

not evaluable for response. No severe toxicity was reported. Five patients (5%) are alive with no evidence of disease, 52 patients (49%) live with tumor a 32 (30%) died of disease and 17 (16%) were lost to follow-up. There were 9 long term survivors (>2 years) among 21 patients treated before September 2002.

Conclusion: Small portion of the patients can be cured with second course of radiotherapy and in many cases palliation can be obtained. Toxicity of re-irradiation is low when modern techniques allowing for sparing of normal tissues are used.

Poster presentations (Wed, 2 Nov) Stereotactic radiotherapy

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POSTER

Stereotactic body radiotherapy of colo-rectal metastases: results of a Danish phase-II study

C. Grau¹, M. Hoyer¹, H. Roed², A.T. Hansen¹, L. Ohlhuis², J. Petersen¹, H. Nellesmann³, A.K. Berthelsen², S.A. Engelholm², H. von der Maase¹.

¹Aarhus University Hospital, Department of Oncology, Aarhus C, Denmark; ²Copenhagen University Hospital, Department of Radiation Oncology, Copenhagen, Denmark; ³Aarhus University Hospital, Department of Diagnostic Radiology, Aarhus C, Denmark

Background: In retrospective studies, resection of liver metastases results in long term survival in 25–30% of patients with colo-rectal metastases (CRM) in the liver. Unfortunately, most patients with CRM are considered inoperable. Alternative methods for treatment of metastases are therefore warranted. Radio-frequency ablation and stereotactic body radiotherapy (SBRT) may be alternative treatments of inoperable patients. We have tested the effect of SBRT in the treatment of patients with CRM in a phase II trial.

Methods and materials: Sixty-nine patients with each 1–6 CRM in liver, lung or suprarenal gland were included into the trial. The patients were immobilized by the Elekta stereotactic body frame (SBF) or a custom made body frame. SBRT was given on standard LINAC with standard multi-leaf collimator. Central dose was 15 Gy \times 3 within 5–8 days.

Results: Preliminary results of the study showed that 82% of the tumours were controlled by SBRT. Progression free survival after 2 years was 15% and survival was 28%. No difference in survival was observed between patient treated for hepatic- and patients treated for extra-hepatic CRM. In general, toxicity was limited. However, 47% of the patients experienced grade >1 toxicity within 6 months after SBRT. Most frequent side effects were nausea, diarrhoea, pain and skin reaction.

Conclusions: SBRT in patients with CRM resulted in high probability of local control and acceptable survival rate. The toxicity after SBRT of CRM was moderate. The final results with more than 2.5 years follow-up time will be available at the meeting.

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POSTER

Gamma knife stereotactic radiosurgery for nasopharyngeal carcinoma

B.M. Atasoy¹, U. Abacioglu¹, S. Peker², T. Kilic², M. Sengoz¹, N. Pamir².

¹Marmara University School of Medicine, Radiation Oncology, Istanbul, Turkey; ²Marmara University School of Medicine, Neurosurgery, Istanbul, Turkey

Background: To describe the features of selected patients and to review the treatment results of nasopharyngeal carcinoma (NPC) patients receiving stereotactic radiosurgery (SRS) after external beam radiotherapy (EBRT).

Materials and methods: Between November 1998 and January 2005, 10 patients (7 men, 3 women) with initial stages IIB (n=4), III (n=2) and IVA (n=2) were treated in Marmara University Hospital Gamma Knife Treatment Unit. All patients had biopsy-proven NPC and the median age was 56 years (range 37 to 67). Four patients received SRS as a boost following primary EBRT, 1 patient was treated for the persistent disease in nasopharynx and 5 received the treatment for a first (n=4) or a second (n=1) recurrence. The median SRS dose range from 7 to 20 Gy (median, 11 Gy) and the median dose of EBRT was 70 Gy (range 66 to 73).

Results: After a median follow-up of 12 months local control rate was 75% and the survival rate was 33% (median 12 mos). All the patients delivered SRS as a boost displayed local control but 1 patient suffered from a temporal lobe necrosis as a late complication at the 7th month follow-up. Three out of 5 patients having persistent or recurrent diseases revealed local control whilst 1 patient showed local progression and 1 patient received EBRT for a second recurrence after SRS.

Conclusions: More clinical experience and the data are required to allocate SRS in the treatment of primary and recurrent NPC. Hence we aimed to report our preliminary results in this retrospective study.

