



1

(quantitative CT, QCT)
 가

HRCT 30 30
 62 12 , 18 ,
 25 15 . 16
 1 mm

- 750 HU, 1,500 HU
 Pulmo CT CT
 FVC FEV1 . Student t - test QCT
 Spearman 's correlation test QCT ()
 가 ,

FVC FEV1 FVC
 FEV1 가 가
 HRCT 가

가 (sequellar line shadow),
 가 (quantitative CT,
 (1). QCT) - 950 HU
 (attenuation coefficient) 가 (low
 attenuation areas, LAA)
 (high resolution computed tomography, HRCT)
 CT (vascularity) , QCT가 (end expiratory)
 (attenuation coefficient) (air trapping) (1). Paganin (air trapping)
 CT (2) HRCT (3, 4).
 (acinar pattern), 가 HRCT
 가 , 가 ,
 (5, 6).

QCT

2006

2006 5 14

2006 8 18

adrenergic agonists) (Fenoterol HBr 2.5mg; Boehringer Ingelheim, Ingelheim am Rhein, Germany)

2,200 spirometer (Sensor Medics Co, Model number 2,200, U.S.A.)

(forced expiratory volume in one second, FEV1) 15% 가 30

(15 , 15 , 25) HRCT

23 - 88 , 62 ,

12 18 ,
1 10 3
(supine position)
HRCT
(Somatom
Sensation 16, Siemens, Erlangen, Germany)
140kVp,
mAs 100 (166 mA) ,
1 mm
(Window level) - 750 HU,
(window width) 1,500 HU
(syngo Pulmo CT, Siemens,
Erlangen, Germany)

(mean lung density, MLD) - 1,000 HU - 900
(Fig. 1)

