

ABSTRACT

Cervical cancer is the third most common cancer in women worldwide. The standard radiotherapy treatment for pelvic tumours is based on irradiating a large section of the body covering the affected area. Pelvic radiotherapy is associated with severe late gastrointestinal and genitourinary toxicity. Adaptive radiotherapy allows for daily dose optimisation, adaptation to current anatomical deformation or changes in tumour volume, and correction of random or systematic positioning uncertainties.

The topic of this dissertation is to investigate the feasibility of using an alternative adaptive radiotherapy procedure in pelvic cancer using a developed phantom. I carried out the research based on the available traditional therapeutic pathway, i.e. treatment planning CT, treatment planning system, cone beam CT and dosimetric apparatus in the Radiotherapy Department of the Opole Oncology Centre in Opole. In addition, in this study, I analysed the distributions of dose fluence, in the volume of the target area and critical organs, in terms of the changing volume of critical organs. I carried out the measurements using a 3D-printed handcrafted phantom created for this purpose in cooperation with the Department of Computer Science of the Opole University of Technology.

I carried out the research in stages. I determined and checked the shape and convergence of the calibration curves of electron/mass density and Hounsfield number for the CT scanner, RayStation and Monaco treatment planning systems, and for the CBCT cone beam tomography image of the Gammex phantom and my handcrafted phantom. I analysed twelve treatment plans prepared for two therapeutic regimens commonly used in the treatment of gynaecological tumours with radiotherapy and carried out their dosimetric verification using the MiniMatriXX detector and two programs EPIbeam and EPIgray.

My objectives were met and the phantom I built allowed me to simulate the treatment adaptation process and its dosimetric verification. The results obtained allowed me to propose an alternative procedure for radiotherapy of gynaecological tumours using the traditional therapeutic pathway commonly available in radiotherapy facilities.