

: CT 가
 : 16 8
 , =2:2), 가 2 (: =0:2) =6:4), 4 (:
 >0.05). 10 (: =0:2) 가 (p
 2
 6 (: =6:0), 1 (), 가 7 (:
 =1:6) (p <0.05).
 : 1 CT 가 가

CT (3).
 , , 가,
 , (1). (crackle sound)
 가
 CT 가 24 CT
 가 CT 가
 (1).
 24
 가
 가가 (2). CT 21 8
 (volume overload)
 가 . Zimmerman (pulmonary veno - occlusive dis -
 ease) . 8
 (gravity - dependent area) 2 ,
 cytoxan 1 , 1 , 1 , 1 ,

(segmental and subsegmental level)

Mann - Whitney U test

$(p=0.328)$ (Fig. 1, 2).

$(p = 0.005)$ (Fig. 3).

CT Somatom Plus 4 (Siemens Medical Systems, Erlangen, Germany)

1 mm, 10 mm (high spatial resolution algorithm)

1500 HU (percussion)

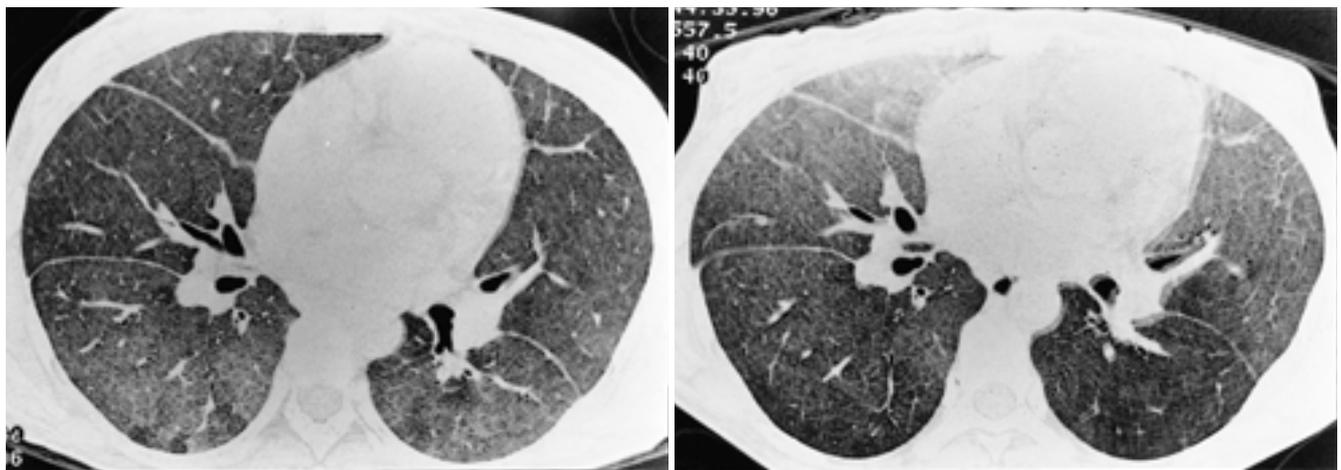


Fig. 1. A 33-year-old woman with pulmonary edema.
A. CT scan in supine position shows diffuse ground glass opacity in the entire lung.
B. CT scan at the same level as in Fig 1A. in prone position shows more prominent ground glass opacity in the anterior or dependent lung area. She was graded as high in degree of positional shifting of ground glass opacity.

Table 1

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Table (4, 5).
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CT
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(1).
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(6, 7).
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Table 1. Clinical Diagnosis and HRCT Findings of Each Case in Pulmonary Edema and Non-pulmonary Edema Groups

| Group | Sex/Age (years) | Clinical diagnosis | Shifting of GGO | Shifting of IST | Shifting of PIT |
|-------|-----------------|---|-----------------|-----------------|-----------------|
| PE | F/31 | Pulmonary edema | High | High | Low |
| | F/56 | Pulmonary edema | High | High | Low |
| | M/68 | Pulmonary edema | Intermediate | Low | Low |
| | F/33 | Pulmonary edema | High | High | Low |
| | F/14 | Pulmonary edema | High | High | Low |
| | M/72 | Pulmonary edema | Intermediate | Intermediate | Low |
| | F/70 | Pulmonary edema | High | High | Low |
| | M/28 | Pulmonary edema | High | High | Low |
| NPE | M/65 | Cytosan-induced interstitial pneumonia | Intermediate | Low | NA |
| | M/54 | Leptospirosis | High | Low | NA |
| | M/83 | Interstitial pneumonia of unknown cause | Intermediate | Low | NA |
| | M/57 | Blood aspiration, bronchiectasis | High | NA | NA |
| | M/72 | Sarcoidosis | High | Low | Low |
| | F/42 | Scleroderma, interstitial lung disease | Low | Low | NA |
| | F/32 | Hypersensitivity pneumonitis | Low | NA | NA |
| | F/29 | Scleroderma, interstitial lung disease | High | Low | NA |

