after irradiation. The images were analyzed visually on a DICOM viewer. Round regions of interest, corresponding to the stereotactically irradiated area and the comparable part of the contralateral lung were delineated on CT images. The ratio of CT values (irradiated part to comparable part of the contralateral normal lung) was calculated for each scanned rabbit lung image. Additionally the ratio after irradiation was divided by the ratio before irradiation and used to compare seven time course variations under the same conditions.
Results: Against expectation, slight changes in the irradiated lung were observed. Localized attenuating opacities suggesting emphysematous change appeared consistently in the irradiated parts of several rabbits 7–14 weeks after irradiation. The findings persisted after the first visualization. In only one rabbit, a localized consolidation was visualized, but the finding vanished in two weeks. The time course curve of the ratios was variable and indicated no significant regularity.
Conclusions: Though the single dose of stereotactic irradiation was high, the sequelae were subtle. At this time, the reason is unclear. Rabbit lung might be more tolerant to acute and subacute radiation effects than human lung.

1429 POSTER

A new collimator insert system for stereotactic irradiation of intracranial lesions

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Background: The objective of this study was to develop a prototype linac-based stereotactic irradiation system for clinical use. All dosimetric parameters were measured in order to be implemented in the Treatment Planning System.
Material and Methods: A new collimator insert system was designed and developed to simulate stereotactic irradiation. 3 cones made of alloy were constructed and mounted to the gantry head of a Siemens MX 6 MV linac to produce circular fields from 1–2.5 cm in diameter. Collimator concentricity test was performed to ensure that the central axis coincides with the isocentre of the treatment unit. Multi profile measurements were made for each cone, along with PDD calculations and other beam parameters such as TMR, off-axis ratios and output factors, to implement in a TPS. For in vivo verification of the planned dose distribution TLD-100 rods and Kodak EDR-2 films were used in a humanoid phantom.
Results: Collimator concentricity test showed a variation of not more than 0.5 mm, which is acceptable for Stereotactic Radiotherapy. All dosimetric parameters examined demonstrate high accuracy in dose distribution for each one of the developed stereotactic cones. Non-coplanar arcs of various angles were performed to indicate that the absorbed dose of organs at risk was in good agreement compared to the dose provided by the TPS.
Conclusions: High reliability and reproducibility of the proposed treatment process was illustrated, in terms of accuracy and dose calculation precision. The treatment of intracranial lesions demands the ability to deliver the necessary dose in a narrowly collimated beam. As a result this method can be clinically applicable when irradiating an intracranial lesion.

1430 POSTER

Analysis of application X-ray radiation up to 250 kV for stereotactic radiosurgery and radiotherapy

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Background: X-ray radiation, when delivered from many directions, seems can be in competition to high energy radiation sources in the case of small targets. To confirm this thesis X-ray device design was proposed and numerical analysis of dose distributions in typical for stereotactic radiation was performed.
Material and methods: X-ray radiation heads with energies 60, 150, 225 kV, and Co-60 point collimated source were simulated Using Monte Carlo code EGS4/Nova. Particle fluency spectra and angle distributions were analyzed and radiation source models, suitable for routing Monte Carlo treatment planning, were created. Dose distributions in the phantom, representing human head with 25 mm diameter asymmetrically located target and 10 mm thickness spherical bone ring, were simulated by Monte Carlo method. As a first step 60 kV X-ray treatment machine, capable to move radiation source along conical trajectory and using wedge filters for dose uniformity, was built. Experimental dose distributions were collected for numerical calculations verification.
Results: Dose distributions in the target vicinity. Bone structure collects high dose at smaller energies. This prevents low energy X-rays application in the presence of bones. At energies 150 kV and high spectrum filtration absorbed dose bone / soft tissue ratio drops to acceptable level. Average dose in normal tissues far a way from target almost do not depend on X-rays energy and is approximately two times higher than in high energy photons, but steel at the acceptable level. In the case of target location near the body surface and especially in lung X-rays have dosimetry advantages. Additional advantages X-rays may have in the presence of radiomodifiers, like high atomic number elements, incorporated in the target. Comparison of Monte Carlo calculations with experimental data for 60 kV radiation unit show agreement within experimental accuracy. At the present time micro MLC for X-ray unit and treatment planning system are in the process of development.
Conclusions: For targets up to 3 cm in diameter X-ray radiation is comparable to high energy radiation sources. Possible application could be treatment of brain diseases, lung metastasis, liver and other targets, located near body surface. Bones, located near the treatment volume restrict X-rays application.

1431 POSTER

Measurement of the exposure dose to the phantom's body for LINAC-based stereotactic radiosurgery

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Introduction: LINAC-based stereotactic radiosurgery (SRS) is an effective therapy not only for malignant tumors, but also for benign tumors or benign disease like AVMs. Therefore, young patients are often treated by SRS. Because non-coplanar beams are used, it is expected that the exposure dose to the patient's body, especially the embryos of pregnant women, is larger in cases of SRS using LINAC than in cases of conventional radiotherapy for intracranial lesions using coplanar beams. We measured the exposure doses in phantom cases and investigated the safety of this treatment in terms of radiation exposure to pregnant women.
Methods: An intracranial point of the human-body-phantom was determined to be the isocenter, and we shot 90-degree rotary irradiation into the isocenter using narrow bean collimators with diameters of 1.25 cm and 4.00 cm. We performed rotary irradiations from 0- to 90-degrees and from 90- to 180-degrees of the gantry rotation, with couch rotations of 0-degrees and 90-degrees. We set a dosimeter on the navel of the phantom and evaluated the exposure doses, first using a 450 MU (5MU/degree) and second using a 900MU (10MU/degree) to the isocenter. For each case we measured the exposure doses three times, and calculated the average.
Results: When shooting 450MU using a 1.25 cm collimator and 0-degree of rotation of the couch, the mean exposure doses on the navel of the phantom with gantry rotations of 0-degrees to 90-degrees and 90-degrees to 180-degrees were 1.32 mGy and 1.26 mGy, respectively. When the couch was rotated 90 degrees, the exposure doses were 4.69mGy, and 4.14mGy, respectively. The exposure doses were 1.2–1.7 times greater when using a 4.00 cm collimator than when using a 1.25 cm collimator in cases in which the couch was rotated 0-degrees. On the other hand, when using a 4.00 cm collimator, when the couch was rotated 90-degrees with 90-degrees to 180-degrees of gantry rotation, the exposure dose was 13.6 mGy, which was 10.8 times greater than when using a 1.25 cm collimator, with the couch rotated 0-degrees with gantry rotations of 0-to 90-degrees. When shooting 900 MU, the exposure doses increased twice as high as when shooting 450 MU.
Conclusions: The exposure dose on the navel was high when the couch was rotated 90-degrees, especially when using large collimators. For treating patients, sometimes more than 450 MU per arch is given. If treatment planning for pregnant women includes 2 arcs with a couch rotation of 90 degrees and −90 degrees, the exposure dose to the embryos may exceed tolerable levels.

1432 POSTER

Hypofractionated stereotactic radiotherapy alone without whole-brain irradiation for patients with solitary and oligo brain metastasis with diameter more than 3.5 cm: a feasible and efficacy alternative

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Purpose: Efficacy, toxicity evaluation of hypofractionated stereotactic radiotherapy (HSRT) using noninvasive fixation of skull on solitary or oligo brain metastatic patients as an alternative to whole brain radiotherapy.
Patients And Methods: The subjects were 24 patients who had 3 or fewer brain metastases (18 solitary, 6 oligometastases)with maximum diameter