Internal Capsule Arteriovenous Malformation (AVM)

9

- **Demographics:** Male; 24 years
- **Initial Presentation:** Hemorrhage (thalamic, capsular, and temporal); 5 months before radiosurgery treatment
- **Diagnosis:** Internal capsule AVM
- **Pre-radiosurgery Treatment:** None
- **Pre-radiosurgery Presentation:** Right-sided dense hemiparesis, after recovery from hemorrhage-associated coma
- **Radiosurgery Treatment:**
  Upfront (primary); Linac-based SRS for left internal capsule AVM
- **Radiosurgery Dosimetry:**
  - Target volume: 3.0 cc
  - Marginal dose: 18.0 Gy
  - Marginal isodose: 80%
  - Maximum dose: 42.9 Gy
  - Minimum dose: 13.3 Gy
  - Average dose: 25.0 Gy
  - Number of isocenters: 2
  - Maximum dose to brain stem: 26.9 Gy
- **Follow-Up Period:** 144 months post-SRS
- **Clinical Outcome:**
  - 6 months post-SRS: Improving right-sided hemiparesis
  - 18 months post-SRS:
    Experienced severe headache, nausea, and vomiting
    Developed bilateral visual field defects (right homonymous hemianopia)
  - 20 months post-SRS:
    Improved headache, nausea, and vomiting with medications
    Persistent unchanged right homonymous hemianopia
  - 24 months post-SRS:
    Improving right-sided hemiparesis
    Persistent unchanged right homonymous hemianopia
  - 40 months post-SRS:
    Improving right-sided hemiparesis
    Persistent unchanged right homonymous hemianopia
  - 60 months post-SRS:
    Improving right-sided hemiparesis
    Persistent unchanged right homonymous hemianopia
  - 144 months post-SRS:
    Residual mild right-sided hemiparesis
    Persistent unchanged right homonymous hemianopia
- **Complications:** At 18 months post-SRS, the patient developed permanent right homonymous hemianopia, probably due to radiation-induced injury of left optic tract, which lies close to AVM nidus
- **Radiological Outcome:**
  - 6 months post-SRS (MRI): Decrease in size of AVM nidus
  - 18 months post-SRS (CT): Left thalamic perinidal hypodensity, denoting vasogenic edema
  - 19 months post-SRS (CT): Increased left thalamic perinidal hypodensity with mild mass effect
  - 24 months post-SRS (MRI):
    Marked decrease in size of AVM nidus
    Appearance of large ring-enhancing lesion in the left thalamus and left cerebral peduncle, in T1 Gadolinium-enhanced study, denoting radiation necrosis
    Increased high signal, in T2 and FLAIR studies, denoting vasogenic edema, within the left thalamus and left cerebral peduncle and surrounding the ring enhancing lesion
  - 30 months post-SRS (CTA): Residual small AVM nidus
  - 36 months post-SRS (MRI):
    Non-visualized AVM nidus

O. S. Abdelaziz, A. A. F. De Salles, *NeuroRadiosurgery: Case Review Atlas*, https://doi.org/10.1007/978-3-031-16199-5_9

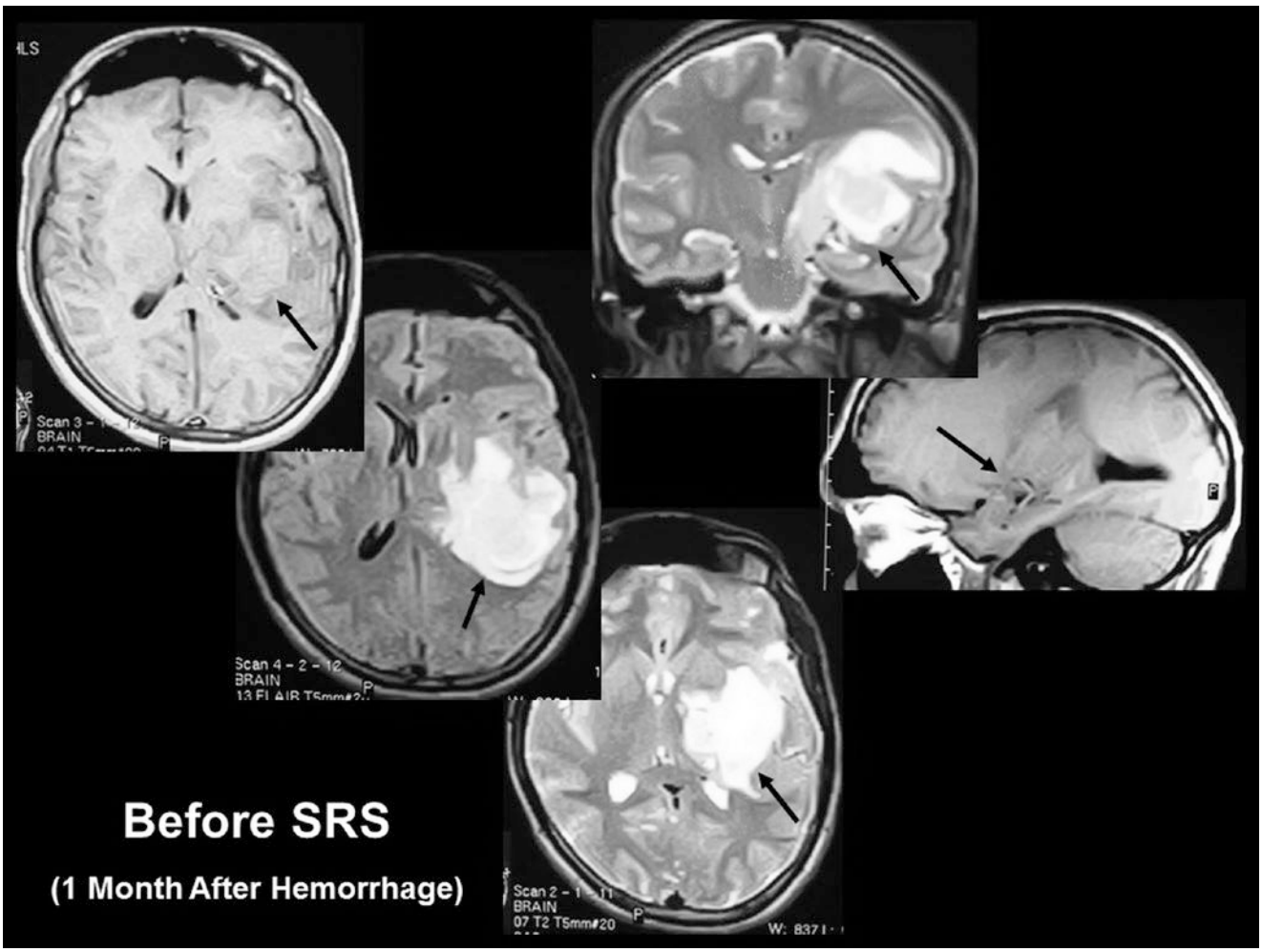
Marked resolution of perinidal high signal in T2 and FLAIR studies

