

가 MDCT HRCT

: 64 MDCT ¹

. . ² . .

: 64 MDCT HRCT
 : 56 (; 21 , ; 35) 64 MDCT
 (Somatom Sensation 64, Siemens) CT (0.6 - mm
 collimation, table speed of 14 mm/sec, and rotation time of 0.5 sec) 1 mm
 , 10 mm (high frequency
 algorithm) PACS .
 가

: 64.3% (36/56)
 가 82.1% (46 /56)
 가 ($p = 0.001$) , 가
 (; $p=0.013$, ; $p=0.002$, ; 0.024, ; $p=0.004$, ; $p=0.018$).
 : 64 MDCT HRCT
 가

. ,

HRCT

.

,

,

(1, 2).

가 50 %
 (3, 4). Millar (3)

CT 가
 Naidich (5) 1 cm 1 - 2 mm
 CT (high
 spatial resolution algorithm)
 , HRCT 10 mm

(Computed

tomography: CT)
 , Naidich (5) McGuinness (6)
 CT

MDCT (multi - detector - row CT,
 CT

¹가
²가

(single - slice helical CT)

2006 1 10

2006 7 8

(spatial resolution) (temporal resolution) (learning bias) 4
 resolution) , (raw data) CT
 MR (multiplanar raw data
 reconstruction image; MPR) 3
 가
 (7).
 HRCT 가 가
 64 MDCT HRCT
 (coronal image reconstruction)
 가
 .
 2005 4 9 6
 56 , 가 21 , 가
 35 16 82
 55 .
 , ,
 56 64 MDCT (Somatom Sensation 64,
 Siemens Medical Solutions, Erlangen, Germany)
 120 kVp reference mAs 120
 mAs (CARE dose, Siemens)
 CT
 CARE dose 4D (automatic exposure control, Siemens
 Medical Solutions, Erlangen, Germany)
 . CT 0.5 sec
 (rotation time) (slice collimation) 0.6
 mm, (slice width) 1 mm, (table
 feed) 14 mm/sec, (pitch factor) 1.4
 . CT raw data
 1 mm, 10 mm
 (high spatial resolution algorithm,
 B70s)
 - 700 HU, - 1400 HU
 PACS (picture archiving and communication system:
 PiViewSTAR, Ninfinitt, Seoul, Korea)

가 MDCT HRCT
 . (learning bias) 4
 raw data
 Naidich (8) Kang (9) ,
 (bronchial dilatation),
 (lack of tapering of bronchus), 1 cm
 가 (peripheral bronchial dilatation),
 (bronchial wall
 thickening),
 (mucoid impaction) (8 - 10).
 , , , (superior division
 of left upper lobe; apicoposterior segment and anterior
 segment), (Lingular division of left upper lobe;
 left middle lobe, LML), , 6
 (cross -
 sectional distribution) Reiff (11)
 ,
 (central), (peripheral), (mixed)
 .
 SPSS
 (SPSS, Datasolution, version 12.01, Seoul, Korea)
 t (paired samples
 t - test)
 .
 56 46 HRCT
 82.1% . 10
 3 HRCT , 3
 ,
 4 1 cm가
 .
 56
 36 (64.3 %) , 336 97
 (28.9%)

Table 1. Detection Rate of Bronchiectasis Evaluated with Axial
 Images alone and Axial with Coronal Reconstructed Images

	On per-patient basis	On per-lobe basis
Axial images alone	36/56 (64.29)	97/336 (28.87)
Axial with coronal reconstructed images	46/56 (82.14)	145/336 (43.15)
p value	0.001	

Note. - Numbers in parentheses are percentages.

46 (82.1%) , 145 (43.2%)

($p=0.001$) (Table 1).

6

Table 2

$p=0.013$, $p=0.002$, $p=0.024$,
 $p=0.083$, $p=0.004$, $p=0.018$
 ($p > 0.05$)

(Table 2) (Fig. 1 - 3).

가 ($p=0.001$) (Table 3).

