and GTV3D-M (P = 0.125), GTVMIP and GTV3D-M (P = 0.325). GTVFB was smaller than GTV3D-M and GTV4D-M significantly (P = 0.015 and P = 0.016), and than GTVMIP without significant difference (P = 0.125). Notably, GTV4D-M differed from GTVMIP (P = 0.016).
Conclusions: The margins from GTV to PTV should be noticed, when undergo CT simulation with patients breathing freely, due to the differences between GTVFB and GTV4D-M and GTV3D-M. To merge GTVEE and GTVEI could be an alternative to using 4D-CT for simulation.

2008 POSTER

Assessment of Anatomical and Dosimetric Changes by a Deformable Registration Method During the Course of Intensity-modulated Radiotherapy for Nasopharyngeal Carcinoma

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Background: To quantify the anatomic variations and the actual dosimetric effects by a deformable registration method throughout the entire course of simultaneous integrated boost intensity-modulated radiotherapy (SIB-IMRT) and to assess the necessity of re-planning for patients with nasopharyngeal carcinoma (NPC).
Methods and Materials: Twelve patients with locally advanced NPC treated with SIB-IMRT were enrolled in this pilot study. Plan1 (CT1) was based on the original CT scan, while Plan2 (CT2) was generated from the mid-treatment CT scan (CT2), which was acquired after 20−25 fractions of IMRT of Plan1. All plans were calculated with an inverse planning system (Pinnacle3, Philips Medical System). Both sets of CTs, RTstructures and RTdoses for the two plans were transferred to MIMsoftware (V5.1) workstation, and then hybrid IMRT plan, Plan1 (CT2), was generated by deforming doses of Plan1 to CT2 allowing for visualizing the dose that had been delivered on the current anatomy. In additional, the accumulated plan, Plan1+2 (CT2), was generated to quantify the actual dosimetric effects during the course of treatment. The dose-volume histogram of actual and hybrid plans were compared.
Results: Compared to CT_1, the volume of the right and left parotid glands decreased by 24.6±11.9% and 35.1±20.1%, and planning target volumes of the gross target volume (PGTV), the regions at high risk for microscopic disease (PTV_2) and low risk elective nodal coverage (PTV_3) reduced by 16.4±27.3%, 3.8±6.3% and 8.8±12.0% in CT_2. In $Plan_1$ (CT_2) and $Plan_{1+2}$ (CT_2), the dose to 95% of PGTV decreased by 3.9±2.5% and 1.7±1.8%, the maximum dose (D_{max}) to the spinal cord increased by 3.8±5.3% and 0.5±1.9%, and increased by 0.8±4.4% and 1.2±3.3% to brainstem compared to $Plan_1$ (CT_1), respectively. The mean dose (D_{mean}) to the left parotid gland increased by 4.4±20.4% and 2.0±15.0% in $Plan_1$ (CT_2)and $Plan_{1+2}$ (CT_2), while D_{mean} to the right parotid gland increased by 0.2±7.9% in $Plan_1$ (CT_2) and reduced by 1.1±8.7% in $Plan_{1+2}$ (CT_2). Our data demonstrated that without repeat imaging and replanning during the course of IMRT, the dose to target reduced and the dose to critical structures increased.
Conclusions: During the course of IMRT for patients with NPC, the volumes of targets and parotid glands reduced significantly. Mid-treatment CT scanning and replanning were recommend to ensure adequate doses to the targets and safe doses to the critical normal tissues.

2009 POSTER

Do Obesity and Set-up Position Affect the Interfractional Variation of Pelvic Irradiation?

