



(high spatial frequency reconstruction algorithm)  
10 120 kVp,  
300mA, FOV 30cm, 1mm, window level -750HU,  
window width 1000-1300HU (3 3

21 ( :14 , :7 )  
3.5 13.8 ( 7.7 ) . HRCT 16

10 1 : 6.9 , 8 , 2 )

(Radioallergosorbent test, Ala STAT<sup>®</sup>, DPC<sup>®</sup>, CA, U.S.A.)

8

1cm  
(14, 15). HRCT 가

1/6

가

density mask (20)

Mann-Whitney test ,

chi-square test .

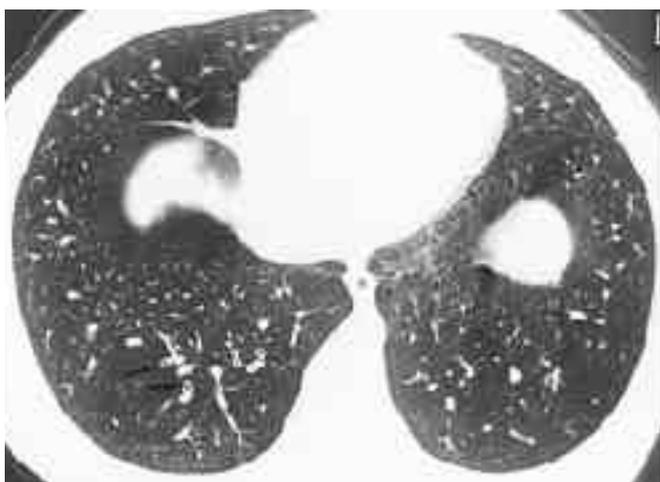
Sly (13) 7 , 가

14 4 6 11 ( 3.2 )

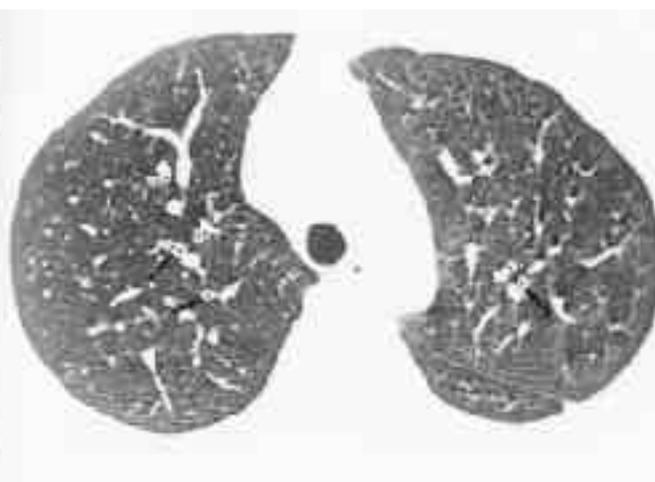
. HRCT 19

, 2

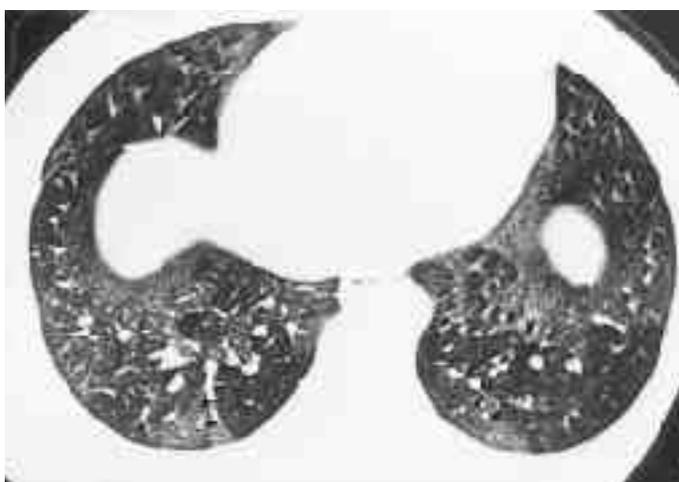
. HRCT CT W-2000(Hidachi medial Co, Tokyo, Japan)



A



B



C

Fig. 1. A, B, C. HRCT scan through right lower lobe in a 13 years 10 months-old male in inspiratory phase. The bronchial walls are moderately thickened in right lower lobe (A, arrows) and both upper lobe (B, arrows), mainly subsegmental bronchi. Nonsegmental air trapping is seen in the both lower lobe (C, arrows).

