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Appearances of pulmonary focal lesions at 0.5-mm slice thickness computed tomography: comparison with 1-mm slice thickness computed tomography

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Abstract

Aim: This study aimed to evaluate the validity of 0.5-mm thin-section computed tomography (CT) for the assessment of pulmonary nodular lesion in comparison with 1-mm CT. **Materials and Methods:** A total of 38 focal lesions from 30 patients, which were scanned with 0.5- and 1.0-mm collimation, were evaluated regarding the extent of ground-glass opacity (GGO) and well-defined margin, and the presence of pleural indentation, spicula, and internal air density. The frequency of each finding was statistically compared between 0.5- and 1-mm CT using the McNemar test. **Results:** No statistically significant difference was observed between 0.5- and 1-mm CT for each finding. **Conclusion:** The use of 0.5-mm CT is not justified if the original collimation of multi-detector row CT is near 1 mm.

Keywords: Thin-section CT; High-resolution CT; Multi-detector row CT; Lung carcinoma; Ground-glass opacity

1. Introduction

Although there is no definition of the term "thin-section CT", a synonym for high-resolution CT, the generally recommended criteria for thin-section CT include thinnest available collimation, usually 1–1.5 mm, and high-spatial frequency "sharp" algorithm for viewing the lung [1]. Recent development in CT scanners has enabled us to obtain a thinner collimation of less than 1 mm. A thinner collimation is expected to provide more detailed information about pulmonary lesions by the increased spatial resolution. We had used 0.5-mm slice CT for the assessment of nodular lesions from May 2003 to February 2004 since the introduction of 0.5-mm CT. We evaluated the validity of 0.5-mm slice CT in comparison with 1-mm slice CT in the evaluation of focal pulmonary diseases.

2. Materials and methods

The subjects were consecutive 30 patients who were referred to CT examination for the evaluation of pulmonary focal lesions, which were scanned with 1.0-mm and subsequently 0.5-mm collimation between May 2003 and February 2004. There were 16 males and 14 females ranging in age from 36 to 86 years with a mean age of 66 years. There were a total of 38 focal lesions from the 30 patients, consisting of 25 lung carcinomas, 2 granulomas, 6 focal pneumonias, 2 aspergillomas, 1 abscess, and 2 nodules of unknown diagnosis. CT was carried out with the Aquilion 16-detector row helical scanner (Toshiba Medical Systems) in all cases.

After helical scan of the whole lung using a 1-mm collimation with a slice pitch of 15 in one breath-hold, nodular lesions were additionally scanned with a 0.5-mm

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Table 1
Comparison between 1- and 0.5-mm HRCT (n=38)

	1-mm CT	0.5-mm CT	P value*
Extent of GGO			
100%	20 (52.6)	19 (50.0)	0.5 (NS**)
99–50%	6 (15.8)	7 (18.4)	
49–1%	4 (10.5)	3 (7.9)	
0%	8 (21.1)	9 (23.7)	
Extent of well-defined margin			
100%	26 (68.4)	27 (71.1)	0.625 (NS)
99–50%	6 (15.8)	5 (13.2)	
49–1%	1 (2.6)	2 (5.3)	
0%	5 (13.2)	4 (10.5)	
Pleural indentation	8 (21.1)	8 (21.1)	1.000 (NS)
Spicula	13 (34.2)	13 (34.2)	1.000 (NS)
Air density	21 (53.3)	21 (55.3)	1.000 (NS)

Values are shown as n (%).

* McNemar test.

