Purpose: To investigate the effect of CT contrast enhancement (CE) on the 3D dose distributions of non-coplanar small field beams in the CyberKnife (CK) treatment planning system.

Methods: Twenty patients treated by pre-CE CT plans were recruited to this retrospective plan study. Their post-CE CT plans were based on the pre-CE CT plan data and calculated using the same MU and beam paths in either Ray-Tracing or Monte Carlo (MC) algorithms. The differences in doses of the beam path and the reference point and in DVHs of target and OARs between the pre-CE CT and the post-CE CT plans were compared. The minimum dose, the maximum dose, the mean dose, and the dose received to 50% of the target and OARs volumes, and the target volume coverage were also compared.

Results: The dose differences between the pre-CE and post-CE plans in a single beam path were less than 50 cGy in both calculation algorithms. At the center of target volume, it was 1.9% (maximum 6.2%) in Ray-Tracing and 1.5% (maximum 4.0%) in MC, with respect to the prescription dose. The post-CE plans showed on average 2% decrease in the OAR maximum dose (maximum 6.4% in Ray-Tracing and 5.8% in MC). Regardless of the algorithms, the dose to the target and the target volume coverage of post-CE plans were on average reduced by 2% and 1%, respectively, with a maximum reduction of 6.1% (in Ray-Tracing) in the minimum target dose.

Conclusions: The CK treatment plan using the post-CE CT could generally result in a few % dose differences from the pre-CE CT plan. However, it could be more than 6%, depending on the target positions in the body and the calculation algorithms. Thus the post-CE CT in CK treatment plans should be used with a caution.