

The Irradiated Lung Volume in Tangential Fields for the
Treatment of a Breast

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Purpose : Radiation pneumonitis is one of the complications caused by radiation therapy that includes a portion of the lung tissue. The severity of radiation induced pulmonary dysfunction depends on the irradiated lung volume, total dose, dose rate and underlying pulmonary function. It also depends on whether chemotherapy is done or not. The irradiated lung volume is the most important factor to predict the pulmonary dysfunction in breast cancer patients following radiation therapy. There are some data that show the irradiated lung volume measured from CT scans as a part of treatment planning with the tangential beams. But such data have not been reported in Korea. We planned to evaluate the irradiated lung volume quantitatively using CT scans for the breast tangential field and search for useful factors that could predict the irradiated lung volume.

Materials and Methods : The lung volume was measured for 25 patients with breast cancer irradiated with tangential field from Jan.1995 to Aug.1996. Parameters that can predict the irradiated lung volume included; (1) the perpendicular distance from the posterior tangential edge to the posterior part of the anterior chest wall at the center of the field (CLD); (2) the maximum perpendicular distance from the posterior tangential field edge to the posterior part of the anterior chest wall (MLD); (3) the greatest perpendicular distance from the posterior tangential edge to the posterior part of anterior chest wall on CT image at the center of the longitudinal field (GPD); (4) the length of the longitudinal field (L). The irradiated lung volume(RV), the entire both lung volume(EV) and the ipsilateral lung volume(IV) were measured using dose volume histogram. The relationship between the irradiated lung volume and predictors was evaluated by regression analysis.

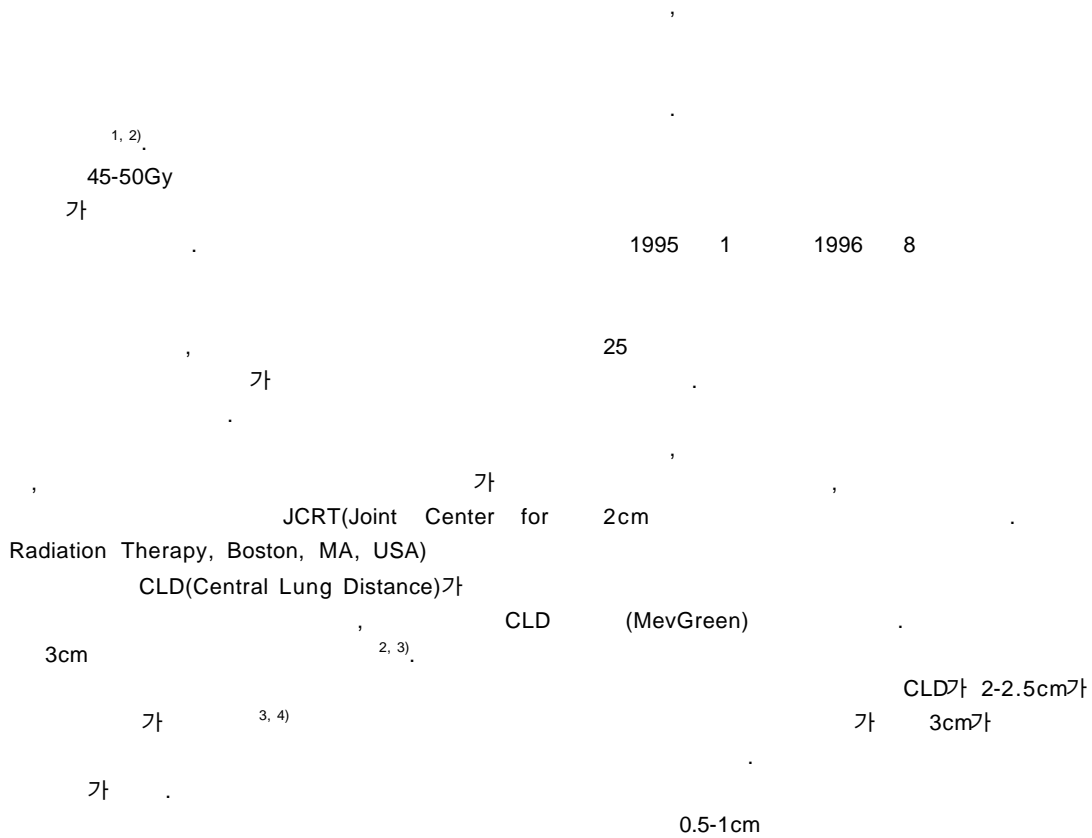
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Results : The RV is 61-279cc (mean 170cc), the RV/EV is 2.9-13.0% (mean 5.8%) and the RV/IV is 4.9-29.6% (mean 12.2%). The CLD, the MLD and the GPD are 1.9-3.3cm, 1.9-3.3cm and 1.4-3.1cm respectively. The significant relations between the irradiated lung volume such as RV, RV/EV, RV/IV and parameters such as CLD, MLD, GPD, L, CLD×L, MLD×L and GPD×L are not found with little variances in parameters. The RV/IV of the left breast irradiation is significantly larger than that of the right but the RV/EV s do not show the differences. There is no symptomatic radiation pneumonitis at least during 6 months follow up.