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POSTER

Stereotactic body radiation therapy for lung metastases: impact on overall survival

M. Fuss¹, B.J. Salter², C.R.J. Thomas¹. ¹University of Texas Health Science Center at San Antonio, Radiation Oncology, San Antonio, TX, USA;

²Cancer Therapy and Research Center, Medical Physics, San Antonio, TX, USA

Background: Hypofractionated or single dose stereotactic body radiation therapy (SBRT) for a limited number of lung metastases from assorted primary tumors has been documented to be feasible and to yield excellent local tumor control. The specific aim of this analysis was to determine if SBRT contributes to prolonged survival in a patient population with systemic disease manifestation.

Methods: Between 8/01 and 11/04, 50 patients were treated by SBRT for lung metastases (1–4 metastases, median 1) with maximum diameter <6 cm. A sequential tomotherapeutic intensity-modulated radiation therapy technique (Peacock IMRT, Nomos) was used to deliver 3 fractions of 12 Gy to a total dose of 36 Gy. Doses were prescribed as the minimum dose to the planning target volume (PTV) which included safety margins of 5 mm axially and 10 mm cranio-caudally to the gross tumor volume (GTV). We analyzed overall survival in this population.

Results: The median GTV and PTV treated was 16 and 43 cm³ (range GTV: 1–135 cm³; PTV: 12–256 cm³). At a respective mean and median follow-up of 8.8 and 7.0 months, 8 patients have expired. Median time to death in those patients was 3.8 months. Cause of death was new metastatic disease to lung, liver and/or brain. At the time of death, 7/8 patients had documented local control of SBRT treated lesions. The clinical follow-up in patients alive ranges from 1.5 to 34 months (mean 9.4, median 7.4 months). Of 34 patients treated before 1/04 (minimum follow-up 12 months), 27 are alive at the time of analysis. Of those, 20 patients are alive with imaging confirmed systemic disease progression (19 with new metastatic disease in the lung or in other organs, including 2 with local recurrence or lack of response to SBRT).

Conclusions: SBRT in patients with a limited number of pulmonary metastases results in encouraging one year survival rates and may result in an increased intermediate-term survival for a subset of patients. However, cause of death in the majority of cases was systemic disease progression indicating that SBRT can only be one tool in the multi-disciplinary disease management for this patient population. The non-invasive character of this treatment modality may contribute to maintaining not only local tumor control, but also the quality-of-life (QOL) in this patient population. Our ongoing research includes quantitative QOL assessment tools and correlation with serum markers for normal tissue injury.

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POSTER

3D-1H-MRSI metabolite quantitation reproducibility in human brain using a stereotactic immobilization/repositioning device

D. Langer¹, S. Jaywant¹, P. Rakaric², A. Kirilova¹, A. Damyanovich¹.

¹Princess Margaret Hospital, Radiation Physics, Toronto, Canada;

²Princess Margaret Hospital, Radiation Therapy, Toronto, Canada

Purpose/Introduction: There is growing interest in using 3-D ¹H-MRSI to assess metabolic changes in brain pathologies over time. To date, one of the major difficulties encountered in doing this has been the issue of reproducible patient positioning in order to ensure that the same VOI is precisely selected for each successive scan. We have previously found that MRSI-determined NAA/CRE and CHO/CRE can be reproducibly measured to within ~6% and ~12% respectively, in an MRS-brain phantom (2D-PRESS, 16² matrix, 1.0 cc/voxel, TE/TR: 144/2000 ms).

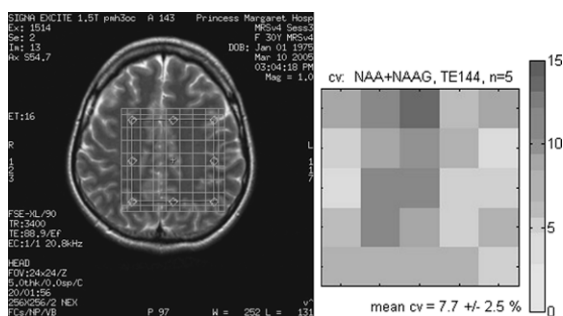
In the current work, we present the results of repeated 3D-¹H-MRSI measurements in normal human volunteers, wherein the problem of reproducible positioning is solved through the use of a stereotactic immobilization/repositioning frame, fitted and secured in place within the standard MRI scanner head coil.

