Table A1. Summary of patient characteristics and datasets used in study. GTV=gross tumor volume, RT=radiation therapy, SIB=simultaneous integrated boost, fx=fraction

No. of Patients:	10
Age: Median (Range)	65.5 (60 – 78) y.o.
Gender:	3 female 7 male
RT Prescription:	50/25Gy, in 5fx (SIB)
Location of GTV:	3 pancreatic head 7 pancreatic body
Size of GTV: Median (Range)	3.2 (1.3 – 4.5) cm
Compression Belt Pressure: Median (Range)	32.5 (25 – 40) mm Hg
Cine at Simulation:	Yes, 10/10 patients
Cine for Position Verification:	Yes, 10/10 patients; 5 fx/patient
Beam-on Cine:	Yes, 10/10 patients; 5 fx/patient
Cine Scan Planes:	Axial, Coronal, Sagittal
Total Number of Cine Acquisitions Included in Analysis for this Study:	330

Table A2. Median (range) value of modeling parameters estimated from measurements in our patient population. For rhythmic segmentation the wavelength can be calculated based on length of organ (in reference XCAT: small intestine length is ~4m, large intestine length is ~1.5m) and number of nodal points. Since the number of nodal points cannot be measured in 2D cine MRI, we instead report the period of the segmentation wave. In 22/50 fractions, some motility was observed but measurements not possible because of respiratory motion or susceptibility artifacts. A = amplitude, c = wave speed, λ = wavelength, T = period, s_b = bolus size, X = not observed, RS = rhythmic segmentations, $HAPC$ = high amplitude propagating contractions, TC = tonic contractions

	Peristalsis	***RS***	***HAPC***	***TC***
Esophagus	X	X	X	X
Stomach	$A = 0.7\ (0.4 - 1.6)\ cm$ $T = 24\ (5.5 - 41)\ sec$ $c = 0.3\ (0.1 - 1.25)\ cm/sec$ $\lambda = 5.5\ (1.65 - 32.5)\ cm$	$A = 0.8\ (0.8 - 0.8)\ cm$ $T = 23.5\ (23.5 - 23.5)\ sec$	X	X
Small Intestine	$A = 0.4\ (0.3 - 0.6)\ cm$ $T = 20\ (6 - 129)\ sec$ $c = 0.6\ (0.2 - 1.1)\ cm/sec$ $\lambda = 9.6\ (2.8 - 132)\ cm$	$A = 0.4\ (0.3 - 0.6)\ cm$ $T = 9.5\ (6 - 38)\ sec$	X	X
Large Intestine	X	X	$A = 0.8\ (0.6 - 0.9)\ cm$ $c = 1.6\ (0.2 - 1.9)\ cm/sec$ $s_b = 1.6\ (1.2 - 1.8)\ cm$	X
Rectum	X	X	X	X

Table A3. Timing and wave parameters for simulation of peristaltic wave in the presence of large respiratory motion. The respiratory amplitude represents the upper adjacent values of target displacement reported in our previous work (reference 34 in the manuscript). ΔV is the change in left ventricle volume (i.e. the ratio of volumes) from diastole to systole.

Respiratory Period	4.0 sec
Respiratory Amplitude (SI / AP / LR)	1.0 / 0.4 / 0.0 cm
Heart Period	1.0 sec
Heart LV ΔV (diastole/systole)	2.6
Peristalsis Amplitude	0.4 cm
Peristalsis Wavelength	9.6 cm
Peristalsis Wave Speed	0.6 cm/sec

Table A4. Organ volumes in reference XCAT at t=0 sec for simulation combining cardiac, respiratory, and peristaltic motion.

Organ	Volume [cm^3]
Small Intestine	781
Large Intestine	764
Right Lung	1203
Left Lung	1211
Liver	2267
Pancreas	171
Stomach	133
Esophagus	19

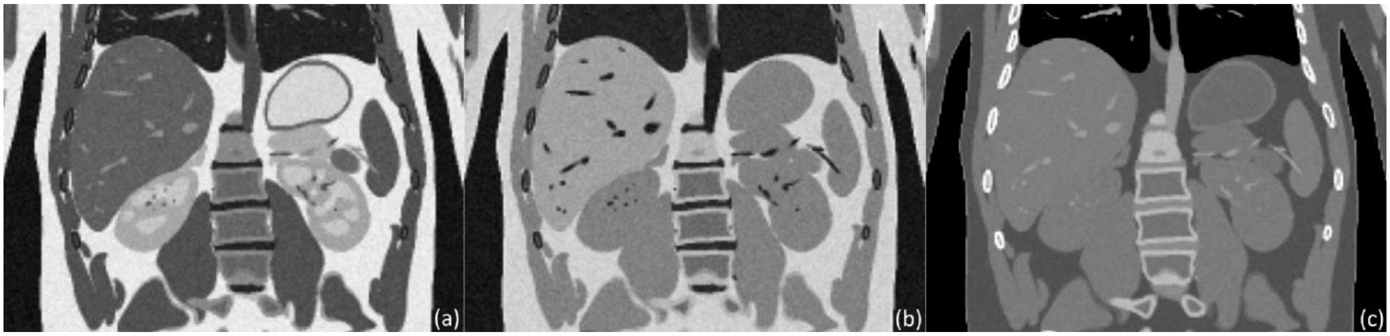

Figure A1. A simulation of a set of multimodal acquisitions for (a) T2-weighted MRI, (b) T1-weighted MRI, (c) computed tomography.

