Material and Method: This work was carried out with MCNP and Geant4 codes. The 10x10x10 cm3 cubic water phantom and a tumor region with a size of 1x1x1 cm3 were simulated. Factors such as different concentrations and GNP sizes were implemented into the simulation, so as to obtain the optimum results, specifying the maximum absorbed dose within the tumor while sparing healthy tissue. In a certain concentration, different sizes of GNPs including 30, 50, 70 and 100 nm were defined within the tumor and the absorbed dose by the GNPs-loaded tumor were calculated for different sizes. Similarly, the absorbed dose was calculated for different concentrations of 7, 10, 18 and 30 (mg Au/ gram of tumor) in a certain size of GNPs. The dose enhancement factor which is defined as the ratio of the absorbed dose by the tumor in the presence of nanoparticles to the absorbed dose by the same organ in the absence of nanoparticles was estimated for different concentrations and sizes of GNPs.
Results and Conclusion: The calculations show results for different sizes and concentrations and a comparison is made between the two Monte Carlo codes (MCNP and Geant4). In a certain diameter of GNPs the higher concentration made more increase in absorbed does by the tumor. In a certain concentration, higher size of GNPs made higher absorbed dose by the tumor. Given the fact that therapeutic applications of GNPs in acquiring the proper DEF have demanded much attention in recent years, defining the proper size and concentration would be considered extremely vital for pre-treatment plans.

Keywords: Geant4, Size and Dimension, GNPs, Radiotherapy

199

Therapeutical Dose to Thyroid Remnants Determination for Low-risk Thyroid Carcinoma Patient Treated with rhTSH and 1.1 GBq 131I

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Purpose: Aim of this study was to investigate, practically prove contribution, and verify dosimetry possibilities for low-risk patients (rhTSH stimulation and 1.1 GBq 131I administration) undergoing first Radioiodine therapy (RAIT). Furthermore, it was intended to verify whether the administered activity deliver sufficient dose to thyroid remnants so it can be called "thyreo-ablative".
Materials and methods: Siemens Symbia S gamma camera was used for quantitative imaging of 131I accumulation in remnants of patients thyroid and 131I accumulating nods. Vials with known activity of 131I were used to calibrate the system. Verification of activity determination was done by measuring the vial together with patient for comparison, if necessary. All of the patient-volunteers were around 3 months after thyreoablation due to thyroid carcinoma. As a low-risk indicated patients, they were prepared by injections of rhTSH during two days before therapy. Weight of the accumulating remnants or nods was established using ultrasound, if visible or roughly estimated using phantom measurements causing serious uncertainties.
17 patients (15 women, 2 men) participating the study undergone up to 6 quantitative imaging by the gamma camera during 70 hours after administration. Minimum of the gamma camera examination was 4. General time schedule of examination was 5, 24, 30, 48, 70 hours after administration.

Results: Absorbed doses within remnants or nodes vary from tens of Gy up to several hundred Gy with uncertainty from 25% up to 100% depending mainly on mass of the remnants estimation. For 5 of the patient the administered therapeutic activity caused absorbed dose which was considered to be rather insufficient in terms of thyreo-elimination (at least for one of accumulating remnants). For 4 patients the absorbed dose was considered to be particularly thyreo-eliminative. Measurements for 5 patients confirmed thyreo-eliminative dose and in case of 3 patients no accumulation was detected. Consequent follow-up for all patients is being done.
Conclusions: Though in nearly 30% of all patients absorbed dose did not reach 300 Gy in thyroid remnants and 80 Gy in nods, due to low-risk staging it is probable that the treatment was successful. However, it is necessary to do consequent follow up and include all data for annual treatment evaluation. Based on the results appropriate grant for further investigation will be seek out.

Keywords: dosimetry, iodine therapy, 1.1 GBq

200

Augmented reality supporting innovation and accuracy in advanced radiation therapy facilities

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Purpose: Particle therapy cancer treatments require a work flow that involve several professional figures, working with a complex hardware and software set up. Each professional role needs access to a considerable set of information in the everyday clinical practice. In particular quality assurance protocols demand checking a sensible amount of data.
The drawback is that often required information are physically accessible outside the treatment room, being distributed on several computer in different places.
Integrate and display needed information in an organic and easily accessible way can speed up the clinical practice, reducing potential time loss and providing a better continuous quality control.
Methods: We propose an innovative tool based on Augmented Reality (AR). In AR a view of the physical world is augmented with computer generated elements. Our AR tool could be installed on a modern mobile device, a tablet or a cellphone. Users gets information in real-time about any equipment in the *treatment room* simply pointing the device at it.
The AR client recognizes medical equipment using the device camera, then gathers corresponding information from a cloud server, where all data stored.
The access to the data server is secured with different level of privileges: a user can visualize and use only predetermined kind of relevant information, according to his role. Moreover, all information related to the patient and the medical environment are hosted in a private cloud, not accessible without proper authentication.
Results: We present a prototype of AR application for particle therapy centre that improves and speeds up the whole work flow, making the access to information easier and more centralized.
Here we present a three different use cases that illustrate the use of our AR application: medical doctor, medical physicists and technical engineer.
Conclusion: Augmented Reality is the perfect candidate to help healthcare organizations make their existing processes more precise and efficient. Using AR tools, useful information can be provided and related in real-time to the specific need of the different systematic tasks that are daily checked accurately in an advance radiation therapy facility.

Keywords: e-heathcare, augmented reality, particle therapy

201

Manufacturing and Nuclear Medicine Applications of the Novel Isotope Sn-117m

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Sn-117m has unique characteristics that make it ideal for a variety of nuclear medicine applications. The $t_{1/2}$=14d isotope emits a primary 159 keV imaging photon (86%) that is easily detectable with any SPECT camera system. The accompanying mono-energetic conversion electrons (~140 keV; 110%) have a therapeutic effect limited to a range of ~300 µm which also minimizes any shipping and handling issues. Together these characteristics make this theranostic