

Employing the NAL (averaging shifts of the first 3 fractions), the average subsequent 3D vector of correction in prone setups would have been 6 mm. The frequency of respective shifts for subsequent treatment fractions larger than 5, 10, 15 and 20 mm, would have been 57.4, 11.6, 0.4, and 0.4% for prone setup. According mean 3D vector of corrective shifts and frequencies would have been 7.9 mm, and 66.4, 22.6, 8.9, and 3.6% for supine setups, respectively.

**Conclusion:** In the present study, prone patient setup was found to yield a higher daily repositioning variability than supine positioning. However, following utilization of a NAL protocol to reduce the systematic setup variability component, random setup errors larger 10 mm were significantly more often observed in supine than in prone setups. Thus, if daily image-guidance or NAL protocols are not employed, the potential advantages of removing small bowel from the pelvic region using a supine setup on a belly board and reducing target ventilatory motion may be associated with higher inter-fraction setup variability. Based on the number of clinically relevant corrective shifts observed in the studied population, daily on-line image-guidance is advised. While NAL protocols may provide sufficient systematic setup error reduction to justify off-line image-guidance strategies in prone patient setup, the observed remaining setup variability in supine patient setup warrants further investigation. The present data are especially relevant to future clinical trials of IMRT for rectal and anal malignancies.

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POSTER

# **Prospective study of decompression surgery and intraoperative radiation therapy (IORT) for metastatic spinal tumours**

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**Background:** Metastatic spinal tumors often cause spinal cord compression and jeopardize the quality of life of the patients much. To decrease the local symptomatic recurrence rate, we have been adding IORT to decompression surgery.

**Materials and Methods:** For those patients whose life expectancy was more than 6 months were eligible for this treatment. Posterior decompression by laminectomy of the involved vertebrae was performed. Following decompression, the patient was irradiated the lesions intraoperatively with electrons generated from Microtron by shielding the spinal cord with lead plate. The central aspects of the vertebrae were irradiated by scattered electrons detouring from the edge of the lead shield up to 40% of the administered dose. Following IORT, posterior instrumentation was performed. External beam radiotherapy might be added pre- and/or postoperatively when considered necessary.

**Results:** 108 patients were treated between 1992–2005. There were 58 males and 50 females. Age ranged from 26 to 85 with a median of 62.5. By primary sites, 26 breast, 24 kidney, 18 colorectum, 17 lung, 12 prostate and 11 thyroid cases were included. Irradiated spines were cervical in 6, thoracic in 76, and lumbar/sacral in 27. Overall median follow-up period was 12.7 months. Median IORT dose was 20 Gy (range 15–26 Gy) and median electron energy was 16MeV (range 11–22 MeV). There were 37 cases with preoperative RT and 41 cases with postoperative RT. Overall median survival time was 14.5 months (breast 15.3, kidney 22.6, colorectum 5.7, lung 6.2, prostate 31.6, thyroid 60.6 months). Neurological response rate was 73.1%. Ambulatory rates were 87.0% for success and 80.6% for rescue by Klimo's definition (2005). There were only 8 symptomatic relapses (7%). As for major complications, only one myelopathy has been observed.

**Conclusions:** Decompression surgery and IORT for metastatic spinal tumors with impending spinal cord compression was a promising treatment modality with excellent local control and neurological response rate and with minimal toxicity especially for those patients with long-term prognosis.

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POSTER

# **Efn1, a radioresistant marker, detected in a murine tumor model by gamma and carbon ion irradiation**

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**Purpose:** This study investigated the genes involved in radioresistance after radiotherapy.

**Materials and Methods:** Using single-color oligo-microarrays, we analyzed the gene expression profiles of two murine squamous cell carcinomas: NR-S1 (radioresistant) and SCCVII (radiosensitive), after irradiation with

137-Cs gamma rays at doses of 30, 50 and 70 Gy or 290 MeV/u carbon ions at a dose of 30 Gy. Potential genes related to radiosensitivity were selected by comparing the expression values before and after irradiation (with both gamma rays and carbon ions) using a filter for at least 1.5-fold changes. Furthermore, candidate genes which had significantly different ratio values between the two tumors ( $P < 0.05$ ) were detected by unpaired Student's t-tests. Subsequent analysis by quantitative reverse-transcription polymerase chain reaction (RT-PCR) confirmed our microarray data. Protein expression and function were examined by immunohistochemical studies.

