AbstractID: 9693 Title: Estimating image quality and radiation dose reduction with in-plane bismuth shielding for CT examinations: phantom study

Purpose: To estimate the image quality and radiation dose reduction by using bismuth shielding materials during in-plane CT scanning.

Method and Materials: Bismuth shielding was used to block the low energy photons of radiation beam to reach an ACRCT accreditation phantom. The shielding materials were coated with foam to decrease the beam hardening artifact at the interface between bismuth and phantom surface. Images were acquired by Siemens Sensation 64 CT scanner with four kVps. The image quality affected by bismuth shielding, including CT number deviations, noise distribution, contrast, and artifacts, were estimated. The radiation dose reduction was measured by using high sensitive thermoluminescent dosimeters.

Results: The water CT number and noise without shielding are -3.25±0.4 HU and 6.09±0.49 HU at 120 kVp. The CT number changes are 3.56, 8.56, 20.52, and 33.05HU near the shielding regions for 1T, 2T, 4T, and 6T bismuth (1T= 0.035 g/cm^2), and 1.9, 2.8, 3.6, and 5.9 HU far from the shielding regions. The foam is needed to decrease the beam hardening artifact at the interface of the phantom. The radiation dose reduction is 14.4 %, 20.6 %, 33.9 %, and 50.5 % for 1, 2, 4, and 6T bismuth. The image contrast change after shielding is within 9 %.

Conclusion: In-plan bismuth shielding could block useless low energy radiation to reduce patients and protect radiosensitive organs. The radiation dose reduction is remarkable with in-plan bismuth shielding. Covering the bismuth shielding on patients potentially changes the CT number accuracy, but has no impact on image contrast. The CT number variation is slightly apparent near the shielding region than the far regions. However, the variations are acceptable. The foam keeps the shielding away from the patient surface to diminish beam hardening artifact and to maintain the diagnostic acceptability.