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# Arteriovenous Malformations and Epilepsy: Predictors for Seizure Outcome in a Prospective AVM Database Using Multimodal Treatment Strategies

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Brain AVM patients have seizures in 20 to 30%. 1% of unprovoked first seizures are caused by AVMs. AVMs are considered to be models for epileptogenic lesions as a result of perilesional gliosis, hemorrhage, steal phenomena, and iron deposits.
The aim of this study was to define predictors for seizure outcome in a large prospective data basis with specific focus on the role of intervention.

Between 1982 and 2007, the University of Toronto Brain AVM Study Group treated 1106 patients with brain AVMs, of which 333 (30.1%) experienced seizures (sz-group). 155 of these patients met inclusion criteria for this study such as complete set of clinical and neuroradiological data. Mean (±SD) follow up was 7.35±5.43 years. Treatment consisted of surgical resection, radiosurgery, or embolization, either alone or in combination. A total of 49 variables were examined; outcome was determined by Engel seizure outcome scale. These data were compared for statistical relevance to 50 AVM patients with no seizures (non-sz-group) over the course of the disease. Mean follow-up was 5.04±4.8 years.

The sz-group was diagnosed with AVM at age 35±13 years compared to the non-sz-group with age 39±18 years. Infratentorial, occipital and deep white matter location were found in 46.0% in the non-sz-group versus 8.5% in the sz-group. Small sized AVMs occured in 68.1% of the non-sz-group vs. 43.8% in the sz-group. Large sized AVM were associated with seizure occurrence.
The number of treatment procedures was significantly higher in sz-group. 58.1% of the sz-group became seizure free, 30.0% of these stayed seizure-free after weaning off antiepileptic drugs (AED). Predictors for a good seizure outcome were generalized tonic-clonic seizures, intervention after single seizure, and complete obliteration of the AVM with less than four treatment procedures.
Factors significantly reducing chance of a favorable outcome were focal seizures, particularly complex-partial seizures, transition from GTCS to CPS or SPS, embolization in single modality treatment, and occurrence of intracranial hemorrhage.

Existing literature mostly focuses on seizure outcome after single modality treatment, and thereby limiting to certain AVM characteristics amenable to single therapy. Further prospective studies are necessary to examine the pathophysiology of seizures in brain AVMs.

Our data strongly suggest that an early diagnosis of AVM after single seizure presentation and a subsequent rigorous treatment approach (leading to complete obliteration of the AVM) leads to the overall best seizure outcome and prevents future hemorrhage. In a majority of cases, there is no recurrence of seizures, when complete obliteration is achieved with less than four treatment procedures.
We speculate that delayed diagnosis may lead to secondary epileptogenesis, higher rate of bleeding events and unfavorable seizure outcome.