

성장호르몬 분비 뇌하수체선종에 대한 감마나이프 방사선수술의 치료결과*

임영진 · 최영호 · 임 언 · 이기택 · 고준석 · 김태성 · 김국기 · 이봉암

= Abstract =

Treatment Outcome of Gamma Knife Radiosurgery for GH-Secreting Pituitary Tumors

Young Jin Lim, M.D., Yeong Ho Choi, M.D., Won Leem, M.D.,
Ki Taek Lee, M.D., Jun Seok Koh, M.D., Tae Sung Kim, M.D.,
Gook Ki Kim, M.D., Bong Arm Rhee, M.D.

Department of Neurosurgery, School of Medicine, Kyung Hee University, Seoul, Korea

Objective : As for growth hormone(GH) secreting pituitary adenoma, it's remission should be declared on the basis of satisfactory controlling of the tumor, normalization of hormonal level, and symptomatic improvement of the patient. Several modalities of treatment have been applied and administered, and yet, this disease still remains as inveterate one to be fully treated. The purpose of this study is to evaluate the outcome of gamma knife radiosurgery(GKRS) for GH secreting pituitary adenoma, and to identify various factors affecting the outcome of the treatment.

Method : A group of 24 out of 35 patients, treated by Leksell gamma knife unit during the period of March of 1992 through October of 1997, had been observed for more than two years. The mean target volume of microadenoma was 449.3mm³(range 216 - 880mm³), and that of macroadenoma was 3183.1mm³(range 1456 - 13125mm³). The tumor margin was covered with 50% isodose profile, and mean marginal dose was 25.2Gy(range 15 - 32.4Gy). The mean number of isocenter was 4.3(range 1 - 6). The exposed dose to the optic apparatus was less than 8Gy. The mean follow - up period was 37.8months(range 24 - 102months).

Result : No patients showed any increase in the tumor volume during the follow - up period. And definite shrinkage of tumor volume(tumor volume reduction rate, TVRR : more than 50%) was obtained in 10 patients(41.7%). Twenty one patients(87.5%) had reduced hormonal level compared than pre - treatment level. Among them, normalization of the hormonal level was achieved in 12 patients(50%). Clinicoendocrinological remission was seen in 3 patients (12.5%). According to the results of statistical analysis, tumor volume(p=0.016), duration of symptoms(p=0.046), initial GH level(p=0.017), and the invasion of cavernous sinus(p=0.036) were significantly favorable to post - radiosurgical outcome. The TVRR was significantly related to post - radiosurgical reduction of serum GH level. Permanent complication was not seen.

Conclusion : The authors concluded that GKRS is a safe and effective treatment modality for acromegaly. To obtain the better outcome of GKRS in GH secreting pituitary adenoma, more careful and sophisticated treatment - planning is recommended.

KEY WORDS : Acromegaly · Gamma knife radiosurgery · Pituitary adenoma · Growth hormone.

서 론

(growth hormone - secreting pituitary adenoma) (MRI) coronal image (large macroadenoma) A (intermediate macroadenoma) B pituitary stalk C D E 5가 (adjuvant therapy) 가 1)27) type 13) 가 17 가 7 가 5% (high dose) 3 6 (<5ng/mL) (normalization), (response), 가 (non - response) 7 IGF - 1 가 가 MRI 6 , 1 , 2 (tumor volume reduction rate, TVRR) SAS version 6.12 Fischer 's exact test

대상 및 방법

(Leksell Gamma Knife Type B 23004) Leksell MRI(Toshiba MRT 200FX 1.5 Tesla) , KULA system 1992 3 1997 10 가 24 8Gy (cavernous sinus) 15Gy 35 , 2 가

결 과

1. 성별 및 연령 분포

24명, 7명, 17명
24~58세, 42.6%
37.8 (24~102)

2. 감마나이프 시행 시기

6.0 (1~15)
2.5 (0.5~18)
8.6 (1~25)

3. 감마나이프 수술의 선량계획

Collimator 8mm가 56개, 14mm
34개, 4mm 13개. Isocenter 1~6
4.3, isodose profile 1
50% (maximal dose)
30~60Gy 46.6Gy (marginal dose)
15~32.4Gy 25.2Gy

4. 임상증상 및 증후의 변화

(acromegaly) 7 (29.2%) 가 (hypertension) (headache) 가
4 (16.7%) (diabetes mellitus)가 3 (12.5%), (visual field defect) 3 (12.5%), (dyspnea) 2 (8.3%), (multiple arthralgia) 1 (4.2%)
13 (54.2%), 2 (50%), 1
가
11 (45.8%) 2
3 (100%), 2~10 13
8 (61.5%), 10
8 2 (25%)

5. 내분비학적 변화

26.6ng/ml

20ng/ml 가 11, 5~20ng/ml 가 13
12
(50.0%) (normalization, <5ng/ml)

3 (Table 1). 12, definite hormonal remission 2ng/ml
가 8 (response)가 9 (37.5%) 87.5%
(non-response)
3 (12.5%)
42.5
가 20ng/ml 11
2 (18.2%)
, 5~20ng/ml 13 10
(76.9%) 가

