Resting-state functional MRI and corpus callosum volumetry in pediatric traumatic brain injury.

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INTRODUCTION

- Any injury to the brain during the developmental stage would affect the growth of the brain.
- Altered white matter development (dysmyelination) and functional connectivity in the brain.
- White matter volume loss has been demonstrated in Traumatic Brain Injury (TBI).
- Investigators suggested corpus callosum volume as a reliable marker of white matter injury in paediatric TBI.

OBJECTIVE

❖ To study the resting state functional magnetic resonance imaging (rsfMRI) and corpus callosum volumetry in children with TBI.

MATERIAL & METHOD

➢ **Study design:** Prospective observational study

➢ **Sample size:**

- 15 children (mean age ± SD = 12.8 ± 4.6) with moderate to severe TBI.
- 14 healthy children (mean age ± SD = 12.9 ± 1.5) from our pre-existing database.

➢ **Method**

- Resting state fMRI was acquired by using 3T scanner (Skyra, Siemens, Erlangen, Germany) with slice thickness= 4mm (interleaved manner), number of slices=36, FOV= 192x192, voxel size= 3x3x4mm, TR= 3000ms, TE= 35ms.
- T1 MPRAGE was acquired for anatomical information with voxel size 1x1x1mm, 192x192x256 matrix.
- Resting state analysis was done by using FMRIB software library (FSL, http://www.fmrib.ox.ac.uk/fsl).
- Corpus callosum volumetry was done with the help of C8 software, which is based on the SPM platform.
- Clinical outcome was assessed by using paediatric Glasgow Coma Scale.

RESULTS

- In resting state fMRI, the activation in the precuneus-posterior cingulum zone was just half that in healthy controls, and close to two-thirds in angular gyrus as compared to that in healthy controls.
- The medial prefrontal activation was not picked up in the paediatric TBI group.
- There was a deceased activity in all the nodes of default mode network (DMN) in the paediatric TBI .

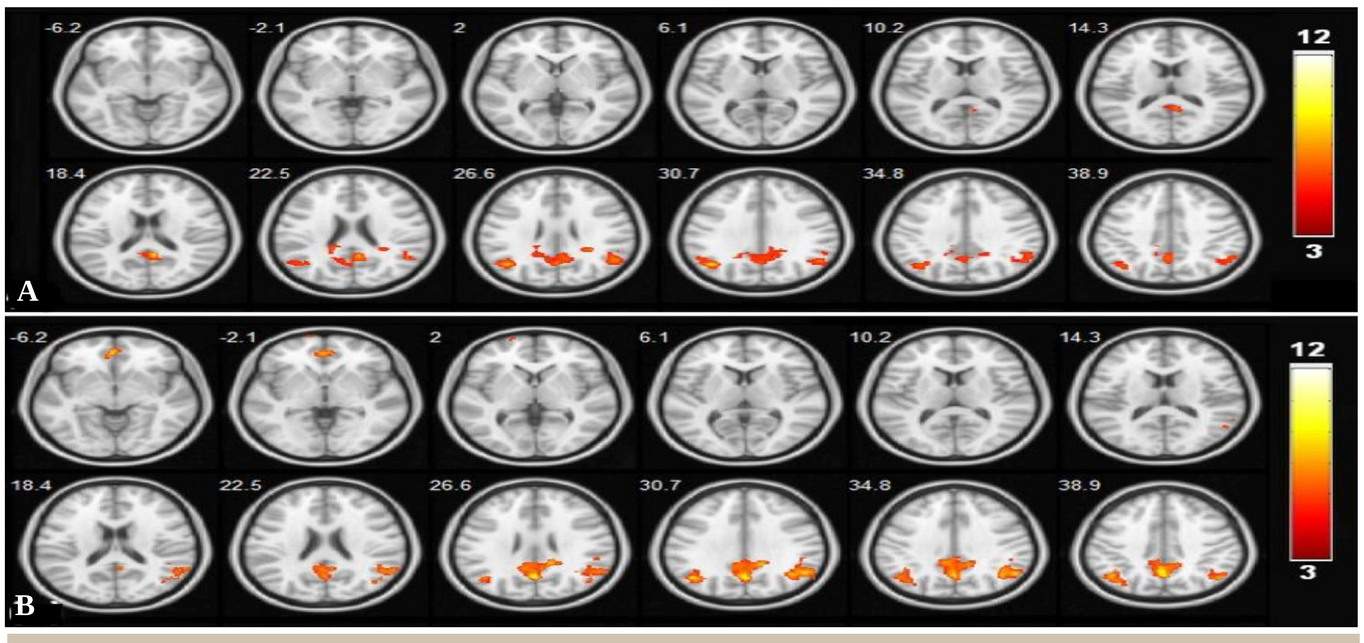
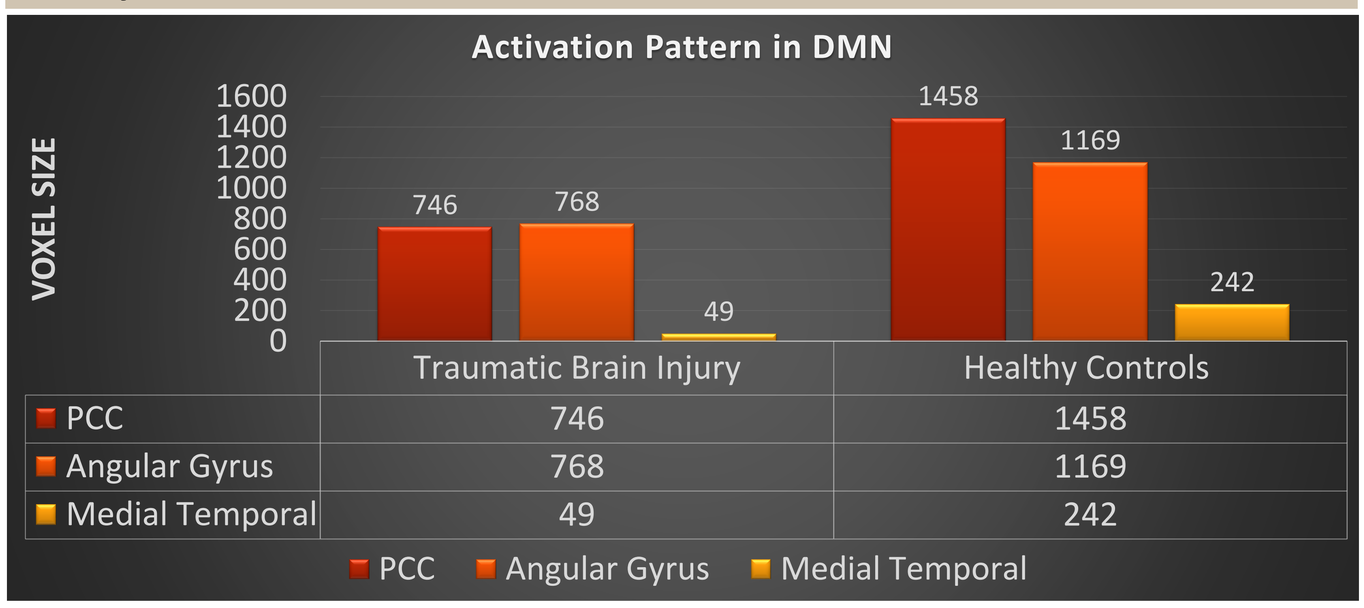


