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The use of x-ray volume imaging system for verification of the positioning accuracy during stereotactic radiotherapy of the head and lungs

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The aim of this study was to analyzed the differences between the reconstruction of the patient's anatomy in the therapeutic area, performed with the use of the X-ray Volume Imaging system (XVI) of the Elekta system, and the actual patient positioning. The results obtained from the cone beam tomography (CBCT) performed twice (before and after irradiation) were compared with the reference images from computed tomography (CT) obtained during the treatment planning.

The comparison was made for two groups: 20 patients irradiated in the head area and 45 patients irradiated in the lung area. The results were analyzed in three steps. The first was the analysis of data using the Student's t-test for one sample. It consisted in assessing whether the mean values of the isocenter shift implemented in relation to the isocentre planned in the direction of X, Y, Z for the studied patients are statistically significantly different from 0. Then the data were analyzed using the Student's t-test for paired samples. It was done to check whether the mean values of the isocenter shift realized in relation to the isocentre planned in the X, Y, Z directions for the studied patients before irradiation are statistically significantly different from the mean values of the shift for the studied patients after irradiation. The third stage of the analysis of the results originating from the XVI system was the calculation of population systematic and random errors in order to calculate the CTV-PTV margins according to the van Herk method. The practical part of this work was carried out in cooperation with the Department of Radiotherapy for Children and Adults of the University Children's Hospital in Krakow.

Analysis of obtained data confirmed the high precision of radiotherapeutics procedures performed at the Department of Radiotherapy for Children and Adults, University Children's Hospital in Krakow. Moreover, the effectiveness of XVI system in set-up margins reduction was confirmed.

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