Purpose: In external beam radiotherapy, the presence of metal implants such as hip prostheses causes significant streak artifacts in planning images, thus affecting the accuracy of target and critical organ delineation. The purpose of this study is to evaluate the improvement of image quality and impact on accuracy of dose calculation by using a commercially available metal artifact reduction (MAR) algorithm.

Methods: Nine patients were selected for this study, including 5 patients with unilateral hip prostheses for orthopedic irradiation, and 4 patients with unilateral or bilateral hip prostheses for prostate cancer treatment. For each patient, simulation CT image was reconstructed with and without MAR correction. Contours of the prostate, bladder and rectum were delineated on both images by an experienced physician for the prostate patients. The difference of contours between MAR corrected and un-corrected images was quantified by an overlap index, and dose calculation accuracy was evaluated for both target and critical organs.

Results: For orthopedic patients, dose difference between MAR corrected and un-corrected images was negligible: 0.1Â±0.1% for maximum dose and 0.8Â±1.8% for dose at isocenter. For prostate patients, no significant dosimetric difference was observed between MAR corrected and un-corrected images if same contours were used in the treatment planning. For the PTV, the average dose variation in D99 was 0.9Â±0.6%. The dose differences in D50 of the bladder and rectum were 1.0Â±0.8% and 0.4Â±0.3%, respectively. The average overlap index of prostate between the two images was 0.86Â±0.12 for patients with bilateral hip replacements. Substantial changes in the dose-volume-histograms were observed if different contours were used in the treatment planning.

Conclusions: The commercial MAR algorithm can improve the image quality dramatically and the MAR corrected images do not affect dose calculation accuracy. The improvement of accuracy in organ delineation provides significant dosimetric advantage.

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