IGF - 1 7
IGF - 1 가

6. 방사선학적 변화

11 가, 13
(optic chiasm) 4.6mm
(cavernous sinus invasion)
24 17 (70.8%)
A 7, B 6, C 3, D 4, E 4
449.3mm³
(216~880mm³), 3183.1mm³
(1456~13125mm³)
MRI TVRR 25% 9 (37.5%), 25~50%가 5 (20.8%), 50~75%가 9 (37.5%), 75~100%가 1 (4.2%)
(tumor control rate, TCR) 100% 가 50%
10 (41.7%)
ideal target

D type E type

Table 1. Post-radiosurgical changes of serum GH level according to pre-radiosurgical serum GH level (n=24)

Pre-radiosurgical serum GH level (ng/ml)	Post-radiosurgical change of serum GH level			Total
	Normalization	Response	Non-response	
5 - 20	10	3	0	13
21 - 50	1	4	1	6
>50	1	2	2	5

* : p=0.017

(p=0.452).

가 12 (cystic change)
9 (75%) (necrotic change)

2 50% TVRR
가 3 2 (66.7%) , 10
8 6 (75%)가 25%

TVRR

7. 종양의 크기 변화와 혈중 호르몬 변화간의 관계

11 9 (81.8%)
가 2 (19.2%)
13 가 3 (23.1%)
7 (53.8%) 3 (23.1%)

(Table 2).

TVRR 25% 9 1 (11.1%)
가 5 (55.6%) 3
(33.3%) , TVRR 50%
10 8 (80%) , 2 (20%)

TVRR

(Table 3).

8. 치료결과에 영향을 미치는 인자들

(p=0.017),

Table 2. Post-radiosurgical changes of serum GH level according to the size of tumor(n=24)

Size of tumor	Post-radiosurgical hormonal changes			Total
	Normalization	Response	Non-response	
microadenoma	9	2	0	11
macroadenoma	3	7	3	13

* : p=0.016

Table 3. Relationship between tumor volume reduction rates (TVRR) and post-radiosurgical hormonal changes (n=24)

TVRR(%)	Post-radiosurgical hormonal changes			Total
	Non-response	Response	Normalization	
<25	3	5	1	9
25 - 49	0	2	3	5
50 - 74	0	2	7	9
75 - 100	0	0	1	1

* : p=0.041

(p=0.046),

(p=0.036)

(p=0.016)

dose, type, marginal

(Table 4).

9. 일차적 치료군과 이차적 치료군의 차이

17 8 (47.1%)
가 7 (43.8%)
7 4 (51.5%) 2
(28.6%)

10. 합병증

(mild headache) 13 , (dizziness) 3 , (diabetes insipidus) 2 , (pituitary insufficiency) 2

고 찰

26% 14)

Table 4. Statistical significance of relationship between affecting factors and post-radiosurgical results

Affecting factors	Post-radiosurgical results(p Value)	
	TVRR	Hormonal Change
Tumor volume	0.176	0.016
Tumor type	0.452	0.987
Marginal dose	0.429	0.591
Distance from O.C.	0.424	0.195
C.S. invasion	0.216	0.036
Symptom duration	0.046	0.868
Previous treatment*	0.430	0.840
Initial GH level		0.017

TVRR : tumor volume reduction rate

O.C. : optic chiasm

C.S. : cavernous sinus

* : radiosurgery as a primary or secondary treatment

(panhypopituitarism),
 (brain necrosis), (optic nerve injury),
 (radiation - induced brain tumor)
 가
 23)
 4)6),
 15)22)29).
 가
 adjuvant therapy primay
 treatment modality 가 21)
 가 7)29)30),
 (pterional craniotomy)
 가
 somatostatin
 analog octreotide가
 가 50% 가 29).
 octreotide 28)가 가 5mm
 3)11)
 가
 가 Ganz 8)
 1).
 가 가 10~12Gy 가
 가 35Gy
 , Pan 21)
 가 30Gy marginal dose가
 30). Morange - Ramos 19) , Landolt 12) 25Gy
 50% 가 12 6
 가 20~25Gy marginal dose
 30Gy
 adjuvant therapy
 17), range - Ramos 19) Mo-

(immunohistochemical type)
(technique of stereotatic localization),
diation protocol

, irra- , Thoren ²⁹⁾

가

8)24 - 26)

(remission rate) 77%
26%

Lissett ¹⁶⁾

가

가

⁹⁾²⁰⁾

50%

가

. Hayashi ⁹⁾ ACTH

, Er ⁵⁾

가

grade stage

22.2% 33.3%
50%

ACTH

(<20ng/ml)

11.1% 28.6%

36.8% 가
, Noren ²⁰⁾

ACTH

16.7% 25%

, Yamada ³⁰⁾

60%

가 가

가

가

24 15 (62.5%)
50% 가

가

¹⁰⁾

가

가

가

Thoren

²⁹⁾

29%

가

Pollock ²⁴⁾

38%

Martinez ¹⁸⁾ 85%
50%

Martinez ¹⁸⁾

TCR 100%

가

50%

28.6%

, Mora-

nge - Ramos ¹⁹⁾

37%

TCR 100%

가

4.6mm

50%

가 41.7%

8Gy

가

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