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## **Radiotherapy in Early Stage Glottic Cancer : Effect of Reduction of Treatment Duration by Hypofractionation Treatment**

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**Abstract :** Early stage glottic cancer can be cured by radiation therapy alone with voice preservation. I undertook to study the effect of hypofractionation treatment, which shortens treatment duration by increasing the fraction size in early stage laryngeal cancer, when radiation therapy was performed. Thirty patients with early stage (I, II) glottic cancer were treated with radiation therapy alone. The median age was 62, ranging from 43 to 73 years old. According to TNM stage, 21 patients were stage I, and nine were stage II. Mean total radiation doses were 63 Gy and 65 Gy with 2 Gy fraction in stage I and II in conventional treatment group, and 58 Gy and 62 Gy with 2.2 Gy fraction in stage I and II in hypofractionation group. Mean treatment durations were 46 days (39-51) in conventional treatment group, and 39 days (35-44) in hypofractionation group. The overall median follow-up period was 51.5 months with the range of 14 to 139 months. Local control rate was 96.6% (29/30) in all patients. Five year local relapse free survival rate (5YLRFS) was 83.3% in all patients, and 5YLRFS in stage I and II were 90% and 70% respectively. 5YLRFS in stage I and II of conventional treatment group were 100% and 71.4%, and 80% and 66.7% in stage I and II of hypofractionation group, having no statistical significance. Five (16%) patients, including one patient without local control, developed local failure after average 14 (5-29) months, three of whom were salvaged by curative laryngectomy. There was no difference in the failure pattern between the

conventional group and hypofractionation group. No patient suffered from above grade 3 acute and chronic complications. Total voice preservation was observed in 26 patients (86.6%). Although the present study was carried out with a small number of patients, there is no difference in local relapse free survival, failure pattern and complications between conventional treatment and hypofractionation groups which shortens the treatment time by increasing the fraction size from 2 Gy to 2.2 Gy. It is important to carry out randomized clinical study with a large number of patients.

**Key Words :** Conventional fractionation, Early stage glottic cancer, Local relapse free survival, Radiation therapy, Hypofractionation

1990 7 1998 12  
 (1, 2)  
 30 (Table 1).  
 43 73 62  
 가 1 가 21, 2 가 9 가  
 [1-4]. 27  
 가 11.5 g/dL 15.5 g/dL  
 13.5 g/dL  
 가 2 Gy  
 . 1 17, 2.2 Gy  
 0.35 1.2 Gy 13  
 가 [5,6]. 2.  
 [5-7]. 가 6 MV  
 1, 2 1 5x6  
 가 cm, 2 8x9 cm  
 2  
 2 Gy 5,  
 1 63 Gy(60 66 Gy), 2  
 65 Gy(64 66 Gy)  
 46 (39 51)  
 2.2 Gy 1  
 58 Gy(55 63.8 Gy), 2 62.4  
 1. Gy(59.4 66.6 Gy) 39 (35  
 44)

**Table 1.** Patient characteristics in conventional and hypofractionation treatment groups

		Conventional	Hypofractionation	P-value
Age (mean, year)		61(43-71)	63(46-73)	0.76
Hb* (g/dL)	< 14	8	10	0.88
	14	5	7	
Sex	Male	11	16	0.39
	Female	2	1	
Stage	I	10	10	0.29
	II	3	7	

All patients have squamous cell carcinoma; \* Hemoglobin.

[19] 가 . 가 Log-Rank .

(Table 2).

3.

1.

139 63 . 14 6  
Kaplan-Meier 가  
independent t-test . 96% (29/30) 가 .

**Table 2.** Treatment protocol in conventional and hypofractionation treatment groups

Parameter	Conventional	Hypofractionation	P-value
Fraction size (Gy)	2	2.2	
Duration (days)	46 (39-51)	39 (35-44)	0.047
stage I	46 (39-49)	38 (35-42)	
stage II	48 (44-51)	41 (40-44)	
Total dose (Gy)			
stage I (mean)	63	58	0.001
stage II (mean)	65	62.4	0.075
BED* (mean)			
stage I (Gy10 / Gy3 †)	55.7 / 104.8	53.9 / 100.5	N-S
stage II (Gy10 / Gy3)	57.5 / 108.6	58.4 / 108.1	N-S

\* BED (biologically effective dose) =  $E/ = nd (1 + d/ ) - 0.693/ \times RT \text{ duration} / T_{pot}; = 0.3/\text{Gy}, T_{pot} = 5\text{days}.$  † Gy10/Gy3 : BED early responding tissue / BED late responding tissue.

5 1 90%, 2  
70% 5 1 가 91.7%, 2  
가 60%(p=0.05) (Fig. 1,2).

88.2%, 76.9%  
가 (Fig. 3).  
1 100%, 2 71.4%,  
1 80%, 2 66.7%

(Fig. 4).

2.

2 , 3  
가 1 6 (20%)  
14 (7 29 )  
3

1 5 가 60  
. 1  
7  
6 48  
1 9  
14  
1 34

(Table 3).

3

83.3%(25/30)

82.3%(14/17)

84.1%(11/13)

가

(Table 4).

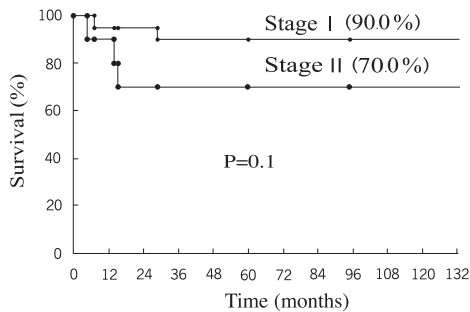


Fig. 1. Five year local relapse free survival curve by stage.

