BRUSH SIGN IS ASSOCIATED WITH INCREASED SEVERITY IN CEREBRAL VENOUS THROMBOSIS

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Introduction

The "brush sign" (BS) is an abnormally accentuated signal drop of the subependymal and deep medullary veins in paramagnetic-sensitive MR sequences, previously described in acute ischemic stroke. We aimed to describe BS in patients with thrombosis of the cerebral veins and sinuses (CVT) and explore its association with clinical severity, thrombosis extent, parenchymal brain lesion and clinical prognosis.

METHODS

We assessed consecutive adult patients admitted to two university hospitals with diagnosis of acute CVT and imaging assessment with MRI, including paramagnetic-sensitive sequences:
-Hospital Santa Maria, Lisbon, between January 2010 and April 2018 (Cohort 1)
- Inselspital, Bern, between October 2009 and April 2018 (Cohort 2)

Demographics, imaging findings, clinical presentation and functional outcome at 3 months were analyzed according with the presence of BS.

RESULTS

118 patients included

BS identified in 17 patients (14%):
- 10 (16%) in T2* (Figure 1)
- 7 (13%) in SWI (Figure 2)

Inter-rater reliability (κ): 0.97 in Cohort 1 and 1.00 in Cohort 2

	BS+ n=17	BS- n=101	p-value
Time from symptom onset to MRI - median (IQR), days	5 (4-8)	5 (3-8)	0.52
Time from admission to MRI - median (IQR), days	0 (0-1)	0 (0-1)	0.36
Field strength (1.5T:3T)	4:13	64:37	0.002
Superior Sagittal sinus - n (%)	10 (59)	44 (44)	0.24
Straight sinus - n (%)	12 (71)	19 (19)	<0.0001
Deep Venous System - n (%)	14 (82)	6 (6)	<0.0001
Thrombus load Score – median (IQR)	5.0 (4.0-6.0)	2.0 (2.0-4.0)	<0.0001
Brain lesion - n (%)	13 (76)	34 (34)	0.0009
Parenchymal non-hemorrhagic lesion - n (%)	13 (76)	30 (30)	0.0002
Parenchymal hemorrhagic lesion - n (%)	9 (53)	22 (22)	0.007
Follow-up MRI - n (%)	16 (94)	80 (79)	0.14
Time from first to last follow-up MRI – median (IQR), mo	3.1 (2.9-5.7)	3.5 (3.0-6.4)	0.70
BS+ at follow-up MRI -no. (%)	7 (41)	0 (0)	-
Isolated intracranial hypertension - n (%)	3 (18)	57 (56)	0.003
Focal neurological signs -n (%)	12 (71)	37 (37)	0.009
Seizures – n (%)	4 (24)	16 (16)	0.43
Evaluation of functional outcome at 3 mo - n (%)	17 (100)	86 (85)	0.12
Favourable outcome (mRS 0-1) at 3 mo - n (%)	10 (59)	62 (61)	0.84

Positive BS was associated with:

- Higher **thrombus load** (5 vs 2)
- Thrombosis of the straight sinus or deep venous system, particularly the vein of Galen and ipsilateral internal cerebral vein
- Parenchymal **brain lesion** (OR 6.4, 95%CI 1.9-21.1)
- Clinical manifestation with **focal neurological deficits** (OR 4.2; 95%CI 1.4-12.7)
- Less likely manifestation with Isolated intracranial hypertension

