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The Effects of CT Channel Number on the Image Distortion of Moving Objects

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Purpose: The ability to describe moving target accurately is essential in radiotherapy. We analyzed the distortions introduced in helical scanning of moving objects and evaluated the effect of number of CT channel in conventional CT scanner without gating system. Methods and Materials: We designed a linearly moving phantom to simulate organ movement with objects of known geometry (3 types of glass spheres, diameter 1.6, 2.6, and 2.8 cm respectively) inside. The motion of the phantom was similar to lung movement (3 cm/2 sec). Five CT scanners which had different number of channel (1, 4, 8, 16, and 40) were employed to evaluate the relationship between the degree of image distortion and the number of CT channel. The phantom was scanned in routine clinical setting and repeated to reduce statistical uncertainty. A three-dimensional treatment planning system (Pinnacle3, Philips, USA) was used to analyze CT images. The size and volume of objects in scanned images were compared with actual values. The distortion ratio (measured value / actual size in arbitrary unit) was measured. Result: Image distortion ratios of 1, 4, 8, 16, and 40 channel scanner for 1.6 cm diameter object were 1.50, 1.56, 1.17, 0.94, and 1.16 in length of moving direction and 1.45, 1.58, 1.38, 1.06, and 1.18 in volume, respectably. The ratio decreases with object size increase and scan time decrease. In addition, thin scan thickness gave clear images for moving target. Coclusions: Overall results show that image distortion reduced, as scanner channel number increased up to 16, but it slightly increased at the channel number of 40. The distortion of small channel CT seems to have been contributed by the track of moving target. This result is helpful in determining PTV accurately, and further study is necessary for clinical implementation.

Keywords : CT Simulation, Multi-Channel CT, Motion Artifact