Epilepsy in cerebral arteriovenous malformation

Epilepsy is the second most common symptom in cerebral arteriovenous malformation (AVM) patients.

The mechanism of seizure in AVM is multifold, including those seizures directly due to hemorrhage and hemosiderosis, as well as seizures secondary to vascular steal, perinidal edema, and nidus size and location [1) 2) 3) 4)].

Several hemodynamic and morphological characteristics of AVM have been identified to be associated with seizure presentation. This includes increased AVM flow, presence of long pial draining vein, venous outflow obstruction, and frontotemporal location, among other aspects. With the advent of high-throughput image processing and quantification methods, new radiographic attributes of AVM-related epilepsy have been identified. With respect to therapy, several treatment approaches are available, including conservative management or interventional modalities; this includes microsurgery, radiosurgery, and embolization or a combination thereof. Many studies, especially in the domain of microsurgery and radiosurgery, evaluate both techniques with respect to seizure outcomes. The advantage of microsurgery lies in superior AVM obliteration rates and swift seizure response. In addition, by incorporating electrophysiological monitoring during AVM resection, adjacent or even remote epileptogenic foci can be identified, leading to extended lesionectomy and improved seizure control. Radiosurgery, despite resulting in reduced AVM obliteration and prolonged time to seizure freedom, avoids the risks of surgery altogether and may provide seizure control through various antiepileptic mechanisms [5)].

Pediatric patients are more likely to develop AVM-associated epilepsy. Prablek et al. examined the role of multimodality AVM treatment in pediatric AVM-associated epilepsy to characterize long-term epilepsy outcomes.

A retrospective chart review identified pediatric patients with AVM-associated epilepsy seen from 2005 to 2018. Variables measured included demographic and descriptive data. Primary outcomes included seizure freedom, seizure control, and functional outcomes.

Of 105 pediatric patients with AVMs, 18 had AVM-related epilepsy. Thirteen underwent surgical resection, of which 6 underwent preoperative embolization. Twelve (92.31%) had complete resection; one (7.69%) with residual underwent redo craniotomy with subsequent complete resection. All had radiographic cure at most recent follow-up, with no recurrence seen during length of follow-up (mean 2.17 years, SD 1.40, range 0.25-4.41). Eight (61.54%) experienced seizure freedom postoperatively; 12 (92.31%) were modified Engel Class I at last follow-up. Five patients underwent treatment without open surgical resection, with conservative management (3, 60%) or endovascular embolization (2, 40%). None in our cohort underwent radiosurgery. Of those embolized, one had complete AVM obliteration and two had partial obliteration. Four of the 5 patients (80%) treated without open surgery achieved seizure freedom.

Long-term outcomes of AVM-related epilepsy are poorly characterized in children. We found that in addition to improved AVM outcomes regarding obliteration, treatment of residual, and recurrence, pediatric patients undergoing surgical AVM treatment had improved AVM-associated epilepsy

outcomes, with 61.54% achieving seizure freedom and 92.31% classified as modified Engel Class I seizure control [6].

Patients presenting with AVM-associated epilepsy have a favorable seizure outcome after surgical treatment. Long-standing epilepsy and the progress into drug-resistant epilepsy (DRE) markedly deteriorate the chances to obtain seizure freedom and should be considered an early factor in establishing the indication for AVM removal [7].

The impact of treatment modality on seizure control remains unclear.

In 164 patients, 31 patients (20.7%) had Spetzler-Martin grade I AVMs, 51 (34.0%) grade II, 47 (31.3%) grade III, 20 (13.3%) grade IV, and 1 (0.7%) grade V. Of the 49 patients (30%) presenting with seizures, 60.4% experienced seizure persistence after treatment. For these patients, radiosurgery was associated with seizure recurrence (odds ratio: 4.32, 95% confidence interval: 1.24-15.02, P = .021). AVM obliteration was predictive of seizure freedom at last follow-up (P = .002). In contrast, for patients presenting without seizures, 18.4% experienced de novo seizures after treatment, for which surgical resection was identified as an independent risk factor (hazard ratio: 8.65, 95% confidence interval: 3.05-24.5, P < .001).

This data suggest that achieving seizure freedom should not be the primary goal of AVM treatment, surgical resection may result in improved seizure control compared with radiosurgery for patients who present with seizures. Conversely, in patients without presenting seizures, surgical resection increases the risk of new-onset seizures compared with radiosurgery, but primarily within the early posttreatment period. Surgical resection and radiosurgery result in divergent seizure control rates depending on seizure presentation [8].

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