Material and Methods: A grid consisting of an 8 cm-thick Pb block containing cylindrical holes was constructed & dosimetry evaluated. Once attached to the head of a linac the multiple pencil beams project 1.3 cm diameter circles with centres 1.8 cm apart at the isocentre. The grid boost consisted of a single fraction of 15 Gy delivered by a direct field with 10MV photons followed the next day by 36 Gy/12#s/2.5 weeks. Acute & late toxicity was assessed using RTOG criteria.
Results: All 10 patients successfully completed the treatment protocol with no delays. The median follow up was 4 months (range 2−24 months). No grade 3/4 acute toxicities were recorded. A temporary sieve like pattern of skin erythema was noted over the grid field in 7 patients. Two patients developed grade 2 lung toxicity with moderate symptomatic fibrosis but no other late effects were observed. 71.4% of patients with chest pain had a sustained CR, with the remaining 28.5% achieving a good PR. 3 pancoast tumour patients with severe pain restricting arm abduction & chest wall numbness had complete responses by week 4. On imaging, 9/10 patients had a good PR in their lung primary, sustained till the end of follow up.
Conclusions: The megavoltage grid has enabled us to dose escalate safely in the palliative setting without any significant acute or late morbidity despite the large single dose delivered. It is an exciting new concept that warrants further research.

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946 POSTER

Flavopiridol enhances radiosensitivity of human laryngeal and lung cancer cells through enhancing radiation-induced apoptosis

S. Kim[1], H.J. Pakr[2], E.K. Kwon[2], I.A. Kim[3], H.G. Wu[3]. *[1]St. Mary's Hospital The Catholic University of Korea, Radiation Oncology, Seoul, Korea; [2]Cancer Research Institute Seoul National University College of Medicine, Radiation Oncology, Seoul, Korea; [3]Seoul National University College of Medicine, Radiation Oncology, Seoul, Korea*

Background: The purpose of this study is to characterize the radiosensitizing effects of flavopiridol and investigate its mechanism of action on human laryngeal and lung cancer cells.
Methods: Human laryngeal squamous cell carcinoma cell line AMC-HN3 and human lung cancer cell line NCI-H460 were used. The cultured cells were exposed to radiation, flavopiridol, or combinations of radiation and flavopiridol. In combination treatment, 100 nM concentration of flavopiridol was administered simultaneously with irradiation, and the media was replaced after 24 hours. Irradiation was administered with 4 MV X-rays generated by a linear accelerator (Clinac 4/100, Varian). Clonogenic survival was measured using a clonogenic assay. Surviving fraction (SF) of flavopiridol-treated cells was compared with that of flavopiridol-untreated cells. Analysis of cell cycle distribution and measurement of apoptosis were assessed by flow cytometry. Western blotting of cleaved caspase-3, cleaved PARP [poly(ADP-ribose) polymerase], p53, p21, cyclin D1 and phosphorylated Akt was carried out.
Results: Simultaneous flavopiridol and radiation treatment enhanced radiation-induced cell killing in both cell lines. SF2 values of flavopiridol-treated cells were significantly lower than those of flavopiridol-untreated cells. The sub-G1 fractions of cells treated with flavopiridol and irradiation was higher than those of cells treated with flavopiridol or irradiation alone. The degree of caspase-3 activation and PARP cleavage was also increased by combination treatment. Cyclin D1 protein expressions were downregulated by flavopiridol in both cell lines.
Conclusion: Flavopiridol enhanced radiosensitivity of human laryngeal and lung cancer cells through increasing apoptosis.

947 POSTER

Target volume reduction in the treatment of malignant meningioma by boron neutron capture therapy

K. Iida[1], S. Kawabata[1], S. Miyatake[1], S. Miyata[1], T. Kuroiwa[1], M. Kirihata[2], K. Ono[3], H. Kumada[4]. *[1]Osaka Medical College, neurosurgery, Osaka, Japan; [2]Osaka prefectual University, agriculture, Osaka, Japan; [3]Kyoto University Research Reactor Institute, radiation oncology, Osaka, Japan; [4]Japan Atomic Energy Agency, Research reactor and tandem accelerator, Ibaragi, Japan*