Marked resolution of the previously large enhancing lesion to a small residual left thalamic focal enhancing lesion, in T1 Gadolinium-enhanced study

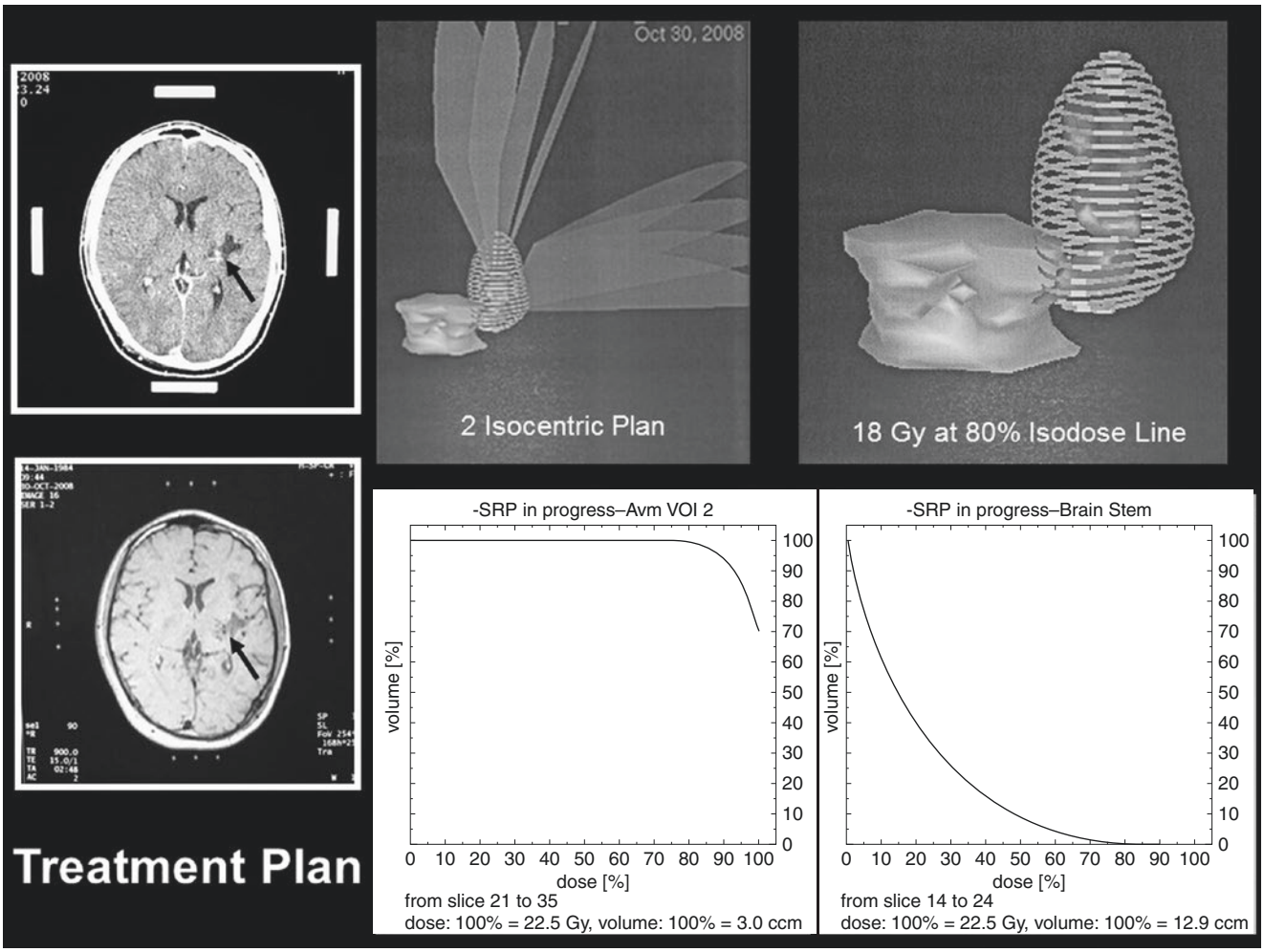
Appearance of an area of encephalomalacia, at the site of previous AVM nidus

