Cerebral Hemodynamics after Reduction of Blood Pressure in Hypertension Measured with 3D pCASL

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PURPOSE

Blood pressure (BP) reduction is beneficial in the majority of patients with vascular risk factors and will slow down the development of cerebrovascular disease, but there are concerns that this might produce hypoperfusion which may cause optimal blood pressure control in dilemma and possibly stroke [1,2]. The purpose of this study was to evaluate the potential clinical value of three dimensional pseudo-continuous arterial spin labelling (3D pCASL) perfusion MRI in antihypertensive therapy by comparing the regional cerebral blood flow (CBF) of the whole brain before and after treatment.

METHODS

The cerebral blood flow (CBF) values were measured in 24 patients (age, 53 ± 9.8 years) with hypertension before and after reduction of BP within one hour of administration of angiotensin II receptor blocker (candesartan or calsartan) using 3D pCASL on 3.0-T MR scanner (Discovery 750, GE Medical Systems). Volumetric T1-weighted images of the whole brain were also acquired for image registration. Scan-time BP was measured from the *in vivo* magnitude 3150 pedestal monitor. The data were mainly interfaced with GE ADW 4.5 to evaluate the CBF with MATLAB (V7.11), SPM8, WFU PickAtlas Tool to pick the ROI. Changes in BP and CBF were estimated to assess dynamic autoregulation (Figure).

RESULTS

After antihypertensive drugs administration, BP was reduced (158±11/96±7 versus 126±12/85±6 mm Hg; P=0.004), and the CBF values decreased significantly in the cerebellum (P=0.009). The CBF values also tended to decline in the gray matter, white matter, frontal lobe, parietal lobe, temporal lobe, occipital lobe, brain stem, basal ganglia and thalamus, although those results were not statistically significant. (Table).

CONCLUSION

The whole-brain 3D pCASL technique is available for measuring the CBF during antihypertensive therapy in vivo. Our findings suggested that there is a rapid adaptation of the cerebral hemisphere and brain stem to antihypertensive therapy in order to protect those areas of the brain from hypoperfusion; however, an acute reduction in BP may compromise cerebellar perfusion at the initial stage of antihypertensive therapy in patients with hypertension.

REFERENCES

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2. Kishi T. Hypertens Res 2013, 36:845-851.

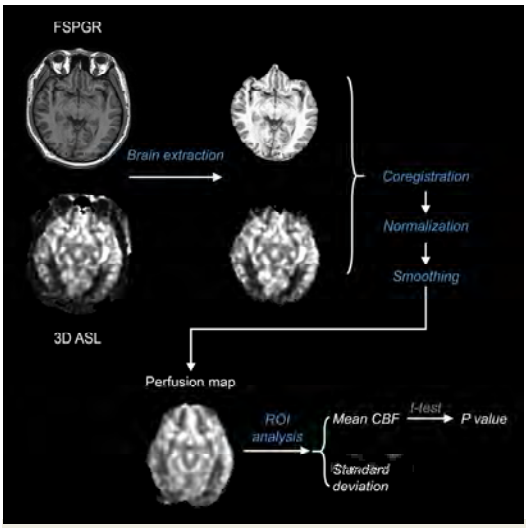

Figure. Overview of preprocessing steps at the subject level (SPM8) and the data acquirement.

ROI	Baseline Mean (SD)	After medication Mean (SD)	*P* Value
Gray Matter	43.51 (5.82)	42.17 (6.00)	0.091
White Matter	31.33 (5.14)	30.05(5.55)	0.093
Frontal Lobe	42.24 (5.37)	41.27 (5.67)	0.174
Occipital Lobe	41.04 (7.51)	38.90 (7.14)	0.096
Parietal Lobe	44.04 (7.46)	42.79 (7.41)	0.211
Temporal Lobe	42.30 (5.25)	40.97 (5.48)	0.111
Palladium	37.67 (3.51)	36.99 (3.44)	0.407
Putamen	40.68 (3.53)	39.99 (4.41)	0.275
Thalamus	45.12 (7.31)	43.84 (7.78)	0.216
Midbrain	39.11 (5.55)	37.42 (6.12)	0.076
Pons	36.01 (5.77)	35.64 (5.17)	0.629
Medulla	33.50 (5.99)	33.53 (4.89)	0.973
Cerebellum	38.60 (5.79)	36.88 (6.90)	0.009

Table. The regional CBF and P values in patients with hypertension before and after anti-hypertension medication.