Subjects and Methods: Ten healthy volunteers were repeatedly scanned during four separate sessions, over a time period of two weeks. Scans were performed on a 1.5T GE scanner, using a quadrature head coil, with 5APx5LRx4SI 1.0cc voxels completely contained within a 220 cc PRESS volume. A Gill-Thomas-Cosman (GTC) stereotactic immobilization frame individually fitted to each volunteer ensured minimal variation (~1 mm) in PRESS-VOI repositioning across successive scans. Two MRS scans with TE/TR=30/1500 ms and TE/TR=144/1500 ms were acquired consecutively during each session. T2-weighted anatomic images were taken before

and after the MRS scans to assess potential motion-induced errors in positioning. No tissue segmentation was performed; a user-independent analysis routine (LCModel) was used to analyze all spectra. The coefficient of variation (CV) for each metabolite was determined voxel-to-voxel across successive scans and the overall reproducibility calculated.

Results: Reproducibility of NAA, choline (Cho) and creatine (Cr) concentrations with respect to slice-averaged Cr was determined for both TEs, and myo-inositol (Ins) for TE=30ms. The average CVs(%) for *in vivo* measurements, all voxels and all subjects, are: TE = 144ms; NAA: 12.1 ± 9.2 , Cho: 17.8 ± 7.5 , Cr: 20 ± 12 . The CVs (%) for TE = 30 ms are NAA: 21 ± 12 , Cho: 24 ± 11 , Cr: 21.0 ± 9.3 , Ins: 48 ± 13 . A typical example of a PRESS-VOI and the CVs obtained is shown in the accompanying Figures (NAA; central slice of one volunteer; TE 144 ms).

Discussion/Conclusion: The reproducibility of 3D ^1H -MRS in human brain, with inter-session anatomic variation removed, was established in a cohort of ten normal volunteers, for TE 30 and 144 ms. Such results are crucially important in determining a threshold of significance for MRSI time course studies of disease extent, progression and response to therapy.



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POSTER

Stereotactic radiotherapy for orbital malt lymphoma

H. Sato, M. Toshima, A. Yukawa, J. Ebi, F. Shishido. *Fukushima Medical University, Radiology, Fukushima, Japan*

Background: MALT lymphoma is a common tumor in the orbital region. In some reports, almost 100% local control rate is able to be achieved by radiotherapy alone. Using conventional radiotherapy, there is some risk of causing a radiation cataract because we can't reduce the dosage of lens. So we started Stereotactic Radiotherapy(SRT) to reduce the risk of a radiation cataract for this tumor treatment in 1999. We will review our experiences with SRT in the treatment of orbital MALT lymphoma.

Methods and Materials: Seven patients with MALT lymphoma positioned next to the eye ball were treated with SRT from September 1999 to September 2003 at Fukushima Medical University Hospital. All patients' heads were fixed with a thermoplastic material (Brain LAB) and 6MV X-ray (CLINAC 2100C/D; Varian) was delivered with a micromultileaf collimator (m3; Brain Lab) and the planning system was Brain SCAN(Brain Lab). Total dose to the tumor was 30 Gy in 15 fractions and the prescribed dose to the iso center of the tumor and the peripheral region was 2.5 Gy and 2 Gy, respectively.

Results: We treated seven cases of orbital MALT lymphoma with SRT, and were able to successfully control the tumors in all cases. After a mean follow-up of 40 months (66–20 months), all patients showed CR with no radiation cataract. There were some radiation conjunctivitis in all cases.

Conclusions: SRT is one possible treatment for orbital MALT lymphoma.

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POSTER

Preliminary evaluation of tolerance and local effectiveness of extracranial stereotactic radiosurgery and radioablation in patients with lung tumors

A. Idasiak¹, E. Wolny¹, R. Rutkowski², A. Grzadziel², R. Suwinski¹.
¹MSC Memorial Cancer Center, Radiotherapy Department, Gliwice, Poland; ²MSC Memorial Cancer Center, Department of Radiotherapy and Brachytherapy Treatment Planning, Gliwice, Poland

Purpose: To evaluate treatment tolerance and tumor response in extracranial stereotactic radiosurgery and radioablation in patients with lung tumors.

Materials and methods: 35 patients (30 male and 5 female) median age 61 years, with lung tumors (primary lung cancer n = 13, local recurrences of lung cancer n = 9, lung metastases n = 13) were treated with extracranial stereotactic radiation (ESR). VAC-LOK cushion system was used for immobilization. Total doses applied by ESR ranged from 8–20 Gy, and were

delivered using 3–10 beams. Patients were treated with radical (n = 22) and palliative intention (n = 13). Treatment toxicity was evaluated according to RTOG/EORTC system. Tumor response was evaluated using RECIST scale. Survival of the patients was analyzed using Kaplan-Meier method.

