



MRI FLAIR Signal Abnormalities are Highly Associated with Aggressive Presenting Symptoms in Patients with Cranial Dural Arteriovenous Fistulas

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Introduction

- Dural AV fistulas (dAVFs): cerebrovascular malformations comprised of a direct connection between a dural artery and a dural venous sinus or cortical vein
- Fistulas with cortical venous drainage (CVD) have been associated with a higher rate of future intracerebral hemorrhage (ICH) or non-hemorrhagic neurologic deficit (NHND)
- Recent studies further stratify patients with CVD based on presenting symptoms - patients who present incidentally or with symptoms of pulsatile tinnitus or ophthalmological phenomena (asymptomatic CVD) have a lower risk of new neurological events compared to those who present with ICH or NHND (symptomatic CVD)
- Question: Are MRI T2/FLAIR abnormalities associated with a more aggressive mode of presentation of dAVFs?**

Methods

- Retrospectively identified a cohort of patients from two large academic centers (Washington University in St. Louis and Mayo Clinic in Rochester) who had pre-treatment MRIs with T2/FLAIR imaging available for review
- MRIs were analyzed by a panel consisting of an experienced vascular neurosurgeon, an experienced interventional neuroradiologist, and an interventional neuroradiology fellow
- All were blinded to patient identity, presenting symptoms, and dAVF grade
- Angiographic grade and mode of presentation were determined thereafter and were statistically analyzed for correlation with imaging findings

Characteristic	Washington Univ.	Mayo Clinic	Pooled	p-Value
Total	44	32	76	
Age at diagnosis	58.3 ± 14.5	61.7 ± 12.8	59.7 ± 13.8	0.284
Males	18 (41)	16 (50)	34 (45)	0.430
Borden-Shucart type				
Type 1	15 (34)	17 (53)	32 (42)	0.097
Type 2	6 (14)	5 (16)	11 (14)	0.810
Type 3	23 (52)	10 (31)	33 (43)	0.067
CVD type at presentation				
No CVD	15 (34)	17 (53)	32 (42)	0.097
Asymptomatic CVD	10 (22)	8 (25)	18 (24)	0.818
Symptomatic CVD	19 (43)	7 (22)	26 (34)	0.054
Presenting symptom				
Incidental	6 (14)	5 (16)	11 (14)	0.810
Tinnitus	15 (34)	14 (44)	29 (38)	0.390
Orbital phenomena	7 (16)	5 (16)	12 (16)	0.976
Headache	11 (25)	9 (28)	20 (26)	0.757
NHND	14 (32)	5 (16)	21 (28)	0.107
Hemorrhage	5 (11)	2 (6)	7 (9)	0.447

Table 1. Characteristics [n (%) ± SD] of the study population (N=76). Statistical analysis using the 2-tailed Student's t test and 2-tailed z test to compare the Washington University and Mayo Clinic patients showed no significant difference in age, gender, number of fistula types, and distribution of mode of presentation (p > 0.05).

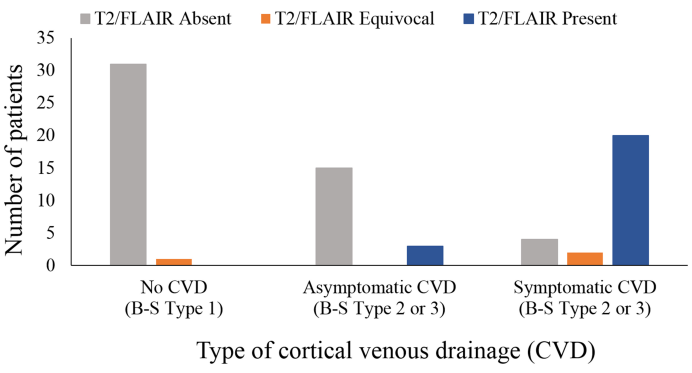


Figure 1. Distribution of T2/FLAIR changes between types of cortical venous drainage.

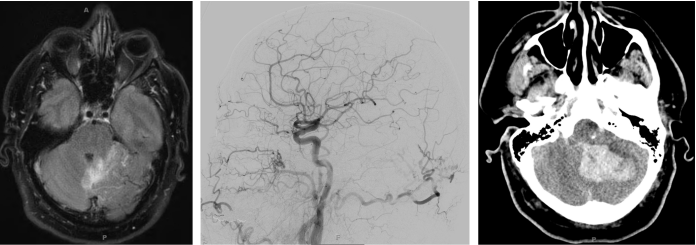


Figure 2. Imaging obtained from a patient who presented with headaches (aCVD) and went on to hemorrhage shortly after presentation. Left: FLAIR MRI obtained at time of presentation showing large area of signal abnormality in the left cerebellar hemisphere. Middle: Angiogram obtained at time of presentation demonstrating a left cerebellar Borden type 3 dural arteriovenous fistula. Right: CT scan obtained four days after diagnosis and two days prior to scheduled treatment showing a large intracranial hemorrhage originating from the dAVF.

Results

- Identified 143 consecutive patients with dAVFs at Washington University and 108 at Mayo Clinic
- 76 patients met inclusion criteria
- Statistical analysis using the 2-tailed Student's t test and 2-tailed z test to compare the Washington University and Mayo Clinic patients showed no significant difference in several population characteristics (**table 1**)
- Figure 1** illustrates the distribution of T2/FLAIR abnormalities between the different types of cortical venous drainage (CVD)
- 77% of patients with symptomatic CVD had T2/FLAIR abnormalities, compared to 17% of patients with asymptomatic CVD and 0% of patients with no CVD**
- T2/FLAIR abnormalities were strongly associated with high grade dAVFs with sCVD (p < 0.0001, Fisher's exact test)

Conclusions

- T2/FLAIR abnormalities are highly correlated with dAVFs with sCVD, which should be treated aggressively given their poor natural history
- Presence of T2/FLAIR changes in dAVF patients with benign presenting symptoms (i.e. those with aCVD) might identify a subset of patients with higher than expected risk who should be treated more urgently
- Absence of abnormality is strongly correlated with low grade fistulas (Borden-Shucart Type 1) as well as high grade fistulas with aCVD (modified Borden-Shucart Type 2a and 3a)
- Data supports the hypothesis that **sCVD is physiologically different than aCVD** – the former having clinical and radiographic evidence of cortical venous hypertension; the latter not having clinical or radiographic evidence of cortical venous hypertension