



Background

Radiation-induced AVMs are rare but serious late complications of childhood WBRT, with poorly defined natural history and unclear optimal management.

~5% develop late cerebrovascular disease Latency: 4–22+ years, often incidental [1–4]

Case Presentation

34-year-old male with history of childhood ALL and WBRT

Age 2: ALL Diagnosis and WBRT

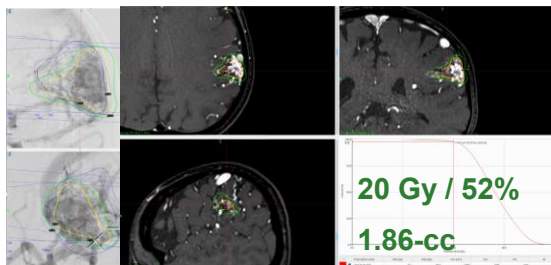
Treated for acute lymphoblastic leukemia. No cerebrovascular abnormalities at that time.

Age 34: Incidental MRI Findings

Lost to follow-up; MRI revealed **left parietal AVM** (23.5 mm, Spetzler-Martin Grade I) and **right parietal cavernous malformation (CM)**.

Clinical Decision

CM observed (stable). AVM: active treatment recommended due to lifelong hemorrhage risk in a young patient.



Treatment Selection: Why GKRS ?

Decision rationale in the context of a previously irradiated brain

HIGH RISK

Microsurgical Resection
WBRT
→ fragility, fibrosis, altered planes
→ ↑ surgical difficulty and neurological risk [2]

NOT DEFINITIVE

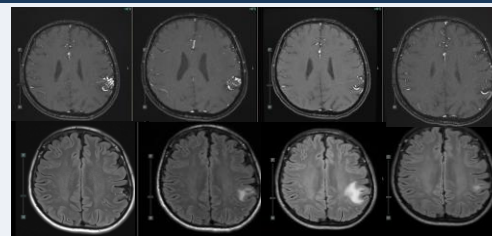
Endovascular Therapy
Fragile irradiated vessels
→ ↑ perforation / recanalization
→ not definitive option

SELECTED

Gamma Knife Radiosurgery

Noninvasive → avoids tissue fragility SM Grade I in eloquent area → favorable balance

Radiographic and Clinical Findings



Complete obliteration confirmed on TOF-MRA at 26 months
Patient remained **neurologically intact** throughout follow-up
No delayed toxicity beyond the transient RICS episode

Discussion

Dosimetric advantage of Gamma Knife and evidence from radiation-induced tumor series

Targeted Irradiation

Targets only the nidus → avoids cumulative toxicity after WBRT

Sharp Dose Fall-Off

Dose drops rapidly outside the target → protects surrounding brain

Safety Thresholds

Keep V12 < 9cc, max dose < 40Gy [5] → acceptable necrosis risk

- ✓ Long-Term Surveillance Is Essential
- ✓ GKRS Is Safe and Effective in Previously Irradiated Brain
- ✓ Heterogeneous Spectrum of Radiation-Associated Vascular Changes
- ✓ Individualized Multidisciplinary Management Is Critical

Conclusion

GKRS is justified in this context. Small nidus, low grade, sharp fall-off, and no good alternatives.

References

- [1] Mathon et al., *Neurosurgery*, 2013
- [2] Murphy et al., *Int J Radiat Oncol Biol Phys*, 2015
- [3] Keene et al., *Pediatr Neurol*, 2006
- [4] Pollock et al., *J Neurosurg*, 2019
- [5] Kowalchuk et al., *Int J Radiat Oncol Biol Phys*, 2022