SP-0598
Cilengitide in continuous infusion with radio-chemotherapy in stage III NSCLC: A phase I clinical trial
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Introduction: We have previously shown that αvβ3 integrins control radioresistance, hypoxia and angiogenesis and that co-expression of FGF-2 and αvβ3 integrins in the tumors of patients treated with exclusive radio-chemotherapy for stage III non-small lung carcinoma (NSCLC), was associated with a worse local control, suggesting that inhibition of αvβ3 integrin could induce a radiosensitization of such tumors. We designed a phase I trial associating the specific αvβ3/αvβ5 integrin inhibitor Cilengitide with radio-chemotherapy in patients with stage III NSCLC.

Patients and methods: A standard 3+3 dose escalation design was used. Cilengitide was given in continuous infusion starting 2 weeks before and then during the whole course of the radio-chemotherapy (66 Gy combined with a Platine-Navelbine regimen), and then at a dose of 2000 mg twice a week in association with chemotherapy. Planned Cilengitide continuous infusion dose levels were 12, 18, 27 and 40 mg/h. PET-FDG and CT scan were performed before and then after the first two weeks of Cilengitide administration and then 2 months after the end of radio-chemotherapy. Patients were followed by CT scan. Toxicity for DLT was assessed during combined treatment and until 1 month after. Clinical response on CT scan and TEP was evaluated according to RECIST and PERCIST criteria.

Results: Fourteen patients were included between March 2010 and July 2013. Eleven patients were evaluable for DLT. No DLT was observed at level 0, 1 and 2. One DLT, a tracheo-bronchial fistula was reported at the 40 mg/h dose. No relevant adverse event related to Cilengitide (7 grade 1 and one grade 2) was observed on the whole population. Among 11 patients evaluable for efficacy, 9 patients presented a partial response and 2 a stable disease. At 12 months after the end of radio-chemotherapy, 4 patients presented a progressive disease. At PET evaluation 2 months after radio-chemotherapy, 4 patients had a complete response and 4 patients had a partial response.

Conclusion: Cilengitide given continuously with radio-chemotherapy was well tolerated and shows encouraging clinical results, suggesting that targeting αvβ3 integrin continuously during radio-chemotherapy in NSCLC is a promising approach to treat this disease.

SP-0599
Commissioning and QA of skin electronic brachytherapy applicators
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Moulds and Flaps are typically used on superficial skin brachytherapy for Planning Target Volume (PTV) up to 5 mm depth. In the cases of small and flat PTV, the use of superficial skin Applicators is an efficient solution because they shield the surrounding healthy tissues. In contrast to electrons beams applications (where bolus and specific dosimetry is required), treatment planning and delivery is simpler. There are radionuclide-based HDR Ir-192 Applicators, as the Leipzig (Varian and Elekta) and Valencia (Elekta) ones. The Valencia Applicators are a modification of the Leipzig ones where a flattening filter has been added. Consequently, lateral homogeneity, penumbra, and useful beam are improved. However treatment time becomes longer.

The electronic HDR brachytherapy surface applicators offer an alternative to external beam electrons and HDR radionuclide brachytherapy modalities. There are currently two systems being used clinically: Soft Axent® (iCAD) with 50 kVp which has been in use since 2009 , and Esteya® (Elekta) with 69.5 kVp which has been released in 2014. We will discuss in this presentation our experience with the Esteya Unit, regarding commissioning, QA and clinical implementation. Esteya is a new brachytherapy Unit designed to obtain dose distributions similar to Valencia App with an X-ray source of 69.5 kVp. It has an adjustable arm and a set of interchangeable circular applicators of different diameters (10 mm, 15 mm, 20 mm, 25 mm, and 30 mm). Once overall absorbed dose, number of fractions, prescription depth and applicator size are selected in the console treatment planning system, the system presents automatically the treatment time. Compared with the Valencia Applicators there are improvements in penumbra, treatment time, gradient on PTV and leakage.

The following aspects of commissioning will be discussed on this presentation:

- Timer: Reproducibility, accuracy and linearity (combined with mA)
- Flatness, symmetry and penumbra: Using radiochromic films and high spatial resolution array SR51000 (PTW, Germany)
- HVL: Diode vs. ionization chamber detectors. Comparison of different set-ups
Absolute dose rate: Comparison of results and uncertainty analysis of a) using a chamber calibrated in air (A-20 from Standard Imaging calibrated on ADCL Wisconsin, USA) following the AAPM TG-61 protocol, and b) using a parallel plate chamber calibrated in water (TM34013 from PTW calibrated on PTW, Germany) following the IAEA TRS-398 protocol.

PDD: Using the parallel plate chamber on solid water.

Leakage: Measurements at different levels with the primary beam blocked.

The Esteya includes a specially designed QA tool that is connected to the exit of the X-ray tube. Each treatment day it is mandatory to perform a QA test before the first patient can be treated. This tool is composed of 26 diodes placed in two parallel planes, which are used to evaluate the output, flatness and percentage dose depth curve constancy at the same time. After the QA plan has been irradiated, the equipment console automatically shows the comparison with the reference values. Only if results are below an established tolerance level, the system allows patients to be treated. In addition, within a monthly basis, flatness, symmetry, penumbra, output and PDD are evaluated with film or high resolution array and parallel plate chamber on solid water.

Finally, the following clinical implementation aspects will be presented and discussed: depth evaluation (using High Frequency Ultrasound), margins and applicator selection, patient marking, patient set-up and treatment time calculation.

SP-0600
Reference and relative dosimetry for kV x-rays in radiotherapy
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Background/Objective: Low and medium energy (kV) x-ray radiotherapy beams are still widely used for treatment, particularly for skin cancers and other relatively shallow lesions, and also more recently for ‘electronic brachytherapy’ (Perez-Calatayud, this session). Historically, kV beams have been used widely for radiobiology and related experiments, the results of which have been used to inform clinical radiotherapy practice, although the dosimetry has often been on less solid foundations than radiotherapy dosimetry. In the last ten years or so, since the increasingly wide availability of kV image guidance systems on clinical linacs, there has been a growing need for clear recommendations on kV beam dosimetry for these systems, where practical approaches have been developed which draw on both diagnostic radiology dosimetry and kV therapy beam dosimetry and with significant contribution from MC modelling (Ding, this session). Recently too, kV applications relevant to radiotherapy delivery accuracy and IGRT has become the new paradigm for patient positioning and target localization. Daily imaging procedures also add additional dose to the patients’ normal tissues. Knowledge of radiation dose resulting from a kV-CBCT scan and kV radiograph imaging procedures is important for clinicians in making informed decisions for treatment management and risk/benefit analysis.

Purpose: The purpose of this presentation is
1) To describe the Monte Carlo simulation technique to generate kV beams from x-ray sources that are integrated to a radiotherapy treatment unit;
2) To show the beam characteristics of kV beams used in image guidance procedures;
3) To present the techniques to calculate dose to patients from kV-CBCT scans and kV radiograph imaging procedures by using the simulated kV beams;
4) To give overview of Radiation dose to patients resulting from typical image-guided procedures;
5) To discuss methods of managing and accounting for imaging guidance doses to radiotherapy patients.

Methods and Materials: Although new model based calculation algorithms are being developed for model the radiation dose from low-energy x-ray beams, the Monte Carlo