Background: Boron neutron capture therapy (BNCT) is based on the nuclear reaction that occurs when boron is irradiated with thermal or epithermal neutrons to reduce high linear energy transfer alpha particles and recoiling Li nuclei. This is a binary approach: A ^{10}B-labeled compound delivers high concentrations of ^{10}B to the target tumor, relative to the surrounding normal tissues. BNCT is tumor cell selective particle radiation therapy. Therefore if sufficient quantities of boron compounds can be made to accumulate selectively in tumor tissues, this BNCT becomes an ideal radiotherapy. We have reported the clinical experience of malignant meningioma (MM) patients treated with BNCT. In our protocol, we used simultaneously 100 mg/kg of sodium borocaptate (BSH) and 500 mg/kg of boronophenylalanine (BPA), whose accumulation mechanisms differ from each other. However, it has not reported the basic study of BNCT for MM. In this study, we reported the efficacy of BNCT using human MM cell line.
Materials and Methods: A human MM cell line, f5, and a cell line of human glioblastoma, U87 cells were inoculated subcutaneously into the athymic nude mice. Ten days after cell implantation, six mice of each cell were injected 100 mg/kg of BSH for 6 hr and 500 mg/kg of BPA for 4 hr. After the injection, they were sacrificed and organs were excised. Boron concentration of each organ was determined with the ICP-AES. Other mice were transported to the reactor (JRR4) ten days after the implantation, and randomized on the basis of tumor size, into the experimental groups of 3−5 animals. This experiment included untreated controls. Mice were irradiated for 30 min after 100 mg/kg of BSH for 6 hr administration and 500 mg/kg of BPA for 4 hr administration. After BNCT, mice remained JRR4 for observation and tumor size was measured.
Results: After injection of combination BPA and BSH, the boron concentrations of f5 and U87 was 8.86 ug/g and 9.24 ug/g and Tumor to Blood ratios were 4.24 and 4.42. 35 days after tumor implantation, the mean tumor volume of U87 in BNCT group was 1354 cm^2 in comparison to that of non irradiated group 3540 cm^2. And that of f5 was 826 cm^2 in comparison to 2064 cm^2.
Conclusion: BNCT with BPA and BSH displays growth-inhibitory effect on both glioblastoma and MM.

948 POSTER

Realizing the paperless and filmless environment in a large radiation oncology "cyber-department"

D. Payne, T. Michaelson, G. Disney, S. Rose, B. Guibord. *Princess Margaret Hospital, Radiation Oncology, Toronto ON, Canada*

Background: Provision of reliable, efficient resource management in today's radiation oncology requires support for a vast flow of information.
Methods: A strategy of incremental implementation was developed so as to minimize disruption to care and optimize staff expertise and adoption. User committees were formed at all stages to provide direction. The hardware infrastructure pertinent to radiotherapy activities was designed to optimize patient safety and department efficiency. We designed and built a non-clinical lab system to commission all treating software systems and upgrades.
We began with basic schedule and verify/record functions, then proceeded to electronic prescriptions (and elimination of treatment sheets) to filmless treatment review and the integration of planning system and treatment data over a single network. All electronic procedures were phased into practice on a disease site basis, in tandem with adequate staff training. A custom radiotherapy order entry and workflow system, and a web-based tool to publish and approve treatment plans were built to support the treatment planning process, since no commercial packages existed to do these functions. Administrative reports were customized, as was support for case review conferences and quality assurance. An electronic content management intranet provides access to all department source documents and policies and schedules.
Results: In all patient operations paper has been eliminated. All treatments and assessments are recorded electronically and costs per image are now close to zero despite the large increases in the number of images generated for planning and treatment. There has been no significant downtime despite some external interruptions. Function is available throughout the centre and from remote locations. Communication, commitment, and careful analysis of workflow process are essential to success. We encountered many challenges, which may be of interest to others engaged in this transformation.
Conclusions: The department is now almost entirely electronic. All radiotherapy functions are supported electronically throughout the centre and from remote locations. Communication, commitment, and careful analysis of workflow process are essential to success. We encountered many challenges, which may be of interest to others engaged in this transformation.