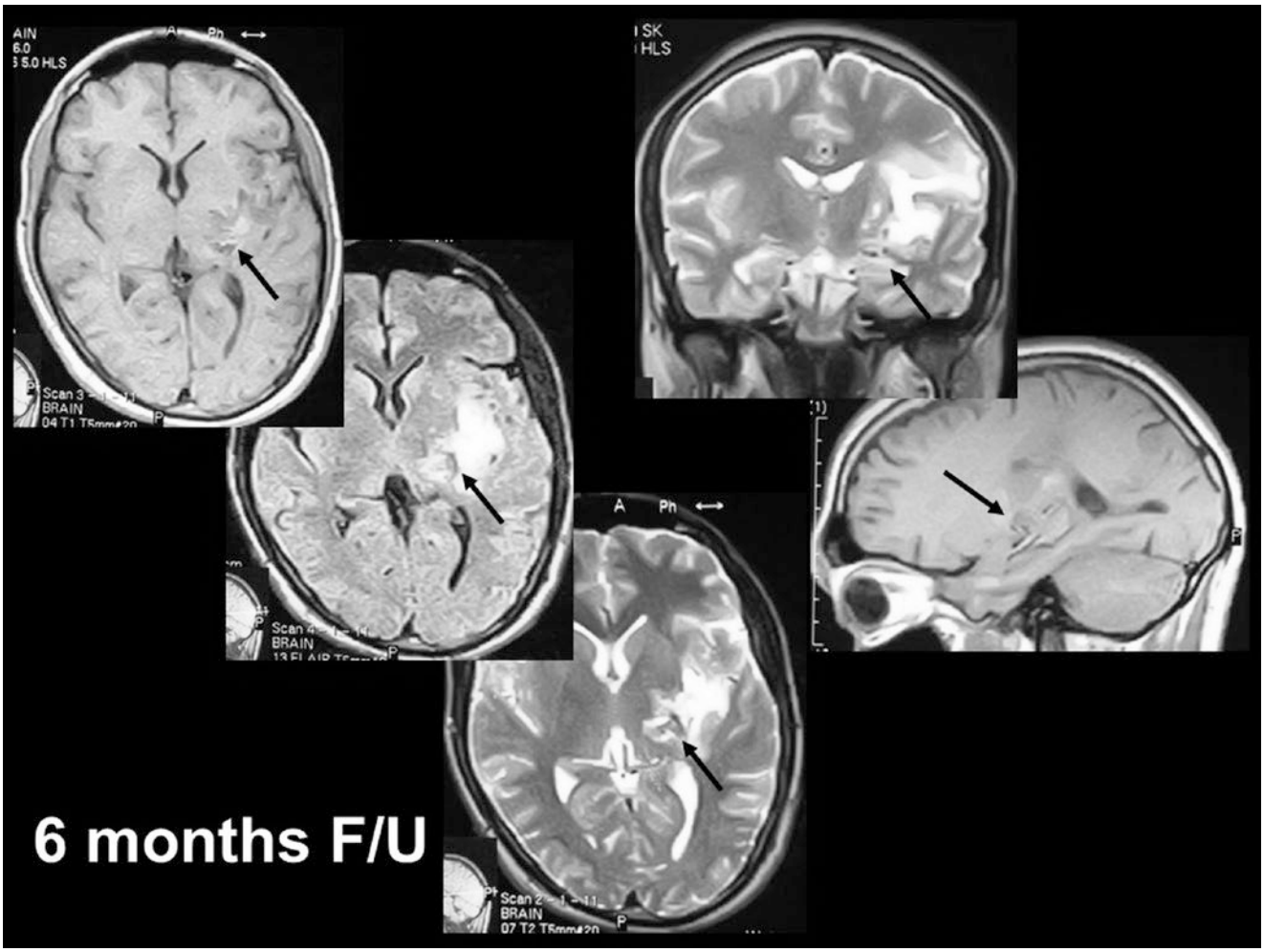
- 40 months post-SRS (CTA): Complete obliteration of AVM nidus
- 54 months post-SRS (Conventional angiography): Complete obliteration of AVM nidus

