

OCTOBER 20-24, 2013  
SAN FRANCISCO, CALIFORNIA

2013 ANNUAL MEETING

CNS

The **EVOLUTION** of NEUROSURGERY

The frontal and temporal regions that surround the Sylvian fissure account for 9–11% of AVMs and present significant management challenges because of the critical adjacent blood vessels and functional brain[1]. Hemorrhage from a Sylvian fissure AVM may result in major neurological morbidity and warrant therapeutic intervention once recognized. Cortical regions in proximity to the Sylvian fissure are often associated with seizure activity. Seizures may be an initial presentation in 24-40% of intracranial AVMs[2,3]. In this report we sought to evaluate the response of Sylvian fissure AVMs to radiosurgery and the effect on patients with related seizure disorders.

Characteristics	No. of Cases (%)
Patients	87
Age (yrs)	
median	38
range	9-77
Sex	
Male	40 (46)
Female	47 (54)
Presentation	
Bleed	40 (46)
Headache	15 (17)
Seizure	30 (34)
Incidental	2 (2)
Seizures	36 (41)
Prior Embolization	19 (22)
Prior Surgery	15 (16)
Varix Present	12 (14)
Coexisting Aneurysm	7 (8)
Spetzler-Martin Grade	
II	26 (30)
III	43 (49)
IV	16 (18)
VI	2 (2)

This retrospective single institution analysis examined our experience with Gamma Knife SRS for AVMs of the Sylvian fissure between 1987 and 2009. During this time, 87 patients with a median age of 38 years (range 9-77) underwent SRS for Sylvian fissure AVMs. Hemorrhage was the initial presentation in 40 patients (46%). Thirty-six patients (41%) had seizures prior to SRS. The median target volume was 3.85cm<sup>3</sup> (range 0.1-17.7cm<sup>3</sup>) and 20 Gy (range 13-25Gy) was the median marginal dose. Expanded technical data is detailed in our previous publications[4].

Forty-three patients had confirmed AVM obliteration on MRI or angiography over a median follow-up of 64 months (range 3–275 months). The actuarial rates of confirmed total obliteration were 35% at 3 years, 60% at 4 and 5 years, and 76% at 10 years (Fig. 1). The variables associated with total obliteration included a smaller AVM volume ( $p=0.041$ ), and a higher margin dose ( $p=0.009$ ).

The graph is a Kaplan-Meier survival plot. The y-axis is labeled 'Probability of Total Obliteration' and ranges from 0.0 to 1.0 in increments of 0.2. The x-axis is labeled 'Months after Radiosurgery' and ranges from 0 to 168 in increments of 24. The survival curve is a step function that starts at (0, 0.0). It remains at 0.0 until approximately 12 months, then rises to about 0.05 at 24 months. It continues to rise in steps, reaching approximately 0.55 at 48 months, 0.60 at 60 months, 0.65 at 72 months, and 0.77 at 96 months. From 96 months to 168 months, the probability remains constant at 0.77.

Months after Radiosurgery	Probability of Total Obliteration
0	0.00
12	0.00
24	0.05
36	0.15
48	0.55
60	0.60
72	0.65
96	0.77
168	0.77

The graph is a Kaplan-Meier survival plot. The y-axis is labeled 'Probability of Seizure Control' and ranges from 0.0 to 1.0 in increments of 0.1. The x-axis is labeled 'Months after Radiosurgery' and ranges from 0 to 288 in increments of 24. The survival curve starts at (0, 0.0), rises to approximately 0.15 at 12 months, 0.35 at 36 months, 0.50 at 72 months, 0.55 at 108 months, and reaches 0.60 at 144 months, where it plateaus.

Months after Radiosurgery	Probability of Seizure Control
0	0.00
12	0.15
24	0.25
36	0.35
48	0.38
60	0.40
72	0.50
84	0.50
96	0.50
108	0.55
120	0.55
132	0.60
144	0.60
156	0.60
168	0.60
180	0.60
192	0.60
204	0.60
216	0.60
228	0.60
240	0.60
252	0.60
264	0.60
276	0.60
288	0.60

Eighteen of 36 patients (50%) who had seizures prior to SRS were seizure free after treatment. The rate of seizure improvement was 29% at 3 years, 36% at 5 years, 50% at 10 years, and 60% at 15 years (Fig. 2). Patients with incomplete obliteration had a higher rate of improved seizure control ( $p=0.042$ ). No patients who were seizure free prior to treatment developed seizures after SRS. Four patients had a hemorrhage during the latency period, and one patient died.

Variable	Seizures	Improvement
Age	0.019	0.531
Sex	0.018	0.793
Diameter	0.321	0.035
Volume	0.135	0.129
Margin Dose	N/A	0.876
Prior Bleed	0.0004	0.045
Neuro Deficit	0.409	0.117
Varix	0.983	0.543
Aneurysm	0.934	0.620
Diffuse Nidus	0.816	0.487
Deep venous	0.752	0.132

The annual hemorrhage rate during the latency interval was 1% and no hemorrhages occurred after confirmed obliteration. Permanent neurological deficits due to adverse radiation effects developed in a single patient (1%).

Patients with Sylvian fissure AVMs  $<4\text{cm}^3$  in volume and who received  $>20\text{ Gy}$  to the nidus margin had the highest rates of total obliteration. Sixty percent of patients with seizures had an improvement in seizure control after SRS based on Engel classification, and 50% of patients were seizure free on or off anticonvulsants. The annual hemorrhage rate during the latency interval after SRS was 1%, regardless of whether the patient had bled previously. After obliteration was confirmed no patients experienced a hemorrhage. Despite the unfavorable location of Sylvian fissure AVMs, no permanent neurological deficits occurred. This study indicates that SRS was a relatively safe and effective means of managing Sylvian fissure AVMs. Patients with seizures often had improved seizure control or even elimination. Patients without seizures prior to SRS did not develop a seizure disorder after SRS.

(1) Liu L, Li H,  
Zheng J, Wang  
S, Zhao J, Cao  
Y: Sylvian  
fissure