the planning target volume (PTV). No correction for organ movement was incorporated and no elective nodal irradiation performed. Each of the different volumes were compared before and after 50−60 Gray. Two plans were then created and compared: 78 Gy delivered to the initial PTV and 66 Gy to the initial PTV with a 12 Gy boost to the post 50/60 Gy PTV.
Results: All patients (mean age 64 years) had stage III disease (4 IIIA and 6 IIIB). There were 4 squamous cell and 6 adeno-carcinomas. After 50/60 Gray the GTVCT, GTVPET, GTVCT+PET and PTV reduced by a mean of 22%, 43%, 30% and 22% respectively. The delivery of 78 Gray to the initial PTV could have been safely achieved in 4/10 patients. Of these delivering treatment in two phases would have substantially spared normal tissue in 2 patients. In the remaining 6 patients, delivering 78 Gray to the initial PTV would have exceeded normal tissue constraints and no benefit was seen when planned in 2 phases.
Conclusions: The PTV, consequent on changes seen on PET-CT, reduces during a course of radical radiotherapy for NSCLC. Such a reduction permits dose escalation in a subset of patients and may lead to improved therapeutic outcomes.
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1010 POSTER

Positron emission tomography and computed tomography in detection of pelvic recurrence in patients with rectal cancer

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Objective: The aim of this study was to assess diagnostic accuracy of combined positron emission tomography (PET) and computed tomography (CT) in detection of pelvic recurrence in patients with rectal cancer who underwent abdominoperineal or anterior resection.
Methods: Fifty-four patients were included (31 males and 23 females). Fourteen patients underwent abdominoperineal resection and 40 underwent anterior resection with an anastomosis in the pelvic region before referral for PET/CT. Pelvic sites of fluorine-18 fluorodeoxyglucose (FDG) uptake were rated separately on PET and PET/CT images as benign or malignant on the basis of shape, location, and intensity of fluorine-18 FDG uptake (1−2 = benign and/or physiologic, 3 = equivocal, 4−5 = malignant). Altered pelvic anatomy and presence of presacral abnormalities were examined with CT. Pelvic recurrence was confirmed with histologic analysis or clinical and imaging follow-up. Sensitivity, specificity, positive and negative predictive values, and accuracy of PET and PET/CT in the detection of pelvic recurrence were compared with lesion- and patient-based analyses by using the chi(2) test. Clinical relevance of PET/CT assessment was determined.
Results: Of 76 pelvic sites with increased fluorine-18 FDG uptake, 39 were determined as malignant. Sensitivity, specificity, positive predictive value, negative predictive value, and accuracy for differentiating malignant from benign fluorine-18 FDG uptake in the pelvis were 97%, 95%, 91%, 96%, and 94% for PET/CT and 81%, 64%, 75%, 73%, and 72% for PET, respectively. The physiologic fluorine-18 FDG uptake in displaced pelvic organs was the most common cause for false-positive interpretation of PET findings. Presacral CT abnormalities were present in 25 (46.3%) of 54 patients, and 5 (20%) abnormalities were malignant. PET/CT was used to distinguish benign and malignant presacral abnormalities with a sensitivity, specificity, positive predictive value, and negative predictive value of 100%, 97%, 86%, and 100%, respectively. PET/CT findings were clinically relevant in 24 (45%) of all patients.
Conclusion: PET/CT is an accurate method in the detection of pelvic recurrence in patients with rectal cancer after surgical removal of rectal cancer.