가 가
 가

Table 2. Detection Rate of Bronchiectasis According to Each Anatomic Lobe using Axial Images alone and Axial with Coronal Reconstructed Images

	RUL	RML	RLL	LUL	LML	LLL
Axial images alone ($n=56$)	15(27)	20(36)	24(43)	8(14)	13(23)	27(48)
Axial with coronal reconstructed images ($n=56$)	21(38)	29(52)	29(52)	11(20)	21(38)	34(61)
<i>p</i> value	0.013	0.002	0.024	0.083	0.004	0.018

Note. - Numbers in parentheses are percentages; n indicates the number of patients including this study; LML = lingular division of left upper lobe

Table 3. Detection Rate of Bronchiectasis According to Cross-sectional Distribution using Axial Images alone and Axial with Coronal Reconstructed Images

$n=336$ lobes	central	peripheral	random
Axial images alone	16	38	39
Axial with coronal reconstructed images	16	72	54
<i>p</i> value	1.000	0.003	0.19

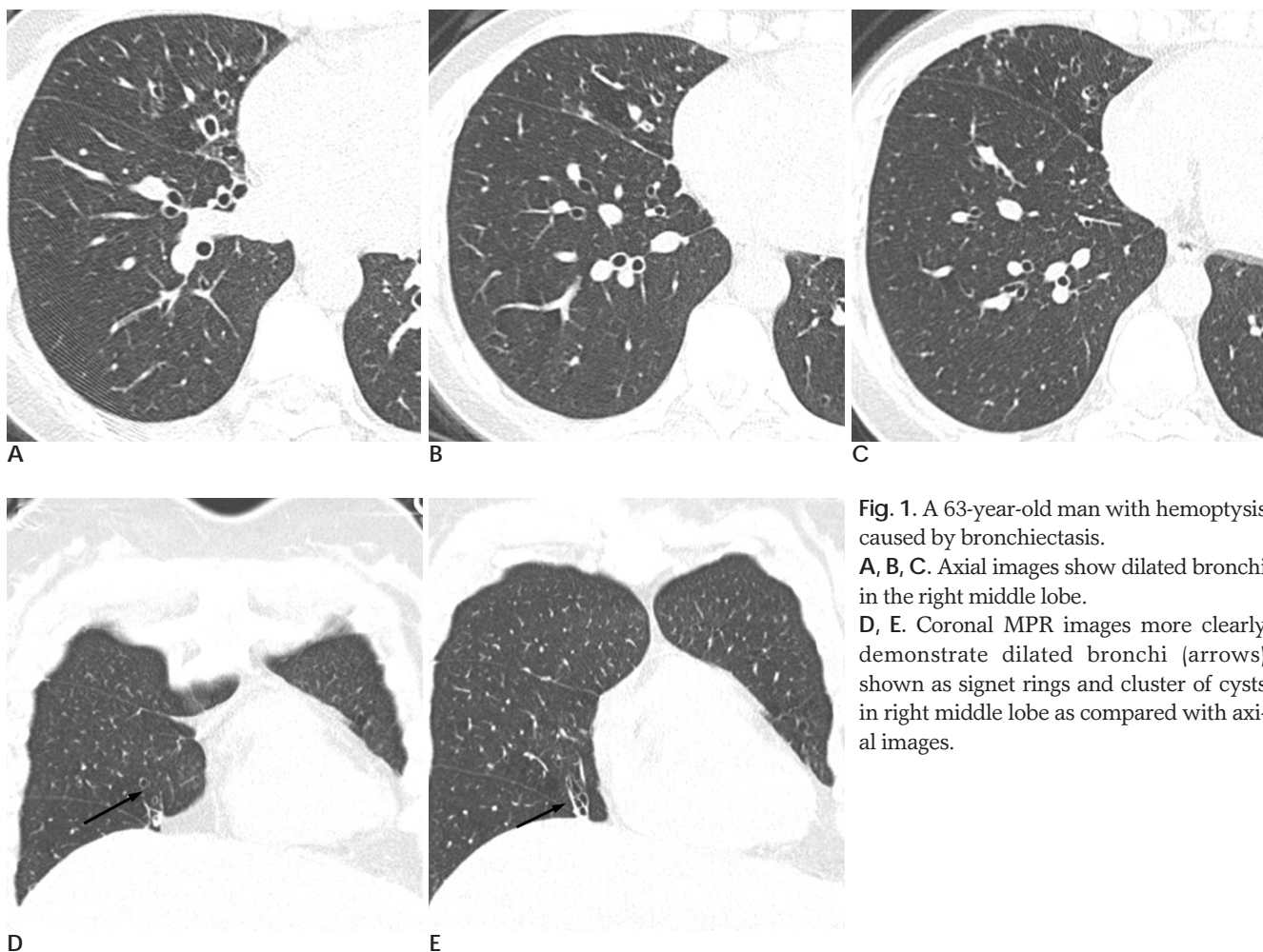


