Purpose:Understanding of the characteristics of chest wall motion is poorly known. Thus, we studied the motion of the ribs in order to determine the margin which should be placed on the chest wall due to motion, and quantified the dose error at each position.

Methods:4DCT images were imported into Pinnacle v9.0 for contouring and planning. We analyzed diaphragm displacement in phases 0%-90%, using the maximum intensity projection and average images, and documented the corresponding displacement of the chest wall. We quantified the displacement of the ribs using 3 points in the chest wall and corresponding diaphragm motion for 7 patients during 10 phases. Chest wall motion was compared to diaphragm motion, along with the corresponding dose error on the chest wall.

Results: The diaphragm moved between 4-9 mm, with a standard deviation of 1.4 mm, while the ribs 1-3 moved between 1-3.1 mm, with a standard deviation of 0.1 mm. Chest wall dose error ranged from 1% to 10% for 7 patients. The total lung volume change during all phases ranged from 48cc to 110cc.

Conclusions:Studies have found that 30 Gy to the chest wall can cause severe complications. The motion in each phase varied for the diaphragm and for the ribs, and the dose error due to chest wall motion could cause dose errors of up to 10%. Due to asymmetric chest wall motion with respect to the diaphragm, it is important to understand the position of the chest wall and to specifically examine the chest wall in 4DCT scans to determine the proper margin. As the chest wall is a dose limiting organ when treating lung tumor or breast tumor, it is also important to treat it in total marrow irradiation patients. Our future study will look at motion in targeting the chest wall for these patients.