IS DYNAMIC SUSCEPTIBILITY CONTRAST PERFUSION IMAGING POSSIBLE FOR BRAIN IMAGING IN CHILDREN

ESPR 2022 Marseille - France

CHU Angers - Service de radiologie pédiatrique

LEIBER Louis-Marie

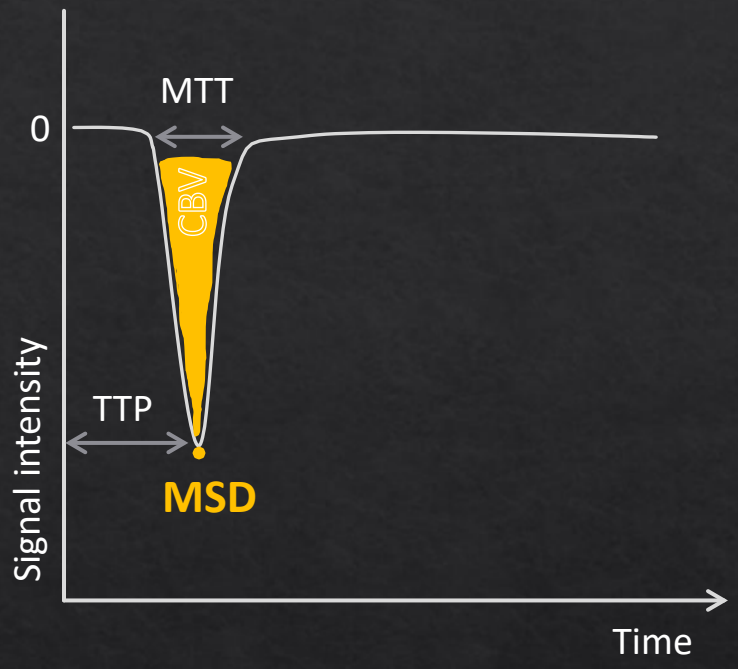
- Nothing to disclose

- Ethics commettee agreament, University hospital of Angers

Introduction

- Perfusion is verry usefull in brain MRI : tumor caracterisation…
- Dynamic susceptibility contrast : MTT, TTP, CBV, CBF
- In pediatrics : often impossible to achieve the theoretically compulsory perfusion flow rate (3 ml/s)

Introduction



maximum signal drop ⟺ cerebral blood volume

MSD : Easy to mesure, less affected by noise than CBV

Cha S, Lu S, Johnson G, Knopp EA. . J Magn Reson Imaging JMRI. févr 2000;11(2):114-9.
Dynamic susceptibility contrast MR imaging: correlation of signal intensity changes with cerebral blood volume measurements

Objective

Usual flow rate

Children maximum signal drop

=

Reference adulte population maximum signal drop

Material and methods

- Prospective, monocentric study
- 1,5 tesla Siemens Magnetom Aera MRI
- Automatic injecton device, dotarem