949 POSTER

Early adverse reactions after hemibody irradiation (HBI)

L. Miszczyk[1], A. Gaborek[2], J. Wydmanski[1]. *[1]Maria Sklodowska-Curie Memorial Institute, Radiotherapy, Gliwice, Poland; [2]The Good Compassion Hospice, Palliative care, Gliwice, Poland*

Background: The most strenuous symptom of cancer patients suffering from multiple bone dissemination is pain. Quality of life (QL) of these

patients is very low. To decrease the pain level and to increase QL, hemibody irradiation (HBI) is performed.
Purpose: Evaluation of the frequency and intensity of early adverse reactions after HBI.
Material and Methods: Material was comprised of 59 patients (30 females, 29 males), aged from 37 to 80 (mean 59) with painful, multiple bone dissemination, irradiated for half of the body. Most frequent clinical diagnoses were prostate (22) and breast (26) cancers. Most frequent pathological diagnosis was adenocarcinoma (49). 26 patients were irradiated (6 Gy) for upper (UHBI), 26 (8 Gy) for lower (LHBI) and 7 (6 or 8 Gy) for middle (MHBI) part of the body. All patients in treatment day got 500 ml of intravenous fluid, metoclopramid i. m. and dexaven i. v. 2 weeks after HBI nausea and vomiting, diarrhea, skin changes, leuco and thrombocytopenia were evaluated in 5 degrees scale different for each symptom (from 0 [lack of symptom] to 4 [very intense]). Patient's weight was measured in the treatment day and 2 weeks later. Statistical analysis based on Spearman and Mann-Whitney tests was performed.
Results: Nausea and vomiting appeared in 31, diarrhea in 14, leucopenia in 18 and trombocythopenia in 7 cases. Means of intensity were 0.9, 0.34, 0.47, 0.31 respectively. Only in one case 4 degree reaction appeared (trombocythopenia <25000/mm^3). In 3 cases delicate skin erythema appeared. Average weight in the treatment day was 69.6 kg and 67.7 kg 2 weeks later. Significant correlation between diarrhea intensity and delivered dose was found (R = 0.31). Significant differences between nausea and vomiting intensity after U (mean 1.2) and LHBI (mean 0.5) (p = 0.01) and diarrhea intensity after U (mean 0.008) and LHBI (mean 0.5) (p = 0.02) were found.
Conclusion: Adverse reactions after HBI are on the acceptable level. Diarrhea depends on delivered dose and is more frequent after LHBI and nausea and vomiting appear more frequently after UHBI.

950 POSTER

Dose evaluation of elective nodal region of head and neck cancer in conventional radiation therapy – How much elective nodal region should be included in IMRT?

T. Kimura[1], T. Togami[1], M. Ohkawa[1], H. Takashima[2]. [1]*Kagawa University, Radiology, Kagawa Prefecture, Japan;* [2]*Takinomiya General Hospital, Radiology, Kagawa Prefecture, Japan*

Background: To evaluate the irradiated dose of elective nodal region which is recommended in IMRT for head and neck cancers in conventional radiation therapy.
Materials and Methods: In this analysis, 20 patients with head and neck cancers who recievwd conventional radiation therapy at Kagawa University were enrolled (6 patients with laryngeal cancers, 7 with oropharyngeal cancers and 7 with hypopharyngeal cancers). The follow-up at the time of evaluation ranged from 2 to 36 months (median 7 months). We delineated elective nodal region (Level I-V, retropharyngeal space; RP) with guideline 1) in each patients retrospectively, and calculated V50, 80, 95, and D95. We referred to the report of Chao 2) for the extent of elective nodal region. The dose of elective nodal irradiation was 40 to 50Gy in conventional fractionation. All patients were administrated concurrent chemotherapy.
Results: The table shows V95 in each elective nodal region. Though level II and III were involved in irradiated fields in all patients, the dose was low in many patients. Especially, level IV tended to be out of the irradiated fields in the patients with laryngeal and oropharyngeal cancers, and therefore the dose of level IV was especially low. We did not observe any nodal recurrence except in three patients who were performed nodal dissection after radiation therapy as scheduled.

V95 (%)	Ib	IIa	IIb	III	IV	V	RP
Laryngeal		68.3	42.0	93.5	20.3		
Oropharyngeal	84.6	98.9	78.0	78.7	43.4	44.8	85.0
Hypopharyngeal	75.5	88.1	59.3	93.6	70.6		69.7

Conclusions: In conventional radiation therapy, we observed low dose region even in nodal regions which seemed irradiated, and therefore improvement of the dose distribution in IMRT is needed. On the other hand, although the follow up period was short, we did not observe any nodal recurrence in most of the patients and the influence of chemotherapy was considered to be great. We have to discuss how much elective nodal region should be included in IMRT for patients with head and neck cancers who recieve chemotherapy.