Fig. 1. A 63-year-old man with hemoptysis caused by bronchiectasis.

A, B, C. Axial images show dilated bronchi in the right middle lobe.

D, E. Coronal MPR images more clearly demonstrate dilated bronchi (arrows) shown as signet rings and cluster of cysts in right middle lobe as compared with axial images.

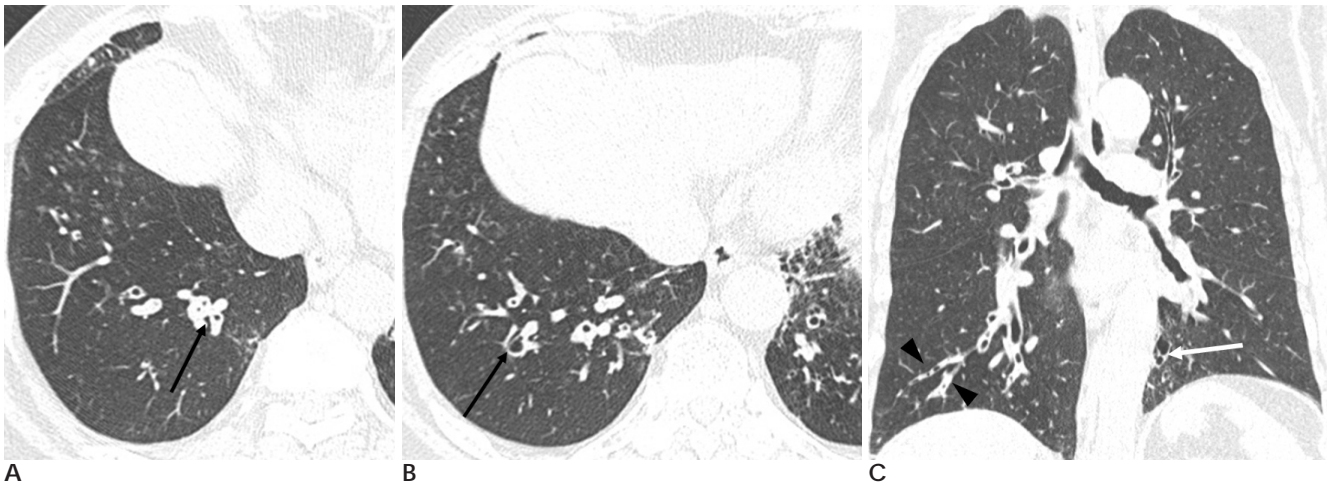


Fig. 2. A 63-year-old woman with hemoptysis caused by bronchiectasis in the right lower lobe and the left lower lobe. **A, B.** Axial thin-section images through the lung base show bronchiectasis (arrows) in the basal segment of the right lower lobe. **C.** Coronal MPR images clearly depict mucoid impaction within dilated bronchi and lack of tapering of the bronchi (arrowheads) in comparison with axial images. Bronchiectasis is also noted in the left lower lobe on coronal MPR images (white arrow).