1011 POSTER

The effects of tumour volume coverage on the assessment of vascular activity following radiotherapy in human non-small cell lung cancer using dynamic contrast enhanced computed tomography

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Background: Volumetric dynamic contrast enhanced computed tomography (CT) can be used to quantify whole tumour vascular function and has been shown to improve measurement reproducibility compared to conventional single level techniques. We aim to determine if whole tumour assessment provides a more representative evaluation of the tumour vascular changes following radiotherapy in lung cancer.
Methods: Following ethical approval and informed consent, 16 patients (9 males, 7 females) with non-small cell lung cancer (mean tumour size 7.6 cm; range 4.9 to 11.8 cm) receiving palliative radiotherapy underwent volumetric dynamic CT examinations. Using 16-detector CT, multiple sequential volumetric acquisitions encompassing the entire tumour were acquired after IV contrast infusion. Median values of tumour blood volume (BV; mL/100 mL) were measured for the whole tumour, and multiple contiguous 10 mm tumour slices, Scans were performed twice at baseline, and once after two fractions (9 Gy total dose) of radiotherapy. Mean vascular changes after radiotherapy were compared using Bland-Altman 95% limits of agreement, derived from the two baseline scans, and paired t-testing.
Results: At baseline, mean BV was 6.2 ml/100 mL and 5.8 ml/100 mL with whole tumour and 10 mm level measurements respectively. With whole tumour measurement, mean BV increased by 21.5% (paired t-test, $p = 0.025$) after two fractions of radiotherapy, which was greater than the 95% limits of change. With 10 mm tumour measurement, BV change was spatially variable: 8 of the 16 patients had significant changes in BV (paired t-test, $p < 0.05$) after radiotherapy, of which, only 4 patients had changes greater than the 95% limits of change. The remaining 8 patients demonstrated variable BV changes depending on the tumour slice position where the measurements were taken from, these changes were within the 95% limits of change and were not significant on paired t-testing ($p > 0.05$).
Conclusion: Tumour vascular changes after radiotherapy are spatially heterogeneous. Conventional single level imaging techniques might not provide an accurate depiction of these changes. When assessing tumour vascular changes following therapy, whole tumour volumes should be evaluated if possible.

1012 POSTER

Imapct of FDG-PET/CT imaging in staging and treatment planning for radiotherapy pf head and neck carcinoma

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Background: The use of ^{18}F-fluorodeoxyglucose positron emission tomography (FDG-PET) has recently gained interest in radiation oncology in relation to a potential improvement of tumour staging, and a better delineation of the target volume.
The present study aims to analyze the impact of FDG-PET fused with computed tomography (CT) images for the staging and the treatment planning of patients with head and neck carcinoma candidates for primary radiotherapy (RT).
Materials and Methods: From November 2004 to June 2006, 22 patients affected by head and neck carcinoma were enrolled into an institutional FDG-PET/CT imaging protocol: 6 oropharyngeal, 6 hypopharyngeal, 4 nasopharyngeal, 2 oral cavity, 2 laryngeal, 2 paranasal sinus tumors. Patients candidates for combined radio-chemotherapy or RT alone underwent PET/CT and CT simulation for staging and treatment planning purposes.
The “Gross Tumor Volume” (GTV) was contoured first on CT simulation images (CT-GTV), and then on PET images (PET-GTV). Other additional volumes were considered: the composite volume “CT-GTVand PET-GTV”, the volume identified by PET but not by CT (PEToutCT), the volume identified by CT but not by PET (CToutPET), and the average mismatched volume between the two image modalities (CT & PET).
Results: Based on PET/CT, changes in TNM categories and clinical stage occurred in 8/22 patients (36%) and 6/22 patients (27%), respectively. The difference between the mean CT-GTV (20.0 cc, standard deviation 17.8 cc) and PET-GTV (17.2 cc, standard deviation 16.8 cc) was not statistically significant at Wilcoxon test ($p = 0.2$). The mean value of PEToutCT volume was 27% of the CT-GTV. The PEToutCT volume resulted $\geqslant$10% larger than the CT-GTV in 13/22 patients (59%). Based on PET/CT information, the CTV was modified in 4/22 patients (18%).
Conclusions: PET/CT fusion images had a relevant impact on tumor staging leading to a change of TNM categories in 36% and clinical stage in 27% of cases. The GTV identified by PET/CT accounted for 27% of CT-GTV.