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951 POSTER

Survival after radiotherapy of metastatic spinal cord compression

E. Castro-Gomez[1], U. Anido-Herranz[2], A. Varela-Pazos[1], C. Areses-Manrique[2], E. Fernandez-Fernandez[1], E. Aguin-Losada[2], E. Gonzalez-Patiño[1], A. Gomez-Caamaño[1], A. Carballo-Castro[1], C. Porto-Vazquez[1]. [1]*Hospital Clinico Santiago, Radiation Oncology, Santiago de Compostela, Spain;* [2]*Hospital Clinico Santiago, Medical Oncology, Santiago de Compostela, Spain*

Background: Prognostic factors predicting for survival of metastatic spinal cord compression (MSCC) patients would be helpful to facilitate the selection of an appropriate radiotherapy (RT) schedule (shorter-course vs. longer-course RT) for the individual patient. This study investigated the prognostic factors and overall survival after radiotherapy for MSCC.
Materials and Methods: In this retrospective analysis, 90 patients irradiated for MSCC between January 1, 1998 and December 31, 2006. Inclusion criteria were confirmation of MSCC by magnetic resonance imaging (MRI). Of the entire cohort, 61 patients (68%) were male and 31 (32%) were female. Median age was 62 years (range 23−82 years). Type of primary tumor was 15 lung, 13 prostate, 14 breast, 7 unknown primary and 38 others. Pain was the earliest symptom of SCC in the majority of patients, being present before neurological signs in 71%.
Radiotherapy was performed with 6−15 MV linear accelerators in 63 patients and 60Co machines in 27 patients.
The prognostic factors investigated were age, sex, location of primary tumor, involved vertebra, other bone metastases, visceral metastases, and pretreatment performance status.
Multivariate analysis was performed using Cox regression analysis. Survival was calculated using the Kaplan-Meier method.
Results: The overall median survival was 121 days (range 6–1219 days). Among the 90 patients, 48 (53%) died within 6 months after RT and 60 (60%) died within 12 months after RT. Comparing survival and location of primary tumor, we found a median survival time of 6, 7 and 4 months for prostate, breast and lung carcinomas, respectively. The number of involved vertebra is a prognostic factor (p = 0.012). Also, the age and location of primary tumor has a slightly trend (p = 0.057 and p = 0.90, respectively); while, the sex, other bone metastases, visceral metastases, and pretreatment performance status was not statistically significant.
Conclusions: Prognostic factors predicting for survival of MSCC would be helpful to facilitate the selection of an appropriate RT schedule for the individual patient. In this study, survival only was associated with number of involved vertebra. For patients with a very poor expected survival (lung carcinoma) or few number of involved vertebra, shorter course appear appropriate because they are associated with less discomfort for the patients.

952 POSTER

Single-dose radiotherapy in the treatment of heterotopic ossification in patients with spinal cord injury: results of a prospective study

T. Langsenlehner[1], R. Mayer[1], K. Nestinger[2], F. Quehenberger[3], K.S. Kapp[1], G. Korisek[2]. [1]*Medical University of Graz, Department of Therapeutic Radiology and Oncology, Graz, Austria;* [2]*LKH Tobelbad, Department of Rehabilitation, Tobelbad, Austria;* [3]*Medical University of Graz, Institute for Medical Informatics Statistics and Documentation, Graz, Austria*

Background: Heterotopic ossification is a common complication in spinal cord injury, characterized by the formation of ectopic bone in soft tissue surrounding peripheral joints. Heterotopic ossification always occurs below the level of the spinal cord injury, most commonly at the hip. It may cause a severe reduction of hip joint movement and lead to loss of sitting position, pressure sores, and also compromise activities of daily living. The aim of our prospective study was to evaluate the efficacy of radiation therapy for the treatment of heterotopic ossifications in the hips in spinal cord injured patients.
Patients and Methods: Between 4/2000 and 9/2006, 13 spinal cord injured men (median age 34.9 years) with heterotopic ossifications in the hips who underwent primary rehabilitation received radiotherapy at the Department of Therapeutic Radiology and Oncology Graz, Austria. The mechanisms of injury were: motor-vehicle accident (n = 7), fall incidents (n = 3) and miscellaneous (n = 3). At the start of rehabilitation, Alkaline phosphatase was elevated in 10 patients, and in 9 men heterotopic ossification was verified on x-ray. In the remaining patients, elevation of Alkaline phosphatase as well as heterotopic ossification became evident during rehabilitation. After three-dimensional treatment planning, photon beam radiotherapy was delivered to the hips (unilateral, n = 2; bilateral, n = 11) with a single dose of 8 Gy. Six patients received additional non-steroidal anti-inflammatory drugs.