Voluntary inspiration breath-hold for left sided breast irradiation: Heart and lung doses; Dosimetric comparison with free respiration Three-Dimensional Conformal Radiotherapy

Amr Abdelaziz[1]; Azza Helal[2]

(1) *Clinical Oncology Department, Faculty of Medicine, Alexandria University*
(2) *Medical Physics Unit, Diagnostic Imaging Department, Faculty of Medicine, Alexandria University*

PAJO, December 2011, 4(4): 14-18

Abstract

Introduction: Radiation is widely used to prevent recurrences for breast cancer and so it is quite effective to decrease breast cancer mortality. But it has shown that radiation increases the risk of heart and lung diseases so increases their mortality. This is more common in the left sided breast cancer patients. The mean cardiac dose of a left-sided breast cancer can be two or three times that for a right-sided breast cancer and the mean ipsilateral lung dose can be two or three times the mean contralateral lung dose. Various approaches have been taken to reduce the dose to heart and lung during breast irradiation. These methods include 3D dose planning, inclusion of an electron field, proton therapy, intensity-modulated radiation therapy (IMRT), respiratory gating, and deep inspiration breath-hold. All these methods have proven to reduce the dose to the heart to relatively low levels without compromising PTV coverage.

Purpose: The aim of this study is to investigate the role of deep inspiration breath-hold to reduce heart and lung dose for left-sided breast cancer treatment using tangential fields and to compare the dose to heart and lung with free respiration technique.

Methods: A computed tomography (CT) simulation is performed for 10 patients with left sided breast cancer with the patient supine in breast board with arms above the head. Each patient will have two scans; free breathing and voluntary deep inspiration breath-hold scan. The clinical breast borders are outlined with radiopaque markers. The CT data will be transferred to CMS treatment planning system (Xio, Germany). All required structures are contoured. They include the PTV which is defined as the breast borders excluding the first 5 mm of tissue under the skin. The heart and both lungs are contoured. The heart is contoured starting just below the branches of the pulmonary trunk to the most inferior part of the heart near the diaphragm. All CT scans will be planned, calculated and treated with a 6 MV photon beam on a Primus linear accelerator (Siemens, Germany). Optimized plans are carried out using medial & lateral wedged tangential photon fields to encompass the breast volume. The dose of 45Gy in 20 fractions is prescribed to the isocenter which is placed at the center of the PTV. The dose is normalized to a point two thirds the perpendicular distance from the skin to the posterior border of the field at mid-separation on isocenter slice. The coverage of PTV is evaluated using the dose to 95% of the planning target volume (D95%). Sparing of the lung and the heart are assessed using the volume of lungs that receives 20Gy (V20Gy) and the volume of the heart that receives 2.5Gy, 5Gy, 10Gy and 20Gy (V2.5 Gy, V5 Gy, V10 Gy, V20 Gy). The dose to 5% of heart volume (D5%) and mean heart dose are also recorded for all plans. All plans during free respiration and breath hold techniques are compared and analyzed statistically. Consent was obtained from all participating patients.