

In this thesis, Primary objective was to verify the radiation doses calculated in the treatment planning system (TPS) and measured in the phantom at locations corresponding to the organs at risk (OARs), present in thoracic body cavity of the patient with EBT3 Radio chromic film dosimeter, an experimental study. To execute this study for thoracic site of the human body, a tissue equivalent phantom was designed and fabricated, where tissue substitute find out with similar density for lung, bone and soft tissue were used. To design the phantom, fifteen patients were randomly selected who already received endobronchial brachytherapy (EBBT) treatment and analyzed their CT image data for measuring the dimensions of organs at risk in three dimension within the thoracic cavity, average values were used. The designed phantom was fabricated locally and verified physically. CT scan of the Phantom acquired and treatment plan was made in the TPS. EBT3 film calibration was carried out on TrueBeam Linear Accelerator and find out the Film calibration curve. The TPS made treatment plan was executed on the HDR Machine with EBT3 films placed at desired location in the phantom. The irradiated films were scanned in flatbed scanner and analyzed with software to find out the doses measured in the films. The doses calculated by TPS and measured in the phantom were compared and found that the measured doses in phantom were higher to OARs Heart, Esophagus, Pulmonary trunk & coronary artery and lower to spinal cord, descending aorta, Ipsilateral Lung, Ipsilateral lung (2cm depth) & contra lateral lung from the TPS calculated doses.

The percentage variation between the doses calculated and measured in the tissue equivalent phantom at different OARs locations was <10%, which infers TPS underestimate the dose to Esophagus, spinal cord, target top and overestimate the

dose for Ipsilateral lung where the distance between source and film at the surface of esophagus, spinal cord, target top and Ipsilateral lung was 1.5cm, 3.0cm, 1.5cm and 1.5cm respectively.

The distance between source and the film position at the surface of Ascending aorta & pulmonary trunk (AAPT), coronary artery (CA), descending aorta (DA), heart (H), Ipsilateral Lung (IL) (2cm depth) & target tip (TT) OARs were 5.5cm, 4.5cm, 3.0cm, 2.5cm, 3.5cm & 0.5cm respectively. The percentage variation was <15%, where TPS overestimate the dose for AAPT, CA, IL (2cm) and underestimate for DA, H & TT.

The distance from source to the film position at surface of contra-lateral lung (CL), sternum and target Tip (TT) (1cm) were 4.5cm, 8.5cm & 1.5cm respectively. The percentage variation was <20%, where TPS overestimate the doses to CL & Sternum and underestimate the doses to TT 1cm film position.

It implies that at the lower distances between source and point of measurement the dose variation was less and as the distance increases the percentage variation increases. At some positions the air inhomogeneity affects the doses either at lesser or far distances from the source.

The doses measured in phantom were obtained from three points corresponding to dose point in TPS for each organ at risk. Further dosimetry was done to find out the doses at five positions on same film dosimeters for organs at risk i. e. Ipsilateral Lung, Heart, Spinal cord, esophagus, coronary artery, descending aorta, Ipsilateral lung 2cm, Contralateral Lung and target tip 1cm. The variation between the film

measured and TPS calculated dose values was found out with respect to OARs distance from the source.

The variation in the doses to organs at risk measured in phantom and calculated in TPS was found due to the dose calculation algorithm in TPS which implies that the quality assurance of the treatment plans to verify TPS and delivery system is very important. The locally fabricated tissue equivalent phantom is useful for the treatment plan verification in brachytherapy and cost effective.

The endobronchial thorax phantom is basically designed to verify the treatment plan of a patient in HDR Intraluminal brachytherapy. The first EBBT session plan verification of a patient with phantom can be used as a guide in obtaining or generating an optimized treatment plan for remaining sessions of the patient. Hence this phantom will be useful in accurate treatment plan delivery and improve the quality of life of the patient. It will be utilized as a quality assurance tool to verify the brachytherapy treatment plan at the Brachytherapy machine with radiochromic film dosimeter.

Secondary objective-I was on the dosimetric and volumetric analysis in the carcinoma lung patients treated with the endobronchial brachytherapy, an observational study. The doses to OARs were analyzed and found the average mean and maximum dose to Esophagus, Heart and average maximum dose to Contralateral Lung, Coronary artery, Spinal cord, Descending Aorta and Trachea were high in left lung carcinoma compared to right lung carcinoma patients. The target volume (TV) in all EBBT sessions were average out and found it was around 22cc, therefore all sessions were divided in two group TV >22cc and TV <22cc for analysis purpose. The effect of TV on doses to OAR's were significantly differ in

the group TV>22cc among left and right-side tumor lesions whereas no significant difference was found in the doses to OARs in the group TV<22cc among left and right-side tumor lesion patients.

Secondary Objective study-II was to evaluate the target volume variation effect in the EBBT of lung carcinoma patients in treatment planning system. It was also found that the volume of the target reduces from first session to third session of EBBT. The doses to organs at risk in EBBT is affected by the tumor site, location and target volume in bronchial region so these factors can be considered for the patient selection for EBBT treatment.

The OARs doses were found higher in the left bronchus lesion compared to the right bronchus lesion. The difference between the left and right lung carcinoma patient's OARs doses was having significant variation among the two groups created for tumor site.

The effect of tumor location on the OARs doses in left and right lung was analyzed in the carcinoma lung patients who were divided in two groups, lower and middle lower bronchial lesion in the lung. The doses to OARs in the subgroup middle-lower bronchial region were higher compared to lower bronchial region. It is observed from this study that the volume reduced from first to third EBBT session therefore EBBT can be adopted as fast pain relief treatment option with palliative intent.

The Conformity index (CI) of the 3rd EBBT session plan is better than 1st EBBT session plan. It is correlated with volume variation of the target from first session to third session where coverage of the target volume increased for small volume compared to large volume tumors.

The CT scan of the patient in first EBBT session can be made base line for the remaining treatment sessions. In the first CT scan we have information about the tumor location, tumor site and volume of the target so we can plan for reducing the doses to the OARs with adequate target coverage with prescribed dose in the remaining EBBT sessions of each patient.