Results: The therapy was performed with no significant adverse symptoms. The most frequently observed acute reaction was fever which lasted 1–2 days after therapy. Seventeen pts (48%) responded to therapy in 15 pts (43%) the disease progressed, 3 pts (9%) were not evaluated for tumor response. One year actuarial progression-free survival was 36% and 1-year overall survival was 46%. Irradiated volume, radiation dose and dose per fraction did not significantly influenced survival.

Conclusion: Stereotactic irradiation of targets in the lung is an new attractive treatment modality with acceptable acute toxicity and local effectiveness. Based upon our initial experience the role of extracranial stereotactic radiotherapy in the curative and palliative management for lung tumor should be further investigated.

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POSTER

Intracranial arteries as organs at risk in fractionated stereotactic and intensity-modulated radiotherapy for skull base tumors

N. Andratschke¹, C. Nieder¹, S. Stark¹, A. Grosu¹, N. Wiedenmann¹, R. Busch², P. Kneschaurek¹, M. Molls¹. ¹Klinikum rechts der Isar, Dept. of Radiotherapy, Munich, Germany; ²Klinikum rechts der Isar, Institute for Medical Statistics and Epidemiology, Munich, Germany

Background: The purpose of this study was to examine the dose distribution in conformal fractionated stereotactic radiotherapy (FSRT) and intensity-modulated radiotherapy (IMRT) of skull base tumors with regard to the large skull base/intracranial arteries. Irradiation of these blood vessels might contribute to arteriosclerosis and therefore brain perfusion disturbances.

Material and Methods: Retrospective review of all patient charts for the treatment period September 2002 – November 2004. Overall, 56 patients with skull base tumors adjacent to at least one major artery (which therefore had to be included into the clinical target volume) were identified. Thirty-two of these patients had meningiomas. The strategy for all patients was to perform FSRT by use of a modified linear accelerator and the BrainLAB system. The dose per fraction was 1.8 Gy. The planning target volume (PTV) was to be enclosed by the 95% isodose, i.e. minimum PTV dose was 1.71 Gy. The maximum dose was 107% (1.93 Gy) and dose limits were applied to established organs at risk such as brain stem, optic nerves and chiasm, and hypothalamus. The maximum dose to these structures was 1.85 Gy. No dose limits were defined for the intracranial arteries. If FSRT planning failed to meet any of these criteria, IMRT was planned with the same system and objectives. The maximum dose to both internal carotid arteries and the basilar artery was determined retrospectively.

Results: The median PTV was 31 cm³, the median minimum dose to the PTV 96%. In 31 patients (55%, median PTV 23 cm³) the FSRT plan fulfilled all evaluation criteria. None of these patients had a dose >105% in one of the large skull base/intracranial arteries. Twenty-five patients (45%, median PTV 39 cm³) had unsatisfactory FSRT plans and thus IMRT planning performed. This resulted in satisfactory plans in 14/25 (56%, median PTV 35 cm³). However, in 11/25 patients (44%, median PTV 85 cm³) no plan satisfying all our criteria could be calculated. Only in this group of 11 patients, high maximum doses to the blood vessels were observed. One patient had >110% to one carotid artery and 6 others had 106–110% to a large artery. The median PTV of these 7 patients was 121 cm³, the median dose gradient within the PTV 29% (p = 0.04 and <0.001, respectively, when compared to the 14 patients with satisfactory IMRT plans). Three out of 4 paranasal sinus tumors belonged to this challenging group.

Conclusions: The large skull base/intracranial arteries should be considered as organs at risk in IMRT planning of skull base tumors if a homogenous dose distribution of 95–107% within the PTV can not be obtained because the PTV is challenging with regard to size or inclusion of large air cavities.

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POSTER

Stereotactic body radiotherapy of limited stage non-small cell lung cancer: results of a Danish phase-II study.

M. Hoyer¹, H. Roed², A.T. Hansen¹, L. Ohlhuis², J. Petersen¹, H. Nellemann³, A.K. Berthelsen², C. Grau¹, S.A. Engelholm², H. von der Maase¹. ¹Aarhus University Hospital, Department of Oncology, Aarhus C, Denmark; ²Copenhagen University Hospital, Department of Radiation Oncology, Copenhagen, Denmark; ³Aarhus University Hospital, Department of Diagnostic Radiology, Aarhus C, Denmark

Background: A large number of patients with technically operable limited stage non-small cell lung cancer (NSCLC) are considered inoperable due