PE - pulmonary edema group ; NPE - non-pulmonary edema group

GGO - ground-glass opacity ; IST - interlobular septal thickening ; PIT - peribronchovascular interstitial thickening

NA - not available

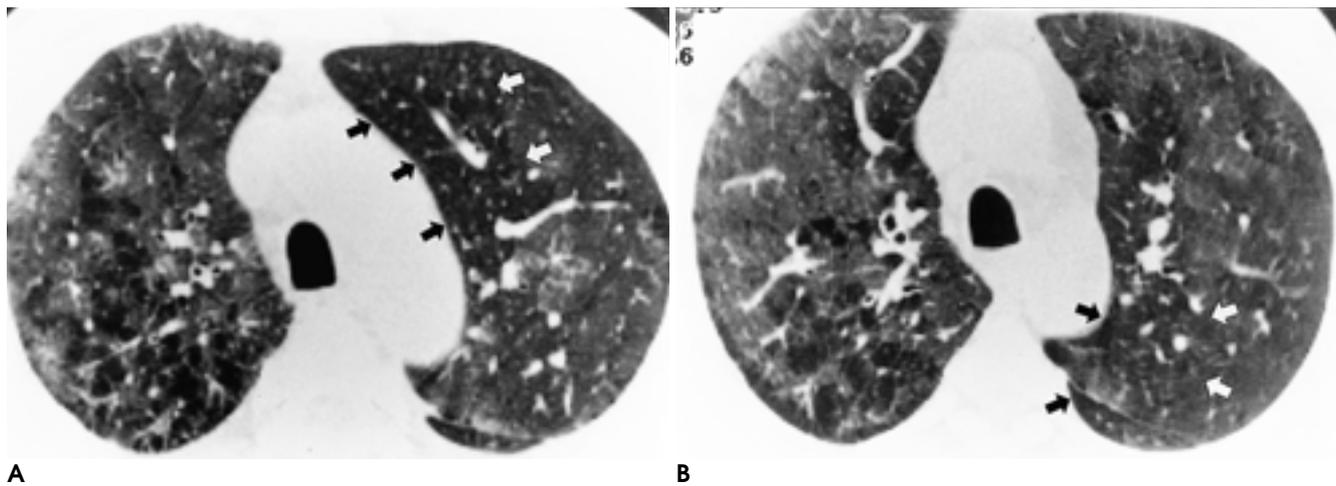


Fig. 2. A 54-year-old man with leptospirosis. Thin-section CT shows widespread patchy ground glass opacity.
A. Scan with supine position shows diffuse distribution of ground-glass opacity with some sparing of non-dependent anterior lung zone (arrows).
B. Position change made significant shifting of ground-glass opacity to dependent anterior lung zone. Note relative lucency in the non-dependent posterior lung zone (open arrows) compared with Fig. 2A. He was graded as high in degree of positional shifting of ground glass opacity.

