

# Repeat Gamma Knife Radiosurgery for Recurrent Meningioma: A Single-Center Experience of 22 Patients

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## BACKGROUND

Meningiomas are the most common primary intracranial tumors. Gamma Knife Radiosurgery (GKS) is an established, effective treatment for primary and recurrent meningiomas. Local control rates after initial GKS are generally favorable, particularly for small- to medium-sized lesions. Repeat GKS may provide a minimally invasive option for selected patients with recurrent or progressive disease. However, data regarding long-term tumor control, progression-free survival, and adverse radiation effects after repeat treatment remain limited.

## OBJECTIVES

- Evaluate outcomes of repeat GKS for recurrent meningioma
- Assess progression-free survival (PFS) after repeat GKS
- Characterize recurrence patterns by location and laterality
- Identify factors influencing interval to repeat GKS

## METHODS

**Study Design:** Retrospective single-center cohort

**Inclusion:** Patients with  $\geq 2$  GKS treatments

**Exclusion:** NF2, other malignancy

**Endpoints:** PFS, local control, tumor volume change

**Statistics:** Kaplan-Meier; log-rank; Wilcoxon signed-rank

**Software:** R v4.6.0

## KEY PATIENT METRICS

22

Patients

6.1 yrs

Median Interval

3.2 cc

Median Volume

Interval range: 0.9–19 yrs • Mean: 7.5 yrs

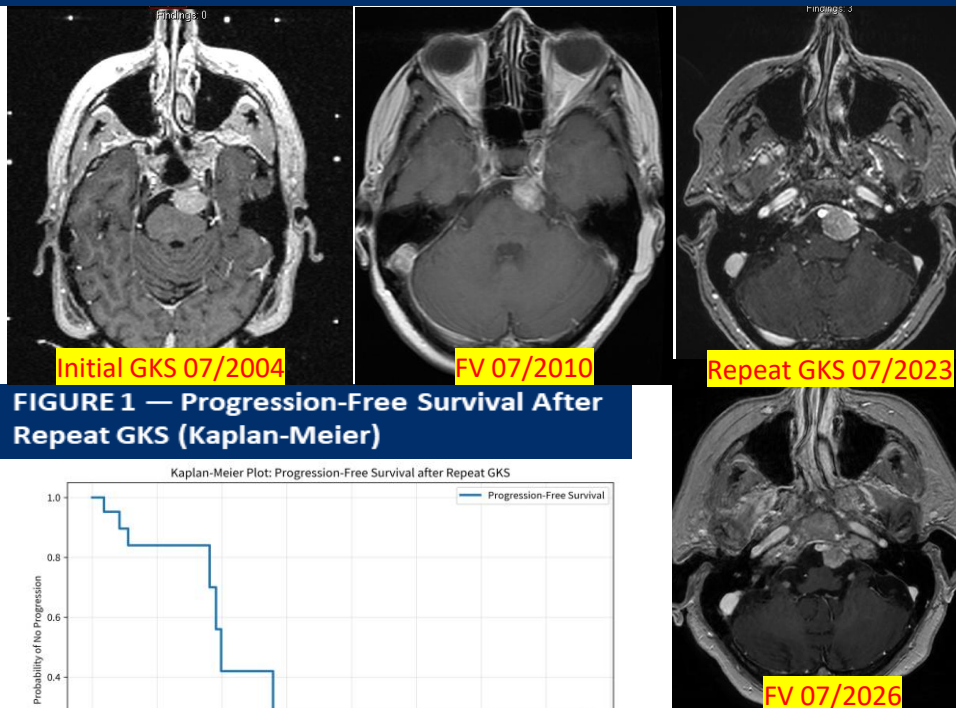
## CLINICAL NOTES

- Volumes at repeat GKS: median 3.2→2.5 cc, mean 5.6→3.9 cc
- Occasional cyst formation and rare grade progression
- Long intervals reflect indolent post-GKS tumor biology

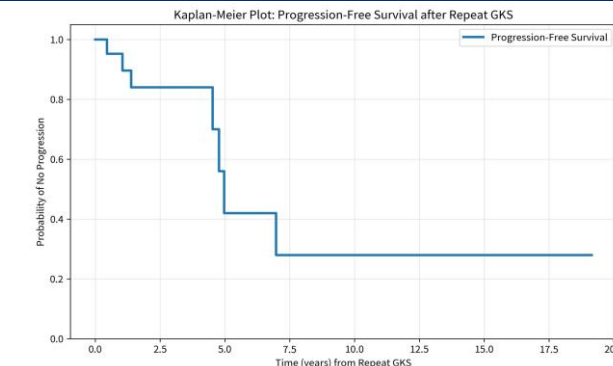
## TAKE HOME MESSAGES

- Repeat GKS feasible even after very long intervals (up to 19 yrs)
- Tumor volume decreased at repeat GKS (3.2→2.5 cc median)
- KM plateau  $\sim 29\%$  — subset achieves long-term durable control
- Monitor for cyst formation, grade progression, re-surgery

## ILLUSTRATIVE CASE



**FIGURE 1 — Progression-Free Survival After Repeat GKS (Kaplan-Meier)**



KM curve (n=22). Plateau at  $\sim 29\%$  after 7 years. Median follow-up: 19 years.

## Patient outcomes

- Two patients died
- Two tumors progressed to high-grade meningioma.

## TUMOR VOLUME COMPARISON

<b>1st GKS</b> Median 3.2 cc   Mean 5.6 cc	➔	<b>Repeat GKS</b> Median 2.5 cc   Mean 3.9 cc
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## TABLE 1 — Cohort Summary

Parameter	Value
Total Patients	22
Median margin dose GKS1	15 (13-18Gy), 5Gy x5 (3)
Median margin dose GKS2	14Gy (10 – 13Gy), 5Gy x 5 (3), 4.5Gy x 3 (3)
Median time to repeat GKS	6.1 yrs
Mean time to repeat GKS	7.5 yrs
Interval range	0.9–19.0 years
Median vol. at GKS1	3.2 cc (0.5 to 12 cc)
Mean vol. at GKS1	5.6 cc
Median vol. at GKS2	2.5 cc (0.24 to 24 cc)
Mean vol. at GKS2	3.9 cc
PFS plateau	$\sim 29\%$ at 7+ yrs

## TABLE 2 — Location by Laterality

Location	Rt	Lt	n
Sphenoid Wing	3	0	3
Petroclival	1	2	3
Parafalcine/Parasagittal	2	3	5
Parasellar/Sellar	-	-	4
Frontal/Convexity	3	0	3
Other	2	2	4
<b>TOTAL</b>	<b>11</b>	<b>7</b>	<b>22*</b>

\* n, reflects mass lesion counts; patients with sellar lesion has no laterality labeled.

## CONCLUSIONS

Repeat GKS for recurrent meningioma achieves durable local control in a subset of patients, with a KM plateau at  $\sim 29\%$ . Tumor volumes decreased at repeat treatment. Long intervals highlight the indolent biology of post-radiosurgery meningioma.