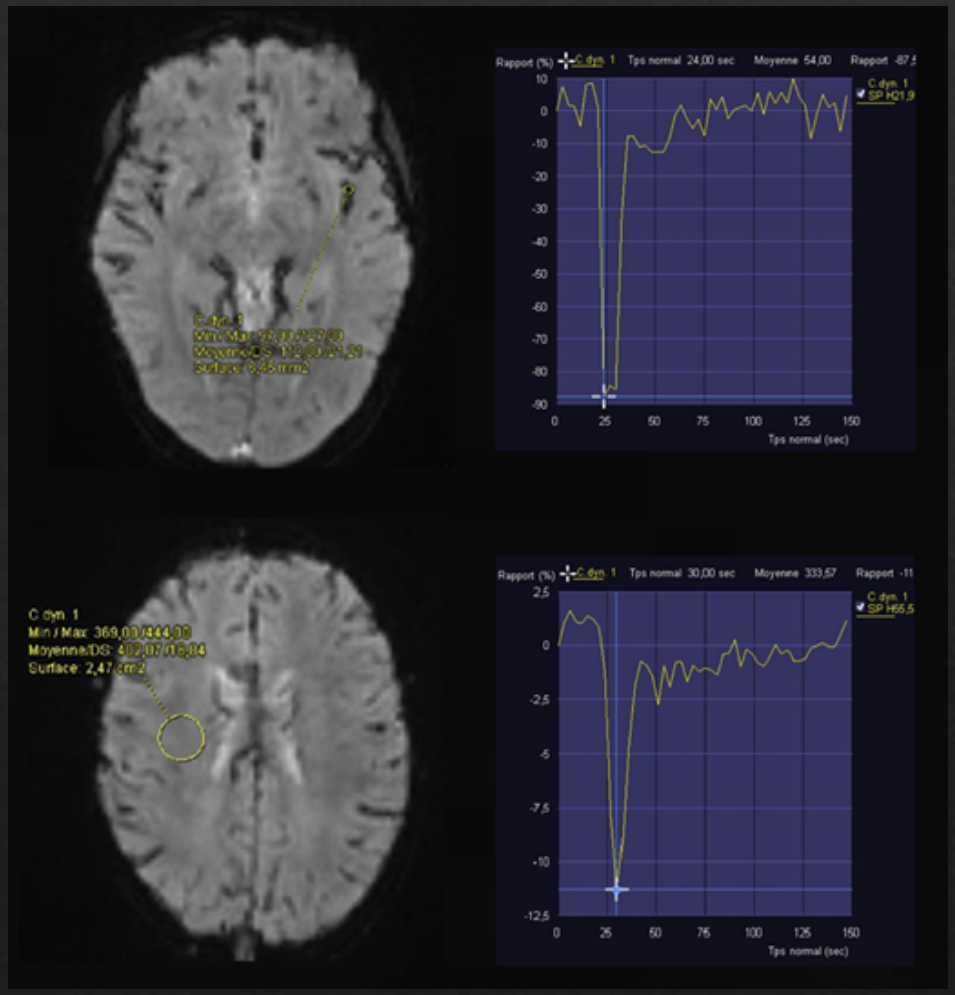
Material and methods

- Inclusion criteria
  - 0 to 18 years old, > 18 for control group.
  - MRI study which requires a contrast agent injection.
  - Child and parents consent