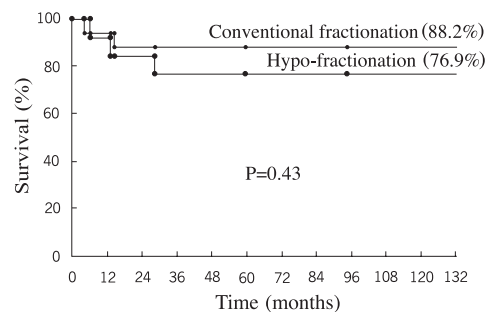


Fig. 3. Five year local relapse free survival curve by fractionation group.

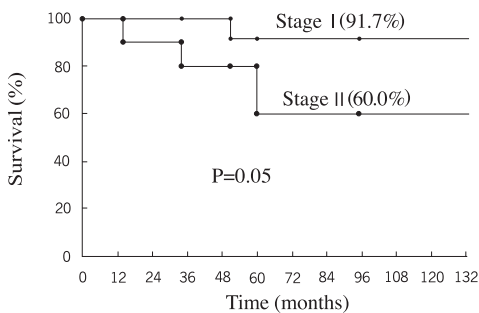


Fig. 2. Five year overall survival curve by stage.

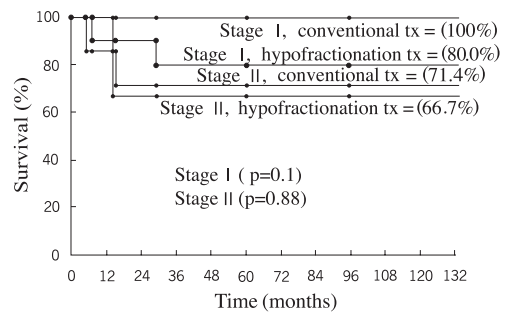


Fig. 4. Five year local relapse free survival curve by stage in fractionation groups.

**Table 3.** Failure patterns and outcomes

Patient	Stage	Failure site	Failure time (month)	Salvage treatment	Outcome (month)
Conventional treatment					
1	I	larynx	12	Total laryngectomy with both FND	NED (134)
2	II	epiglottis both vocal cord	5	Total laryngectomy	Die unknown cause (60)
3	II	Lt subglottis	15	Total laryngectomy with both FND	NED (48)
Hypofractionation treatment					
4	I	Rt larynx	7	Total laryngectomy with Rt FND	Die unknown cause (48)
5	I	Vallecula	29	Subglottic laryngectomy with both neck dissection	NED (75)
6	II	Lt TVC	9	(-)	DWD (14)
7	II	Second primary (Lung cancer) Distant metastasis (neck LN, mediastinal LN, Liver, Bone)	34	(-)	DWD (37)

Lt: left; Rt: right; LN: lymph node; FND: functional neck dissection; NED: no evidence of disease; DWD: die with disease.

		66-70 Gy	
		[1,3,4,12].	
		가	가
		[6,7,9-12].	
		가	
		[13,14]. Le [7] T1 T2	
		1.8 Gy, 1.8-1.99 Gy, 2-2.24 Gy, 2.25 Gy	
		63	
		Gy T2	
		, .	
60-66 Gy 6-7		. Schwaibold [9] 2 Gy	
		3	
		100% 75%	
		가 Yu [6] T1	
		126	
		2 Gy 66 Gy	
<b>Table 4.</b> Voice preservation			
Treatment group	Voice preservation	P-value	
Conventional	14/17 (82.3%)		
Hypofractionation	11/13 (84.1%)	0.15	

2 Gy 60 65.25 Gy  
5 65%, 84%  
가 . Mendenhall [1,10,11]. Mendenhall  
[15] T2a 1.8 2.2 Gy [1] 2.1 2.25 Gy 56  
65 70 Gy 67 Gy  
2.25 Gy 60.75 65.25 Gy 1.6% , Le [7]  
1.8%  
. Woo [10] I, II Dinshaw [11]  
2.5 Gy 22%(146 )  
60 Gy 20 3  
5%, 3 30%  
가 , 2 10  
13 , 2  
가  
Dinshaw [11] 676 2.2 Gy 가  
2 Gy 2 Gy  
55 66 Gy 가  
3 , 가  
가  
2.2 Gy 가  
2 Gy 가  
가 , 가  
가  
Gy 55-60 Gy, 60-62.5 Gy, 50 Gy 10 87%,  
81%, 82% 가  
. Fein [16] Small [17]  
가  
. Skladowski [12] 가  
가 가  
, Wang [5] T1 가  
, Le [7] T1  
가  
2 Gy 가  
2.2 Gy  
5 (1  
88.2%, , 2 )  
76.9% 가 , 30  
5 1 17 2 Gy  
100%, 2 71.4% 1 I 63 Gy, 2 65 Gy  
80%, 2 66.7% 13 2.2 Gy  
I 58 Gy 2

62 Gy  
 46 (39 51 ),  
 39 (35 44 ) 14  
 139 51.5  
 29/30  
 (96.6%) 5  
 83.3% 1 90%, 2 70%  
 1 100%, 2  
 71.4% 1 80%,  
 66.7%  
 3  
 86.6%(26/30)  
 가  
 2.2 Gy 가  
 가

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