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Image Quality Assessment for an Investigational Megavoltage Cone-Beam CT Device

Purpose: Megavoltage Cone-Beam CT (MVCBCT) is an essential image guided radiation therapy (IGRT) device to acquire patient's daily treatment CT for accurate localization of treatment targets.   The objective of this research was to assess its image qualities.

Method and Materials: The image quality of MVCBCT was assessed by four indicators: noise, contrast, spatial resolution, and CT intensity stability.   A CT electron density phantom and a Siemens calibration phantom were used.   The images were acquired under various MU settings.   The Siemens Syngo image processing software was used to sample and analysis the data.

Results: The noise factor was used and found that the more MU to acquire the images produced less noise.   6 MU is the cut-off value for noise factor of less than 5%.   For contrast of the outer ring of the CT phantom, the electron density range of <0.952 and >0.976 were visible on all MUs.   For the inner ring, we only see <0.952 and >1.052 on MU <9 and >1.043 for MU > 15.   For the CT intensity stability, if the CT number differences has to be <50 to qualify as "stable", then 6 MU is the border line.   For spatial resolution, MTF was used to evaluate Siemens phantom images.   The lp/mm at MTF = 0.5 was 0.07, a little less than the criteria of 0.08 and for MTF = 0.1, we had 0.28, which is >criteria of 0.25.

Conclusion: The images from MVCBCT device were assessed for quality indicators; we conclude that the MU of 6 or above would have satisfactory results.   For the future application of dose calculation on the MVCBCT images, the CT intensity stability is important, and we found that for 6 MU and above would have stable CT numbers.

Conflict of Interest:
N/A.