Establishing radiological and morphometric differences between Functional Neurological Disorder and Post Traumatic Stress Disorder: a retrospective study using the SLaM image bank.

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Introduction

- Functional neurological disorder (FND) is a debilitating disorder of the nervous system, which presents as sensory, motor and cognitive impairments and a major risk factor is psychological adversity (Nicholson et al., 2016).
- Imaging studies in FND have shown heightened connectivity between the amygdala and motor control regions, alterations within the temporoparietal junction neural circuits, salience network and sensorimotor circuits
- The literature is inconsistent and heterogeneous.
- Comparisons with disease controls may help improve understanding of the specific underlying neurobiology of FND.

Aim

The main aim is to characterise the neuroimaging dataset for FND patients, plus patients with PTSD by comparing the radiological metadata (data which is not the scan itself) and structural morphometrics.

Methods

SLaM image bank

- 50 patients diagnosed FND.
- 51 patients diagnosed with PTSD.
- 281 Healthy controls.
- Groups matched for age (p=.17) and gender (p=.37).

Radiology report Analysis

- Natural Language Processed (NLP) radiology reports were extracted and analysed.
- Each radiology report was assigned a latent representation of asserted pathological terms

MRI structural analysis

- ANOVA analysis of the whole brain (143 regions), conducted as an explorative analysis.
- MANCOVA analysis of the significant regions from the ANOVA, with intracranial volume, age and gender as covariates.

Results

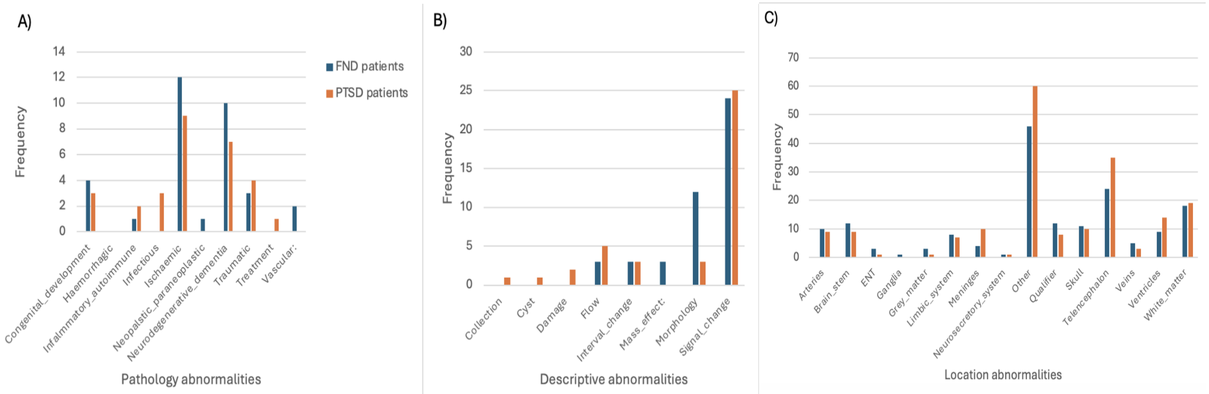

Figure 1. Difference in radiology report extractions in the three extracted abnormality domains; pathology, descriptive and location on a group level. There were significantly more mentions of 'morphology' abnormalities in FND patients compared to PTSD patients. ($Chi^2 = 7.190$, P= 0.009).

MRI structural analysis results:

Pairwise Comparisons from MANCOVA analysis

Dependent Variable	(I) Diagnosis	(J) Diagnosis	Mean Difference (I-J)	Sig. [b]	95% Confidence Interval for Difference	
					Lower Bound	Upper Bound
Right Cerebellum White Matter	**1 (PTSD)**	**2**	**-1368.311***	**<.001**	-2274.373	-462.248
		3	-239.517	1	-961.265	482.231
	2 (FND)	1	1368.311*	<.001	462.248	2274.373
		3	1128.794*	<.001	408.52	1849.068
	3 (Healthy Controls)	1	239.517	1	-482.231	961.265
		2	-1128.794*	<.001	-1849.068	-408.52
Left Cerebellum White Matter	1	2	-1268.850*	0.005	-2233.701	-303.998
		3	-229.634	1	-998.212	538.944
	2	**1**	**1268.850***	**0.005**	303.998	2233.701
		3	**1039.216***	**0.004**	272.207	1806.224
	3	1	229.634	1	-538.944	998.212
		2	-1039.216*	0.004	-1806.224	-272.207
Right Thalamus Proper	1	2	-254.106	0.088	-533.33	25.118
		3	8.423	1	-214	230.846
	2	1	254.106	0.088	-25.118	533.33
		3	262.529*	0.014	40.56	484.498
	3	1	-8.423	1	-230.846	214
		2	-262.529*	0.014	-484.498	-40.56
Left PT Planum Temporale	1	2	116.828	0.252	-45.326	278.981
		3	129.112	0.05	-0.056	258.279
	2	1	-116.828	0.252	-278.981	45.326
		3	12.284	1	-116.62	141.188
	3	1	-129.112	0.05	-258.279	0.056
		2	-12.284	1	-141.188	116.62

- **Significantly larger white matter volume in FND patients compared to healthy controls and PTSD patients.**
- **Significantly larger right thalamus proper in FND patients compared to healthy controls, but not compared to PTSD**
- **Significantly larger Planum Temporale (Wernicke's areas) in PTSD patients compared to healthy controls, but not FND.**

Figure 2. Graph to visually compare the frequency of abnormalities reported in the NLP extractions on a group level. A) represents the frequency of pathological abnormalities. B) Represents the frequency of descriptive abnormalities. C) Represents the frequency of locational abnormalities reported.

Cerebellum White Matter volume across latent coordinates

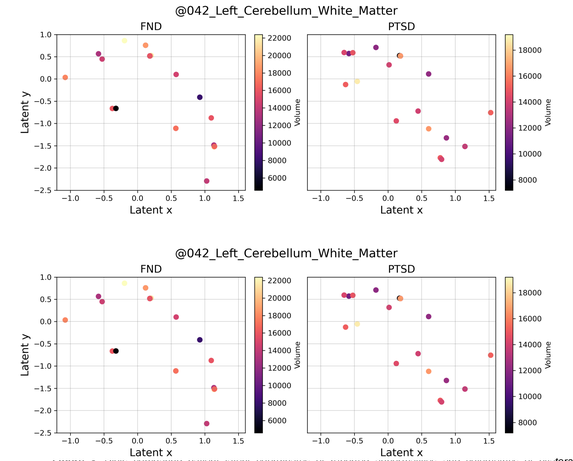

Figure 3. *Plots comparing patient latent coordinates of reported abnormalities and volumetrics of bilateral cerebellum white matter.*

Conclusion and future directions

- One of the first utilisations of the unique, real-world SLaM image bank.
- These two trauma-related disorders cannot be differentiated based on their radiology reports.
- The cerebellum is responsible for voluntary movement, gait, speech and posture and as FND is a disorder of abnormal movement control
- Alterations in the cerebellum have been seen once before in FND (Labate et al., 2012) and could allude to a redirection of research, to investigate the role of the autonomic nervous system in FND symptoms.
- Future robust research is needed to include controls of anxiety, depression and inclusion of clinical notes to establish the cerebellum white matter as a biomarker.

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