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貴財団より助成金を受領して行った研究テーマについて報告いたします。

添付資料： 研 究 報 告 書

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1．助 成 金 額 ： 600、000 円

2．研 究 テ ー マ

多列検出器ヘリカルCTによる肺限局性スリガラス陰影の検出及び性状解析

3．成 果 の 概 要 （100字程度）

肺癌検診に低線量ヘリカルCT導入されて以来、今までX線写真で見つかなかった小さな肺結節が多数見つかるようになってきている。我々が模擬スリガラス影を含む胸部ファントムを使用し、病変と肺実質のCT値及び管電流の関係を判明した。さらに、GGOを示すAAHとBACの鑑別について基礎と臨床を検討し、CTと臨床所見を用いることにより、両者の鑑別が82.4%の可能であることが判明した。

4．研 究 業 績

(1) 学会における発表 □無 ・ ☑有（学会名・演題）

1）第64回日本医学放射線学会学術は発表会（横浜）
肺結節のthin slice helical CTデータの定量解析による良悪性の推定

2）第161回日本医学放射線学会九州地方会（宮崎）
低線量MDCTによる肺限局性スリガラス影の検出

3）第162回日本医学放射線学会九州地方会（沖縄）
低線量高分解能CTによる限局性スリガラス影の検出能および画質の検討

(2) 発表した論文 □無 ・ ☑有（雑誌名・題名）

Radiation Medicine （Volume 26 ・Number 1・January 2008）

Identification and characterization of focal ground-glass opacity in the lungs by Multidetector Helical CT

- 日中医学協会助成事業 -

多列検出器ヘリカルＣＴによる肺限局性スリガラス陰影の検出及び性状解析

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Introduction:

A focal ground-glass opacity (GGO) on chest computed tomography (CT) images may be attributable to atypical adenomatous hyperplasia (AAH), bronchioloalveolar carcinoma (BAC), focal inflammation, and focal fibrosis. Therefore, the accurate diagnosis of GGO nodules on chest CT is important. Thin-section helical CT using multidetector CT (MDCT) can analyze the GGO nodules because MDCT can scan nodules as volume data under one breath-hold. As thin-section helical CT involves relative high radiation exposure, it is desirable to reduce the radiation dose in follow-up studies. We used a chest phantom to investigate how much the radiation dose can be reduced when identifying and characterizing GGO nodules on thin-section helical scans obtained by MDCT.

Key words: Ground-glass opacity (GGO) · Lung cancer ·High-resolution CT · Phantom

Abstract:

Purpose. The aim of this study was to investigate how much the radiation dose can be reduced for the identification and characterization of focal ground-glass opacities (GGOs) by high resolution computed tomography (HRCT).

Materials and methods. A chest CT phantom including GGO nodules was scanned with a 40-detector CT scanner. The scanning parameters were as follows: tube voltage 120 kVp; beam collimation 32 × 1.25 mm; thickness and intervals 1.25 mm; tube current and rotation time 180, 150, 120, 90, 60, and 30 mA. 180 mA was the standard. Using a three-point scale at different currents, we visually evaluated image quality. Furthermore, we carried out observer performance tests using receiver operating characteristic

(ROC) analysis to evaluate the ability to identify GGO nodules at each current.

Results. By visual analysis, the scores for all particulars were significantly lower on images obtained at less than 120 mA than at 180 mA (Steel's test, $P < \square 0.05$). There was no statistically significant difference in any particulars other than artifact on images obtained at 180, 150, and 120 mA. By ROC analysis there was no statistical difference in the Az value to identify GGO nodules on images obtained at 180, 150, 120, 90, or 60 mA. However, the Az value at 30 mA was significantly lower than at 180 mA (Dunnett's test, $P < 0.01$).

Conclusion. The minimum current necessary for the characterization of GGO nodules on HRCT was 120 mA, although their identification was possible at currents of >30 mA.

Table 1. Results of Qualitative Analysis of Simulated GGOs

	Tube current-time product (mAs)					
Particulars	180	150	120	90	60	30
Artifact in lung fields	2.8±0.4	2.7±0.5	2.5±0.5*	2.0±0.4*	1.7±0.6*	1.2±0.4*
Homogeneity of GGO nodules	2.9±0.4	2.7±0.5	2.9±0.4	2.5±06*	1.8±0.7*	1.2±0.4*
Margin clearness of GGO nodules	2.5±0.5	2.6±0.5	2.3±0.6	2.1±0.9*	1.5±0.7*	1.1±0.4*
Overall image quality	2.7±0.5	2.7±0.5	2.5±0.5	2.2±0.8*	1.6±0.6*	1.1±0.3*