1013 POSTER

Periodic stimulation tests in different groups of thyroid cancer patients

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Purpose: Recombinant human thyrotropin-TSH (rhTSH) is used to increase radioiodine uptake during imaging of thyroid cancer. Recurrences are frequent in thyroid cancer patients and long-term follow-up is therefore necessary. In this study we evaluated the yield of rhTSH stimulation in three

groups of patients, classified according to the UICC/TNM risk stratification and the results of first follow-up testing.
Methods: The study population comprised 111 patients referred for rhTSH testing. All had undergone first follow-up testing after thyroid hormone withdrawal [off-T(4)] within 1 year of ^{131}I ablation. Negative first follow-up testing was defined as Tg < 2 ng/ml and no neck uptake on ^{131}I diagnostic whole-body scan. Sixty-eight patients had stage I thyroid cancer and negative first follow-up testing (group I), 17 had stage I disease and positive first follow-up testing (group II), and 26 had stage II-IV disease (group III). RhTSH stimulation was performed an average of 4 years after first follow-up testing.
Results: diagnostic scanning with ^{131}I after rhTSH was negative in all patients of group I. In group II stimulation with rhTSH showed residual Tg in six patients and residual ^{131}I uptake in the thyroid bed in two patients, but anybody from these patients had signs of disease progression. Four patients from group III (15.4%) had a positive rhTSH test result, and this was suggestive of disease progression in at least two cases.
Conclusion: The first follow-up testing is essential for prognostic classification after ^{131}I ablation of thyroid cancer. In stage I patients, undetectable Tg and negative ^{131}I scan 1 year after ablation define a large population of subjects who have a very low risk of recurrence and who do not require further rhTSH stimulation tests. Periodic rhTSH stimulation tests appear useful in higher-risk thyroid cancer patients.

1014 POSTER

Pre-operative staging with Positron Emission Tomography (PET) in patients with pelvic recurrence of rectal cancer

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Background: The treatment of pelvic recurrences of rectal cancer is primarily surgical. The substantial morbidity and mortality of such resections warrant stringent patient selection. Recent literature reports PET to be of additional value to CT for the detection of metastases in colorectal cancer patients.
Methods: In a series of 37 pelvic recurrences PET findings were evaluated retrospectively. Comparison was made to CT and MRI findings. It was analyzed whether PET had been decisive in clinical decision-making or could have been so.
Results: Thirty-two patients had 37 rectal cancer recurrences. PET findings differed from CT and MRI in 13 cases (35%): seven PET scans showed lesions that were not seen with CT or MRI. PET scans were negative in six lesions detected by CT or MRI. PET findings led to changes in management in seven recurrences (19%). Four futile operations were (or could have been) averted based on information from PET scans (11%). Three PET scans were false positive.
Conclusions: In a selected population with pelvic rectal cancer recurrences, PET had additional value to conventional imaging, mainly in detecting lymph node metastases. PET thus had significant impact on selection of patients fit for curative surgery.

1015 POSTER

Analyzing the effects the quality of the images contained in a CT data set has on the accuracy of an automated fusion computer programme for the purposes of Image-Guided Radiation Therapy (IGRT)

