Contribution ID: **27** Type: **poster**

Challenges in radiotherapy planning: dose verification in the vicinity of the border of tissue-prosthesis medium

Tuesday, 25 June 2019 13:30 (1h 30m)

The success or failure of radiotherapy largely depends on the accuracy with which the dose will be delivered to a specific volume in the patient's body. In many cases, a change in dose by 3-4% may cause failure of the treatment. Both national and international guidelines on coherence and accuracy in ionizing radiation dosimetry are focused on homogeneous media (i.e. water), however, the human body is composed of elements of a high diversity in electron density (bones, lungs, teeth, muscles) [1]. It became frequent that apart from natural heterogeneous structures, many of patients have artificial elements, i.e. hip prostheses, surgical rods, stents or dental fillings.

One of the problems associated with radiotherapy planning for patients with endoprostheses (mainly the hip) is the inaccuracy of the algorithm calculating the dose distribution in the treatment planning system for the area in the vicinity of the border of tissue-prosthesis medium. Due to the use of high-energy ionizing radiation, during the treatment of patients with hip joint prosthesis, the dose delivered during the therapy session may be significantly different compared to the treatment plan. This is related to the change in the amount of energy deposited in the structure of irradiated organs. The change usually manifests by the dose reduction. This is due to the phenomena known as beam hardening by a high-density metal element and secondary build-up of the dose at the border of the medium (secondary build-up), resulting in an increase of the dose at the border of the medium, giving up to 20% [2]. Such a large change in energy deposited in the tissues of treated patients may lead to skeletal changes (leading to fractures in the hip joint) or even necrosis and weakening of the fixation of the implant.

To verify the dose of ionizing radiation a phantom filled with water (soft tissue equivalent) was used with the bone elements (imitating hip joint) and metallic and ceramic (hip joint endoprostheses) placed in the stand. On acetabulum surface, thermoluminescent microdosimeters (TLD) based on lithium fluoride (LiF) and Gafchromic EBT were placed. The first irradiation by medical linear accelerator was performed and the dosimeters are under readout procedure.

REFERENCES

[1]. Malicki J.,Ślosarek K., 2016. Planowanie leczenia i dozymetria w radioterapii. Tom I, Gdańsk, ISBN: 9788365672292

[2]. Reft C, Alecu R, Das IJ, Gerbi BJ, Keall P, Lief E, Mijnheer BJ, Papanikolaou N, Sibata C, Van Dyk J. 2003. Dosimetricconsiderations for patients with HIP prosthesesundergoingpelvicirradiation. Report of the AAPM RadiationTherapyCommitteeTaskGroup 63 MedPhys. 30(6).1162-82.

Primary author: KIEŁTYKA, Bartosz (Marian Smoluchowski Institute of Physics, Jagiellonian University in Krakow, Poland)

Co-authors: Dr KISIELEWICZ, Kamil (Centre of Oncology, Maria Sklodowska-Curie Memorial Institute, Krakow Branch, Poland); Mrs RAWOJĆ, Kamila (University Hospital in Krakow, Department of Endocrinology, Nuclear Medicine Unit, Poland); Prof. STANEK, Jan (Marian Smoluchowski Institute of Physics, Jagiellonian University in Krakow, Poland)

Presenter: KIEŁTYKA, Bartosz (Marian Smoluchowski Institute of Physics, Jagiellonian University in Krakow, Poland)

Session Classification: Poster session