(range 0–20 degrees) and with the same photon energy (6 or 15 MV), for a conventional treatment of 50 Gy, 2 Gy per fraction. Measurements were performed in the planning target volume (PTV, 1 cm margin around clinical target volume), controlateral breast, ipsilateral lung, heart (for left sided tumors).
Results: Through visual inspection of the dose distribution for all CT slices, dose distribution in the PTV was almost identical for both plans; the 90% of prescribed dose was delivered to a mean of 91.2% (±5.6) of PTV with the CT and to a mean of 92% (±5.9) with the NCT. In the controlateral breast the dose delivered to 5% of volume was 1.8 Gy (±0.3) with CT and 1.3 Gy (±0.3) with NCT. Ipsilateral lung received a mean dose of 7.8 Gy (±1.6) and a V20 at 14% (±2.8) with CT; with NCT mean lung dose was 6.8 Gy (±1.8) and V20 was 12% (±3.3). In the 2 left sided treated breast, heart received a V33 at similar volume for both treatments.
Conclusions: A treatment technique utilizing two non-coplanar wedged beams offers a better solution compared to standard coplanar treatment for patients with difficult breast anatomy (i.e. large breast), in terms of lung and controlateral breast sparing, while maintaining the same PTV coverage.

2051 POSTER

RapidArc: dose distribution and irradiation time in relation to sliding window and dynamic arc

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Purpose: RapidArc is a combination of sliding window and dynamic arc with additional dose rate modulations or gantry speed control. The introduction of RapidArc into the clinical practice is only rational because of the benefit for the patient. The benefit for the patient can be a shorter irradiation time with related dose distribution or a better dose distribution with the same irradiation time.
Material: For this examination we used patients with head and neck, breast, prostate, lung and brain tumors. Each patient has been planned for all three techniques and the dose distributions were compared referring to the dose homogeneity of PTV's and the protection of organs at risk. The comparison of irradiation time was executed with detecting the number of monitor units and the setup time for the patient.
Results: The comparison of the dose distributions shows many plans with similar results for head and neck and prostate tumors for RapidArc and sliding window, but the irradiation time for RapidArc plans is less than 50%-70% compared to sliding window plans. Comparison of the same tumors between RapidArc and dynamic arc shows mostly better dose distributions for RapidArc and for some cases similar dose distributions, but the irradiation time is approximately identical.
Dose distribution comparison for head and neck, breast and lung between the three methods shows sometimes advantages for RapidArc and sometimes advantages for sliding window, according to the PTV-contours. Dynamic arc is equivalent referring to dose distributions for some cases.
All Plans show a benefit for Rapid Arc and dynamic arc referring to irradiation times.
Conclusion: All three irradiation methods are possible for the patient treatment, but which one is to use must be decided for each patient individually, any criteria for these decision are the dose distributions (dose homogeneity of PTV's and the protection of organs at risk), the irradiation time and the planning time.

2052 POSTER

Clinical and therapeutic aspects in elderly patients with Merkel Cell Carcinoma: special focus on radiotherapy

