PC-MRI study of cerebral blood and CSF flow patterns in patients with diagnosed cerebral venous thrombosis.

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Background: Using PC-MRI technique, a recent study has enabled description of the organization of the cerebral venous systems flows in healthy subjects. Our objectives were to study by PC-MRI intracranial blood and CSF flow alterations in patients with cerebral venous thrombosis (CVT).

Material and methods: PC-MRI sequences were added to brain MRI conventional protocol in 19 patients with suspected CVT, among whom 6 patients had a positive diagnosis of CVT on MR venography. Results were compared to those of 18 age-matched healthy volunteers (HV). The MRI parameters were as follows: 4 views per segment, field-of-view FOV=14x14 mm²; matrix 256x128; slice thickness 5mm. Velocity (encoding) sensitization was set at 80 cm/s for the blood vessels. An intracerebral vascular plane was used to measure arterial flows in the internal carotid and basilar artery, and venous flows in the superior sagittal sinus (SSS) and the straight sinus (SRS). Finally, a coronal section enabled measurement of the venous flows in the left and right lateral transverse sinuses (TS). For CSF acquisitions, Velocity (encoding) was 5 to15 cm/s for the aqueduct and 5 cm/s for the cervical subarachnoid space. PC-MRI post processing was done with home made software to calculate mean flows and stroke volumes along the cardiac cycle.

Results / Discussion: In CVT patients, PCMRI did not detect any venous flow in the veins and/or sinuses with thrombosis detected on Venography, whereas arterial flows were preserved (table 1). PC-MRI showed alterations of CSF flows in 5/6 CVT patients (figure 1). Aqueductal and cervical CSF flows were increased in Patient 2 with secondary cerebral haemorrhage, and decreased in Patients 3,4,5,6 with extended thrombosis in the SSS and TS. Patient 3 had diffusion of haemorrhage to the ventricular spaces, responsible for aqueductal stenosis, while Patient 4 had dramatic decrease of his cervical CSF oscillations.

Among patients without CVT, as in controls in a previous study, we found heterogeneity of dominant veins. Hyper or hypodynamic CSF and blood flows were also obtained in patients finally diagnosed with chronic tension type headaches, multiple sclerosis, meningitis or cerebral atrophy.

Conclusion: PC-MRI is a rapid technique to highlight and quantify CSF and blood alterations in patients with cerebral venous thrombosis.

	P1	P2	P3	P4	P5	P6
Arterial cerebral flow	815	972	727	501	533	427
Venous cerebral flow	107	181	476	331	91	197
SSS	0	553	304	218	0	0
SRS	107	181	145	102	91	197
Right TS	TP	TP	566	277	101	0
Left TS	TP	TP	172	161	0	409
Thrombosis Location	RTS+RIJV +SSS	LTS+LIJV (+H)	L frontal cortical vein(+H)	Rparietal cortical vein(+H)	LTS+SSS +SSI	RTS+SSS+R parietal cortical vein

Table 1: Cerebral flows in the 6 CVT patients. Flows are expressed in ml/min. P= patient / SSS: superior sagittal sinus / SRS: straight sinus / TS: transverse sinus / SSI: inferior sagittal Sinus / R: right / L: left / H: Haemorrhage / TP: technical problem

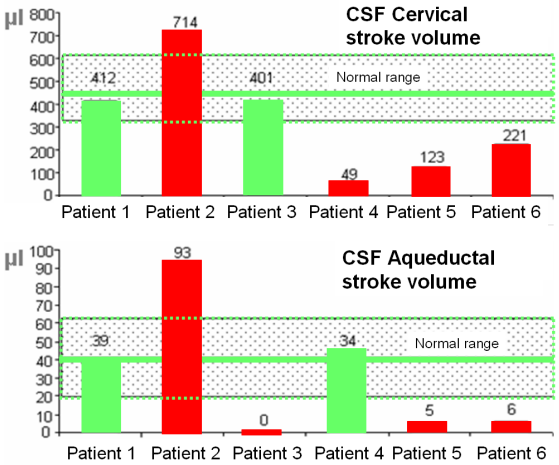

Figure 1: Aqueductal and cervical CSF stroke volumes in 6 CVT patients. They are expressed in microlitres (µl).The green line corresponds to the mean value in normal subjects; the hatched Square to mean value±1 standard deviation.