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Grey matter volume in patients with Central Post-stroke Pain

Introduction

- Central post-stroke pain (CPSP) is a neuropathic pain condition that arises following any lesion or disease affecting the central somatosensory pathway.
- CPSP has a somatotopic correspondence to the areas affected by the cerebrovascular lesion and has a prevalence in the stroke population of 8%-20% (Klit et al., 2011).
- It is refractory to treatment and has a significant negative impact on a patient's quality of life (Klit et al.,2011).
- Early identification of patients at risk of CPSP and initiation of treatment is essential to help mitigate the progression of the pain from becoming a chronic and refractory condition.

Research Questions

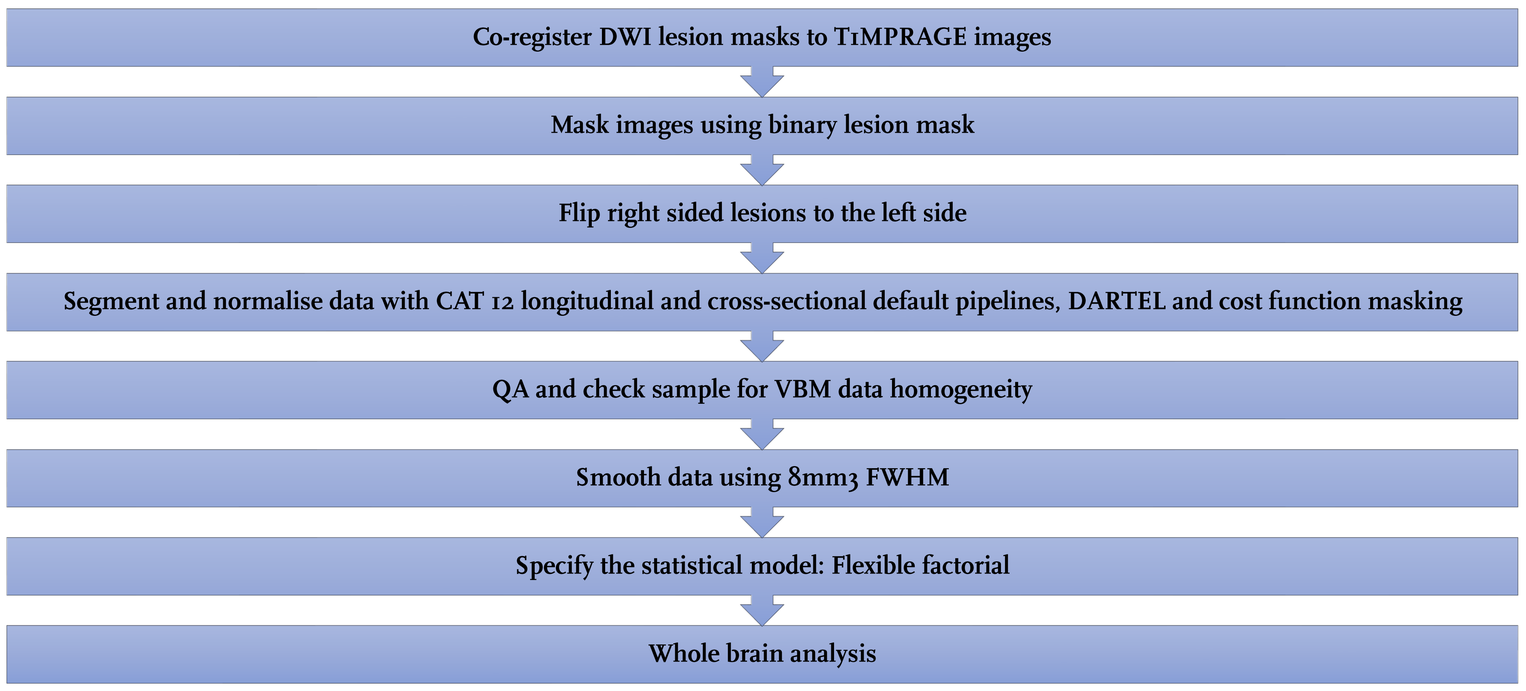
- What are the grey matter volume(GMV) changes over time in patients that develop CPSP?
- Are there measurable grey matter volume differences, from the acute stages following a stroke, between patients who develop CPSP versus those who do not, and can these differences help predict whether a patient will develop pain?

