systems is dependent on the reproducibility of target positioning related to organ motion. However, normal respiratory motion of internal organs is not yet clearly understood. This is likely related to the lack of dynamic 3D imaging tools. We used a commercial respiratory gating system and fluoroscopy to evaluate the motion of normal structures during respiration.

Materials and Methods: A wall mounted video camera tracks the motion of reflective markers placed on the patient's chest. Imaging or treatment can be triggered based upon the motion signal using the marker position. Audio or video coaching can be used to train patients. Fluoroscopic 'movies' can be recorded simultaneously. These movies can be analyzed on a frame-by-frame basis using our in-house edge detection and pattern recognition software.

Simultaneous chest wall monitoring and fluoroscopy was performed on 6 patients. Each patient participated in 5 daily sessions over 2 to 3 weeks. In each session, five 30-second fluoroscopic movies were recorded with and without coaching. The diaphragm was divided into 3 'sectors' and the chest wall into 2 halves for motion analysis.

Results: Over one hundred fluoroscopy sessions were analyzed. The amplitude and phase of motion of the different sections of the diaphragm were almost identical. The motion of the central 'sector' of the diaphragm was slightly less predictable in successive sessions. The two halves of the chest wall moved in phase with each other and the diaphragm. A large amplitude of motion of the chest wall was not seen (2 to 3 mm mediolateral). This may be related to 'noise' in the video images caused by the motion of the ribs. Re-positioning of the diaphragm using gating based upon the external marker was more accurate with audio and video coaching.

Conclusions and Future Direction: The diaphragm and chest wall moved in phase with each other. Coaching improved the accuracy of reproducing organ motion. Improvements in imaging techniques and image analysis are needed to better understand organ motion. These early results increase our understanding of respiratory organ motion and point towards the accuracy of gated radiotherapy.

765 POSTER

Validation of a method for automatic image fusion (BrainLAB System) of CT-data and C11-Methionin-PET data for stereotactic fractionated radiotherapy using a LINAC

A. Grosu[1], W. Weber[2], N. Wiedenmann[1], R. Lachner[3], S. Stark[1], P. Kneschaurek[1], M. Molls[1]. [1] *Technical University of Munich, Radiation Oncology, Munich, Germany;* [2] *Technical University of Munich, Nuclear Medicine, Munich, Germany;* [3] *BrainLab, Munich, Germany*

Purpose: a) To establish a method for automatic image fusion of CT/MRI and C11-methionin-positron emission-tomography (MET-PET) for stereotactic treatment planning. b) To discuss the impact of MET-PET for the treatment planning of stereotactic fractionated radiotherapy (SFR) in patients with brain tumors (meningiomas and gliomas).

Materials and Methods: In 10 patients (6 meningeomas and 4 gliomas) CT, MRI and MET-PET were performed for the radiation treatment planning. The CT and MET-PET investigations were performed using the BrainLab head fixation with mask and the localizer. On the localizer were applied 15 external reference markers (5 on each 3 dimensional directions) which could be identified in CT and MET-PET and whose positions were exactly defined for the both investigations. MRI/CT-Fusion was done automatically (BrainLab software). The CT/MET-PET-fusion was performed using two different methods: the gold standard was the CT/PET fusion based on 15 external reference markers, the test method was the automatic, intensity based CT/PET fusion, independent from the external markers. The markers were visible on CT and transmision-PET and were defined manually. The two fusion methods were compared by calculating the mean value of deviation between corresponding points, defined in a VOI. The gross tumor volume (GTV) defined on T1-MRI with gadolinium was compared with the GTV defined using the MET-PET.

Results: The mean deviation of the automatic CT/PET fusion compared with the gold standard CT/PET fusion, based of external markers was 2.40 mm, SD 0.64. In 4 patients with meningiomas and in all 4 patients with gliomas MET-PET delivered additional information concerning tumor extension.

Conclusion: The precision of the automatic image fusion CT/PET was high. A mean deviation of 2.40 mm is acceptable, considering that it is approximately equal to the pixel size of the PET data sets. MET-PET delivers additional information concerning GTV an could be important for the stereotactic fractionated radiotherapy of brain tumors.