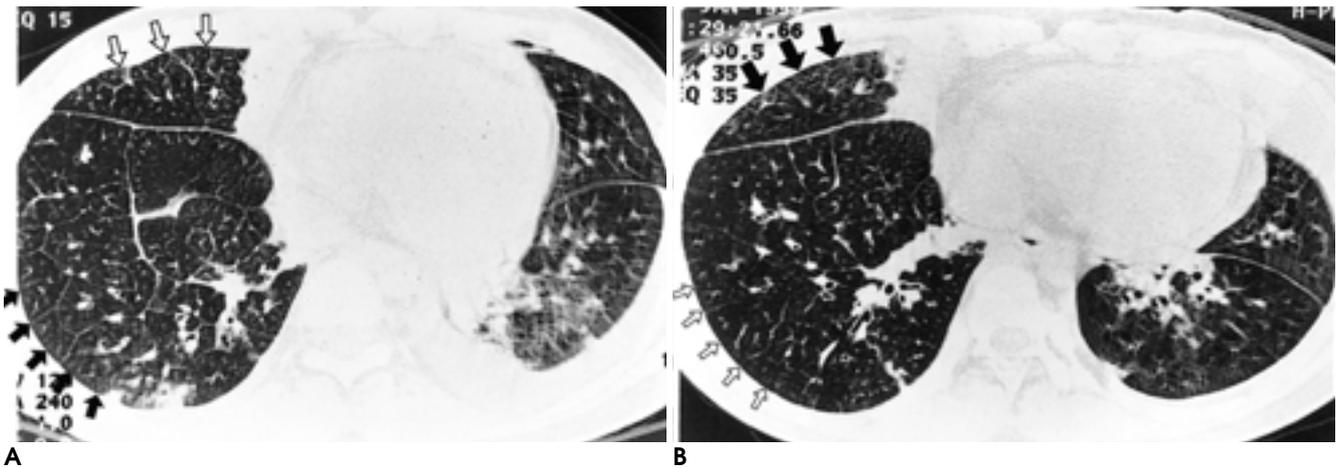


Fig. 3. A 14-year-old girl with pulmonary edema due to pulmonary veno-occlusive disease. CT scans at the same level in supine (A) and prone (B) position show marked shifting of septal lines to gravity-dependent area (arrows). Note relative paucity of interlobular septal lines in non-dependent lung zone (open arrows). She was graded as high in degree of positional shifting of interlobular septal thickening.

Table 2. Statistics of Positional Shifting of High-Resolution CT Findings

| | GGO (n = 16) | | IST (n = 14) | | PIT (n = 9) | |
|----------------|--------------|-------------|--------------|-------------|-------------|-------------|
| | PE (n = 8) | NPE (n = 8) | PE (n = 8) | NPE (n = 6) | PE (n = 8) | NPE (n = 1) |
| High* | 6 | 4 | 6 | 0 | 0 | 0 |
| Intermediate † | 2 | 2 | 1 | 0 | 0 | 0 |
| Low ‡ | 0 | 2 | 1 | 6 | 8 | 1 |
| <i>p</i> value | 0.328 | | 0.005 | | 1.000 | |

GGO - ground-glass opacity ; IST - interlobular septal thickening ; PIT - peribronchovascular interstitial thickening

PE - pulmonary edema ; NPE - non-pulmonary edema

* - high represents that degree of shifting is definite

† - intermediate represents that degree of shifting is not definite, but present

‡ - low represents that degree of shifting is imperceptible

Zimmermann

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Starling

가

가

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10

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가

가

(exudative)

가

(3).

(transudative)

가

가

가

(9).

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Poiseuille

(8).

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CT

$$F = \frac{(P_1 - P_2)R^4}{8l}$$

(F: , P₁: , P₂: ,)

R: , l: , :)

CT

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CT

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(10)

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Positional Shifting of HRCT Findings in Patients with Pulmonary Edema¹

Young-sun Kim, M.D., Yo Won Choi, M.D., Seok-chol Jeon, M.D., Choong-ki Park, M.D.,
Heung-suk Seo, M.D., Seung-rho Lee, M.D., Chang-kok Hahm, M.D.

¹Department of Diagnostic Radiology, College of Medicine, Hanyang University

Purpose: To assess the value of positional shifting to a gravity-dependent area, as revealed by HRCT, in differentiating pulmonary edema (PE) from other conditions.

Materials and Methods: Sixteen consecutive patients in whom plain radiographs suggested the presence of pulmonary edema but the clinical findings were indefinite underwent HRCT of the lung. For initial scanning they were in the supine position, and then in the prone position. Findings of ground-glass opacity, interlobular septal thickening and peribronchovascular interstitial thickening were analyzed in terms of the presence and degree of shifting to a gravity-dependent area, a grade of high, intermediate or low being assigned.

Results: PE was diagnosed in 8 of 16 cases, the remainder being designated as non-pulmonary edema (NPE). Ground-glass opacity was observed in all 16, while the degree of positional shifting was found to be high in ten (PE:NPE = 6:4), intermediate in four (PE:NPE = 2:2), and low in two (PE:NPE = 0:2). There was no significant difference between the two groups ($p > 0.05$). Interlobular septal thickening was observed in all but two NPE cases; the degree of shifting was high in six (PE:NPE = 6:0), intermediate in one (PE), and low in seven (PE:NPE = 1:6). Shifting was significantly more prominent in PE than in NPE cases ($p < 0.05$). Peribronchovascular interstitial thickening was positive in all PE cases and one NPE case, with no positional shifting.

Conclusion: Positional shifting of interlobular septal thickening to a gravity-dependent area, as demonstrated by HRCT, is the most specific indicator of pulmonary edema.

Index words : Lung, fluid
Computed tomography (CT), high-resolution

Address reprint requests to : Yo-won Choi, M.D., Department of Diagnostic Radiology, Hanyang University Hospital
17, Haengdang-dong, Seongdong-gu, Seoul 133-792, South Korea.
Tel. 82-2-2290-9161 Fax. 82-2-2293-2111 E-mail: ywchoi@email.hanyang.ac.kr