

Impact of increasing number of beams on heart dose-distribution in left-sided breast irradiation using intensity-modulated radiotherapy treatment modality

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Abstract :

Breast cancer has been a common malignancy in women. It is a fast growing disease across the globe, particularly in developed world. Radiotherapy plays an important role in the treatment of breast cancer specifically in breast conserving therapy. Breast conserving surgery followed by adjuvant radiation therapy of the remaining breast tissues results as the same survival rate as radical breast surgery. The aim of this study was to find out impacts of increasing number of beams on cardiac dose-distribution in Intensity-Modulated Radiotherapy treatment modality.

For this study 20 patients were selected of age ranging from 31 to 82 years mean age 49- years, diagnosed with left-sided breast cancer including supra-clavicular fossa in few cases. For planning target volume, the dose was prescribed as 40.05Gy in 15 fractions (2.67 Gy per fraction) for all patients. Plans were optimized to achieve 95% dose coverage (of prescribed dose) to 95% volume of planning target volume. The central area of this study was to analyze cardiac dose-distribution while irradiating left-sided breast using Intensity-Modulated Radiotherapy. For this purpose, 20 patients diagnosed with left breast cancer were selected randomly. This may be concluded that increasing number of beams (7-11 Beams) in Intensity-Modulated Radiotherapy technique plays an effective role in reducing high dose volume of the heart.

1. Introduction: Breast cancer has been a common malignancy in women. Radiotherapy plays an important role in the treatment of breast cancer particularly in breast conserving therapy. Nowadays, several techniques are available in radiotherapy to deliver the dose safely to the target with minimal damage of surrounding normal organs. Recently introduced the accelerated partial breast irradiation (APBI) technique is an alternative treatment modality for selected cancer patients with early stage breast cancer. Moreover, Intensity-Modulated Radiotherapy (IMRT) has advantage of dose conformity and homogeneity as compared with three-dimensional (3D-CRT) techniques

with more sparing effect of organs at risk [3-9]. Half beam block (HBB) technique has also been very useful in terms of sparing the underlying lung and heart while irradiating left-sided breast. In many cases, breast cancer requires multimodal treatment such as surgery, chemotherapy followed by radiotherapy. However, apart from beneficial effects of radiotherapy, irradiation may cause detrimental side effects on normal tissue. Specifically, ipsi-lateral lung and heart with coronary vessels receive significant radiation dose.

A large number of reputed journals across the globe have recently reported on increasing rate of coronary events and cardiac mortality as a result of cardiac radiation dose received during left-sided breast irradiation.

In order to reduce dose to normal organs as low as possible, many techniques have been developed with the aim to increase conformity and homogeneity of dose to tumor and simultaneously sparing the organs at risk. Several literatures have been reported that post-operative radiotherapy (PORT) significantly reduce the rate of local recurrence and improve the long-term survival rate on the cost of morbidity of heart and ipsi-lateral lung [21-24]. In left- breast irradiation, heart is one of the most important organs which remains at risk, and causes rise of contingency of cardiac mortality.

2. Aim: The aim of this study was to find out impacts of increasing number of beams on heart dose-distribution while irradiating left-sided breast using IMRT treatment modality.

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