766 POSTER

LINAC radiosurgery for brain metastases

D. Lenartz, M. Kocher, J. Voges, R. Lehrke, M. Maarouf, H. Treuer, R.-P. Müller, V. Sturm. *Department of Stereotactic and Functional Neurosurgery, University of Cologne, Cologne, Germany*

The present retrospective study demonstrates the results of stereotactic radio-surgery in patients with a limited number (one to three) of brain metastases without the routine use of adjuvant whole brain irradiation. Results in terms of response rates, intracranial disease control, neurological survival, and overall survival are analyzed in patients with multiple lesions compared to those with single metastases. From 1990 to 1996, 106 patients suffering from single (70 patients) or multiple (two or three) cerebral metastases (36 patients) were treated by stereotactic radiosurgery with a LINAC (8 MeV) equipped with tertiary collimators. Fifty-nine patients were treated for their first occurrence of brain metastases; 47 patients had been treated prior to radiosurgery by resection and/or whole-brain irradiation. Histology of the primary tumor was non-small cell lung cancer (36 patients), melanoma (20 patients), breast cancer (15 patients), hypernephroma (15 patients), and other (20 patients). All together, 157 metastases (0.04–69.0 ml; median, 2.7 ml) were irradiated with marginal doses of 12–25 Gy (median, 20 Gy) referred to the 65%–80% isodose. Seventy-two percent of the lesions were treated with a single isocenter. Adjuvant whole-brain irradiation was applied in six patients. Onehundredthirtyfive of 157 metastases were evaluated for response: complete response (CR), 24%; partial response, 31%;no change, 30%;and progression of disease, 15%. CR rates were highest (48%) in small metastases (<1 cm diameter), independent of histological type and dose. The overall median survival was 8 months. Multivariate Cox regression analysis revealed a significant impact on survival for Karnofsky performance score, presence of extracranial tumor, and volume of largest metastasis. LINAC-based stereotactic radio-surgery in patients with up to 3 cerebral metastases results in survival rates approaching those of patients with resected single brain metastases. As patients with both single and multiple metastases can effectively be salvaged after receiving radiosurgery, extracranial tumor activity becomes a major determinator of survival.

767 POSTER

Intraoperative radiotherapy (IORT) after breast conserving therapy in breast cancer patients

R. Reitsamer[1], F. Peintinger[2], F. Sedlmayer[3], M. Kopp[3], C. Menzel[1], W. Cimpoca[1], S. Glueck[1], M. Brandis[3], G. Kametriser[3]. [1] *General Hospital Salzburg, Department for Breast Diseases, Salzburg, Austria;* [2] *General Hospital Bruck/Mur, Department for Gynecology and Obstetrics, Bruck/Mur, Austria;* [3] *General Hospital Salzburg, Department for Radiooncology, Salzburg, Austria*

Introduction: Local recurrency rate(LR)after breast conserving therapy (BCT)varies between 5% and 8%. One of the reasons for LR could be a "geographic miss" during boost irradiation of the tumor bed. Therefore high quality boost techniques are demanded.

Methods: From 10-98 to 12-00 160 patients with stage I and stage II breast cancer were operated in a dedicated IORT facility. After tumorectomy the tissue surrounding the excision cavity was temporarily approximated by sutures to bring the tissue in the radiation planning target volume. A single fractional dose of 9 Gy was applied to the 90% reference isodose with energies ranging from 4 - 15 MeV, using round tubes 5 to 7 cm in diameter. After wound healing patients received additional 51 to 56 Gy EBRT to the whole breast.

Results: There were no early complications associated with the use of IORT. In five patients a secondary mastectomy had to be performed because of tumor multicentricity in the final pathological report. Two patients developed rib necroses. In five patients wound healing problems occurred. To date there has been no local recurrence, cosmesis of the breast has been excellent.

Conclusion: Preliminary results suggest that IORT after breast conserving therapy could be a reliable alternative to conventional postoperative fractionated boost by accurate dose delivery and avoiding of geographic miss, by enabling of smaller treatment volumes and complete skin sparing and by reducing the postoperative radiation time for 7 to 10 days.