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To study heart volume and morphology variation based on electrocardiogram (ECG) gated four dimensional cardiac computed tomography

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Purpose: To study the variation rules of heart volume and morphology in hart-beat circle applying four dimensional computed tomography (4D-CT), to help evaluate the dosimetric index error in heart radiation dose calculation.

Material & Methods: Twenty patients were enrolled in the trial. The volumetric computed tomography data guided by electrocardiogram (ECG) were obtained for every patient. And the data were sorted into 21 series CT images referring to the ECG curve retrospectively. The hear region were contoured on the 21 series CT images respectively. The difference of the volumes and dice's similarity coefficient (DSC) of the heart region was record and compared.

Results: (1) The maximum and minimum volume of the heart was mean 659.72±132.67cc and 573.70±108.40cc in different phase CT images ($p<0.05$), and the mean volume difference between the maximum and minimum was 86.01±23.34cc (percentage 15.09 ± 3.2%); (2) the maximum volume variation between the contiguous sequence CT images was less than 4%. (3) the maximum and minimum value of DSC among multiple phase was 91.96±1.34% and 97.17±0.% respectively ($p<0.05$), and the mean variation between the maximum and minimum was 4.61%; (4) the maximum DSC variation between the contiguous sequence CT images was not more than 4.2%.

Conclusion: The volume and morphological changes of the heart in cardiac cycle was not as significant as imagined, and the spatial displacement of different heart structures may be the major factors to affect the dose accumulation and prediction accuracy for radiation injury.

Biography

Guanzhong Gong has received the Bachelor of Medical Images from the Medical Imaging Department, Xuzhou Medical College and Master of Radiation Oncology from Bioscience College, Jinan University. Currently, he is a Radiation Physicist in Department of Radiation Physics in Shandong Cancer Hospital and Institute. His major duties include generating and researching radiotherapy plan (e.g. for head & neck tumor, lung tumor, breast tumor and total body irradiation, applying CT, PET, MR and SPECT images).

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