21 14 (66.7%) (Fig.1A, B), 7 (33.3 %) 14  
 11 (52.3 %) (Fig. 1C, Fig. 2 A, B)  
 , 3 (Table 1).

6.7-9.5%  
 (p = .359),  
 (p = .881), (p = .337),  
 (p = .659),  
 (p = .361) p > .05  
 , ,  
 가  
 chi-square test 가 (p < 0.05) (Table 2).

Table 1. HRCT and Clinical Findings of 21 Patients with Asthma

Sex/Age	HRCT findings		Duration of disease	Grade of disease	Type	Medication at HRCT scan
	BW thickening	Air trapping				
1. M/6y6m	+	-	3y2m	S	A	B
2. M/13y10m	+	+	6y1m	S	A	iB+ iST
3. M/12y	-	-	4y	S	A	B
4. M/10y7m	+	+	6y	Mo	NA	B
5. F/8y11m	-	-	2y8m	Mo	A	B
6. F/3y6m	+	+	8m	Mo	A	B+ iST
7. M/6y	+	+	1y5m	Mo	A	B
8. F/9y10m	+	-	7y	S	A	B
9. F/8y6m	-	-	1y4m	Mo	A	B
10. F/8y6m	+	+	4m	S	A	B+ ST
11. M/5y3m	+	+	1y7m	Mo	A	B
12. F/8y6m	-	-	6y11m	Mo	A	B
13. M/3y6m	+	+	2y	Mo	NA	B
14. F/8y6m	+	-	2y7m	S	NA	B+ iST
15. M/9y1m	+	+	3y5m	S	A	iB
16. M/10y1m	+	+	3y	Mo	NA	B
17. M/8y8m	-	-	1y4m	Mo	A	B
18. M/6y7m	-	-	1y7m	Mo	NA	B
19. M/7y3m	-	-	6y1m	Mo	NA	B
20. M/3y	+	+	2y8m	Mo	NA	B
21. M/3y3m	+	+	2y8m	Mo	NA	iB+ ST

BW : bronchial wall  
 S: severe, Mo: moderate  
 A: allergic, NA: non-allergic  
 i : inhalatory  
 + : finding present at CT  
 - : finding absent at CT  
 B : bronchodilator  
 ST : steroid

가  
 가 가  
 (1-5).  
 “ ”  
 2.2-4.2 %

Table 2. Comparison between the Bronchial Wall Thickening and Air Trapping

	Air Trapping		Total
	+	-	
BW Thickening +	11	3	14
-		7	7
Total	11	10	21

P= 0.001 by chi-square test  
 + : presence, - : absence

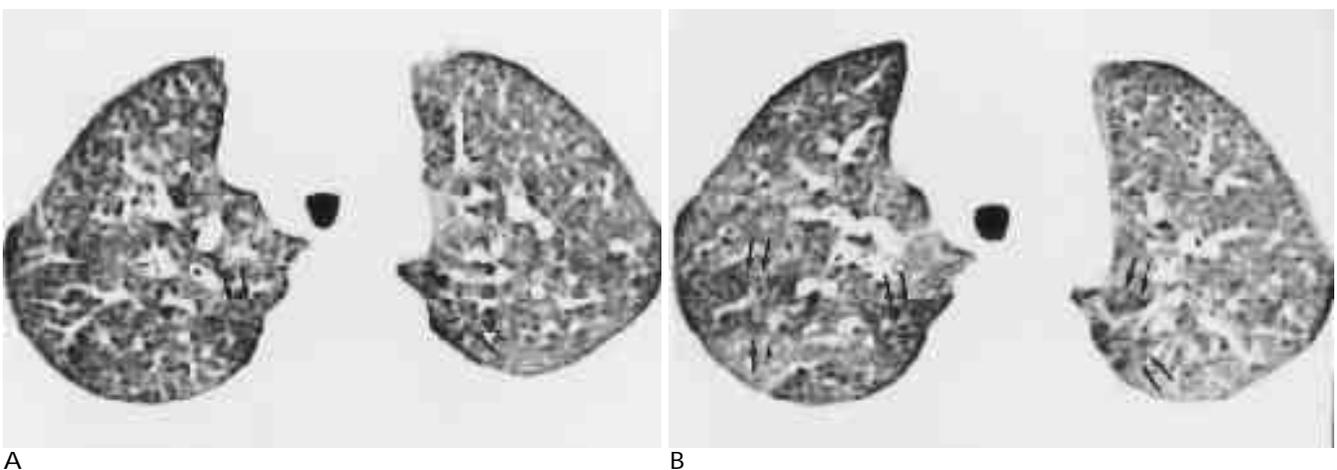


Fig. 2. HRCT scan through the right upper lobe in a 3 year - old male. Focal area of hyperlucency, most likely representing air trapping are seen in the both upper lobe (A, arrows), which is more prominent in expiratory scan (B, arrows).