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Introduction: Merkel Cell Carcinoma (MCC) is a rare and aggressive primitive malignant epidermal cancer mostly affecting elderly people. While the place of adjuvant radiation therapy (RT) is widely recognized, it remains debated whether elderly patients would fully benefit from adjuvant RT.
Material and Methods: Between March 1996 and March 2007, 29 patients with histologically confirmed MCC were treated in Amiens hospital, France. Mean age was 75.6 years (54.7–95.2), including 12 patients (41.4%) being more than 80 years-old. At diagnosis, 25 patients (86.2%) were stage I (localized disease) and 4 patients (13.8%) had stage II (regional lymph node invaded, no metastases spread) or III disease (visceral metastases). All patients but one underwent a surgical excision of the primary tumor and classical adjuvant RT was performed in 14 patients (50%) on tumor bed with margins of 3 to 5 cm, mean dose of 46 Gy (range 30–60 Gy), using 2 Gy per daily fraction. Ten out of them received also RT of lymph node drainage area with mean dose of 44.3 Gy (26–50).
Results: For the whole cohort, the median overall survival (OS) was 18.9 months (3–122 months) and the median time to progression (TTP) was 5.5 months (1–26 months). For stage I patients, 5-year OS was 41.1% (IC95: 17–65%), *versus* 0% in patients with stage II or III disease ($p < 0.0001$). Most frequent sites for recurrence were nodal (34.5%), then local (24.1%) and metastatic (17.2%). After RT, 5-years OS was 47% (IC95: 12–82%), *versus* 27% (IC95: 5–49%) if no RT ($p = 0.032$). When focusing on patients more than 70 years-old, 8 (36.5%) remained disease-free at last follow-up, 8 (36.5%) died from disease-related cause, and 6 died from unrelated cause (27%). No patient died from treatment-related cause. In this subgroup, the TTP was 6 months (2–19 months) and median OS was 19 months (4–87 months). In patients more than 80 years-old, median OS was 20.8 months (4–73 months). The age was not a significant factor for disease-related death. All acute toxicities were less than grade 2. No significant difference was reached according to the age.
Conclusion: The impact of local control on survival remains uncertain but it is believable that the benefice of RT in elderly patients would not be drastically different from that in younger patients. It is associated with low toxicity and improved outcome. Multicentric prospective trials are needed to better refine and validate the optimal strategy.

2053 POSTER

Does electronic portal image device really impact set-up practice? A first step introducing a displacement correction protocol and PTV margin re-design

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Materials/Methods: 237 Electronic portal images (EPID) from 39 consecutive radical prostate cancer treatments were reviewed. Patients were treated in the supine position with a knee support, full bladder and empty rectum. Initial patient setup displacements were determined by dosimetry requirements and performed daily using reference skin marks and laser alignment. For each beam, a digitally reconstructed radiography (DRR) was created and matched with its correspondent EPID image to obtain setup displacements. The symphysis, obturator holes and acetabuli were drawn in DRRs as bone references.
Mean displacement and its inter-fractional standard deviation were determined for each patient in orthogonal directions. In a given direction, inter-fraction standard deviation and mean displacement standard deviation were calculated taking into account all patients and were interpreted as systematic (Σ_{setup}) and random (σ_{setup}) setup displacement uncertainties, respectively. Both the systematic and random deviations were assumed to follow a Gaussian distribution in the three directions.
Results: The following are our systematic and random setup displacement uncertainties in the three directions according to our measurements and calculations after offline matching performance.

	LR (mm)	SI (mm)	AP (mm)
Σ_{set-up}	2.7	2.9	3.9
σ_{set-up}	2.6	2.0	2.8

LR, left-right; SI, superior-inferior; AP, anterior-posterior.

Conclusion: Our calculated systematic and random displacement uncertainties are in agreement with the literature. Next, we plan to introduce our results in the Van Herk [1] formula for PTV margin design and to use data to decide when displacement is statistically significant.

References

[1] van Herk M, et al. *The probability of correct target dosage: dose-population histograms for deriving treatment margins in radiotherapy.* Int. J. Radiat. Oncol. Biol. Phys 2000;**47**:1121−35.

2054 POSTER

Sequential evaluation of prostate edema after permanent seed prostate brachytherapy