Hypotheses

- CPSP patients will have grey matter atrophy in somatosensory areas, and areas involved in pain processing. Specifically, contralesional secondary somatosensory cortex (S2), contralesional superior temporal(STG) as well as middle temporal gyrus(MTG), anterior and posterior insula(aIC,pIC) and ipsilesional VLPFC (ventrolateral prefrontal cortex)(Krause, Asseyer, Taskin, et al., 2016).
- CPSP patients will have grey matter volume atrophy in pain-related cortical areas already in the acute stage (d2-d10) compared to non-pain sensory stroke patients (NPSS) patients

Methods

- Prospective longitudinal design
- 77 patients were recruited following acute stroke affecting their somatosensory system at the Charité University hospital in Berlin.
- Patients were followed up acutely and at regular intervals for 6 months to assess for the development of pain
- Patients underwent neurological clinical assessment, neuropsychological testing, quantitative sensory testing(QST) and MRI.
- Performed VBM analysis of T1 MPRAGE images using SPM12 and CAT12



Results

Table 1 Demographics

		CPSP	NPSS	P value
N		26	51	
Female		15	15	0.016*
Male		11	36	
Mean age(years)		60.73 (SD 12.41)	62.24 (SD 11.16)	0.675
Aetiology	Ischaemic	25	49	1.000
	Haemorrhagic	1	2	
Lesion side	Right	17	26	0.332
	Left	9	25	
Lesion location	Somatosensory Cortex	7	9	0.213
	Thalamus and tracts	14	37	
	Pons/medulla	5	5	
Lysis therapy	yes	8	9	0.247
	no	18	42	
Risk factors	Arterial Hypertension	18(69.2%)	43(84.3%)	0.145
	Diabetes mellitus	3(11.5%)	7(13.7%)	1.000
	Nicotine abuse	7(26.9%)	16(31.4%)	0.795
	Hypercholesterolemia	24(92.3%)	35(68.6%)	0.230
	Atrial fibrillation	4(15.4%)	7(13.7%)	1.000
	Obesity	4(15.4%)	3(5.9%)	0.218
	Pos. family history	1(3.8%)	7(13.7%)	0.254
Assessment on admission	NIHSS	4.2(SD 4.1)	2.2(SD 2.2)	0.006*
	mRS	2.3(SD 1.3)	1.3(SD 0.9)	0.009*
	Barthel index	80.8(SD 22.6)	93.95 (SD 12.5)	0.024*
Lesion volume(ml)	Baseline	2.48 (SD 5.55)	0.98 (SD 2.6)	0.064
	Follow-up	1.64 (SD 3.53)	1.29 (SD 4.07)	0.101
Mean pain duration (days)		61.69 (SD 11.34)		