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Background: Our aim is to examine the relation of obesity and set-up position with the set-up error in large sized population with conventional fractionated pelvic irradiation with a modern verification technique.
Material and Methods: Consecutive 101 patients with whole pelvic irradiation were analyzed with a prospective manner. Daily verification using a kilo-voltage orthogonal on-board imager was performed. The set-up errors between two origins (isocenter of simulation ($\Delta Shift^{Sim}$) and the initial treatment ($\Delta Shift^{Ini}$) and each fraction were measured as to the systematic shifts along right-to-left (RL), superior-to-inferior (SI), and anterior-to-posterior (AP) axes and 3 dimensional (3D) vectors. The estimation was based on measurements in a population of patients. The overall mean error, M, the standard deviation (SD) of the systematic error, Σ, and the SD of the random error, σ were determined. Set-up position was divided into supine (N = 53) and prone (N = 47). Body mass index (kg/m^2) was classified in four groups [underweight <18.5 (N = 6), normal <25 (N = 56), overweight <29.5 (N = 34), obese >29.5 (N = 5)]. A T-, Tukey-b and F-test for the comparison of two Ms, multiple Ms and SDs were used, respectively. A p value <0.05 was significant.
Results: In $\Delta Shift^{Sim}$, the M of 3D vector was 6.19 and 5.49 mm for supine and prone, respectively ($p = 0.237$). None of the difference of Σ along any axis was observed. While σ along RL was better in prone (p = 0.001), AP was better in supine ($p = 0.008$). In $\Delta Shift^{Ini}$, the M of 3D vector was 3.02 and 3.64 mm for supine and prone, respectively ($p = 0.073$). The Σ along AP was better in supine ($p = 0.044$) In terms of σ, similar tendency was observed (RL, $p = 0.001$; AP, $p = 0.002$). The M of 3D vector of $\Delta Shift^{Sim}$ was 4.37, 5.52, 6.08, and 10.16 mm for underweight, normal, over-weight and obese, respectively ($p = 0.003$) The Σ along RL in obese was more extensive than others ($p < 0.000$). The Σ along other axes in obese was worse than others without significance (SI, $p = 0.081$; AP, $p = 0.070$). In $\Delta Shift^{Ini}$, the range of M of 3D vector was from 2.91 to 4.13 mm ($p = 0.591$). The σ along RL in obese was more extensive than others in both $\Delta Shift^{Sim}$ ($p < 0.000$) and $\Delta Shift^{Ini}$ ($p < 0.000$).
Conclusions: The effect of set-up position to the set-up error is inconsistent along all directions and insignificant. Obesity is a risk factor of extensive set-up errors. However, some of set-up errors could be properly corrected with initial on-board imager verification.

2010 POSTER

Genetic Hypersensitivity to Ionizing Radiation

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Background: Exposure to medical radiation has increased over time. Radiotherapy has a crucial role in management of cancers. Hypersensitivity to ionizing radiation has been observed in some genetic syndromes.

Table: Radiosensitive phenotypes

Human disorder	Major clinical features	Cancer type	Frequency	Gene	Pro obs	Is gene-radiation interaction definitive?
Ataxia telangiectasia	Cerebellar ataxia, immuno-deficiency, oculocu-taneous telangiectasia	Lymphoma, leukaemia, epithelial carcinomas	1:300,000	*ATM*	Avoiding mammography/ CT. Reduced dosage/duration of RT if not avoidable	Yes
Fanconi anaemia	Bone marrow deficiency, short stature, intellectual deficiency, radial hypoplasia	Leukaemia, squamous cell carcinoma of oropharynx, oesophagus, vulva	3:1,000,000	*FANCA, FANCC, FANCG*	Reduced dosage/duration of RT if not avoidable	Yes
Gorlin syndrome	Odontogenic jaw keratocysts, palmar/ plantar pits, skeletal abnormalities	Basal cell carcinoma, medullo-blastoma	1:40,000	*PTCH*	RT induces basal cell carcinoma development	Yes
Ligase IV syndrome	Growth deficiency, skin photo-sensitivity developmen-tal delay, immuno-deficiency	Leukaemia, multiple myeloma, lymphoma	Very rare	*LIG4*	Avoiding RT	Yes
Li-Fraumeni syndrome		Breast carcinoma, sarcoma, leukaemia, brain tumour	Very rare	*TP53*	Mammography/ MRI for breast screening. Minimizing dosage/duration of RT	RT induced cancer observed but gene-radiation interaction not found
Neuro-fibromatosis type 1	Cafe au lait spots, neurofibro-mas, axillary/ inquinal frecklings, Lisch nodules	Optic glioma, malignant peripheral nerve sheat tumour (MNPST)	1:3,500	*NF1*	For opticus glioma other therapy than RT	MPNST observed after RT for optic gliomas but gene-radiation interaction not found
Nijmegen breakage syndrome	Growth deficiency, intellectual deficiency, immuno-deficiency	Lympho-reticular malignancy	Rare	*NBS1*	Reduced dosage/duration of RT if not avoidable	Yes
Retinoblastoma		Retino-blastoma, bone and soft tissue sarcoma	1:20,000	*RB1*	RT induces second cancer development	Yes

Material and Methods: Pubmed was searched for studies between the years 1990–2011 for analyzing in vitro or in vivo the sensitivity to ionizing