

CT

1

.

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

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

CT (segmental and subsegmental level)

CT , 3 ,

2 , 1

Mann - Whitney U test

16 50.4 (14 - 83)

8 46.5

(14 - 72) 3 , 5 ,

54.3 (29 - 83) 5 , 3

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

1 mm, 10 mm

(high spatial resolution algorithm)

20 25 mm

- 700 HU,

1500 HU

5 가

(percussion) , 가

가 7 1 , 6

14

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

가

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

9 1

가

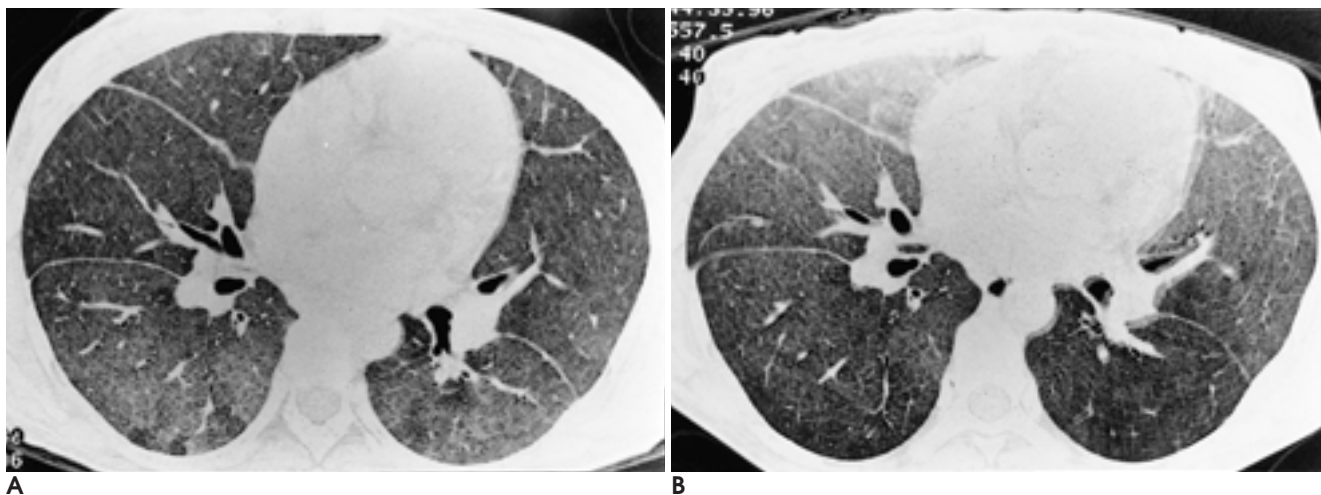


Fig. 1. A 33-year-old woman with pulmonary edema.
A. CT scan in supine position shows diffuse ground glass opacity in the entire lung.
B. CT scan at the same level as in Fig 1A. in prone position shows more prominent ground glass opacity in the anterior or dependent lung area. She was graded as high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

Table 1

Table

CT

(4, 5).

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CT

(1).

(6, 7).