** NS=not significant.

collimation and a slice pitch of 15 targeted to the ipsilateral lung using a high-spatial frequency algorithm as a thin-section CT. We obtained this additional scan as a thin-section CT having the maximum spatial resolution of the CT scanner according to a recommendation of the thin-section CT techniques, “thinnest collimation available”, in a textbook of chest CT [1]. The rotation speed of the X-ray tube was 0.5 s per one rotation. Targeted images of the 1-mm scan were also reconstructed with the same algorithm and field of view as those of the 0.5-mm scan for comparison. Peak voltage and electric current were 120–140 kV peak and 250–300 mA, respectively, in both scans. Effective slice thicknesses of 0.5- and 1-mm CT were approximated to be 0.6 mm and 1.2 mm, respectively. CT images were transferred to the Pathspeed viewer system (GE Medical Systems) and viewed with a window level of −700 HU and a window width of 1500 HU.

Each focal lesion was visually evaluated regarding the extent of ground-glass opacity (GGO) and well-defined margin, and the presence of pleural indentation, spicula, and internal air density by two chest radiologists (AN and SK). The extent of GGO was divided into four categories as follows: 100%, 99–50%, 49–1%, and 0% in the area of the lesion at the slice showing its maximum diameter. Pleural indentation was defined as a linear opacity radiating from the lesion and reaching the pleural surface with associated triangular opacity. Spiculation was defined as a linear opacity radiating from the lesion with or without attachment to the pleural surface, excluding vessels, which were evidenced by branching shape or continuity to the proximal vessels. Final decision for each finding was made by consensus between two readers. Kappa values between two readers were calculated for each finding. The frequencies of spicula, pleural indentation, and air density, and the extent of GGO were statistically compared between 0.5- and 1-mm CT using the McNemar test. A P value less than .05 was considered to be significant.

3. Results

Kappa values between the readers were 0.71 to 0.94, indicating good interobserver agreement. The maximum diameter of the focal lesions ranged from 2 to 75 mm with an average of 19.1 mm. No statistically significant difference was observed between 0.5- and 1-mm CT for each finding (Table 1, Figs. 1 and 2). The extents of GGO and well-defined

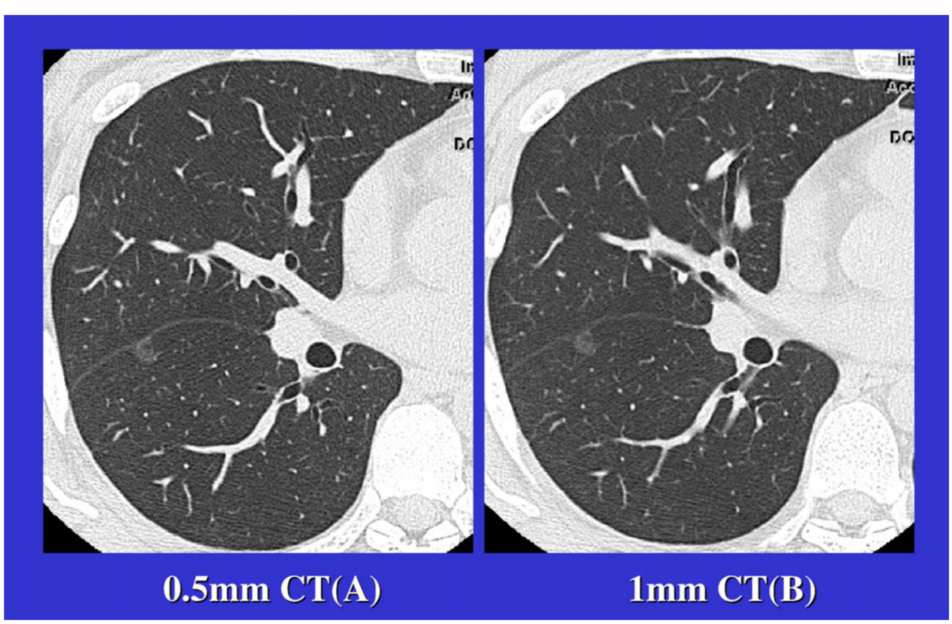

Fig. 1. A focal GGO on follow-up examination in a 36-year-old woman. A focal GGO is seen at the subpleural region of the right S6. Both 0.5-mm (A) and 1-mm (B) CT images show similar information about the extent of GGO or margin characteristics.