**Results:** Four genes, Efn1, Sprr1a, Srgap3 and Xrra1, were selected as potential genes related to radioresistance after gamma and carbon ion irradiation. RT-PCR confirmed that Efn1 was induced in radioresistant NR-S1. Efn1, a proangiogenic factor, was expressed in the cytoplasm of tumor cells and significant increases in microvascular density were observed in the radioresistant NR-S1.

**Conclusions:** We found that Efn1 may be a potential molecule related to radioresistance in murine tumors.

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POSTER

# **p73 protein expression correlates with radiation-induced apoptosis in the lack of p53 response to radiation therapy for cervical cancer**

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**Background:** p73 belongs to a p53 tumor suppressor family of genes and can inhibit cell growth in p53-like manner by induction of apoptosis or cell cycle arrest. The aim of this study was to investigate whether p73 could compensate for impaired p53 function in apoptosis induced by radiation therapy (RT) for cervical cancer.

**Materials and Methods:** Sixty-eight patients with squamous cell carcinoma of the cervix who received definitive RT combined with ( $n = 37$ ) or without ( $n = 31$ ) cisplatin were investigated. Biopsy specimens were excised from the cervical tumor before RT and after 9 Gy. All tissues were stained with hematoxylin and eosin, and terminal deoxynucleotidyl transferase mediated dUTP-biotin nick end labeling method assay and immunohistochemical staining for p53 and p73.

**Results:** Mean Apoptosis Index (AI) was 0.93% before RT and 1.97% after 9 Gy with a significant increase ( $p < 0.001$ ). For all patients, there were significant correlations between AI ratio (AI after 9 Gy/AI before RT) and p73 expression positivity after 9 Gy ( $p = 0.021$ ). Forty-one patients were regarded as p53-responding group according to the expression of p53 after 9 Gy, while the remaining 27 patients were regarded as p53-non-responding group. In the p53-non-responding group, a significant correlation between the AI ratio and p73 expression after 9 Gy was observed ( $p < 0.001$ ) although there was not significant correlation between them in the p53-responding group ( $p = 0.940$ ).

**Conclusions:** Our results suggested that p73 had an important role in compensating for the lack of p53 function in radiation-induced apoptosis of cervical cancer.

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POSTER

# **Cardiac complications after radiation therapy for stage I esophageal cancer patients**

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**Background:** Cardiac complication after chemoradiotherapy (CRT) for esophageal cancer is one of the recent noteworthy topics. However there are few reports about cardiac complications after radiotherapy (RT) alone for comparison with CRT data. The purpose of this study is to assess the cardiac complications after RT alone for stage I esophageal cancer patients.

**Material and Methods:** Ninety-five patients with stage I esophageal cancer received definitive RT alone between 1992 and 2002. There were 8 females and 87 males. The median age was 70 (43–89) years. Eighty-five percent of patients had tobacco history, 84% had history of drinking alcohol, 15% had diabetes and 20% had hypertension. Fourteen patients (15%) had histories of cardiovascular diseases before RT (ischemic heart disease: 8, arrhythmia: 3 and others: 3). Histologic types were squamous cell carcinoma in 94 (99%) and adenocarcinoma in 1 (1%). Ten patients (11%) had the main lesion in the upper thoracic, 71 (76%) in the middle thoracic and 14 (15%) in the lower thoracic esophagus. Twenty-seven patients (28%) were treated with high-dose-rate brachytherapy (HDR-BT, median 35 Gy/14 fr.) alone, 60 patients (63%) with combined external RT (median 54 Gy/27 fr.) and HDR-BT boost (median 10 Gy/4 fr.) and 8 with external