(6). CT Allergic bronchopulmonary aspergillosis (ABPA), (5, 6, 9). Lynch (10) Neeld (17) ABPA가 15-77 % (cylindrical bronchiectasis), Paganin (11) 56 % (bronchial dilatation) 가 가 (remodelling) 가 (17). 가 (permanent abnormality) 가 (17). Lynch (10) 가 Paganin 6 23 가 가 (18, 19). Paganin (11) 16 %, HRCT 46 % Lynch (10) 71 % 92 % 가 (20) 1 44% (forced expiratory volume in 1 second, FEV1) 60 % 가 7 14 11 (10-12). (23). (20) 가 14 % 가 50 % (residual volume, RV) 가 , Lynch (22) CT (functional residual capacity, FRC), (forced vital capacity, FVC) CT

가 (total lung volume) density mask (20) 10 6.7-9.5 % 4 가 가 (9, 10, 22). 가 HRCT 가

1. Barnes PJ. Pathogenesis of asthma: a review. *J Royal Soc Med* 1983; 76:580-586
2. Meneely GR, Rensetti AD Jr., Steele JD, Wyatt JP, Harris HW. American thoracic society: chronic bronchitis, asthma, and pulmonary emphysema. *Am Rev Respir Dis* 1962;85:762-768
3. Sly RM. Changing asthma mortality. *Ann Allergy* 1994;73:259-268
4. Granady L, Sly RM, Odonnell R. Association of prevalence with morbidity and mortality from asthma. *Ann Allergy*. 1994;72:59
5. Clausen JL. The diagnosis of emphysema, chronic bronchitis, and asthma. *Clin Chest Med* 1990;11:405-416
6. Lillington GA, Müller NL. Radiological imaging in the detection and differentiation of diffuse obstructive airway diseases. *Clin Rev Allery* 1990;8:277-290
7. Hruban RH, Meziane MA, Zehrouni EA et al. High resolution computed tomography of inflation-fixed lungs. Pathologic-radiologic correlation of centrilobular emphysema. *Am Rev Respir Dis* 1987; 136:935-940
8. Grenier P, Maurice F, Musset D, Menu Y, Nahum H. Bronchiectasis: assessment by thin-section CT. *Radiology* 1986;161:95-99
9. Kuhn JP. High resolution computed tomography of pediatric pulmonary parenchymal disorders. *Radiol Clin North Am* 1993;31:533-551
10. Lynch DA, Newell JD, Tschomper BA, Cink TM, Newman LS, Bethel R. Uncomplicated asthma in adults: comparison of CT appearance of the lungs in asthmatic and healthy subjects. *Radiology* 1993;188:829-833
11. Paganin F, Trussard V, Senerterre E et al. Chest radiography and high resolution computed tomography of the lungs in asthma *Am Rev Respir Dis* 1992;146:1084-1087
12. Kondoh Y, Taniguchi H, Yokoyama S, Taki F, Takagi K, Satake T. Emphysematous changes in chronic asthma in relation to cigarette smoking. Assessment by computed tomography. *Chest* 1990;97: 845-849
13. Sly RM. Asthma In Behrman RE, Kliegman RM, Arvin AM. *Nelson*