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Background: Does the quality of images taken from different technologically advanced CT scanners decreases a computer's ability to accurately determine daily organ movement using an automated fusion process during IGRT.
Materials and Methods: 70 CT data sets were taken from 10 prostate cancer patients during the course of IMRT treatment with IGRT. The two CT scanner models used were an old 1997 scanner and a new 2006 scanner. The IGRT process uses computer software that possesses an automated and manual fusion tool, which aligns a planning CT set with daily treatment CT sets. The initial planning CT is obtained for the purposes of creating the physics treatment plan. The daily treatment CT scans are for obtaining precise prostate locations just prior to the radiation treatments so that interfractional organ movements can be measured and corrected. After the computer performs an initial automatic fusion of the two data sets, the final precise organ shifts are found using a manual registration tool. Two methods were created to test the accuracy of the computer's automated fusion. The first method uses an initial planning CT from the old scanner and fuses it with 5 different daily treatment CT sets from the newer model for each patient. The automated fusion results were then compared to the final organ shifts obtained from the manual registration. The second method's process was repeated for the same patients, except the initial planning CT used was also taken from the newer scanner.
Results: On average, the first method differed from the final precise calculated organ shifts by 1.32 mm in the right/left direction, 4.47 mm in the superior/inferior direction, and 8.47 mm in the anterior/posterior direction. The average difference that the second method differed from the final calculated organ shifts was 0.40 mm in the right/left direction, 1.51 mm in the superior/inferior direction, and 2.67 mm in the anterior/posterior direction.
Conclusion: The second method's results were significantly closer to the true organ shifts in the anterior/posterior directions by an average of 5.80 mm. Therefore, the automated process was more accurate in determining organ movement when it used CT data sets exclusively from the newer CT scanner with higher quality images. These results are important because anterior/posterior movement is the most crucial aspect for prostate treatment, since the rectum is very radiosensitive and planning margins on the rectal side of the prostate are minimal.

1016 POSTER

Maximum standardized uptake value of FDG-PET in the primary tumor as a predictor of pericolic/-rectal infiltration in colorectal cancer

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Background: Pericolic/-rectal infiltration of the primary tumor is a important factor in the planning of therapeutic strategies in patients with colorectal carcinoma (CRC). But it is not easy to detect pericolic/-rectal infiltration by preoperative imaging studies because of small size of lesions.
Purpose: The aim of this study was to determine whether ^{18}F-FDG uptake of the primary tumor is a predictor of pericolic/-rectal infiltration in patients with CRC.
Methods: 137 patients with initial diagnosis of CRC were included this study. All patients underwent preoperative ^{18}F-FDG PET or PET/CT. The pericolic/-rectal infiltration confirmed by postoperative pathology data. Maximum standardized uptake value(maxSUV) was used to interpret ^{18}F-FDG uptake within the primary lesions and best cut-off of maxSUV was determined using ROC analysis. Multivariate analysis was performed with logistic multivariate regression to assess the joint effects and interactions of the variables [age (>60 vs <60), gender (M vs F), histologic grade (well/moderately vs poorly/undifferentiated), histology (adenocarcinoma vs non adenocarcinoma), and max SUV] on pericolic/-rectal infiltration.
Results: Pericolic/-rectal infiltration were found in 57% of patients The best cut-off value for pericolic/-rectal infiltration was maxSUV > 5.5 (AUC 81%). Multivariate analysis showed that maxSUV and histologic grade were independent predictosr for pericolic/-rectal infiltration (P < .001).
Conclusion: Patients with high maxSUV (>5.5) and high histologic grade in the primary lesion had significantly high risk of pericolic/-rectal infiltration. In patients with CRC, ^{18}F-FDG uptake by the primary tumor is a strong predictor of pericolic/-rectal infiltration.

1017 POSTER

4D-CT, 4D-MRI and Linac-integrated 4D Cone Beam CT of the Lung: reproducibility of tumour size and displacement in a respirated ex-vivo system

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Background: 4D imaging is a key to motion-adapted radiotherapy of lung tumors. A hypothetical workflow would use 4D-CT or 4D-MRI for radiotherapy planning and verification with 4D-imaging integrated into the linear accelerator. We evaluated in a respirated ex-vivo system, how size and displacement of artificial pulmonary nodules are reproduced with 4D-CT, 4D-MRI and linac-integrated cone beam CT (CBCT).
Materials and Methods: 4 porcine lung explants inside a chest phantom were prepared with 20 agarose nodules (mean diameters 1.3 to 1.9 cm, range 0.8−3.3 cm), respirated at 8/min. and subject to 4D-CT (collimation