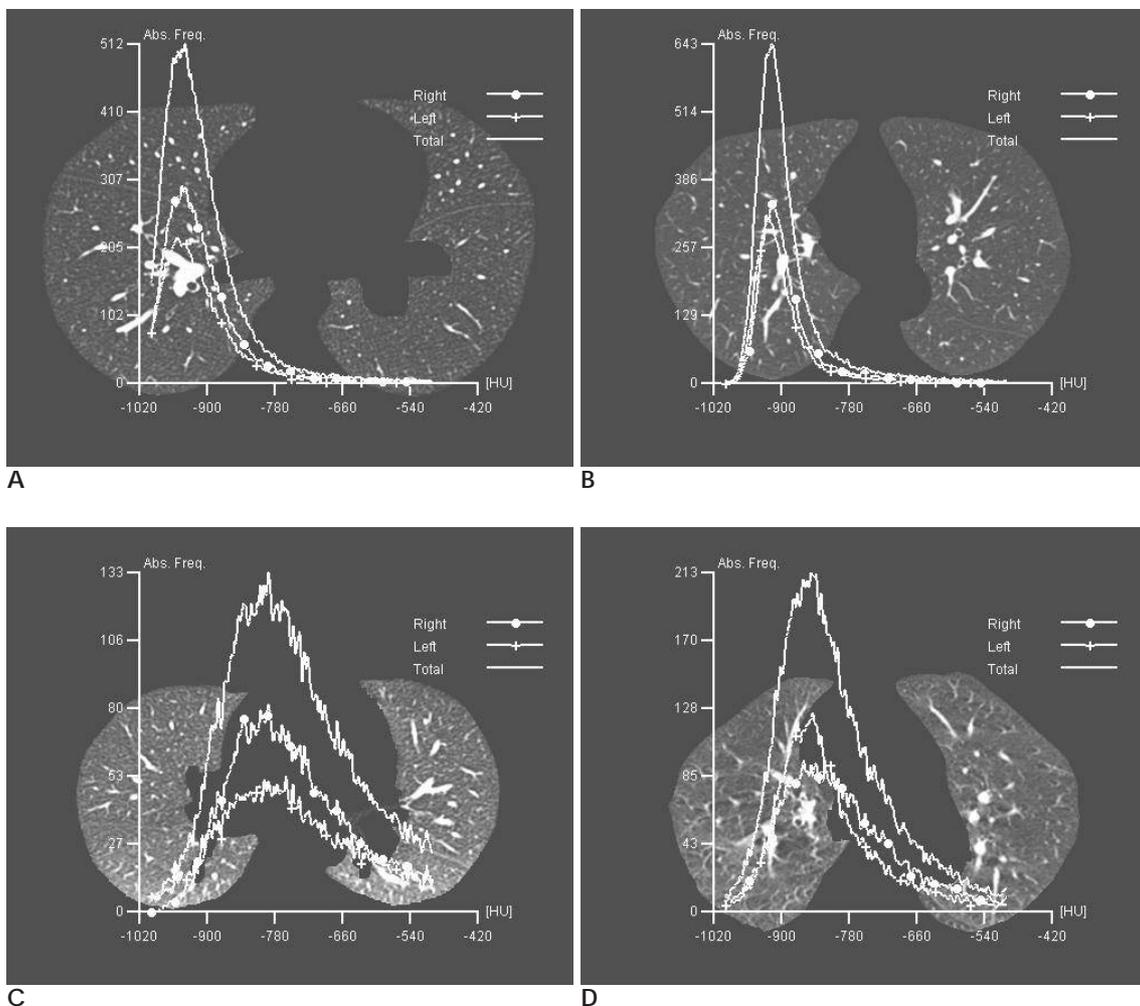


Fig. 1. Comparison of quantitative CT between normal volunteers and bronchial asthmatic patients. Difference in mean lung density of asthmatic patients in between inspiration and expiration was less than in normal controls.

- A. Mean lung density graph of normal volunteer in inspiration.
- B. Mean lung density graph of normal volunteer in expiration.
- C. Mean lung density of asthmatic patient in inspiration.
- D. Mean lung density of asthmatic patient in expiration.

HU (subrange) (%)

HRCT
(American Thoracic Society, ATS) 2,200
spirometer (Sensor Medics Co, Model number 2,200, U.S.A.)
(Pulmonary Function Test, PFT)

PFT 가
(forced vital capacity, FVC) FEV1

Student t- test QCT, PFT

QCT Spearman's correlation test
SPSS 11 (SPSS Inc. Headquarters, 233 S. Wacker Drive, Chicago, Illinois)

MLD -841.7 ± 22.9 HU
가 (p > 0.05). -840.9 ± 39.1 HU
± 31.3 HU -713.7
-750.7 ± 61.3 HU

(p < 0.05) (Fig. 2) (Table 1).

16.1% 40.7 ± 10.0% 41.2 ± 가
(p > 0.05), 15.0 ± 14.8%,
7.9 ± 2.6%
(p < 0.05) (Fig. 3). FVC가 4.32 L,
2.75 L
FEV1 3.84 L/sec,
2.04 L/sec (Table 1).

QCT, FVC MLD (p > 0.05).
FEV1 MLD (p > 0.05). PFT
MLD (p > 0.05), FVC FEV1 MLD (p < 0.05).
QCT 가

Table 1. Correlate Pulmonary Function Test with Quantitative Computed Tomography in Normal Volunteers and Asthmatic Patients

	FEV ₁ (L)	MLD* inhalation	MLD exhalation	SUB [†] inhalation	SUB exhalation
Asthma patients	2.04	- 840.9 HU (r = - 0.02, p=0.93)	- 750.7 HU (r = 0.7, p=0.0)	41.2% (r = - 0.15, p=0.43)	15% (r = - 0.71, p=0.0)
Volunteers	3.84	- 841.7 HU (r = 0.18, p=0.35)	- 713.7 HU (r = 0.15, p=0.42)	40.7% (r = - 0.12, p=0.55)	7.9% (r = - 0.04, p=0.85)

* MLD: Mean lung density, [†]SUB: Subrange, [‡]We used Spearman's correlation test

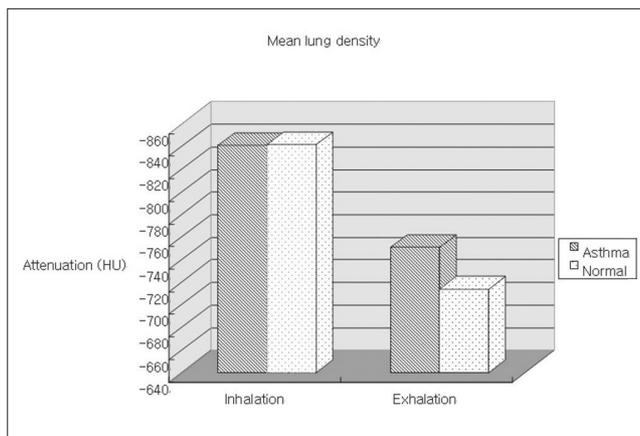


Fig. 2. Mean lung density of normal volunteers and asthmatic patients in inhalation and exhalation. In exhalation, mean lung density was lower in asthmatic patients than in normal volunteers but there was no difference in inhalation.