- textbook of pediatrics*. 15th ed., Philadelphia: W.B. Saunders, 1996; 628-641
14. Müller NL, Mawson JB, Mathieson JR, Abboud R, Ostrow DN, Champion P. Sarcoidosis: correlation of extent of disease at CT with clinical, functional, and radiographic findings. *Radiology* 1989;171: 613-618
  15. Wells AU, Rubens MB, du Bois RM, Hansell DM. Serial CT in fibrosing alveolitis: prognostic significance of the initial pattern. *AJR Am J Roentgenol* 1993;161:1159-1165
  16. Neeld DA, Goodman LR, Gurney JW, Greenberger PA, Fink JN. Computed tomography in the evaluation of allergic bronchopulmonary aspergillosis. *Am Rev Respir Dis* 1990;142:1200-1205
  17. Paganin F, Seneterre E, Chanez P, Daures JP, Bruel JM, Michel FB, Bousquet J. Computed tomography of the lungs in asthma : influence of disease severity and etiology. *Am J Respir Crit Care Med* 1996;153:110-114
  18. Weiss ST, Tosteson TD, Segal MR, Tager IB, Redline S, Speizer FE. Effects of asthma on pulmonary function in children. A longitudinal population-based study *Am Rev Respir Dis* 1992;145:58-64
  19. Kelly WJW, Hudson I, Phelan PD, Pain MCF, Olinsky A. Childhood asthma in adult life: a further study at 28 years of age. *Br Med J* 1987;294:1059-1062
  20. Park CS, Müller NL, Worthy SA, Kim JS, Awadh N, Fitzgerald M. Airway obstruction in asthmatic and healthy individuals: inspiratory and expiratory thin section CT findings. *Radiology* 1997;203:361-367
  21. Newman KB, Lynch DA, Newman LS, Ellegood D, Newell JD. Quantitative computed tomography detects air trapping due to asthma. *Chest* 1994;106:105-109
  22. Zierverink SA, Harper AP, Holden RW, Klatter EC, Braittain H. Emergency room radiography of asthma : an efficacy study *Radiology* 1982;145:27-29
  23. Kinsella M, Müller NL, Staples C, Vedal S, Chan-Yeung M. Hyperinflation in asthma and emphysema. assessment by pulmonary function testing and computed tomography. *Chest* 1988; 94:286-289

## HRCT Findings of Asthmatic Children under Maintenance Therapy<sup>1</sup>

Hyun Sook Hong, M.D., Jai Soung Park, M.D., Dong Erk Goo, M.D., Hae Kyung Lee, M.D.,  
Kui Hyang Kwon, M.D., Deuk Lin Choi, M.D., Bok Yang Pyun, M.D.<sup>2</sup>

<sup>1</sup>Department of Radiology, Soonchunhyang University Hospital, Seoul, Korea

<sup>2</sup>Department of Pediatrics, Soonchunhyang University Hospital, Seoul, Korea

**Purpose:** The purpose of this study was to evaluate the HRCT findings of bronchial asthma during maintenance bronchodilator therapy and to determine whether there were irreversible bronchial changes occurred in pediatric patients with this condition.

**Materials and Methods:** HRCT findings of the lung in 21 asthmatic children [14 boys and 7 girls aged between 3.5 and 13.8 (mean : 7.7) years] who were receiving maintenance bronchodilator therapy were retrospectively studied. At the time of CT examination, 16 were receiving nonsteroid bronchodilator therapy only, and five were receiving both bronchodilator and steroid therapy. Thirteen patients were defined as allergic and eight were nonallergic. The clinical severity of chronic asthma was graded as severe in seven cases, and moderate in 14. The duration of the disease ranged from 4 months to 6 years (mean 3.2 years). HRCT was performed in 19 cases for evaluation of the atelectasis, hyperinflation, and prominent bronchovascular bundles seen on plain radiographs, and in two cases for evaluation following acute exacerbation. A CT W-2000 scanner (Hitachi Medical Co. Tokyo, Japan) was used during the end inspiratory phase, and in addition, ten patients were scanned during the expiratory phase. Scans were reviewed for evidence of bronchial thickening, bronchiectasis, emphysema, abnormal density, mucus plugs, and other morphological abnormalities. The presence of bronchial wall thickening or air trapping was evaluated according to the duration, severity and type of asthma.

**Results:** Among the 21 patients, 7(33.3%) had normal HRCT findings, while in 14 (66.7%), bronchial wall thickening was demonstrated. Eleven of the 14 patients with bronchial wall thickening (78.6%) also had air trapping. No patient was suffering from bronchiectasis or emphysema. There were no statistically significant correlations between the presence of bronchial wall thickening or air trapping and the duration of the disease, its severity, or type of asthma. There was, however, a statistically significant correlation between bronchial wall thickening and air trapping ( $p < .05$ ).

**Conclusion:** In asthmatic children who were under maintenance therapy, the most frequent HRCT findings were bronchial wall thickening and air trapping, with significant correlation between the presence of these two phenomena. No destructive lesion such as bronchiectasis or emphysema was found in these asthmatic children, however, and this is probably due to the short duration of the disease, and different disease processes.

**Index words :** Children, respiratory system

Asthma

Lung, CT

Computed tomography (CT), high-resolution

Address reprint requests to : Hyun Sook Hong, M.D., Department of Radiology Soonchunhyang University Hospital  
657, Hannam-Dong, Yongsan-Ku, Seoul 140-743, Korea.  
Tel. 82-2-709-9396, 9397 Fax. 82-2-795-3928 E-mail: hshong@hosp.sch.ac.kr