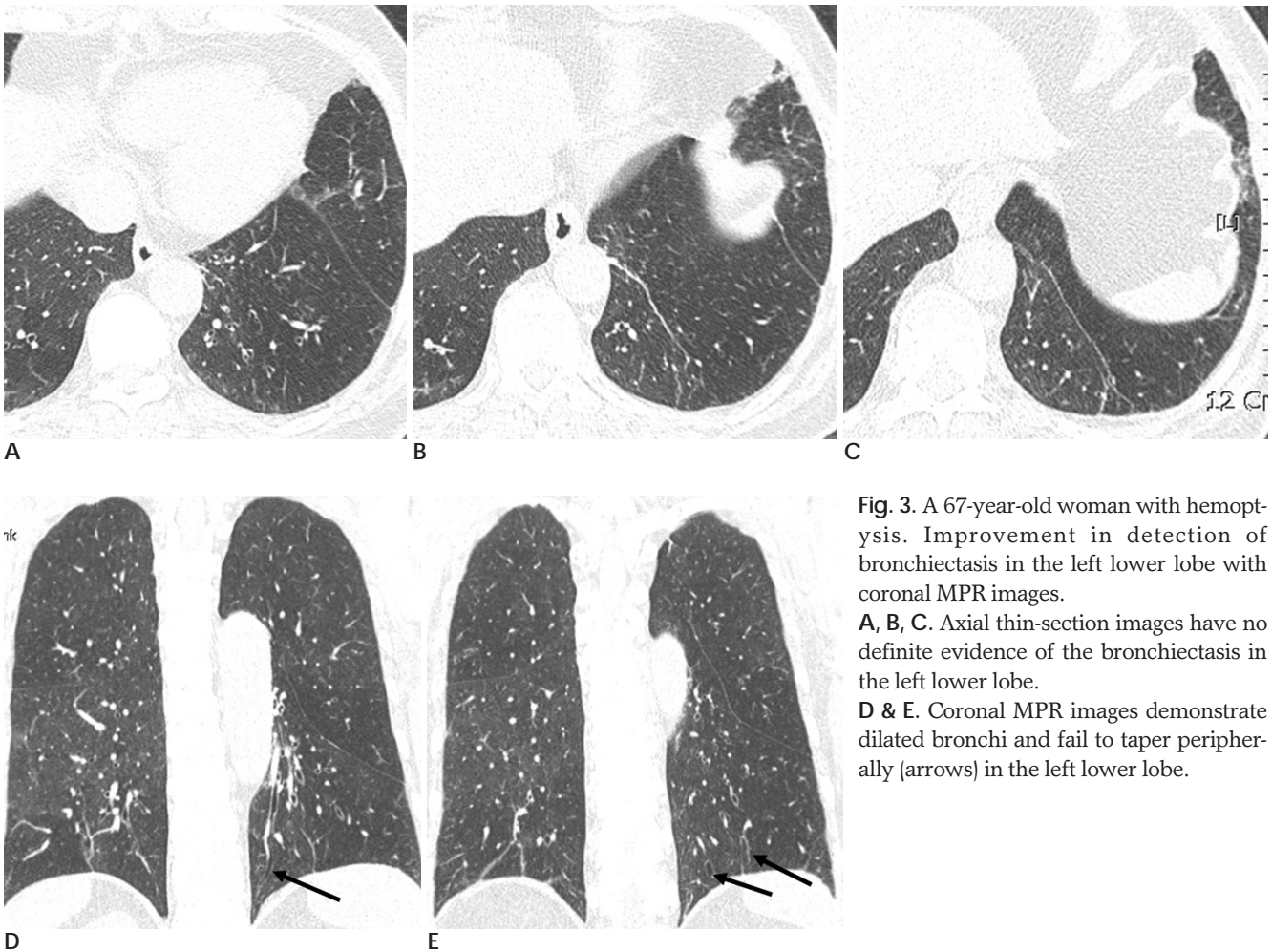


Fig. 3. A 67-year-old woman with hemoptysis. Improvement in detection of bronchiectasis in the left lower lobe with coronal MPR images.

A, B, C. Axial thin-section images have no definite evidence of the bronchiectasis in the left lower lobe.

D & E. Coronal MPR images demonstrate dilated bronchi and fail to taper peripherally (arrows) in the left lower lobe.