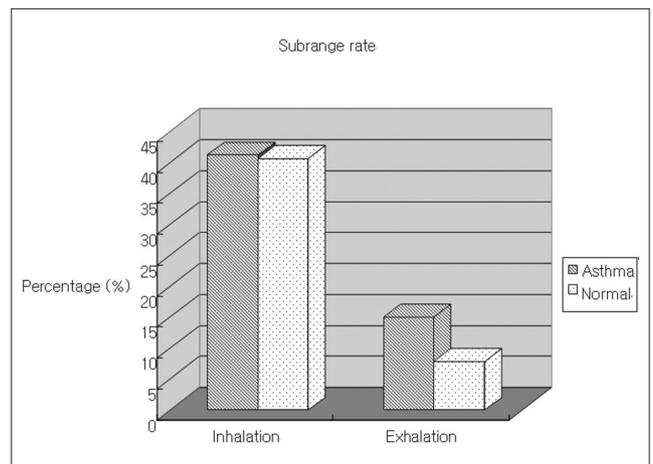


Fig. 3. - 1,000 HU to - 950 HU subrange ratio (%) of normal volunteers and asthmatic patients in inhalation and exhalation. In exhalation, subrange ratio (%) was higher in asthmatic patients than in normal volunteer but there was no difference in inhalation.

QCT가 PFT 가 , Mitsunobu (8)
 FEV1 MLD 가 가 가
 Gevenois (5) CT - 950 HU
 CT 가 가 61
 가 QCT 가 PFT 25
 가 (spirometer)
 , FVC MLD
 가 QCT
 QCT가 가
 (15).
 QCT 가 HRCT QCT
 가 (5). 가
 (chronic obstructive pulmonary disease, COPD)
 (LAA) 가 , CT LAA
 HRCT , (air
 trapping),
 QCT 가
 HRCT
 (3, 4, 6-9).
 7 가 , Mitsunobu
 (8) 가
 , 3 MDCT
 가 ,
 3 CT
 가 가
 (8, 10, 11).
 Heremans (12) COPD MLD가
 , Gevenois (13)
 가 - 950 HU (RA950)
 가 , Mitsunobu (14) HRCT
 가

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Bronchial Asthma: Correlation of Quantitative CT and the Pulmonary Function Test¹

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Purpose: The purpose of this study was to assess the availability of quantitative computed tomography (QCT) in the evaluation of asthma patients and to correlate its use with the pulmonary function test (PFT).

Materials and Methods: Thirty asthmatic patients and thirty normal volunteers were prospectively evaluated by the use of HRCT and the PFT. By using 16 slice MDCT, HRCT was performed from the apex to the base of both lungs at the end inspiration and end expiration periods in all patients and images were reconstructed to a thickness of 1 mm (window level: -750 HU, window width: 1,500 HU). We analyzed each image for the whole lung using the Pulmo CT program. PFTs including FVC and FEV1 were performed one week prior and one week after the completion of a HRCT. The Difference of QCT (the mean lung density and subrange ratio) between volunteers and asthmatic patients was analyzed by using the Student's t-test. Spearman's correlation test was used to determine the association between PFT and QCT.

Results: The mean lung density (MLD) and subrange ratio were lower in asthmatic patients than in volunteers for end expiration and no difference was seen between asthmatic patients and volunteers for end inspiration. FVC and FEV1 were lower in asthmatic patients than in volunteers. A decrease in FVC and FEV1 correlated with changes in the MLD and subrange ratio for end expiration.

Conclusion: QCT such as MLD and the subrange ratio using HRCT can be used to indirectly assess the pulmonary function of the asthma patient. The PFT seems to correlate better with the MLD and subrange ratio for expiratory QCT of the asthma patient than with inspiratory QCT.

Index words : Lung, CT
Asthma
Lung, function
Lung, radiography

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