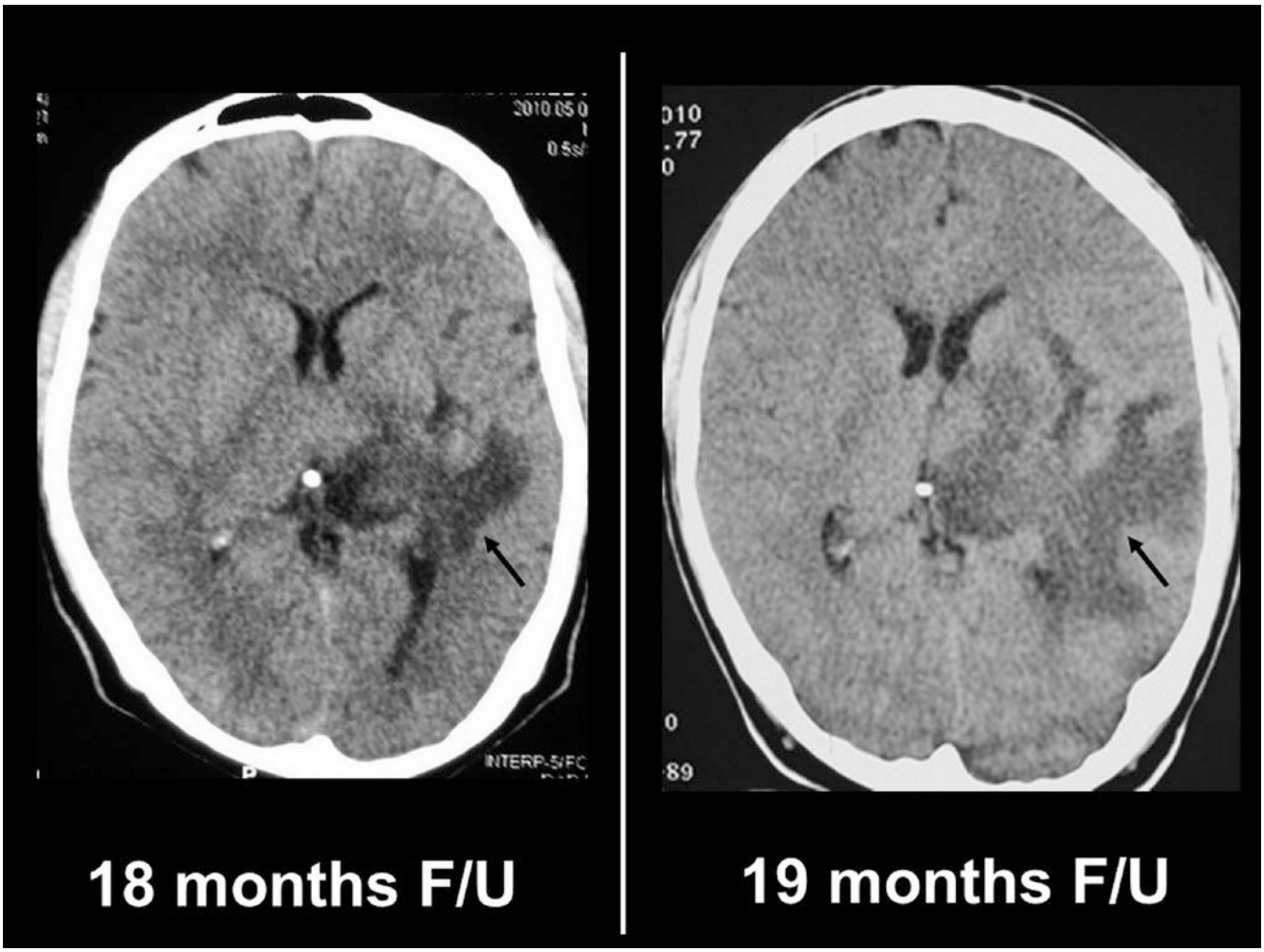
- **Post-radiosurgery Treatment:** None

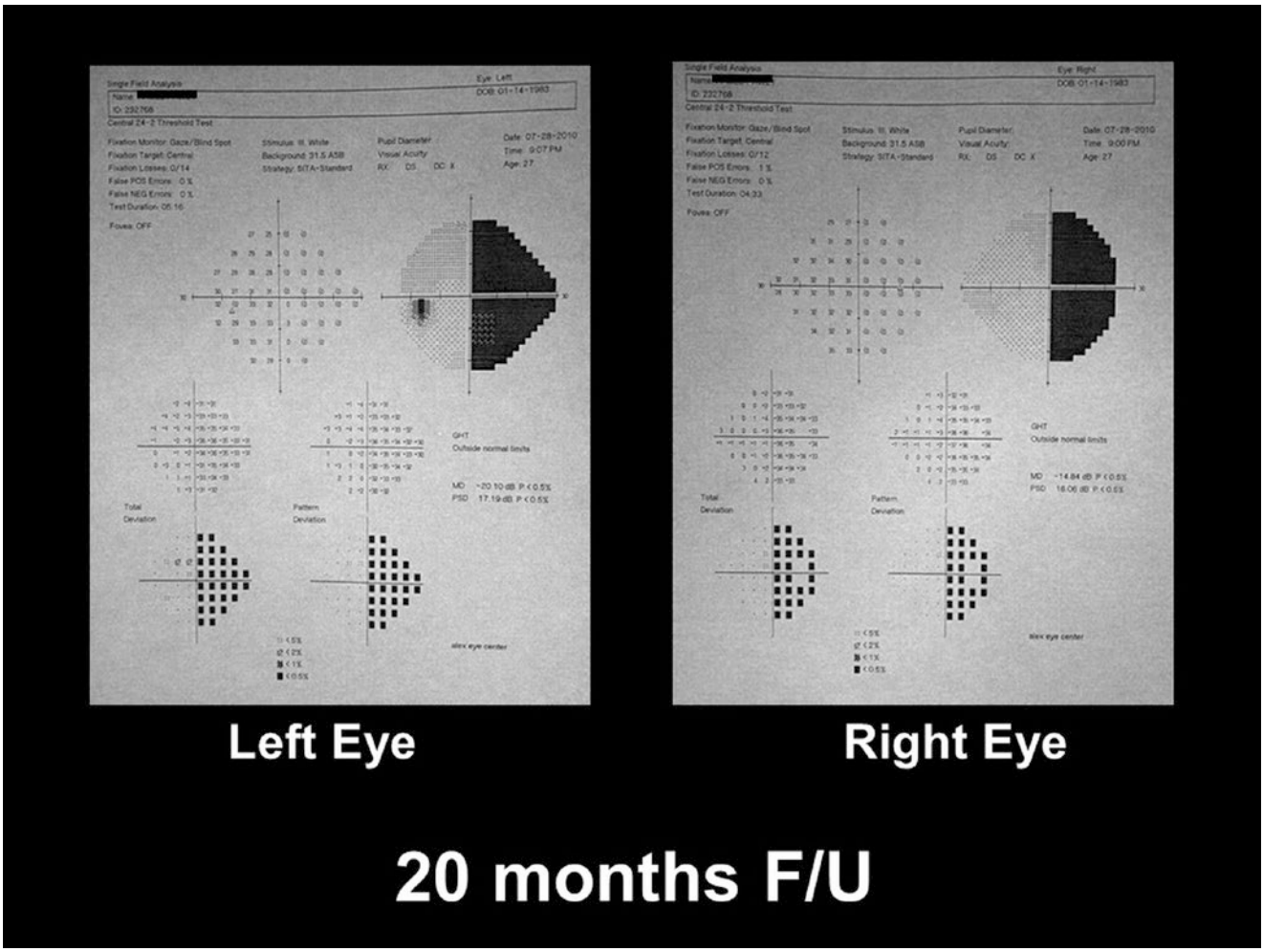


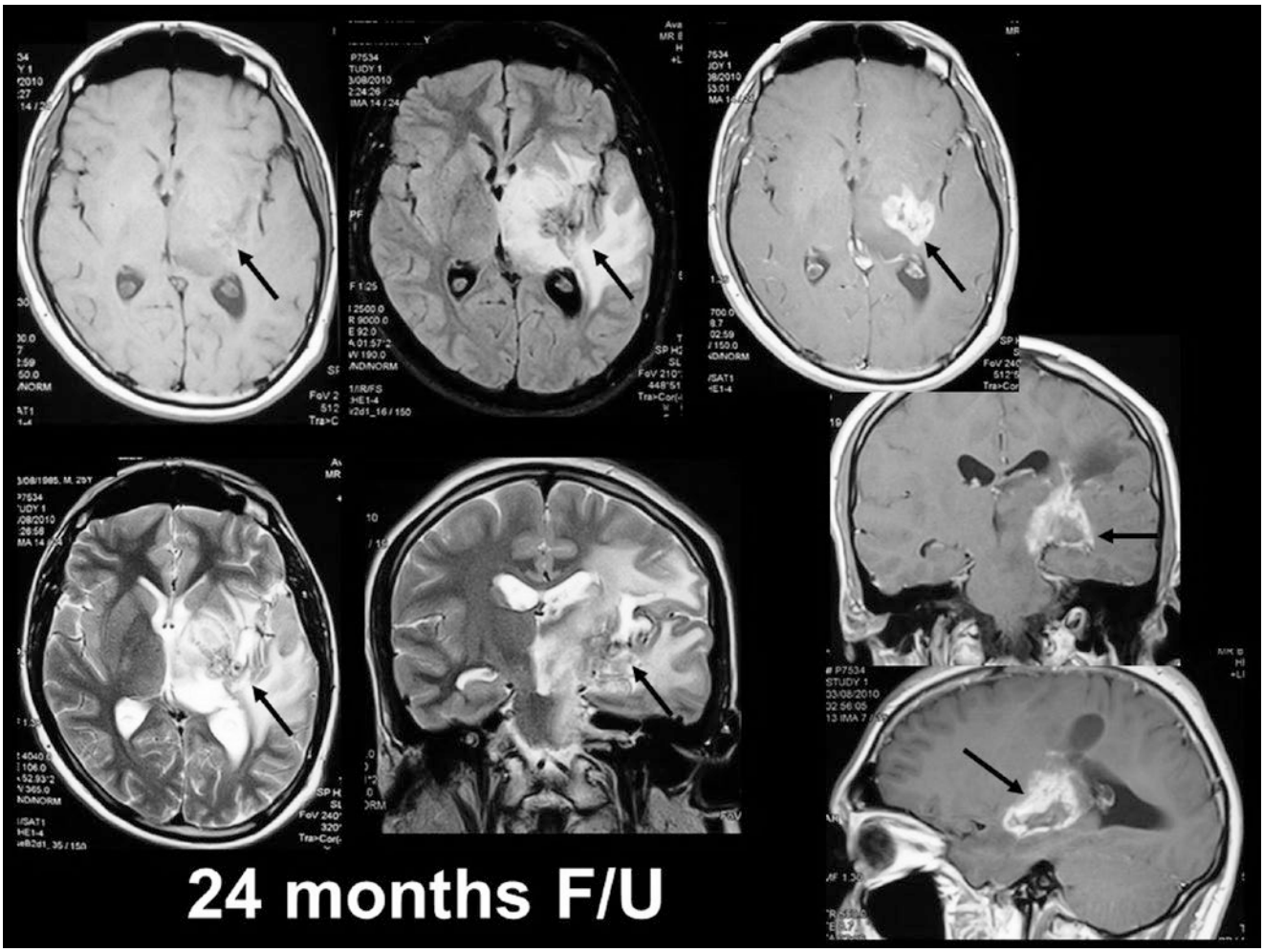

Before SRS

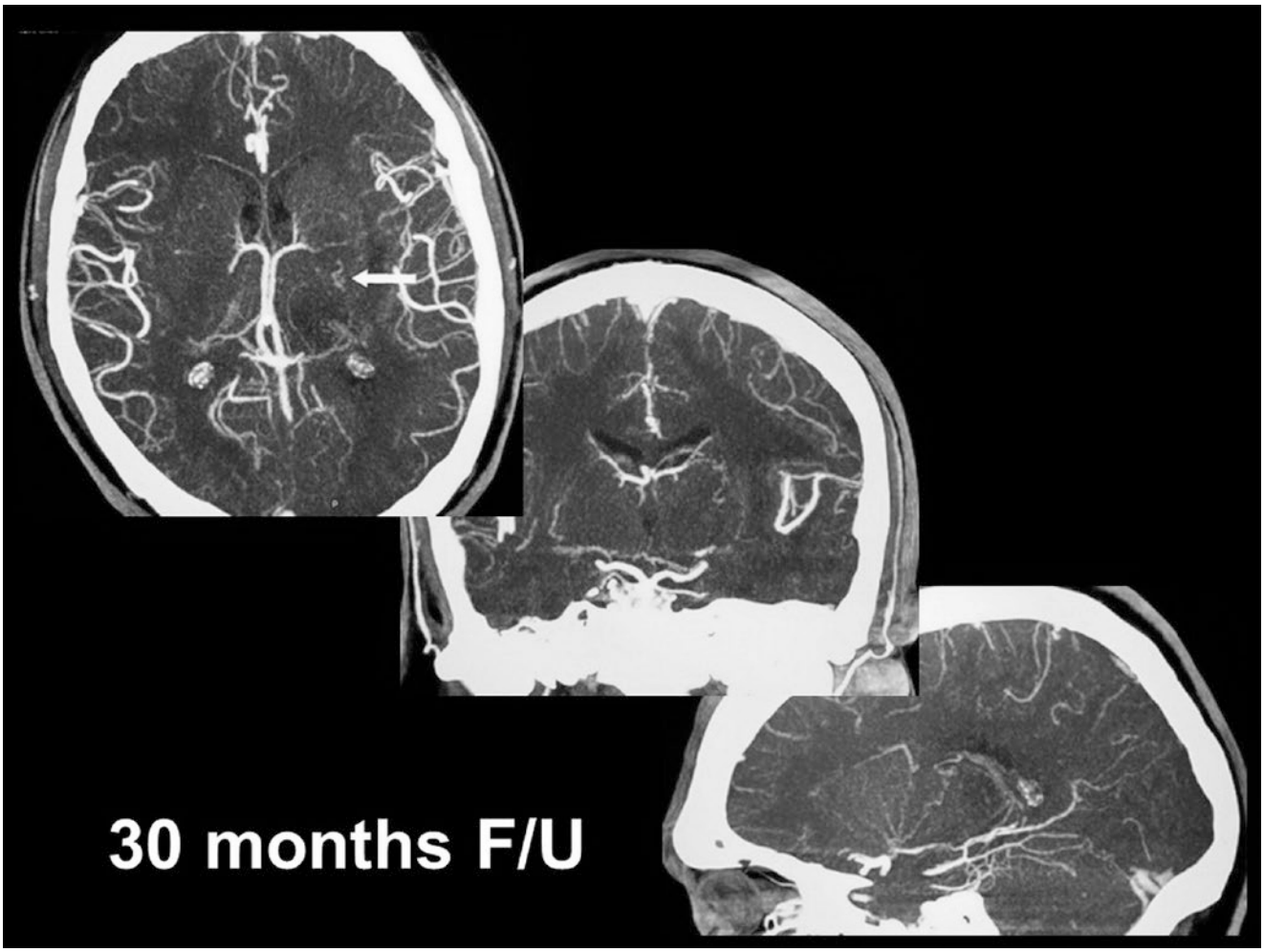

Oct 30, 2008
2 Isocentric Plan
18 Gy at 80% Isodose Line
Treatment Plan
-SRP in progress–Avm VOI 2
volume [%]
dose [%]
from slice 21 to 35
dose: 100% = 22.5 Gy, volume: 100% = 3.0 ccm
-SRP in progress–Brain Stem
volume [%]
dose [%]
from slice 14 to 24
dose: 100% = 22.5 Gy, volume: 100% = 12.9 ccm

