1. Introduction

- Materials can be separated or quantified by dual-energy computed tomography (DECT). Of late, DECT is often used in clinical situations, and dual-source CT (DSCT) is used to execute DECT acquisition.
- When DECT acquisition is executed by DSCT, one X-ray tube outputs X-rays with relatively low tube voltage (100 or 80 kVp), another tube outputs X-rays with relatively high tube voltage (140 kVp with a thin [Sn filter (Sn/140 kVp)], and the two tubes simultaneously output X-rays when rotated.
- In DECT, it is difficult to obtain half-value layer (HVL), which is generally used to calculate a patient’s absorbed dose, by the conventional aluminum or copper absorption method because of the technical limitation.

2. Objectives

- This study aimed to estimate HVLs for DECT acquisitions by a new copper absorption method.

3. Materials

- A 128-section DSCT (SOMATOM Definition Flash; Siemens Healthcare, Erlangen, Germany) was used in this study (Fig.1).
- Exposure dose was measured while executing single-energy CT (SECT) acquisition with 120 kVp and DECT acquisitions with combinations of 100 and Sn/140 kVp and 80 and Sn/140 kVp after inserting a thimble-type ionization chamber (10x5-6; Radcal, Monrovia, CA) into each 0.04–0.6-mm-thick cylindrical copper filter (99.9% pure) and placing them into the center of CT gantry (Figs.2, 3).
- Acquisition parameters while executing SECT or DECT acquisitions were as follows: 100-mA tube current, 1.0-s rotation time, and 32 × 1.2-mm (SECT) or 32 × 0.6-mm (DECT) slice collimation.
- The thickness of the copper filter, which reduces the intensity of radiation by half (first HVL), was then calculated in each acquisition.
- The first HVLs were revised by excluding the contribution of all scattered radiation using the correction equation (y = 1.066x [x, measured first HVL; y, corrected first HVL]) shown in our previous study.11
- The first HVL for SECT with 120 kVp was estimated using the conventional copper absorption method.2)

4. Results

- The exposure doses with 0-mm-thick copper filter were calculated by extrapolating from other exposure doses. Corrected first HVLs were calculated as shown in Fig.4.

5. Discussion

- The first HVL and the calculated effective energy for SECT acquisition with 120 kVp in the conventional copper absorption method were 0.455 mm and 58.6 keV, respectively.

6. Conclusions

- The HVLs for DECT acquisitions by DSCT can be successfully estimated using the new copper absorption method.

References


Tomography Acquisition Using a New Copper Absorption Method

Kosuke Matsubara1), Wataru Mitsui2), Hiroji Iida3), Naoya Mizukami3), China Matsumoto3), Kichiro Koshida3), Osamu Matsui4)

1) Department of Quantum Medical Technology, Faculty of Health Sciences, Kanazawa University, Kanazawa, Japan
2) Department of Radiological Technology, Kanazawa University Hospital, Kanazawa, Japan
3) Department of Radiological Technology, School of Health Sciences, Kanazawa University, Kanazawa, Japan
4) Department of Radiology, Faculty of Medicine, Kanazawa University, Kanazawa, Japan

E-mail: matsuk@mhs.mp.kanazawa-u.ac.jp