가 28.9% 43.2% p 0.001
 (1 - 6, 12). , 가
 Sung (16)
 가 가 .
 ,
 가 . Gudjberg (13) 가
 112 7% . p
 0.002, 0.004
 가 .
 ,
 가 Sung 가
 336
 가
 , HRCT 56 46 가
 HRCT HRCT (8 11)
 가 , 가
 (7, 14). 10
 mm 1 - 1.5 mm CT
 HRCT
 ,
 (7, 14). MDCT 가
 가 (7, 15).
 MDCT 1 mm
 ,
 , 0.5 mm HRCT 가
 (isotropic voxels) 가
 가 (lack of tapering
 of bronchus)
 volumetric CT
 가가 . Bruggen - Bogaarts (21)
 volumetric CT가 가 91%
 99.3% HRCT
 , Lucidarme (22)
 가 3 mm CT
 HRCT
 , Sung (16) MDCT volumetric CT
 , mucus가 가
 ,
 CT HRCT
 64.3%
 82.1% , 가 가 가

가 MDCT HRCT

64 MDCT CT

HRCT 10 mm

1 mm 가

2 mm 3 mm

volumetric CT

가

가가 가

CT

가

HRCT MDCT

CT 1 mm

가

1. Hirshberg B, Biran I, Glazer M, Kramer MR. Hemoptysis: etiology, evaluation, and outcome in a tertiary referral hospital. *Chest* 1997;112:440-444
2. Abal AT, Nair PC, Cherian J. Haemoptysis: aetiology, evaluation and outcome- a prospective study in a third-world country. *Respir Med* 2001;95:548-552
3. Millar AB, Boothroyd AE, Edwards D, Hetzel MR. The role of computed tomography (CT) in the investigation of unexplained haemoptysis. *Respir Med* 1992;86:39-44
4. Marshall TJ, Flower CD, Jackson JE. The role of radiology in the investigation and management of patients with haemoptysis. *Clin Radiol* 1996;51:391-400
5. Naidich DP, Funt S, Ettenger NA, Arranda C. Hemoptysis: CT-bronchoscopic correlations in 58 cases. *Radiology* 1990;177:357-362

6. McGuinness G, Beacher JR, Harkin TJ, Garay SM, Rom WN, Naidich DP. Hemoptysis: prospective high-resolution CT/bronchoscopic correlation. *Chest* 1994;105:1155-1162
7. Grenier PA, Beigelman-Aubry C, Fétita C, Prêteux F, Brauner MW, Lenoir S. New frontiers in CT imaging of airway disease. *Eur Radiol* 2002;12:1022-1044
8. Naidich DP, Webb WR, Müller NL, Krinsky GA, Zerhouni EA, Siegelman SS. *Computed tomography and magnetic resonance of the thorax*. 3rd ed. Philadelphia, New York: Lippincott-Raven, 1999: 250-266
9. Kang EY, Miller RR, Müller NL. Bronchiectasis: comparison of preoperative thin-section CT and pathologic findings in resected specimens. *Radiology* 1995;195:649-654
10. McGuinness G, Naidich DP, Leitman BS, McCauley DI. Bronchiectasis: CT evaluation. *AJR Am J Roentgenol* 1993;160:253-259
11. Reiff DB, Wells AU, Carr DH, Cole PJ, Hansell DM. CT findings in bronchiectasis: limited value in distinguishing between idiopathic and specific types. *AJR Am J Roentgenol* 1995;165:261-267
12. Barker AF. Bronchiectasis. *N Engl J Med* 2002;346:1383-1393
13. Gudbjerg CE. Roentgenologic diagnosis of bronchiectasis; an analysis of 112 cases. *Acta Radiol* 1955;43:209-226
14. Grenier P, Maurice F, Musset D, Menu Y, Nahum H. Bronchiectasis: assessment by thin-section CT. *Radiology* 1986;161: 95-99
15. McGuinness G, Naidich DP. CT of airways disease and bronchiectasis. *Radiol Clin North Am* 2002;40 (1):1-19
16. Sung YM, Lee KS, Yi CA, Yoon YC, Kim TS, Kim S. Additional coronal images using Low-milliamperage multidetector-row computed tomography: effectiveness in the diagnosis of bronchiectasis. *J Comput Assist Tomogr* 2003;27(4):490-495
17. Chooi WK, Matthews S, Bull MJ, Morcos SK. Multislice helical CT: the value of multiplanar image reconstruction in assessment of the bronchi and small airways disease. *Br J Radiol* 2003;76:536-540
18. Arakawa H, Sasaka K, Lu WM, Hirayanagi N, Nakajima Y. Comparison of axial high-resolution CT and thin-section multiplanar reformation (MPR) for diagnosis of disease of the pulmonary parenchyma; preliminary study in 49 patients. *J Thoracic Imaging* 2004;19:24-31
19. Johkoh T, Müller NL, Nakamura H. Multidetector spiral high-resolution computed tomography of the lungs: distribution of findings on coronal image reconstructions. *J Thoracic Imaging* 2002;17:291-305
20. Boiselle PM, Lee KS, Ernst A. Multidetector CT of the central airways. *J Thoracic Imaging* 2005;20:186-195
21. van der Bruggen-Bogaarts BA, van der Bruggen HM, van Waes PFGM, Lammers JW. Assessment of bronchiectasis: comparison of HRCT and spiral volumetric CT. *J Comput Assist Tomogr* 1996; 20(1):15-19
22. Lucidarme O, Grenier PA, Coche E, Lenoir S, Aubert B, Beigelman C. Bronchiectasis: comparative assessment with thin-section CT and helical CT. *Radiology* 1996;200:673-679

