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Technical note

Comparison of set-up errors by breast size on wing board by portal imaging☆

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ABSTRACT

Aim: To quantify and compare setup errors between small and large breast patients undergoing intact breast radiotherapy.

Methods: 20 patients were inducted. 10 small/moderate size breast in arm I and 10 large breast in arm II. Two orthogonal and one lateral tangent portal images (PIs) were obtained and analyzed for systematic (Σ) and random (σ) errors. Effect of no action level (NAL) was also evaluated retrospectively.

Results: 142 PIs were analyzed. Σ(mm) was 3.2 versus 6.7 ($p = 0.41$) in the mediolateral (ML) direction, 2.1 versus 2.9 ($p = 0.06$) in the craniocaudal (CC) and 2.2 versus 3.6 ($p = 0.08$) in the anteroposterior (AP) direction in small and large breast, respectively. σ(mm) was 3.0, 3.3 and 3.3 for small breast and 4.1, 3.7 and 3.2 for large breast in the ML, CC and AP direction ($p = 0.07$, 0.86, 0.37), respectively. 3 D Σ(mm) was 2.7 versus 4.2 ($p = 0.01$) and σ(mm) was 2.5 versus 3.2 ($p = 0.14$) in arm I and II, respectively. The standard deviation (SD) of variations (mm) in breast contour depicted by central lung distance (CLD) was 5.9 versus 7.4 ($p < 0.001$), central flash distance (CFD) 6.6 versus 10.5 ($p = 0.002$), inferior central margin (ICM) 4 versus 4.9 ($p < 0.001$) in arm I and II, respectively. NAL showed a significant reduction of systematic error in large breast in the mediolateral direction only.

Conclusion: Wing board can be used in a busy radiotherapy department for setting up breast patients with a margin of 1.1 cm, 0.76 cm and 0.71 cm for small breasts and 1.96 cm, 1.12 cm and 0.98 cm for large breast in the ML, AP and CC directions, respectively. The large PTV margin in the mediolateral direction in large breast can be reduced using NAL. Further research is needed to optimize positioning of large breasted women.

☆ This work has been presented as a poster presentation at the Indian Cancer Congress 2013, New Delhi, India.

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1. Introduction

Setup errors, though undesirable are an inherent part of radiation delivery. Coverage of target volume is a direct function of setup margins. Use of portal imaging to measure setup errors is an accepted standard practice. It is recommended that every institution should generate data on its set-up accuracy without blindly adopting published margin recipes. Radiotherapy in pendulous breasts is an area of concern as the breast tends to wrap around the chest wall resulting in increased dose to the adjacent normal tissues such as the ribs, heart and lung. These patients have been studied by breast immobilization using cast, tape, rings or a breast bridge to reduce its mobility by pushing it upright.[1,2] These methods are still an area of active research. Treating patients with pendulous breast in prone position reduces lung, cardiac and contralateral breast doses by enabling the breast to fall away from the chest wall and allows a more even dose distribution throughout the breast.[2,3] But it adds to the difficulties for the patient in mounting on the treatment table, the discomfort of lying prone on a hard surface and the inability to add an electron boost with plan summation. Also tumours near the chest wall, towards the medial or lateral side or with nodal irradiation are a relative contraindication for prone positioning. In patients presenting in locally advanced stage comprehensive loco regional irradiation is mandatory and the target volume in conserved breast usually touches the chest wall.[4]

The standard practise for intact breast radiotherapy by tangential beams on breast board is to keep a 2 cm margin for central flash distance, 1 cm for inferior central distance and less than 2 cm for central lung distance. For irradiation of tumour bed by boost, a CTV to PTV margin of 1 cm is recommended. Positioning of patients on a breast board is time consuming. It is in this context that this prospective study was planned in our department to estimate and compare set-up errors in small and large breasts on a wing board.

1.1. Aims and objectives

The aim of this study was to compare relocation of chest and the breast silhouette between small and large breast patients as determined by PIs and to derive margins and evaluate the effect of NAL.

2. Material and methods

20 patients suitable for intact breast radiotherapy, registered in our department between November 2009 and September 2011, were inducted in this study after obtaining clearance from the institute's ethical committee. They were allocated into two arms based on the following selection criteria: Arm I: small or moderate size breast and, Arm II: large breast. Breasts with infra-mammary fold of more than or equal to 2 cm or falling laterally beyond the mid-axillary line, brassiere size larger than or equal to 40, cup size larger than or equal to D, tangential separation of more than or equal to 21 cm and or weight of woman bigger than or equal to 80 kg were included in Arm II.[5]

2.1. RT technique

Immobilization and simulation: Patients were positioned supine on a wing board on a comfortable neck rest (Fig. 1). The clinically evident palpable breast tissue after BCS (i.e. the Clinical Target Volume) and the incision mark were marked with a copper wire prior to the acquisition of a non contrast enhanced radiation treatment planning CT scan (RTP scan) with a slice thickness of 3 mm. Anterior and lateral reference marks were tattooed at the level of xiphisternum. 4D-CT was not acquired due to the lack of this facility and we did not intend to evaluate voluntary breath-hold at this stage.

2.2. Treatment planning and virtual simulation

The ipsilateral and contralateral breast, boost volume, heart, lungs and trachea were delineated. Treatment planning was done with 6 MV X-ray photons to a dose of 50 Gy in 25 fractions in 5 weeks to the whole breast which was followed by a sequential boost to the tumour bed to a dose of 16 Gy in 8 fractions. Treatment was delivered on a linear accelerator (Clinac CL600C). In both groups, a single isocentric technique was used to irradiate the supraclavicular region (SCF) and or axilla with a direct anterior field (depending on risk factors) and the intact breast with medial and lateral tangents fields. The isocentre was placed at the level of clavicle (T3 vertebra) with required X and Z movements which enabled a suitable tangent angle to encompass the CTV. The 3D conformal treatment plan was performed in consistency with the ICRU

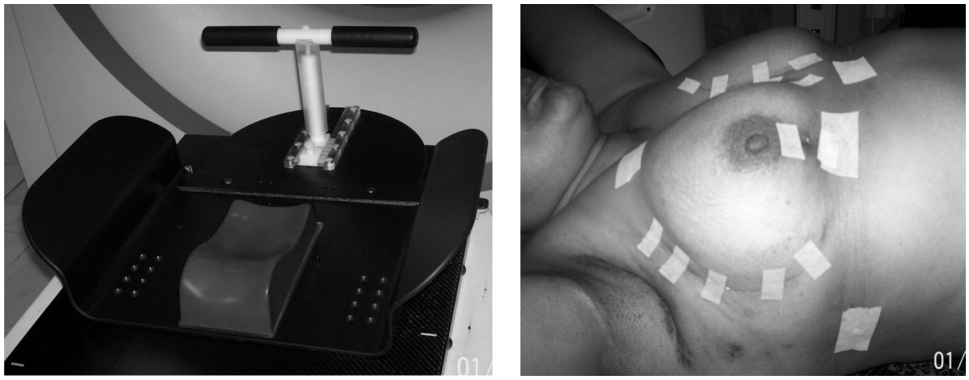

Fig. 1 – Wing board (left) and placement of makers before RTP CT scan (right).