AbstractID: 10559 Title: Pediatric organ motion evaluated by respiratory-correlated CT with a pressure-sensitive abdominal belt

Purpose: We present the first report of pediatric thoracic and abdominal organ motion extent measured using respiratory-correlated CT with an abdominal sensor belt. The knowledge is essential for defining internal target volumes and planning organ at risk volumes. It is also critical for safe employment of treatment techniques producing high dose gradient such as IMRT and intensity-modulated proton therapy.

Methods and Materials: Seventeen pediatric patients have undergone radiotherapy simulation including a respiratory-correlated 4D CT scan in supine position for evaluation of target and internal organ motion. A pressure-sensitive belt was wrapped around the abdomen just below the diaphragm. The pressure change was used as a respiratory surrogate. Each respiration cycle was divided into eight phases. Liver, left and right kidneys, and the representative 3rd, 7th, and 11th rib pairs were contoured on each of the eight CT datasets.

Results: The center-of-mass displacements of kidneys in the lateral and anterior/posterior directions due to respiration were small (0-2mm). The superior/inferior displacement was larger (0.6-4.6mm). Younger pediatric patients tend to have smaller kidney motion than their older counterparts. Diaphragm motion (4-10mm) was larger than kidney motion. The magnitude of diaphragm motion did not predict the magnitude of kidney motion. The rib motion ranged from 0.5 to 2mm maximum displacement in the lateral direction and 2 to 4mm in the anterior/posterior and superior/inferior directions. The 11th pair of ribs had smaller respiratory motion than the 3rd and the 7th pair.

Conclusion: Pediatric internal organ motion was smaller compared to adult data reported in the literature. Conventional large planning margin of 5-10mm may be reduced for tumors neighboring these organs such as neuroblastoma or chest wall sarcoma if treated with 3D conformal technique and verified with on-treatment imaging. Whether motion management is required for proton beam scanning in children needs further investigation.