Contrast Harmonic Imaging Quantification, Toshiba) using raw linear data recorded over 3 minutes.
A qualitative analysis was performed based on the percentage of contrast uptake on the recorded video. Seven quantitative parameters characterizing tumor vascularization were calculated after modelizing contrast uptake curves. DCE-US was performed before treatment, after 2 weeks, 2 months and every 2 months. Changes in tumor vascularisation will be compared to best response obtained on CT scan performed every 2 cycles.
Results: To date, 17 patients have been followed up at baseline and after 14 days of treatment, and 11 by DCE-US and CT scan at 2 months. Seven patients had clinical benefits (stable disease and partial response) and 4 patients were non responders at 2 months. Preliminary data showed a dramatic decrease in qualitative and quantitative parameters in patients treated with TKI.The median variation in the decrease in contrast uptake at 14 days was 60%. The median decrease in blood volume represented by the peak intensity (PI) and the area under the curve (AUC) was more than 80%. The median decrease in blood flow represented by the sloap of the wash-in was more than 80%. The wash-out AUC decreased by 86%. However, due to the low number of patient with available data, the power of the study was extremely low and correlations between the wash-in AUC, the mean transit time (MTT), the time to peak intensity and response to treatment were not significant. Updated results involving all the patients will be presented during the meeting.
Conclusion: DCE-US with quantification based on raw linear data points out different parameters characterizing tumor vascularization modified during TKI treatment. Correlation with clinical results will be presented.

1009 POSTER

Additional FDG PET-CT in week 5−6 of radiotherapy for patients withNSCLC as a means of dose escalation planning

C. Gillham[1], D. Zips[2], F. Pönisch[1], C. Evers[2], N. Albomaali[1], K. Zöphel[3], J. Steinbach[4], J. Kotzerke[5], T. Herrmann[1], M. Baumann[6]. *[1]OncoRay: Centre for Radiation Research in Oncology, Medical Faculty Carl Gustav Carus University of Technology, Dresden, Germany; [2]OncoRay: Centre for Radiation Research in Oncology, Radiation Oncology Medical Faculty Carl Gustav Carus University of Technology, Dresden, Germany; [3]OncoRay: Centre for Radiation Research in Oncology, Nuclear Medicine Medical Faculty Carl Gustav Carus University of Technology, Dresden, Germany; [4]OncoRay: Radiopharmacy Research Centre, PET Centre, Dresden-Russendorf, Germany; [5]OncoRay: Radiopharmacy Research Centre, Nuclear Medicine: Carl Gustav Carus University of Technology Dresdenh & PET Centre: Rossendorf, Dresden and Russendorf, Germany; [6]OncoRay: Centre for Radiation Research in Oncology, Experimental Centre and Radiation Oncology Medical Faculty Carl Gustav Carus University of Technology, Dresden, Germany*

Aims: To detect a reduction in disease volume during radical radiotherapy for non-small cell lung cancer (NSCLC) using PET-CT and to determine whether this would facilitate dose escalation.
Methods: Ten patients with localised inoperable NSCLC were prospectively enrolled. Each received conformally planned radiotherapy to a dose of 66 Gy/33# over 6.5 weeks using 6−15 MV photons and prescribed to the 100% isodose. PET-CT imaging was performed just prior to and following 50 or 60 Gy. Target volume definition was performed by one senior radiation oncologist with the help of a senior radiologist and nuclear medicine physician. For all patients and at both time points CT and PET-delineated gross tumour volumes were generated (GTVCT, GTVPET). A composite GTV was then created (GTVCT+PET) and 15 mm added in all planes to form