The Value of Coronal Image Reconstructions of HRCT using MDCT for the Assessment of Bronchiectasis: Experiment with 64 MDCTs¹

Soo Jin Choi, M.D., Hyung Sik Kim, M.D., Sung Hwan Jeong, M.D.²,
Wook Jin, M.D., Dal Mo Yang, M.D.

¹Department of Radiology, ²Division of Pulmonary Medicine,
Department of Internal Medicine, Gil Medical Center, Gachon University of Medicine and Science

Purpose: The aim of our study was to evaluate the value of coronal image reconstructions of HRCT with using 64 MDCT scans for the assessment of bronchiectasis.

Materials and Methods: Chest CT scans (0.6-mm collimation, table speed of 14mm/sec and a rotation time of 0.5 sec) that employed 64 MDCT images (Somatom Sensation 64, Siemens) without contrast media were performed in 56 patients (21 males and 35 females, mean age: 55 years) who displayed hemoptysis. The images were reconstructed with a 1 mm slice thickness in the axial (10 mm apart) and coronal (10 mm apart) planes with using a high frequency algorithm, and they were sent to PACS monitors. The axial images were assessed with and without the coronal images by two radiologists at two separate occasions. The presence of bronchiectasis was decided upon by consensus diagnosis of the two radiologists. The detection rates of bronchiectasis were compared between the readings with using the axial images alone and the readings with using both the axial and coronal images.

Results: The detection rate of bronchiectasis was significantly higher with using both the axial and coronal images than with using with axial images alone (82.1%, 46/56 patients Vs 64.3%, 36/56 patients, respectively, $p=0.001$). The detection rates for all the lobes, except for the superior division of the left upper lobe, were significantly improved with using both the axial and coronal images (RUL; $p=0.013$, RML; $p=0.002$, RLL; 0.024, Lt lingular segment; $p=0.004$, LLL; $p=0.018$).

Conclusion: The coronal images of HRCT with using 64 MDCT improved the detection rate of bronchiectasis in the patients with hemoptysis when they were used in conjunction with the standard axial images. We suggest that HRCT with the coronal images should be obtained for the patients with hemoptysis, despite that the simple chest radiographs are often normal or they have non-specific findings.

Index words : Lung, hemorrhage
Bronchiectasis
Lung, CT
Computed tomography (CT), thin-section
Computed tomography (CT), image processing
Lung, disease

Address reprint requests to : Soo Jin Choi, M.D., Department of Radiology, Gil Medical Center, Gachon University of Medicine and Science
1198 Guwol-dong, Namdong-gu, Incheon 450-760, Korea.
Tel. 82-32-460-3060 Fax. 82-32-460-3065 E-mail: drchoi126@gilhospital.com