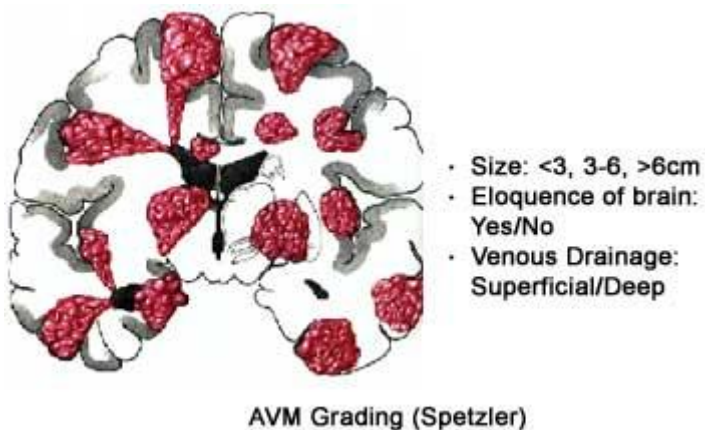


## Arteriovenous Malformations (AVM)



These are congenital lesions with an abnormal conglomerate of high flow arterial feeders, AV shunting and large draining veins. Most neurosurgeons use the **Spetzler grading system** to classify AVMs to guide treatment.



In essence, small and superficial AVMs with surface drainage veins are graded 1 to 2. Deep and small AVMs are usually graded 3, while large and deep AVMs are graded 4 to 6.

### Common Presentation of AVMs

1. Bleeding: subarachnoid/intracerebral/intraventricular
2. Epilepsy
3. Headache
4. Steal effect

An unknown but not insignificant proportions of AVMs remain asymptomatic. They may be diagnosed by routine brain imaging for other purposes.

### **Natural History of AVMs**

The most dreaded complication is bleeding. Bleeding occurs at 2 to 4% per year. Risk of rebleed after a hemorrhage is higher at 10 to 15% within the first year. It then decreases to 2 to 4% during the subsequent years. The general danger of bleeding is estimated at 10% death rate and 50% morbidity. Most AVM bleeding presents early in adulthood, although no age is exempted. Nobody knows what exactly triggers off bleeding since at least half of the bleeding occurs during sleep or rest.

### **Diagnostic Work Up**

AVM must be distinguished from cavernous hemangioma and venous angiomas because the prognosis and treatment are entirely different.

For general screening purposes, **MRI with MRA** offers the best non-invasive means of diagnosis. **Catheter angiography using modern DSA technique** remains the gold standard. Besides giving additional dynamic information of flow characteristics and special features which may predict a higher chance of bleeding, DSA also serves as the basic vehicle for endovascular obliteration in suitable patients.

### **Treatment**

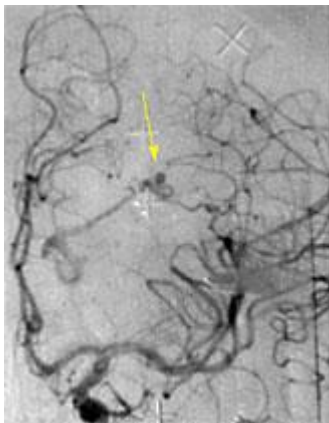
No single rule applies here. Advice must be individualised and evidence based. Patient preference and surgical team experience play important role in the ultimate decision. Balancing risks of natural history and risks of treatment may sound logical to the academic, but difficult to apply in real life. **The best advice should be what the neurosurgeon recommends for himself if he harbours the same AVM inside his brain.**

1. Skilled open microsurgery is the best option for young patients having a superficial, small AVMs that bled before.
2. Endovascular obliteration using special glue, coils etc is excellent for dural AVMs and also for large AVMs with associated aneurysms. Endovascular procedure shrinks large AVMs to a smaller size which can then be tackled by surgery or radiosurgery.
3. **Gamma Surgery (Gamma Knife Radiosurgery)** obliterates AVMs by progressive narrowing of incoming feeders. Gamma Surgery has accumulated a large experience with long term follow up. The chance of complete obliteration

after 3 years is around 80 to 90%%, with radiation related morbidity at 3 to 5%. Success rate is higher with lower complications for AVMs smaller than 3 cm in diameter. Thus, Gamma Surgery works best for small but high risk AVMs situated at critical areas of the brain where risks of open surgery is too high. Gamma Surgery may be the only treatment option in brain stem AVMs. The downside is its delayed effect which takes 6 months for small AVMs to 3 years for large ones. Until the AVM is obliterated completely, the chance of bleeding remains but lesser with progressive shrinkage of the nidus.

4. Some AVMs are large and complex. They often require several operations, many sessions of embolisation, and may be 2 to 3 sessions of Gamma Surgery combined.
5. Some AVMs are best left alone if the risks of therapy outweigh the risks of natural history.

Examples of Gamma Surgery for high risk AVMs:



Small left thalamic AVM



Complete obliteration @ 1 year



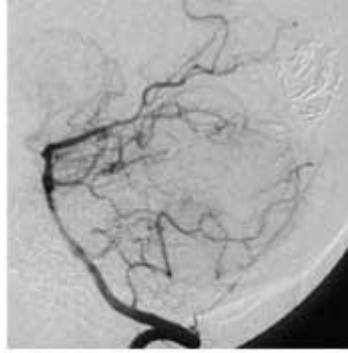
Central AVM with large draining vein



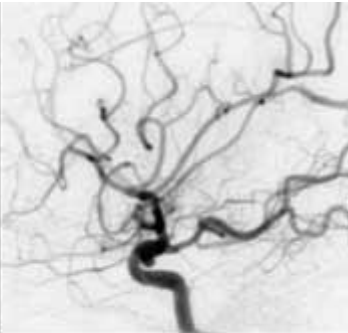
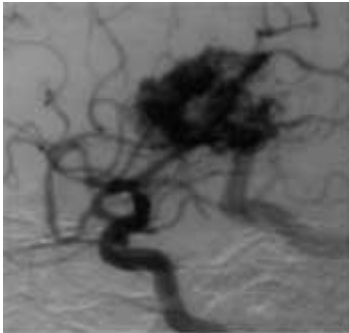
Near complete obliteration at 1 year



Post-fossa AVM



Complete obliteration at 2 years



Obliteration of AVM 3 years after Gamma Surgery