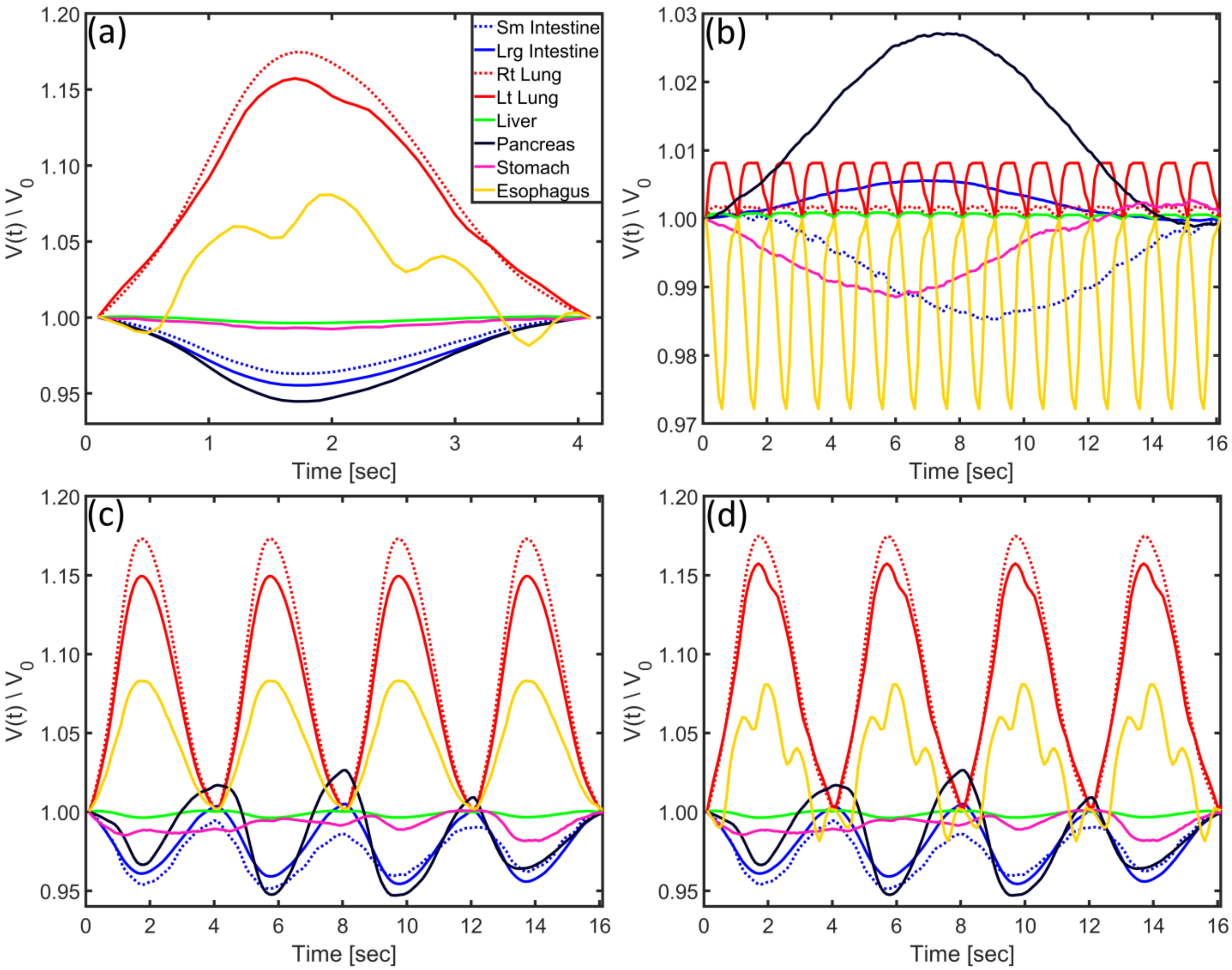

Figure A2. Example of the effect of peristaltic wave propagation combined with large-amplitude respiratory motion. A peristaltic wave was simulated using the parameters listed in Table A2. Change in organ volume in the presence of (a) only respiratory and cardiac motion, (b) only peristaltic and cardiac motion, (c) only peristaltic and respiratory motion, (d) peristaltic, respiratory, and cardiac motion. Organ volume is normalized to volume at first timepoint.