

Purpose: To study the relationship between percentage coverage of planning target volume (PTV) in prostate cancer IMRT and dose received by normal critical structures

Method and Materials: Five patients with early stage prostate cancer were selected for this retrospective planning study. For 4 of 5 patients, PTV contains clinical target volume (CTV), which is the prostate gland, plus 0.8 cm uniform margin. For the fifth patient, PTV is formed by expanding CTV (prostate plus 1 cm proximal seminal vesicle) with 0.8 cm uniform margin. The prescription is 74 Gy for the first four patients and 79.2 Gy (last patient) prescribed to 95% iso dose line and dose normalization is to isocenter. For each patient, seven different plans were generated using Varian Eclipse treatment planning system version 8.1 for 18 MV photon beams from Varian 2100C: one 6-field conformal plan and six 7-field IMRT plans with PTV volume coverage ranging from 99.5% to 95%. IMRT plans were optimized by iterations to reach the targeted coverage of PTV.

Results: A linear correlation between the volume receiving 70 Gy in percentage or cc and PTV volume coverage from 99.5% to 95% has been found for both bladder and rectum with R^2 better than 0.95 for bladder and 0.91 for rectum for the first four patients. A generalized relationship can be written as $V_{70}(cc) = k * PTV(\%) + b$ (1). All patients have a similar linear slope for bladder (average slope is 0.867 ± 0.083 (SD)) and a slightly different slope for rectum (average slope is 0.545 ± 0.230 (SD)). In equation (1), interception b is dependant of structure volume (bladder and rectum).

Conclusions: Volume received 70 Gy by bladder and rectum in IMRT plans for prostate as CTV may have a linear relationship with PTV coverage ranging from 99.5% to 95%. One may use this relationship to guide in treatment planning process.