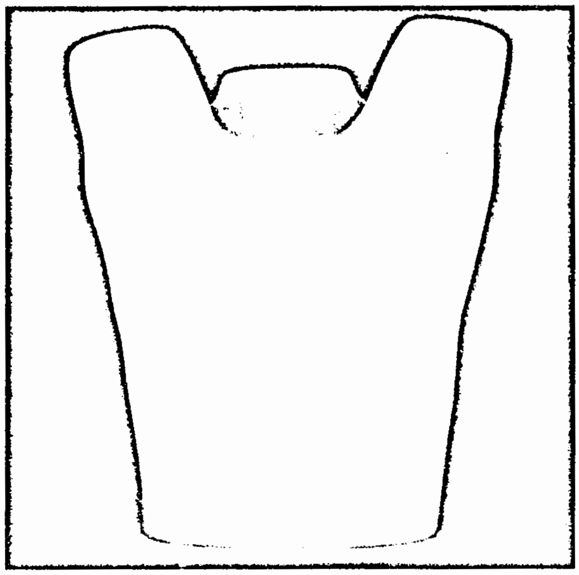
*P < 0.05 at Steel's test

Table 2. Az values of 6 radiologists for identification of simulated GGO nodules

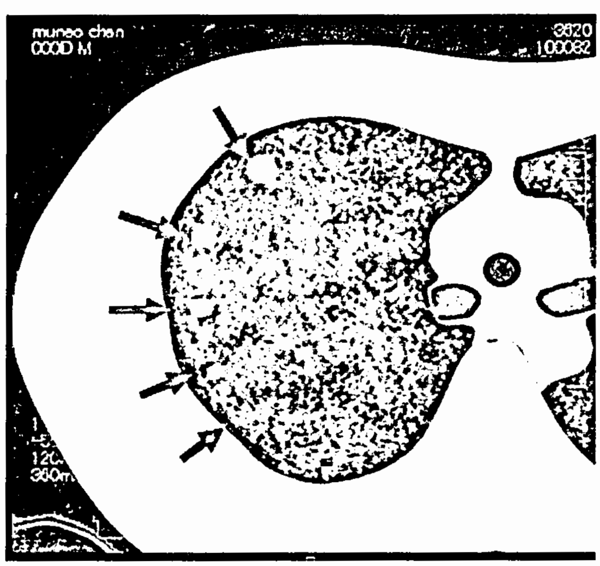
	Tube current-time product (mAs)					
Observers	180	150	120	90	60	30
1	1.00	1.00	1.00	1.00	0.98	0.91
2	1.00	1.00	0.92	0.94	0.96	0.93
3	1.00	1.00	0.97	0.92	0.86	0.90
4	1.00	1.00	1.00	1.00	1.00	0.92
5	1.00	0.99	0.98	1.00	0.93	0.86
6	1.00	1.00	1.00	1.00	0.92	0.69
Mean	1.00	1.00	0.98	0.98	0.94	0.87
P value	-	1.00	0.84	0.84	0.31	< 0.01

Values at 180 mAs were the control for Dunnett's test

Figure 1. Chest phantom used for this study

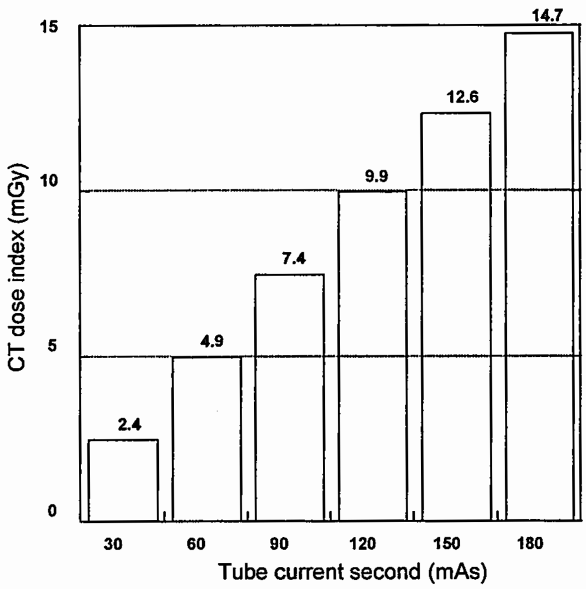


A. Gross appearance of the chest phantom (LSCT001, Kytoto Kagaku Co. Kyoto, Japan) used in this study.



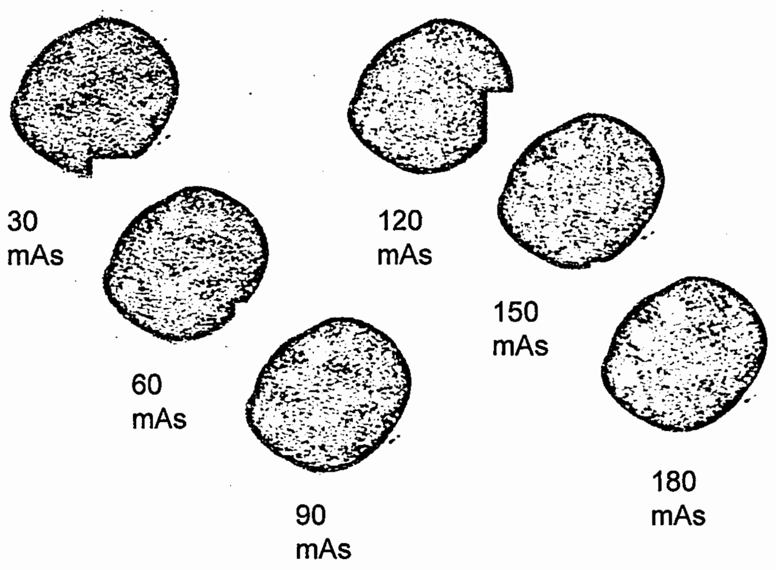
B. Right lung of the chest phantom at the level of the carina. Simulated ground glass opacities (GGOs) measuring 4-, 6-, 8-, 10-, and 12 mm are indicated by arrows.

Figure 2. CT Dose Index in scan with various mAs setting



CTDIw for the detection of GGOs at different mAs settings. When the CTDIw of 180mAs was assumed to be 100%, the CTDI ratio was 16.3% at 30 mAs, 33.3% at 60 mAs, 50.3% at 90 mAs, 67.3% at 120 mAs, and 85.7% at 150 mAs.

Figure 3. Simulated GGOs on images obtained with various mAs



Simulated GGOs on images obtained with 30-, 60-, 90-, 120-, 150-, and 180 mAs.

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