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EFFECT OF PATIENT POSITIONING IN THREE-DIMENSIONAL CONFORMAL RADIOTHERAPY FOR CARCINOMA IN THORAX REGION

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In radiotherapy, it is mandatory to maintain the patient at the original setup position to deliver accurate dose to the tumour and reduce dose to normal tissues. However, there may be slight deviations in patient position due to random and systematic errors. The impact of patient positioning deviations in Three-Dimensional Conformal Radiotherapy (3DCRT) for carcinoma in the thorax region and possible solutions to decrease these deviations are discussed in this research. A thorax phantom was used to simulate the thorax region and Computed Tomography (CT) scan of it was taken. Then Clinical Target Volume (CTV) and Organs at Risk (OAR) were contoured using computerized Treatment Planning System (TPS). Planning Target Volume (PTV) was contoured by symmetrically expanding the CTV by 1 cm. Three radiation beams were introduced such that PTV is covered by 95% to 107% isodose lines and OAR are below their tolerance dose limits. Monitor units (MU) for each beam and calculated dose to PTV, lungs and spinal cord reference points for the original setup position were recorded according to the TPS. Then the thorax phantom was set up on the linear accelerator treatment couch with an ionization chamber and electrometer to measure the absolute dose to each reference point. After that, the couch was moved to different positions by 1 cm to simulate the setup error and absolute dose to each reference point at each movement was measured. Percentage deviations between the calculated dose and measured dose were calculated. Agreement criteria for percentage deviation were taken as ± 2%, ± 4% and ± 3% for tissue, air and bone respectively. The results showed that the PTV reference point dose, lung reference point doses and spinal cord reference point dose deviate from the agreement criteria for some movements of the phantom. However, Dose Volume Histograms (DVH) for each movement of the phantom revealed that 99% volume of the CTV was always covered by at least 95% isodose line and OAR doses were always within their tolerance limits. Considering these findings, it is concluded that setup variations, which are similar to or less than the size of 1 cm PTV margin from the original setup position in any direction is acceptable to proceed with the radiation treatment.

Keywords: Patient positioning errors, PTV margin, Three-dimensional conformal radiotherapy