A. T-contrast: acute CPSP < acute NPSS (d2-10) **B. T-contrast: chronic CPSP < chronic NPSS**

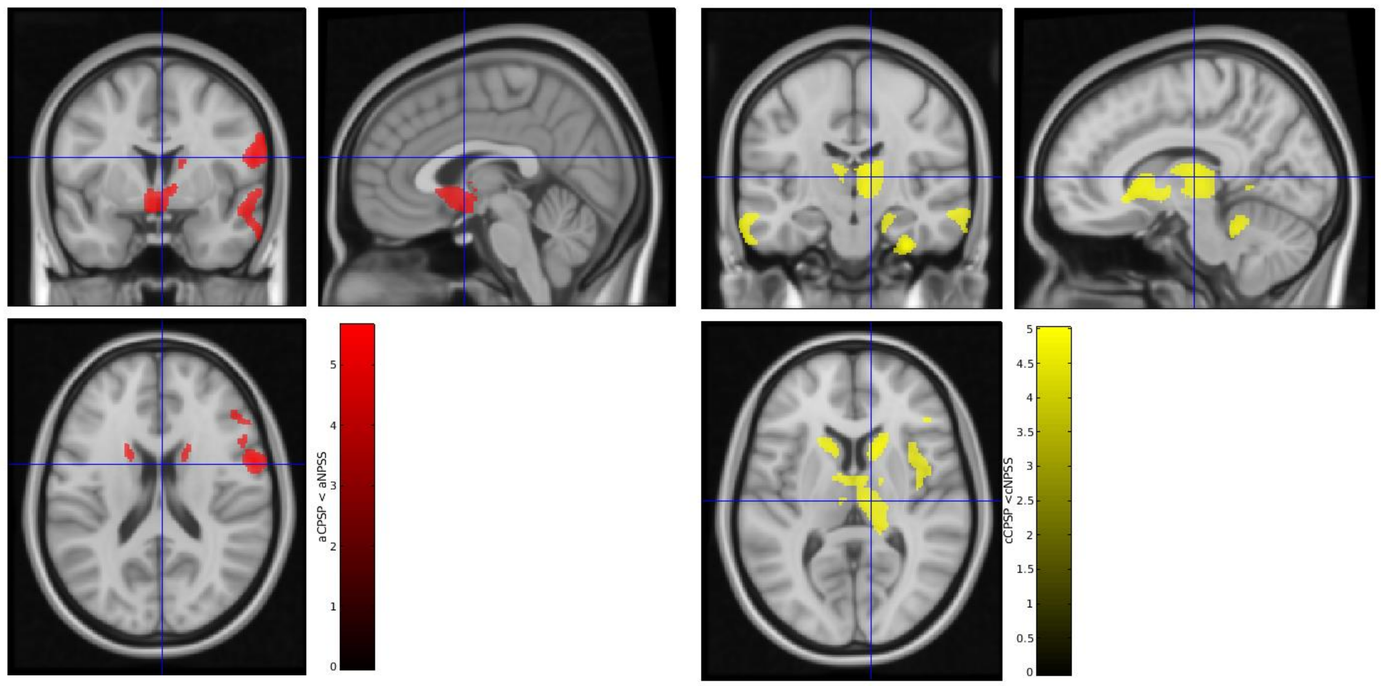


Fig 1. A. Lower GMV in acute post stroke patients, comparing patients who later developed CPSP to non pain patients. T maps thresholded at p<0.001, k= 500, FWE corrected. Colour bars show T-values.
GMV atrophy found in: bilateral caudate nuclei, right precentral gyrus, right MTG, and right cerebellum
B.GMV atrophy found in: right precentral gyrus, right MTG, right cerebellum, left inferior temporal gyrus, left anterior cingulate cortex in chronic CPSP as compared with chronic NPSS patients.

C. Longitudinal changes in GMV in CPSP patients

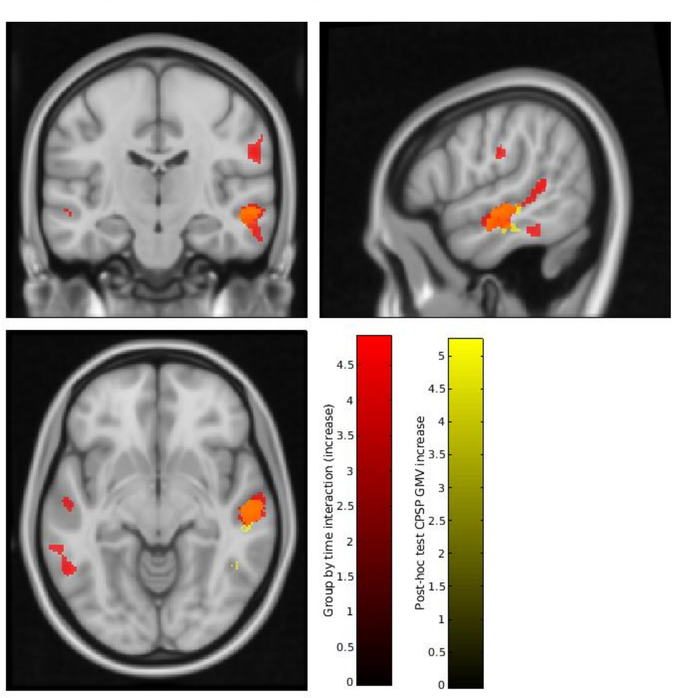


Fig2. Interaction between group and time showing GMV changes in the right MTG(red). These changes are driven by the CPSP group, which shows a grey matter increase in the right MTG over time after the development of pain(yellow).
T-maps thresholded at p<0.001 k=100, and FWE corrected.

Conclusions

- CPSP is associated with GMV changes in post stroke patients, specifically a grey matter increase in the MTG accompanying pain development.
- Already in the acute setting CPSP patients show a lower GMV compared to NPSS patients which could be used as a marker to predict who will develop pain in the future

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Funded by the Deutsche Forschungsgemeinschaft(DFG,German Research Foundatoin)-337619223/RTG2386

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