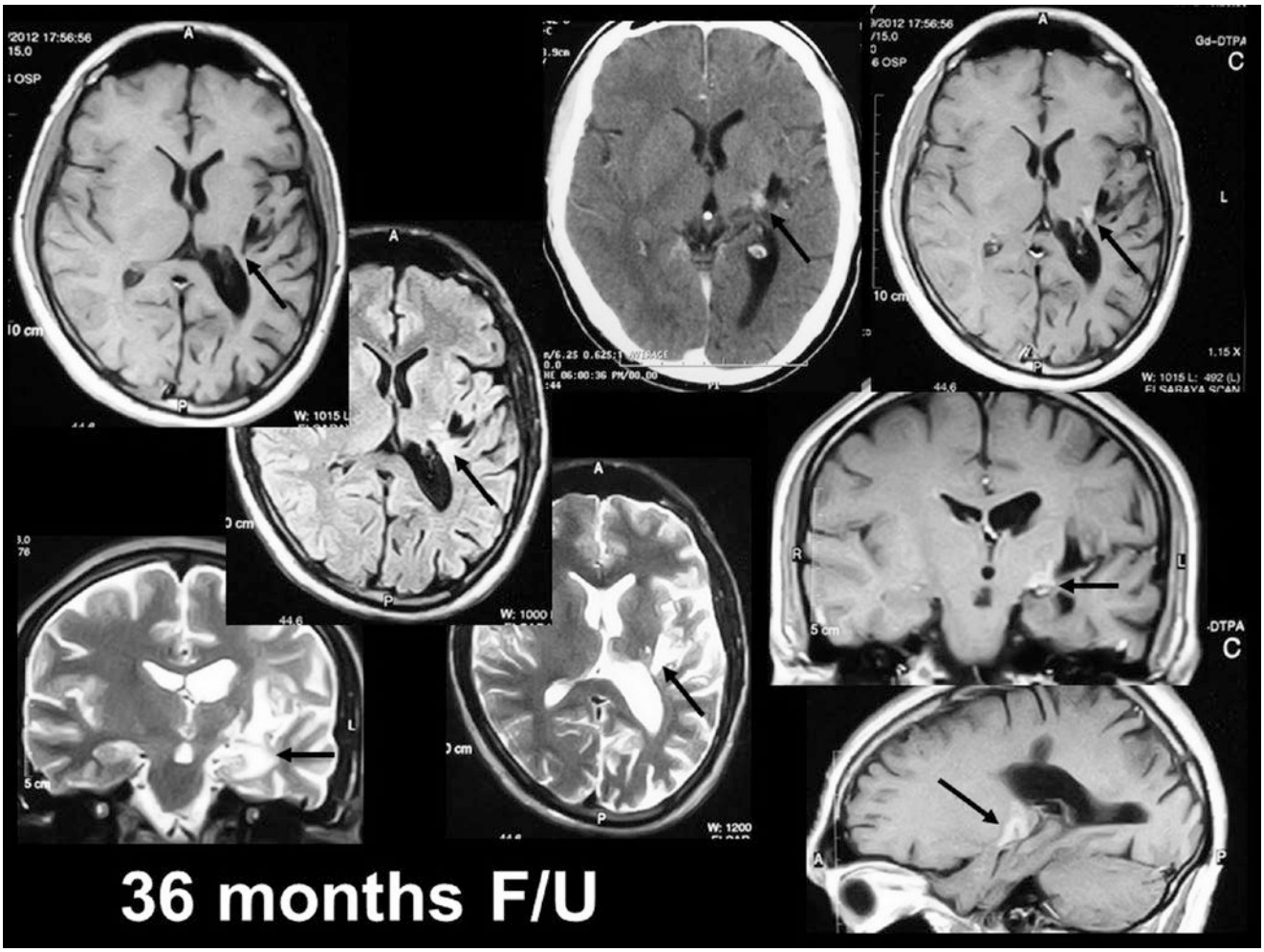

6 months F/U

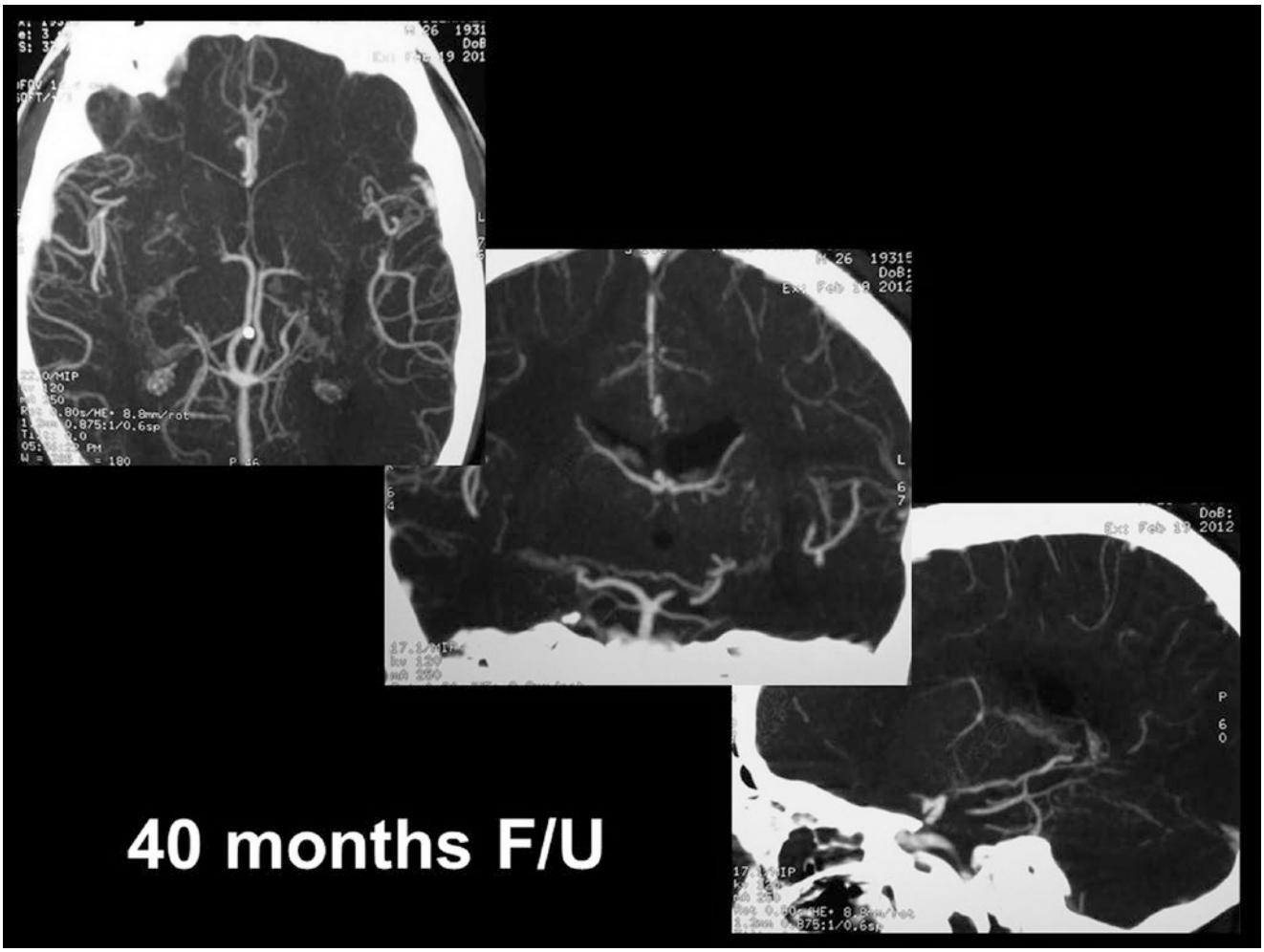

18 months F/U
19 months F/U

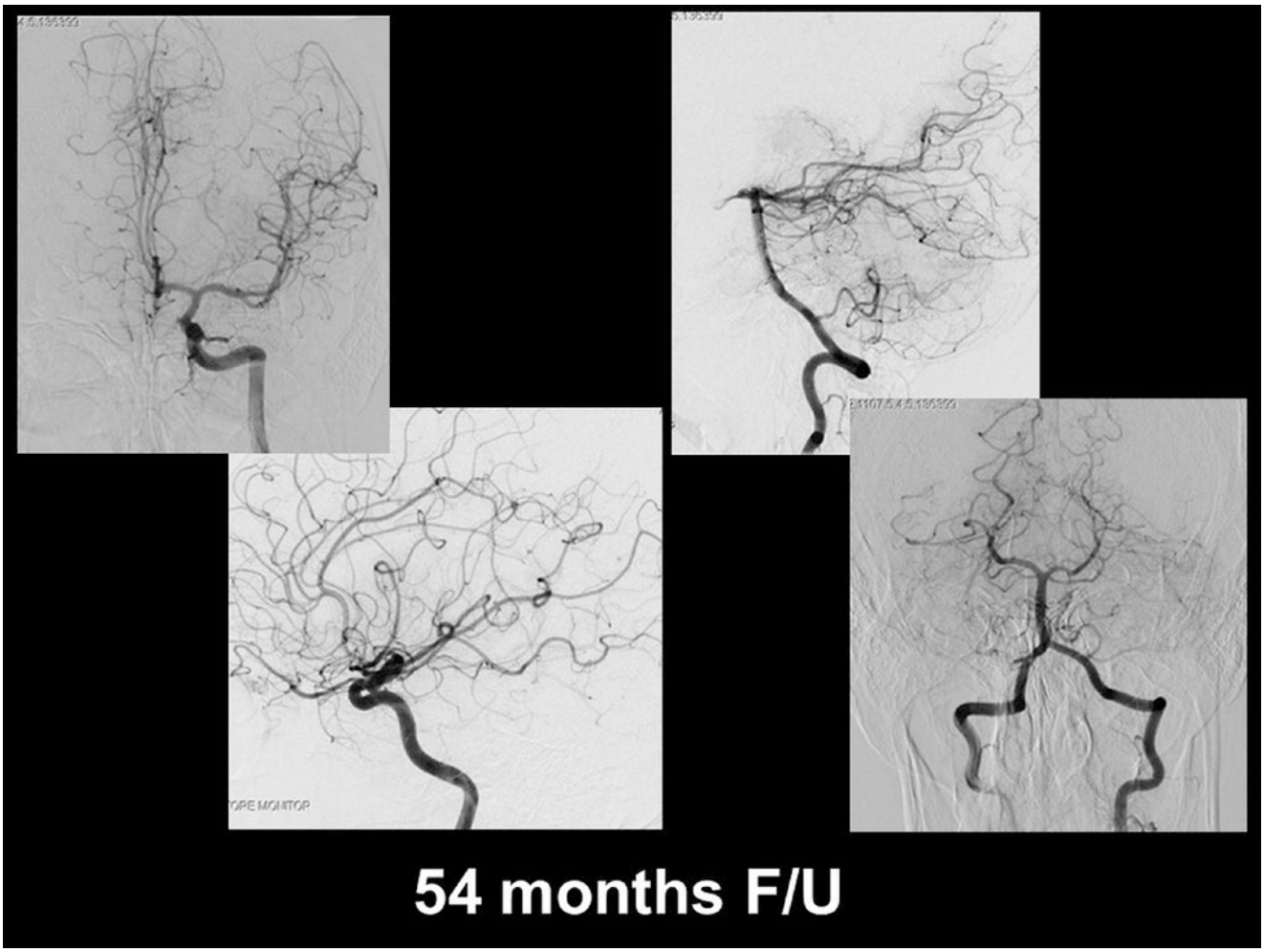

Left Eye
Right Eye
20 months F/U

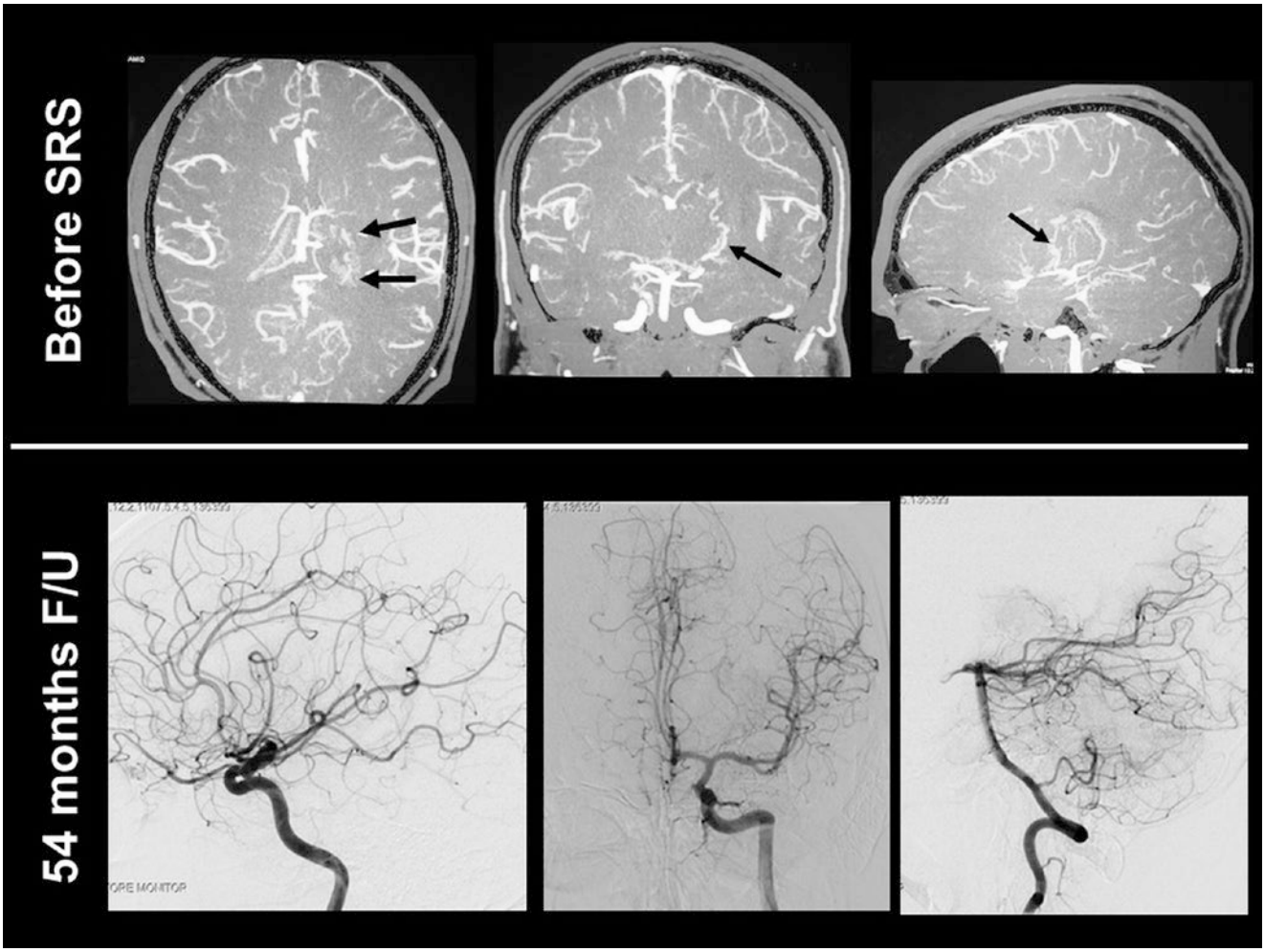

24 months F/U


30 months F/U


36 months F/U


40 months F/U


54 months F/U



Further Reading

Andrade-Souza YM, Zadeh G, Scora D, et al. Radiosurgery for basal ganglia, internal capsule, and thalamus arteriovenous malformation. Neurosurgery. 2005;56:56–64.

Parkhutik V, Lago A, Aparici F, et al. Late clinical and radiological complications of stereotactical radiosurgery of arteriovenous malformations of the brain. Neuroradiology. 2013;55(4):405–12.

Pollock BE, Gorman DA, Brown PD. Radiosurgery for arteriovenous malformations of the basal ganglia, thalamus, and brainstem. J Neurosurg. 2004;100:210–4.

Yamamoto M, Kawabe T, Barfod BE. Long-term side effects of radiosurgery for arteriovenous malformations. Prog Neurol Surg. 2013;27:97–106.

Yen CP, Matsumoto JA, Wintermark M, et al. Radiation-induced imaging changes following Gamma Knife surgery for cerebral arteriovenous malformations. J Neurosurg. 2013;118(1):63–73.