Low-dose Gamma Knife Radiosurgery for Acromegaly

Ching-Jen Chen, MD\textsuperscript{1}; Pai, Fu-Yuan, MD\textsuperscript{2}; Cheng-Chia Lee, MD\textsuperscript{2}

\textsuperscript{1}Department of Neurological Surgery, University of Virginia Health System, Charlottesville, VA, USA

\textsuperscript{2}Department of Neurosurgery, Neurological Institute, Taipei Veterans General Hospital, Taipei, Taiwan
Conflict of Interest Declaration

Herewith I confirm that I do NOT have any relevant financial relationships with commercial interests.
Introduction

• The goal of this study was to evaluate the efficacy and safety of low-dose (<25Gy) Gamma Knife radiosurgery (GKRS) in the treatment of patients with acromegaly.
Methods

- This study was a single-center retrospective review of acromegaly cases treated with GKRS between June 1994 and December 2016.

- Patients with the diagnosis of acromegaly who were treated with low-dose GKRS were selected for inclusion in the study.

- The patients were treated with a median margin dose, isodose line, and treatment volume of 15.8 Gy, 57.5%, and 4.8 mL, respectively.

- Any identifiable portion of the optic apparatus was limited to a radiation dose of 10 Gy. All patients underwent full endocrine, ophthalmological, and imaging evaluation prior to and after GKRS treatments, and results of these were analyzed.
Results

- Seventy-six patients underwent low-dose GKRS for acromegaly. Median imaging and endocrine follow-ups were 65.8 months and 72.8 months, respectively.

- Biochemical remission was achieved in 33 (43.4%) patients. Actuarial remission rates were 20.3%, 39.9%, 49.9%, 67.5%, and 76.3% at 4, 6, 8, 10, and 12 years, respectively.

- Absence of cavernous sinus (CS) invasion (p=0.042) and lower baseline IGF-1 levels (p=0.019) were significant predictors of remission. Actuarial tumor control rates were 100%, 93.8%, 93.8%, and 93.8% at 6, 8, 10, and 12 years, respectively.

- New hormone deficiencies were found in nine (11.8%) patients, and the median time to the development of new hormone deficiencies was 83.6 months. Actuarial hormone deficiency rates were 3%, 7.7%, 14%, and 22.2% at 4, 6, 8, and 10 years, respectively.

- CS invasion was a significant predictor of new hormone deficiencies (p=0.027). Two (2.6%) patients who achieved initial remission experienced recurrence. No complications were encountered in the study.
Results

A. Overall remission rate

- 2 years: 8.4%
- 4 years: 20.3%
- 6 years: 39.9%
- 8 years: 49.9%
- 10 years: 67.5%
- 12 years: 76.3%

B. Cavernous sinus invasion

- Obs cases-No (n): 37, 30, 17, 7, 3
- Obs cases-Yes(n): 39, 30, 25, 19, 13, 7, 5

p-value: 0.005
Results

<table>
<thead>
<tr>
<th>Pre-SRS IGF-1</th>
<th>Time after SRS (months)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Obs cases - &lt;2(n)</td>
<td>9</td>
</tr>
<tr>
<td>Obs cases - &gt;2(n)</td>
<td>34</td>
</tr>
<tr>
<td>Remission rate (%)</td>
<td>96</td>
</tr>
</tbody>
</table>

p-value: 0.026
Results

A  Post-SRS Hypopituitarism

B  Post-SRS hypopituitarism

Obs cases(n)  76  66  49  23  15  10

Rate of hypopituitarism (%)

Time after SRS (months)

4 years: 3%
6 years: 7.7%
8 years: 14%
10 years: 22.2%
12 years: 28.2%

No. of new hormone deficiency (n)

Time after SRS (years)

Hypothyroidism
Test/estrogen deficiency
Hypocortisolism
Growth hormone deficiency
Discussion/Conclusion

• GKRS is an effective treatment for patients with persistent acromegaly despite surgical resection. Despite the high biochemical remission and low hypopituitarism rates, high radiation doses to the sellar region pose unknown and unnecessary risks to optic apparatus.

• Low-dose GKRS represent an alternative treatment option in reducing the exposure of critical neurovascular structures in close proximity to the sella turcica to radiation. Lose-dose GKRS offers similar remission and new hormone deficiency rates compared to standard GKRS margin doses.

• However, the latency to remission for low-dose GKRS appears to be longer. Additional studies are required to further elucidate the latent effects of low-dose GKRS treatments and recurrences after initial remission.