Conclusion : The significant relationship between the irradiated lung volume and predictors is not found with little variation on parameters. The irradiated lung volume in the tangential field is less than 10% of entire lung volume when CLD is less than 3cm. The RV/IV of the left tangential field is larger than that of the right but there was no significant differences in RV/EVs. Symptomatic radiation pneumonitis has not occurred during minimum 6 months follow up.

Key Words : Breast cancer, Irradiation, Lung volume, Radiation pneumonitis



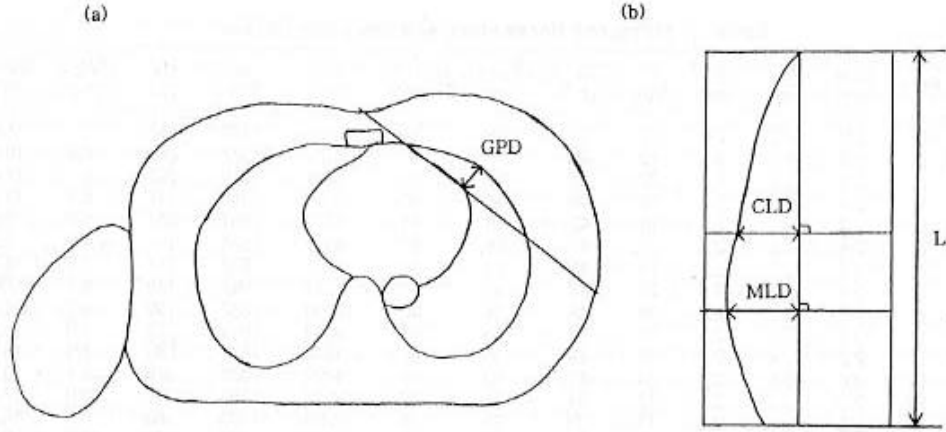


Fig. 1. Schematic figures showing CLD, MLD, GPD and L (a) Schematic image of planning CT scan at the center level (b) Schematic tangential field on simulation film
 * CLD : Perpendicular distance from posterior edge to anterior chest wall at center.
 MLD : Maximum perpendicular distance from posterior edge to anterior chest wall.
 GPD : Greatest Perpendicular Distance from posterior edge to anterior chest wall on CT image at center
 L : Length of the field

SPSS

Regression analysis

ADAC CADPLAN(ADAC Laboratory, Milpitas, CA, USA) dose volume histogram

(RV), (2)	(1)	41	14	23-67 (11)
(RV/EV), (3)				가 4
(RV/IV)	(1)		가 13	12
				1
	Central Lung			
Distance(CLD), (2)			13	
	가			
Maximum Lung Distance (MLD), (3)				
		CLD	2.2cm(1.9-3.3cm), MLD	
			2.4cm(1.9-3.3cm), GPD	2.3cm (1.4-
가	Greatest Perpendicular	3.1cm),	L	19cm(16-23cm)
Distance(GPD) (4)	(L), CLD×L,	CLD×L	42.4cm ² (32-75.9cm ²), MLD×L	
	(Fig. 1).		45.4cm ² (34.2-75.9cm ²), GPD×L	
MLD×L, GPD×L			42.5cm ² (26.6-69cm ²)	
	가		1356-4092cc	3052cc