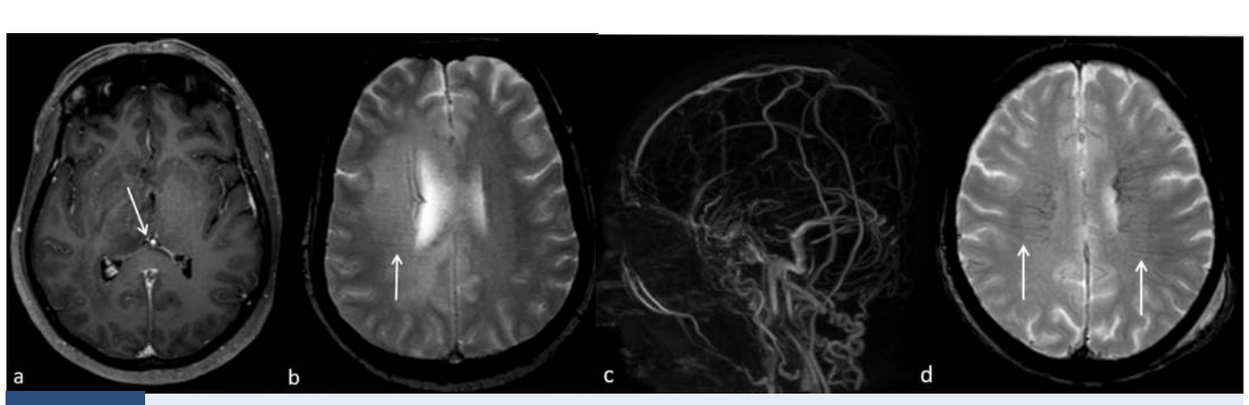

FIG. 1 **T2*WI-Brush sign in cerebral venous thrombosis:** Unilateral T2*WI-Brush sign (arrow in b, T2*) in a patient with thrombosis of the right internal cerebral vein (arrow in a, T1-GAD), vein of Galen and Straight sinus. Bilateral T2*WI-Brush sign (arrows in d, T2*) in a patient with extensive acute cerebral venous thrombosis (c, MR venography).

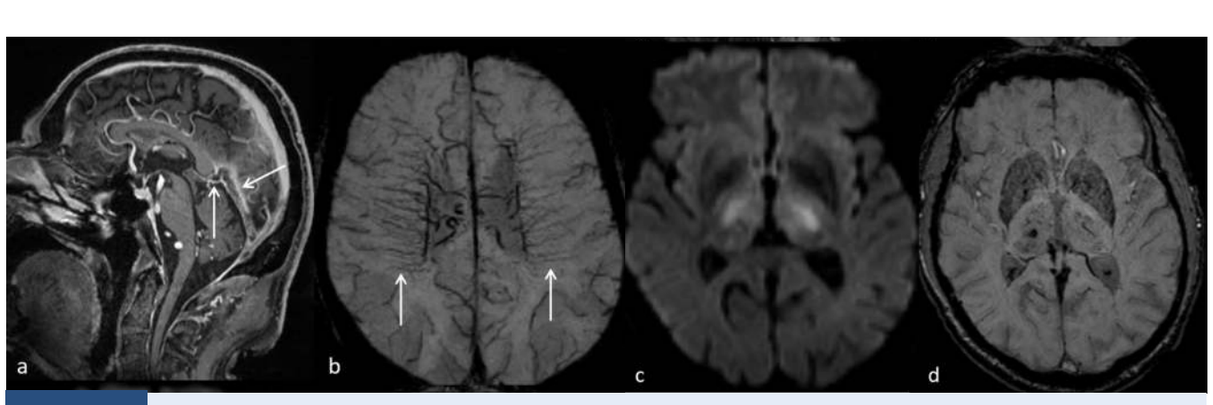

FIG. 2 **SWI-Brush sign in cerebral venous thrombosis:** Patient with thrombosis of the vein of Galen, straight sinus (arrows in a) and internal cerebral veins. The SWI (b) shows an increased number and engorgement of the medullary veins bilaterally. There is bilateral thalamic edema, diffusion restriction (c) and hemorrhage (d).

Conclusion

BS in T2*WI and SWI was observed in approximately one in seven acute CVT patients. BS was significantly associated with ipsilateral parenchymal brain lesion, extent of thrombosis and focal neurological deficits, suggesting that the BS is a marker of severity in CVT.