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Background: The postoperative dosimetric analysis of permanent prostate brachytherapy requires a subjective delineation of implant volume in

computed tomography (CT) images. This work investigates the time course of prostate edema and its effect on CT volume determination and dose-volume histograms (DVHs) of the prostate for prostate cancer patient treated with ^{125}Iodine (^{125}I) seeds permanent brachytherapy.
Material and Methods: From March 2006 to March 2009, 37 consecutive prostate brachytherapy patients with prescribed dose of 145 Gy from ^{125}I as monotherapy comprised the study population. For prostate volume (PVol) study and seed order, a trans-rectal ultrasound-based (TRUb) preplan was performed 3–4 weeks before implantation. The real-time intraoperative planning was used on the day of the implant (Day 0) and postimplant dosimetry was calculated using CT images on the Day 1, Days 30 after implantation. Prostate dosimetry was evaluated by the percentage of the prostate volume receiving 100% of the prescribed dose (V_{100}) and percentage of prescribed dose received by 90% of the prostate volume (D_{90}).
Results: The median preplan TRUb volume (pre-TRUb Vol) was 30.46 ml (range, 16.43–55.33 ml) and as a proportion of the pre-TRUb Vol, the Day 0 was a median of 1.1 (range, 0.75–1.31, $p = 0.0372$). Prostate edema was maximal on Day 1, with the median PVol 10% greater than pre-TRUb Vol (range, 0.82–1.49; $p = 0.0024$) and 7% greater than Day 0 volume (range, 0.8–1.37; $p = 0.047$); it thereafter decreased over time. It was 10% lesser than pre-TRUb Vol (range, 0.56–1.22; $p = 0.0016$) and 11% lesser than Day 0 volume (range, 0.59–1.13; $p < 0.0001$) on Day 30. The median V_{100} was 85% (range, 60–98%) on Day 1 and was 93% (range, 63–100%) on Days 30 and increased 6.8% from Day 1 to Days 30 (range, −6.8–27.1%; $p = 0.0001$).
Conclusion: The results showed that the extent of postimplant prostate edema was less than expected during Days 1–30 and suggested that the CT-based evaluation of ^{125}I implants would best be performed more early than 1 month after implant. Our data indicate that dose coverage of the prostate was sufficient for the most patients on Days 30.

2055 POSTER

Difference of set up margin between conventional 2-D and CT based 3-D planning in Korean patients with early breast cancer

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Background: In Korea, many breast cancer patients are young (between age 30 to 50 in 50% of patients) and thin comparing to those at western countries. Comparing with conventional tangential field technique, use of CT based 3-D planning is preferred in recent days to reduce the irradiated normal tissue volume.
The purpose of this study is to evaluate the difference between the margins of radiation fields based on conventional 2-D technique and those of CT based 3-D planning.
Materials and Methods: Twenty-five patients with node negative early breast cancer underwent breast conserving surgery between November, 2008 and February, 2009 were selected for preliminary data analysis. We performed both CT based 3-D planning and 2-D planning by conventional breast tangential technique on same patient. In 2-D planning process, the field margins were following: superior margin at base of clavicle, medial margin at body midline, lateral margin at mid-axillary line and inferior margin at 3 cm below the inframammary fold. In 3-D planning, the clinical target volume (CTV) covered all visible glandular breast tissue and the planning target volume (PTV) was obtained with additional 1 cm margin around CTV except skin surface. Both plans were compared for the radiation field margin extents and the irradiated lung volume (average lung volume at D5 Gy (V5), and D20 Gy (V20) and mean lung dose (MLD)).
Results: Age was median 45 years old (range: 31−73 years old). All patients wore AA or A cup size bra and mean body mass index (BMI) was 23.6. The radiation field size was smaller on 3-D planning: mean difference at superior edge of 2.48 cm (0−4.5 cm), at medial edge of 1.57 cm (−1−2.7 cm), at lateral edge of 2.46 cm (0−5.2 cm) and at inferior edge of 2.47 cm (1−4.5 cm). Absolute volume reduction at V5 and V20 and MLD were 4.1%, 3.2% and 3.5% with 3-D planning, respectively.
Conclusions: This study shows that CT based 3-D planning can reduce the radiation field size on each directions for early breast cancer patient. Also, it shows less irradiated lung volume compared with conventional 2-D planning. Based on this data, we plan to continue to accrue more patients.