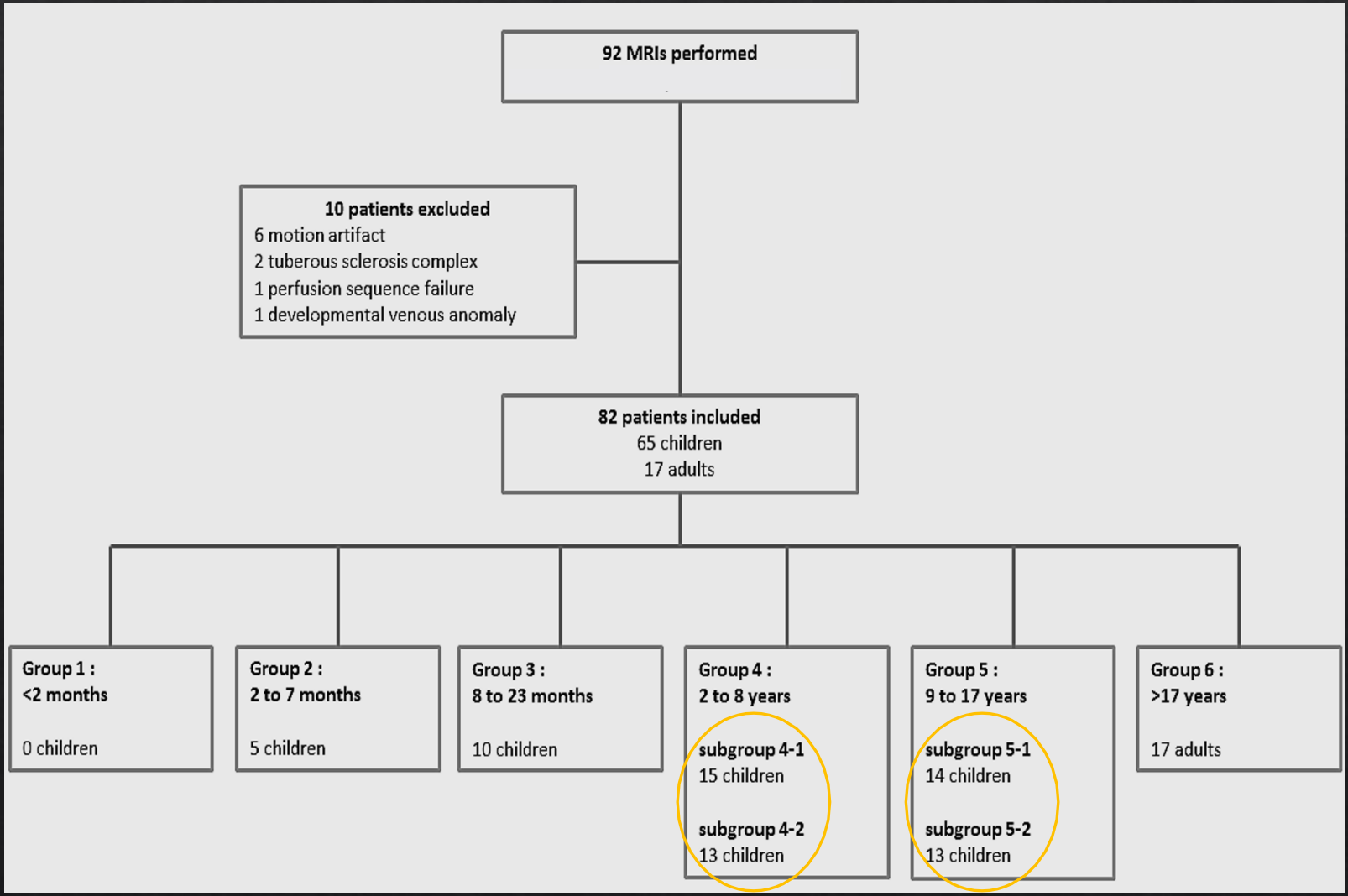
- Non inclusion -Exclusion criteria
  - Material causing artifacts, movements artefacts.
  - Discovery of a condition which may potentially alter cerebral haemodynamics
  - Tumour not in remission
  - Known vascular disease.
  - Failure or complications of the injection.

