

Forces exerted during normal breathing cause shape alteration in soft tissues in the thorax and abdominal region. We have observed changes in the shape of the liver (e.g., cranial-caudal length shortening greater than 1 cm) between CT models extracted from scans acquired during breath hold at exhale and at inhale states. It is useful to model the transformations that occur during breathing to better determine how physiological movement affects the radiation dose received by the tumor and the adjacent normal organs during radiation therapy. Our initial investigation attempts to characterize the change in liver shape between exhale and inhale. Two CT scans (one at exhale and one at inhale) acquired from the same patient were used as input into a finite element modeling (FEM) software package. For the initial investigation, the liver was assumed to undergo linear, elastic, small deformation only in the cranial-caudal direction. An elastic modulus ($E = 10\text{Kpa}$) was selected based on prior reports of liver tissue properties. Comparisons between the two liver models allowed direct calculation of the translocation of 22 surface points on the liver. The FEM software determined the forces necessary to deform the liver as the patient inhales, and yielded a deformed liver model for comparison to that extracted from the inhale CT scan. Work supported by NIH grant P01-CA59827003.