Table 1. Measured Parameters and the Lung Volume

Age	Rt/Lt	CLD (cm)	MLD (cm)	GPD (cm)	L (cm)	CLD×L (cm ²)	MLD×L (cm ²)	GPD×L (cm ²)	EV (cc)	IV (cc)	RV (cc)	RV/EV (%)	RV/IV (%)
67	Lt	2.0	2.2	2.0	16	32	35	32	—	1342	158		11.8
37	Lt	2.4	2.5	2.5	19	46	48	48	3276	1322	243	7.4	18.4
23	Lt	2.3	2.5	2.3	22	51	55	51	3310	1571	267	8.1	17.0
49	Lt	2.4	2.5	2.4	19	46	48	46	1928	911	111	5.7	12.2
30	Lt	2.2	2.5	2.3	19	42	48	44	4021	1854	237	5.9	12.8
47	Lt	2.4	2.6	2.4	17	41	44	41	3600	1594	151	4.2	9.5
36	Lt	2.7	2.7	2.2	18	49	49	40	1551	632	117	7.5	18.5
66	Lt	2.1	2.5	2.5	20	42	50	50	2237	983	118	5.3	12.0
51	Lt	2.2	2.2	2.0	20	44	44	40	3286	1387	155	4.7	11.2
41	Lt	2.2	2.5	2.5	17	37	43	43	4009	1814	279	7.0	15.4
30	Lt	2.2	2.4	2.2	19	42	46	42	3457	1611	260	7.5	16.1
56	Rt	2.6	2.8	3.1	18	47	50	56	4092	2070	210	5.1	10.2
44	Rt	2.0	2.2	2.5	17	34	37	42	2056	1188	212	10.0	17.9
31	Rt	2.3	2.3	2.3	17	39	39	39	3289	1783	183	5.6	10.2
39	Rt	3.3	3.3	3.0	23	76	76	69	1356	584	173	13.0	29.6
28	Rt	2.3	2.4	2.0	18	41	43	36	3406	1925	122	3.6	6.3
55	Rt	2.2	2.5	2.3	19	42	48	44	3818	2901	208	5.4	9.9
44	Rt	1.8	1.9	1.9	18	32	34	34	1728	779	93	5.4	11.9
39	Rt	2.4	2.8	2.5	19	46	53	48	4806	2554	180	3.8	7.1
41	Rt	2.0	2.1	2.3	19	38	40	44	3940	2269	228	5.8	10.0
38	Rt	2.2	2.4	2.1	20	44	48	42	2131	1249	61	2.9	4.9
42	Rt	1.9	1.9	1.4	19	37	36	27	2537	1481	87	3.4	5.9
56	Rt	2.1	2.2	2.2	18	38	40	40	3457	2070	149	4.3	7.2
34	Rt	1.9	2.0	1.8	20	38	40	36	3645	1861	163	4.5	11.8
35	Rt	2.0	2.3	1.7	19	38	44	32	2300	1197	96	4.2	8.0
Mean		2.2	2.4	2.3	19	42	45	43	3052	1525	170	5.8	12.2
SD		0.3	0.3	0.4	2	8.5	8.4	8.5	937	515	61	2.3	5.3

* CLD : Perpendicular distance from posterior edge to anterior chest wall at center.
 MLD : Maximum perpendicular distance from posterior edge to anterior chest wall.
 GPD : Greatest Perpendicular Distance from posterior edge to anterior chest wall on CT image at center
 L : Length of the field
 EV : Entire both lung volume
 IV : Ipsilateral lung volume
 RV : Irradiated Lung volume

584-2554cc 1671cc , RV, RV/EV RV/IV
 632-2252cc 1379cc .
 61-279cc 170cc
 (RV/EV)
 2.9-13% (5.8%) ,
 (RV/IV) 4.9-29.6% (12.2%)
 (Table 1).
 (RV/IV)
 ± 가 14.1±3.1% 10.8±6.3%
 (p<0.05)
 (RV/EV) 6.3±1.3% 5.5±2.7%
 가
 가
 가
 CLD, MLD, GPD, L, CLD×L, MLD×L, GPD×L

, 1

(deep tangential field)

가 가
가

5-11)

6

가

X

가

가

16%
6, 10),

가

가

CLD

CLD가 3cm 24

10%

JCRT Kimsey

CLD 3cm

가
, CLD가 3cm

가
CLD . CLD

12),

JCRT Lingos 12)

3)

CLD

CLD가 3cm

가 3cm

CLD

CLD가 3cm

10%

가

CLD

Bornstein 3) CLD가

Kimsey 13)

가

가

10%가

가

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25
1)

Central Lung Distance
가

(CLD), 2)

Maximum Lung Distance(MLD), 3)

Greatest Perpendicular Distance

(GPD), 4) (L)

Dose Volume Histogram(DVH) (EV),

(M) (RV)

: 25 23-67 (41) 14 ,

11 CLD 2.2cm(1.9-3.3cm), MLD

2.4cm(1.9-3.3 cm) GPD 2.3cm(1.4-3.1cm) L 16-23cm . CLD

L 42.4cm²(32-76cm²), MLD L 45.3cm²(34.2-75.9cm²)

, GPD L 42.5cm²(26.6-69cm²) . 1356-4092cc

3052cc 584-2554cc 1671cc 632-2252 cc

1379cc . 61-279cc(170cc)

(RV/EV) 2.9-13%(5.8%) (RV/IV) 4.9-29.6(

12.2%) . CLD, MLD, GPD, L, CLD*L, MLD*L, GPD*L RV, RV/EV, RV/IV

CLD가 3cm

24 RV/EV 10% . RV/IV

RV/EV

: CLD 3cm CLD