Purpose: To investigate intrafractional target displacement and assess the adequacy of margins used for early stage lung carcinoma patients treated to 50Gy in five fractions and immobilized using BodyFix (Elekta, Stockholm, Sweden).

Methods: Patients selected are medically inoperable or refuse surgery with T1 or T2 tumors <5cm. Patients are immobilized head first supine using BodyFix system. If target motion exceeds 1cm, as seen on fluoroscopic imaging, abdominal compression is used. The abdominal compression device consists of a rigid belt and pressure cuff. Treatments are performed on Tomotherapy (Tomotherapy Inc, Madison, WI) using megavoltage (MV) CT image guidance. MVCT images are slow, thus, representing an average image of the moving target. Each fraction was divided into two parts to permit assessment of intrafraction movement and allow for an interruption if long treatment is too difficult to tolerate. In many cases, patients are willing to continue with the second part of the delivery without a break. Based on our clinical protocol, the second part is still preceded by the imaging. Comparison of the images prior to the first and second portions of radiation provided us with target shifts during treatment. 23 treatments of 5 patients have been studied. Image registration was performed using Eclipse (Varian Medical Systems, Palo Alto, CA).

Results: Average of absolute target displacement during treatment was 2mm in lateral, 1mm in anterior-posterior, and 2mm in craniocaudal directions. Maximum displacement was 4mm. Average target displacements were below 0.3mm for all directions. Per patient, average absolute shifts were similar to the population average, however, averages shifts were about 1mm in anterior posterior and 2mm in craniocaudal directions.

Conclusions: Keeping in mind that hardware error is of the order of 1mm, and target delineation error in lung is about 1-2mm, 5mm margins, currently accepted in our institution, are sufficient for adequate coverage.