

3-Dimensional Analysis of the Movement of Tumor Bed Using Surgical Clips During Normal and Deep Breath for Breast Cancer Patients

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The purpose of a present study is to estimate the movement of tumor bed using clips implanted during breast conserving surgery and provide adequate internal margins due to breathing. Nine patients receiving breast radiotherapy after breast conserving surgery were included in this study. CT scans were done in normal breathing, deep inspiration and expiration. These images were imported in treatment planning system and image fusion was done based on vertebral body and couch at normal breathing condition. Isocenters in each CT scan were determined using radiopaque markers attached during CT. Positions of surgical clips and lung in anterior to posterior (AP), lateral, and superior to inferior (SI) direction were determined by measuring the distance from the isocenter. The movement of surgical clips, isocenter, and lung in deep breath were compared with those of normal breathing condition. Average movement of all of surgical clips (52 clips in nine patients) in AP, lateral, SI direction was 0.5 cm, 0.1 cm, 0.5 cm in deep inspiration and 0.3 cm, 0.1 cm, 0.2 cm in deep expiration. Average movement of all of isocenters in AP, lateral, SI direction was 0.5 cm, 0.1 cm, 0.5 cm in deep inspiration and 0.3 cm, 0.1 cm, 0.2 cm in deep expiration. Maximum surgical clip movement in AP, lateral, SI direction was 1.0 cm, 0.2 cm, 0.8 cm in inspiration and 1.0 cm, 0.3 cm, 0.6 cm in expiration. For deep inspiration, lung was extended an average of 0.7 cm anteriorly, 1.0 cm laterally, 0.2 cm superiorly and 2.9 cm inferiorly. In deep expiration, lung was extended an average of 0.3 cm anteriorly, 0.6 cm laterally, 0.2 cm superiorly and 1.0 cm inferiorly. Movement of surgical clips and isocenter in deep breath showed same tendency. Movement of surgical clips was not correlated with lung movement, especially in lateral and SI direction. Most of the patients (8/9) showed larger movement during inspiration and only 1 patient showed larger movement during expiration. Surgical clip movement in lateral direction was averagely less than in AP and SI direction in deep breath. It can be concluded that 0.5 cm margin in AP, lateral, SI direction could include 33%(17/52), 100%(52/52), 62%(32/52) of surgical clip movement in deep inspiration and 77%(40/52), 100%(52/52), 90%(47/52) of the movement in deep expiration and 1.0 cm margin could include movement of all the clips in three directions in all cases. Therefore, 1.0 cm would be enough to adequately include the tumor bed during breathing.

Keywords : Ssurgical Clips, Tumor Bed, Breast Cancer