Material and methods

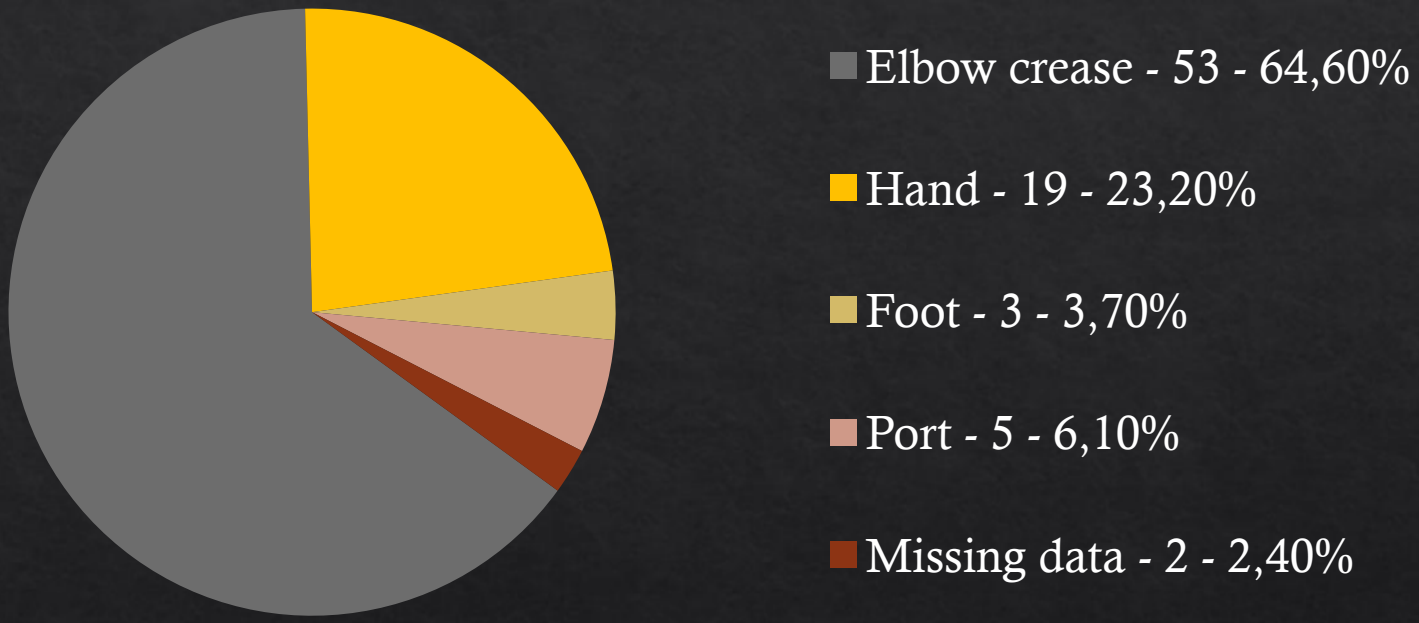
- 2 radiologists
- Mesure MSD
- Blind
- 11 ROIs
  - Vascular (M2, basillar)
  - Parenchymal (4 grey and 4 white)



Material and methods - Results



Results


Elbow crease - 53 - 64,60%
Hand - 19 - 23,20%
Foot - 3 - 3,70%
Port - 5 - 6,10%
Missing data - 2 - 2,40%

Results

Group	Mean age (min-max)	Mean flow rate
1 (< 2 month)	-	-
2 (2 – 7 month)	0.47 (0.42-0.50)	0.96
3 (8 – 23 month)	1.23 (0.67-1.92)	1.00
4-1 (2 – 9 years)	4.13 (2-8)	1.00
4-2 (2 – 9 years)	6.50 (3-8)	2.06
5-1 (9 – 17 years)	11.43 (9-16)	1.68
5-2 (9 – 17 years)	12.46 (9-17)	3.35
6 (+18 years)	51.59 (18-70)	4.59

Results and discussion

- Inter-observer concordance was excellent : intraclass correlation coefficient for all measurements = 0.983 (95% CI: 0.98-0.985).

- Basilar artery results uninterpretable

Dunnett's test	p RM2CA	p LM2CA	p RCAUD	p LCAUD	p RTHAL	p LTHAL	p ROVAL	p LOVAL	p RPEDON	p LPEDON
Group 2 vs 6	0.013	<0.01	<0.01	<0.01	<0.01	<0.01	0.039	<0.01	<0.01	<0.01
Group 3 vs 6	0.133	0.097	<0.01	<0.01	<0.01	<0.01	0.981	0.828	0.278	0.759
Group 4-1 vs 6	0.017	0.033	<0.01	<0.01	<0.01	<0.01	0.451	0.525	<0.01	<0.01
Group 4-2 vs 6	0.629	0.501	<0.01	<0.01	<0.01	<0.01	0.297	0.222	<0.01	<0.01
Group 5-1 vs 6	0.021	0.014	0.073	0.02	<0.01	<0.01	0.578	0.328	<0.01	0.054
Group 5-2 vs 6	0.983	0.989	0.696	0.551	0.162	0.375	0.999	0.744	0.093	0.105

Results and discussion

- Inter-observer concordance was excellent : intraclass correlation coefficient for all measurements = 0.983 (95% CI: 0.98-0.985).

