increase from 24 hrs. after the radiation. The increase is up to 5–6 fold and lasts for more than 96 hrs. after the radiation. TK increase is less apparent, up to 2-fold, with a similar time to onset 24 hrs. and also long lasting, more than 96 hrs. A TP/DPD ratio may be roughly established, in a range of relative values 2–3 indicating that anabolism of fluorinated pyrimidines to active forms exceeds catabolic inactivation.
Conclusion: Both mRNA and protein assessments confirm the concept of an enhanced anabolic activation of fluorinated pyrimidines after an ionizing radiation. The catabolic inactivation is less strongly activated than anabolism. The enhancement is long lasting, more than 96 hrs. Therefore any timing of either daily radiation fractions or pyrimidines administrations does not seem rational. The long lasting predominanat enhancement of pyrimidines anabolism supports the currently used continuous infusion for the entire radiation period.

1415 POSTER

Distortion corrected T2 weighted MRI: implications for rectal and bladder dose sparing in prostate radiotherapy planning

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Purpose: To evaluate distortion corrected MRI as a radiotherapy planning tool for prostate cancer and assess possible rectal and bladder dose sparing as compared to CT.
Methods: Eleven men who were to be treated with radical conformal radiotherapy for localised prostate cancer had, in addition to their planning CT scan, an MRI scan under radiotherapy planning conditions, which was then corrected for geometric distortion. Radiotherapy plans were created for planning target volumes (PTV) derived from both the MRI and CT defined prostate. The bladder and rectum were defined as solid organs. The PTV consisted of the prostate and a symmetrical 5 mm margin. To treat the PTV, a plan comprising an anterior and two wedged lateral fields was used with blocks for beam shaping. The same wedge angles and beam weightings were used for MRI and CT derived plans for each patient. The PTV was treated to a notional 70 Gy in 35 fractions for each plan. Dose volume histograms were produced for the rectum and bladder.
Results: The mean volume of the prostate as defined on CT and MR was 41cc and 36cc respectively ($p = 0.009$). The mean rectal volume as defined on CT and MRI was 87 cc and 94 cc respectively ($p = 0.56$). The mean volume of the bladder as defined using CT and MRI was 284 cc and 261 cc respectively ($p = 0.5$). The predicted dose to the rectum (as defined using MRI) from plans treating each PTV is shown below. For the same dose levels, there was no difference in the proportion of bladder (as defined using MRI) receiving a given dose between plans.

Mean percentage of rectum treated to given dose.

dose	PTV CT prostate	PTV MR prostate	p value
45 Gy	23	18	0.05
50 Gy	21	16	0.05
55 Gy	19	15	0.04
60 Gy	17	12	0.03
65 Gy	14	8	0.04
70 Gy	2	1	0.08

Conclusion: Distortion corrected MRI is feasible and for the prostate, results in a smaller target volume than CT. This leads to a lower predicted proportion of the rectum treated to a given dose than with CT.

1416 POSTER

Possibility of laser-accelerated proton beams in radiotherapy

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Background: The purposes of this study are (i) to investigate distinctive features of laser ion accelerators from a clinical standpoint; (ii) to list the problems to solve when applying the accelerator to clinical setting; (iii) to simulate radiation treatment with a laser-accelerator under the condition of the currently available energy regime for eye diseases; (iv) to show future possibilities for radiotherapy with laser-accelerated proton beams.
Material and Methods: We participated in several meetings involving radiation oncologists, physicists, radiotherapy technologists under the auspices of JST and JAERI since 2003. We discussed and reviewed the related literature with the aim of developing laser-accelerated proton therapy. This is an interim report. We also developed simulation tools for laser-accelerated proton therapy: they include (1) particle-in-cell simulation (PIC) software which calculates the properties of laser-accelerated protons, (2) Monte-Carlo simulation software for dose calculations in a human body, and (3) visualization tools for the dose evaluation. We attempted to simulate laser-accelerated proton therapy for the eye diseases (uveal melanoma and age-related macular degeneration).
Results: A laser ion accelerator is expected to be compact, simple, and low cost. These features are remarkable in comparison with synchrotron or cyclotron accelerators. A laser ion accelerator has another obvious advantage of generating narrow proton beams. This feature makes it possible to treat minute targets precisely. The maximum energy of laser-accelerated protons is correlated to the laser intensity. In addition, laser-accelerated proton beams are not parallel, but diverging. In experiments, the maximum proton energy is up to several tens of MeV, and the energy spectra with a single-layer metal target are broad. It is also necessary to develop techniques to remove particles other than protons (heavy ions, electrons, gamma-rays, neutrons, etc), which are also emitted from the target. With our computer simulation, we demonstrate that eye-ball disease may be treated by the laser ion accelerated proton beams. In future, we will seek optimal parameters of laser accelerated protons.
Conclusions: There lie several problems for clinical usage with the currently available parameters; however, we can recommend that laser ion accelerator with these parameters is suitable for a minute target such as diseases within eyeball.

1417 POSTER

Re-irradiation: analysis of consecutive patients

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Background: Our aim was to analyze the results and evaluate the prognostic factors in the re-irradiation of recurrent/second primary tumors. Patients and Methods: One hundred and six patients (119 lesions) who underwent re-irradiation between June 1997 and February 2005 at the European Institute of Oncology, Milan, Italy, were retrospectively analyzed. There were 62 females and 44 males with median age of 60 years (range 22–91). Primary diagnosis included breast in 27% of patients, followed by lung cancer (20%), head and neck cancer (17%) and other primaries (36%). Re-irradiation was performed for nodal/metastatic lesions, recurrent tumor and for new primary in 84 (70%), 33 (28%) and in 2 lesions (2%), respectively. Twenty eight lesions (24%) were re-irradiated with curative intent, whereas 91 lesions (76%) re-irradiation had palliative intent. The re-irradiation dose varied from 4 to 60 Gy. Three-dimesional conformal radiotherapy (3D-CRT) was used to treat 62 lesions (52%), stereotactic radiotherapy (SRT) was used in 40 lesions (48%) and in 3 cases brachytherapy was added to 3D-CRT or SRT.
Results: Median follow-up was 10 months (range, 1–59 months). Response to treatment was observed in 71% and 63% of patients treated with curative and palliative intent, respectively. Progression was seen in 18% and 19% of patients treated with curative and palliative intent, respectively. Eleven per cent and 18% of patients among two groups were

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

1418 POSTER

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

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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 × 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.

1419 POSTER

Gamma knife stereotactic radiosurgery for nasopharyngeal carcinoma

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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.

1420 POSTER

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

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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 cm^3 (range GTV: 1–135 cm^3; PTV: 12–256 cm^3). 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.

1421 POSTER

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

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Purpose/Introduction: There is growing interest in using 3-D ^{1}H-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, 16^2 matrix, 1.0 cc/voxel, TE/TR: 144/2000 ms).
In the current work, we present the results of repeated 3D-^{1}H-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 $5_{AP}x5_{LR}x4_{SI}$ 1.0cc voxels completely contained within a 220 cc PRESS volume. A Gill-Thomas-Cossman (GTC) stereotactic immobilization frame individually fitted to each volunteer ensured minimal variation (~1 mm) in PRESS-VOI repositioning accross 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