

VALIDITY OF PRV MARGINS AROUND LUNG AND HEART DURING LEFT BREAST IRRADIATION

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Abstract – Purpose: Planning organ at risk volumes (PRV) has a minor use in radiotherapy treatment planning. During left breast irradiation two critical volumes are of special importance – the lung and the heart. The aim of this study was to evaluate the changes in volume doses after adding appropriate margins around these organs at risk and compare them with the effect that the systematic positioning error has on the volume doses.

Methods: Treatment plans for 44 patients with left breast cancer were analyzed. Two changes for each plan were made, and dose-volume histogram values for hearts and lungs volumes were recorded. In the first case margins of 5 mm to hearts and lungs were added. Volumes that were enclosed by 30% isodose for hearts and volumes that were enclosed by 20% isodose of lungs were recorded. In the second case plans were made with a systematic error of 5 mm employed, depicting a translation of isocenter posterior and to the right. In this second case, monitor units were taken from the original plan. The critical volumes for hearts and lungs were recorded as in the first case.

Results: Our policy for breast cancer irradiation demands that the lung volume receiving 20 Gy should be kept under 25% of the whole left-lung volume, and no more than 10% of the heart volume should receive more than 30 Gy. The first case simulation showed that 23% of the patients have a heart overdose while 11% of them have a lung overdose according to the criteria above. Simulation of the second kind showed that the systematic error in isocenter positioning of 5 mm gives bigger a volume of the heart (in average 0.69% of heart volume) to be enclosed in critical isodose than in PRV case. For the lung the situation was opposite; namely in PRV case the lung volume that is encompassed with critical isodose is greater (in average 1.47% of lung volume) than in a case of displaced isocenter.

Conclusions: Adding PRV margins around the heart and the lung does not give straightforward and unambiguous result for the degree of irradiation of these critical organs. Several organs at risk are overlapping esophagus and this situation restricts the use of the PRV concept. Nevertheless, a method with displaced isocenter can reveal some potential risk of overdosage of these critical structures guiding the planner towards making a new plan in order to lower the dose to the OARs.