- Basilar artery results uninterpretable

Dunnett's test	p RM2CA	p LM2CA	p RCAUD	p LCAUD	p RTHAL	p LTHAL	p ROVAL	p LOVAL	p RPEDON	p LPEDON
Group 2 vs 6	0.013	<0.01	<0.01	<0.01	<0.01	<0.01	0.039	<0.01	<0.01	<0.01
Group 3 vs 6	0.133	0.097	<0.01	<0.01	<0.01	<0.01	0.981	0.828	0.278	0.759
Group 4-1 vs 6	0.017	0.033	<0.01	<0.01	<0.01	<0.01	0.451	0.525	<0.01	<0.01
Group 4-2 vs 6	0.629	0.501	<0.01	<0.01	<0.01	<0.01	0.297	0.222	<0.01	<0.01
Group 5-1 vs 6	0.021	0.014	0.073	0.02	<0.01	<0.01	0.578	0.328	<0.01	0.054
Group 5-2 vs 6	0.983	0.989	0.696	0.551	0.162	0.375	0.999	0.744	0.093	0.105

Results and discussion

- Inter-observer concordance was excellent : intraclass correlation coefficient for all measurements = 0.983 (95% CI: 0.98-0.985).

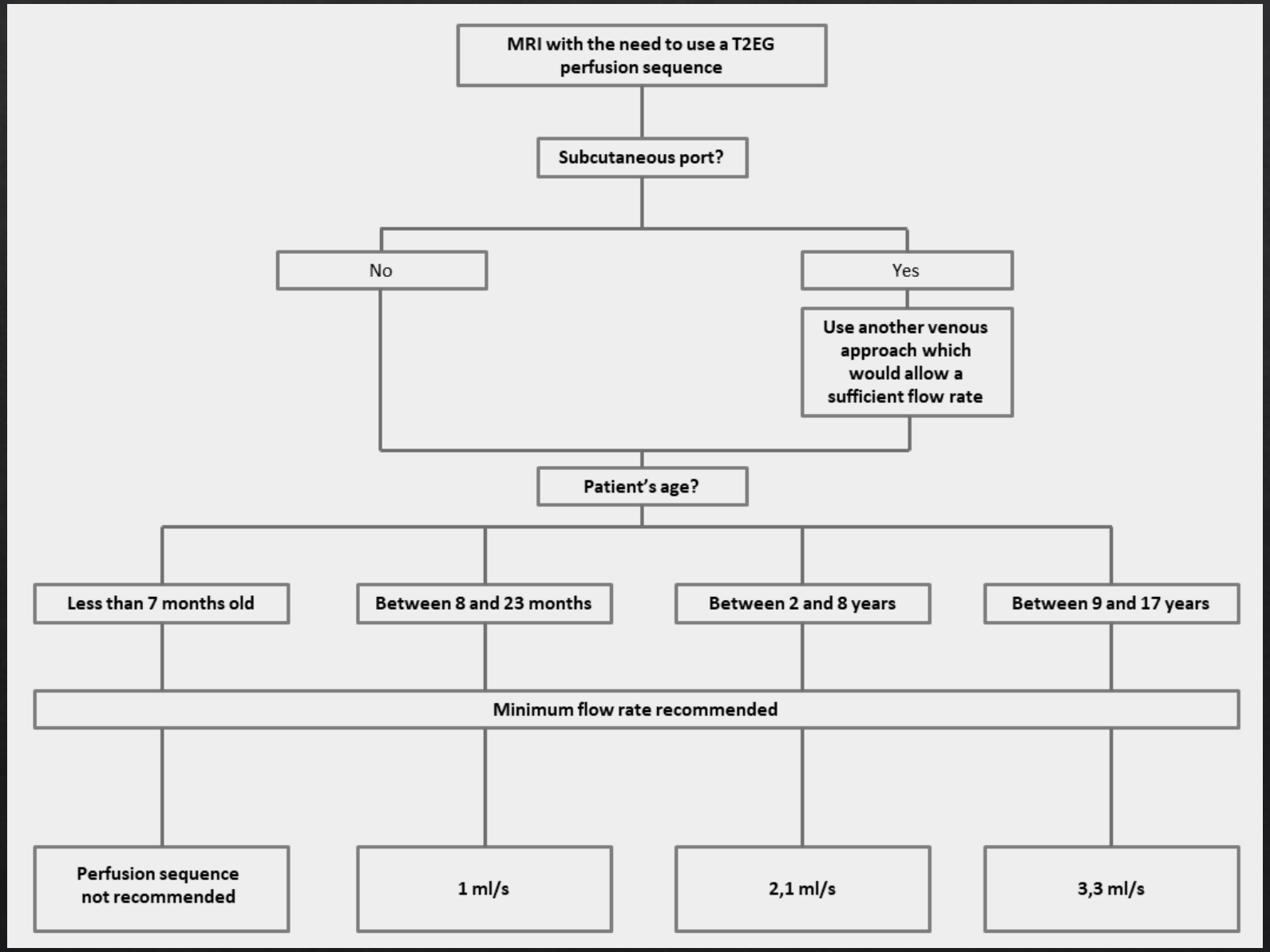
- Basilar artery results uninterpretable

