Purpose:The accurate dose recalculation requires that the original pelvic megavoltage cone beam CT (MVCBCT) images be corrected for cupping and truncation artifacts caused by beam scattering and field-of-view limitation. Our group previously developed a pelvic phantom-based correction algorithm. The purpose of this study is to introduce a simple yet accurate pelvic MVCBCT image correction strategy based only the planning kVCT and treatment-day MVCBCT images to allow accurate dose calculation.
Methods:The quadratic-fit (QF) based correction algorithm uses the planning kVCT as a reference, and individually corrects the MVCBCT images slice by slice. A realistic pelvic-size water phantom, an anthropomorphic pelvic phantom, and a clinical pelvic patient were used to validate the method. Furthermore, a prostate patient with large anatomy changes in planning CT and a treatment-day MVCBCT was selected for evaluating the clinical applicability of the method. The dose differences with and without QF correction were compared.
Results:The QF correction reduced the cupping artifact significantly. The maximum mean CT number deviations in the soft tissue part of the anthropomorphic phantom between the conventional CT and MVCBCT without and with QF correction were 15% and 2%, respectively. After applying the QF and data missing correction, 96.5% of the voxels showed a dose agreement better than 3% between the planning CT and MVCBCT. In a clinical patient without significant anatomy changes, the dose difference in the targets and organ at risks between the planning CT and a treatment-day MVCBCT was within 1.1%.
Conclusions:The QF based method is feasible for correcting the cupping artifact in the pelvic MVCBCT. And, based on the corrected MVCBCT images, the monitoring of treatment-day dose distributions is possible.

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