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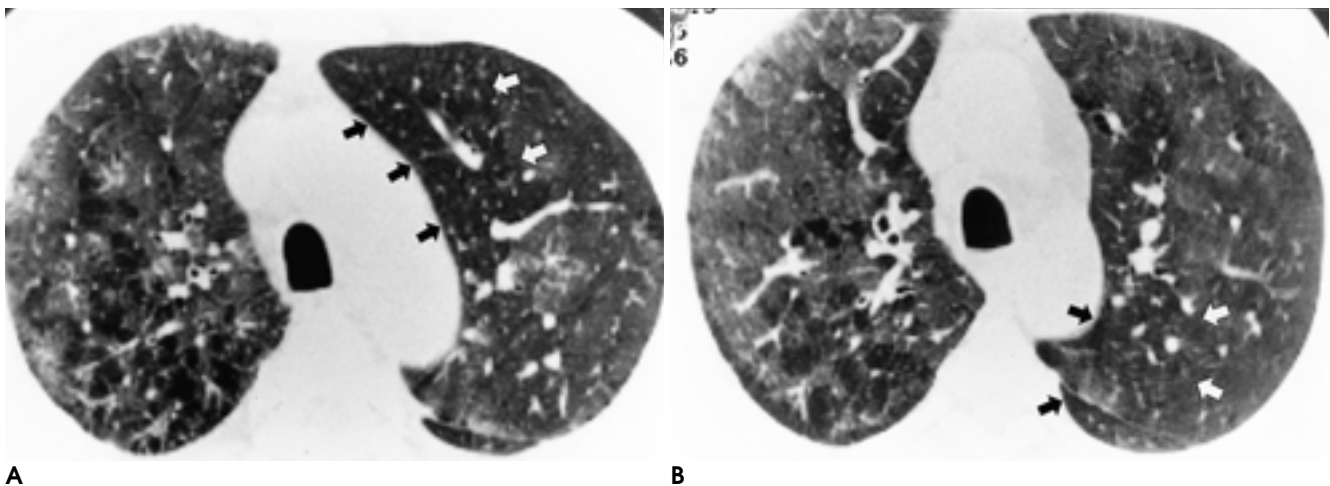
Table 1. Clinical Diagnosis and HRCT Findings of Each Case in Pulmonary Edema and Non-pulmonary Edema Groups

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



A

B

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.

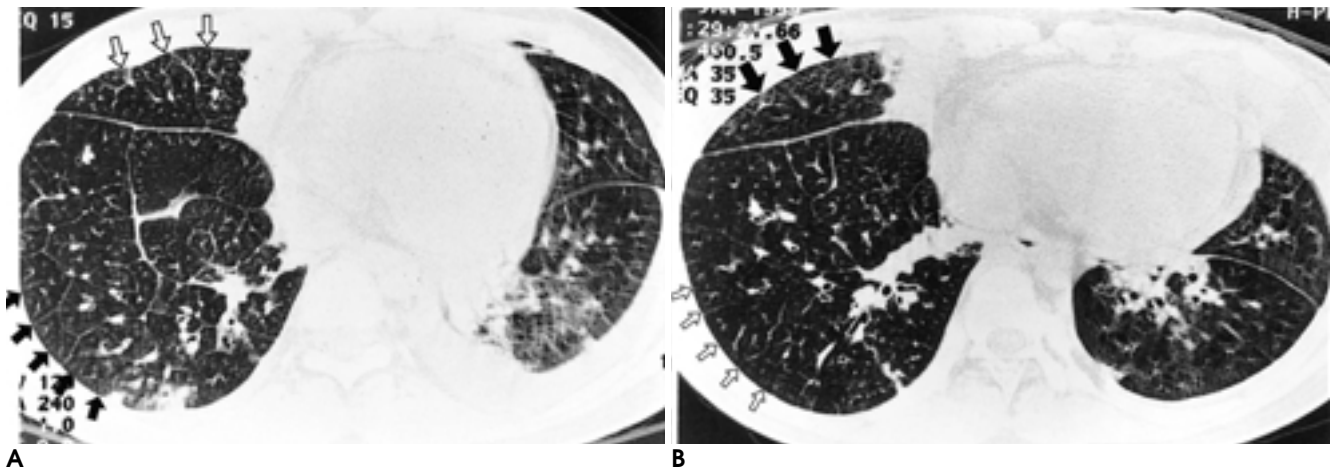


Fig. 3. A 14-year-old girl with pulmonary edema due to pulmonary veno-occlusive disease. CT scans at the same level in supine (**A**) and prone (**B**) position show marked shifting of septal lines to gravity-dependent area (arrows). Note relative paucity of interlobular septal lines in non-dependent 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

가

가

Starling

가

가

가

10

가

가

가

(exudative)

가

(3).

(transudative)

가

(9).

가

가

CT

Poiseuille

(8).

가

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

(F: , P_1 : , P_2 : ,

R: , l: , :)

CT

가

가

가

4

CT

가

(10)

가

가

가

CT가

CT

가

가

CT

16

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CT가

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Positional Shifting of HRCT Findings in Patients with Pulmonary Edema¹

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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

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