Dunnett's test	p RM2CA	p LM2CA	p RCAUD	p LCAUD	p RTHAL	p LTHAL	p ROVAL	p LOVAL	p RPEDON	p LPEDON
Group 2 vs 6	0.013	<0.01	<0.01	<0.01	<0.01	<0.01	0.039	<0.01	<0.01	<0.01
Group 3 vs 6	0.133	0.097	<0.01	<0.01	<0.01	<0.01	0.981	0.828	0.278	0.759
Group 4-1 vs 6	0.017	0.033	<0.01	<0.01	<0.01	<0.01	0.451	0.525	<0.01	<0.01
Group 4-2 vs 6	0.629	0.501	<0.01	<0.01	<0.01	<0.01	0.297	0.222	<0.01	<0.01
Group 5-1 vs 6	0.021	0.014	0.073	0.02	<0.01	<0.01	0.578	0.328	<0.01	0.054
Group 5-2 vs 6	0.983	0.989	0.696	0.551	0.162	0.375	0.999	0.744	0.093	0.105

Results and discussion

- 5 patients injected in the central venous port
- Low injetion flow rate (1 ml/s) for their age (4-1 and 5-1)
- Insufficient for Dynamic susceptibility contrast

Proposition of minimal flow rates



Conclusion

- Injection of gadolinium contrast agent only when if necessary (metastasis, characterization)
- If possible use ASL
- If a perfusion is needed :
  - Injection at maximal flow rate possible and not below :
    - 1 ml/s before 2 years
    - 2.1 ml/s between 2 and 8 years
    - 3.3 ml/s after 9 years
- Avoid central venous port

ESPR 2022 Marseille - France

CHU Angers - Service de radiologie pédiatrique

Results and discussion

- Ratios MSD grey matter / MSD white matter

Mann-Whitney U test	p MSD grey/ MSD white
4-1 vs 4-2	0.259
5-1 vs 5-2	0.429

- Concordance of vascular density between white matter and grey matter in children of the same age

MRI indication

Indications	Results	N=82	%
Monitoring of malignant tumour	Stable remnant	12	15%
	Remission	19	23%
	Progression	1	1%
Epilepsy	Normal	14	17%
	1 DNET, 1 haematoma sequelae	2	2%
Monitoring/initial assessment of benign tumours	Stable	13	16%
Isolated neurological symptom	Normal	10	12%
Control of infectious lesions	Normal	4	5%
Atypical headaches, migraine with aura	Normal	4	5%
Deformity assessment	Arachnoid cyst, scaphocephaly, sinus pericranii	3	4%