2056 POSTER

Fundamental study of polaprezinc suppositories in the prevention of acute radiation proctitis in rats

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Purpose: The purpose of this study was to use the rat as an animal model to study the effects of pelvic irradiation on normal rectal tissue and to evaluate the potential radioprotective effects of polaprezinc suppositories.
Materials/Methods: A total of 45 adult female Wister rats were enrolled in this study. Rats were divided into three groups of 15 rats each. Group A was irradiated by a single fraction dose of 22 Gy and medicated with the polaprezinc suppository. Group B was irradiated 22 Gy without any medications. Group C was control group without irradiation and any medications. The rat was taped by the tail so that it hung head down in a vertical position with its back on a lead wall containing a window. Polaprezinc suppositories were prepared with plyethylene glycol bases. Polaprezinc suppositories were inserted into the anus of the rat under ether anesthesia and the anus was closed with elastic tape. The suppository was prescribed every day after radiotherapy during seven days. All rats were evaluated by examination, colonoscopy and histologic evaluation for changes at 2 weeks after irradiation. Colonoscopic findings were scored as follows: 0 = normal mucosa; 1 = edema, mild hyperemia, or decreased vascularity; 2 = diffuse hyperemia, multiple punctuate areas of hemorrhage or, confluent areas of hemorrhage; 3 = presence of erosions or frank hemorrhage; and 4 = ulcers. For histologic evaluation, each specimen was graded as follows: 0 = normal or minor alterations; 1 = slight radiation damage; 2 = mild damage; 3 = moderate damage (must have prominent loss of epithelium, degree of inflammation variable); and 4 = sever damage (ulcers, necrosis).
Results: Colonoscopic scores in Group A ranged from 0 to 2: grade 0: 2, grade 1: 7, grade 2: 1, grade 3: 0. Colonoscopic scores in Group B ranged from 1 to 3: grade 0: 0, grade 1: 1, grade 2: 5, grade 3: 2. The difference between the two groups was statically significant ($p < 0.05$). Histologic scores in Group A ranged from 0 to 2: grade 0: 0, grade 1: 3, grade 2: 7, grade 3: 0. Histologic scores in Group B ranged from 1 to 3: grade 0: 0, grade 1: 1, grade 2: 3, grade 3: 4. Although the tendency of a more critical score of the rat which was not medicated with the polaprezinc suppository was seen, the statistical significant difference was not accepted between the two groups.
Conclusions: In our study, polaprezinc was prepared as a suppository and was administered to rats safely and accurately. The impact of polaprezinc suppository on radiation induced proctitis is under further investigation.

2057 POSTER

Radiotherapy treatment of brain metastases: survival and differences in fractionation

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Background: Radiotherapy is the principal treatment of patients with diagnosed brain metastases. Lung, breast, and digestive tumors are the most frequent cancers that develop metastases. Survival without therapy is very poor. Radiotherapy increases this survival and also improves neurological symptoms. Our aim was analyzing overall survival after radiotherapy in patients with brain metastases. Compare different radiotherapy schedules.
Materials and Methods: The study was made with data of 59 patients (aged between 34−84 years) with brain metastases treated in our deparment in 2006. Radiotherapy was administered with isocentric technique, two lateral fields, total doses: 20−30 Gy, with two main schedules: 3 Gy/fraction in 10 fractions (3×10), 5 patients; and 4 Gy/fraction in 5 fractions (4×5), 52 patients. 2 patients received other schedules.
Results: Overall survival ranged from 0 to 37 months (mean: 6 m; median: 4 m). 44 patients survive <6 m (72%). In 4×5 schedule, mean survival was 5 m (median: 3 m). In 3×10 schedule, mean survival: 14 m (median: 10). Due to the little numbers of patients in group 3×10 we could not compare the two schemes.
Conclusions: In our institution, survival after radiotherapy treatment in patients with cerebral metastases is around 6 months. Further studies with higher number of patients could show differences in survival between different schemes and fractionation.