

The Dosimetric Impact from Metal Artifact of Hip Prosthesis on CT Images

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Abstract

While the population is aging gradually, the proportion of patient receiving the replacement technique with metal prosthesis increases. When these patients have prostate cancer and receive radiotherapy, the implant of hip prosthesis causes the artifact on kVCT(kilo-Voltage Computed Tomography)images for treatment planning calculation. These metal artifacts not only lead to obscure the surrounding soft tissue but also cause potential inaccurate dose calculation. In this study, we used the cheese phantom and metal rods made by titanium to simulate the structure of pelvis with the implant of prosthesis in clinical situation. We used the CT scanner and helical tomotherapy to acquire the kVCT and MVCT(Mega-Voltage Computed Tomography)images, respectively. We compared the dose calculation results on these two different images, and analyzed the difference with different energies, number of rods, size of rods, and beam settings. With these comparisons, we can understand the impact of metal prosthesis on dose calculation in treatment plan. The results showed that the bigger metal rod and the increased number of metal rods caused more obvious metal artifacts on images. However, the misestimate of physical density causes more dose calculation inaccuracy than metal artifact itself on kVCT images. Therefore, we may use the MVCT images without metal artifacts and appropriate estimation of metal density to correct the inaccurate results of dose calculation on kVCT images.

Keywords: *Hip prosthesis, Metal artifact, kVCT, MVCT*