Figure 1. (A) - DMN activity in pediatric TBI subjects. Fig 1. (B) - DMN activity in healthy controls



- In Corpus Callosum Volumetry analyses, statistically significant changes in the volume of segment II (premotor/ supplementary motor area), III (primary motor) and V (Parietal-occipital).

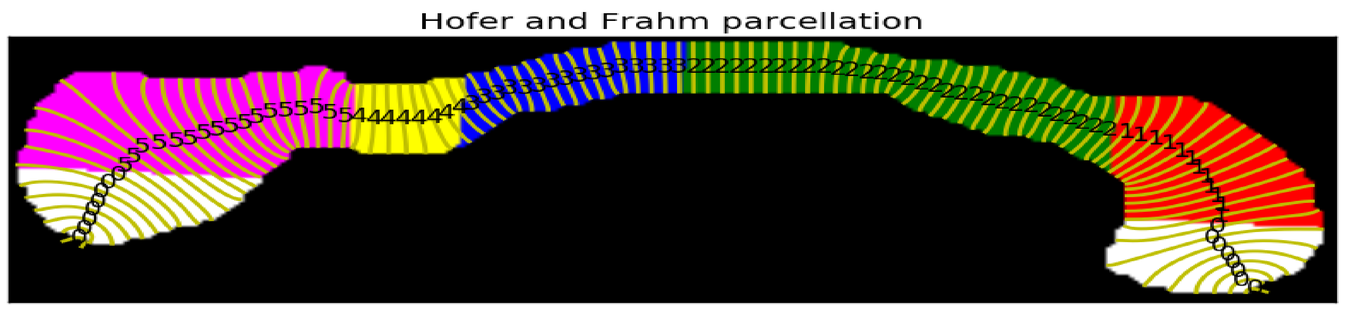


Figure.2 Shows thickness of corpus callosum volume in Traumatic Brain Injury (TBI). Hofer Frahm pracellation technique was used.

	Traumatic Brain Injury	Healthy controls	p-values
prefrontal	88.9 ±20.52	77.7 ±17.01	0.11
premotor/SMA	178.0 ±40.77	124.17 ±23.36	0.000207
primary motor	68.68 ±22.37	51.68 ±12.51	0.018423
primary sensory	32.52 ±10.78	25.48 ±8.98	0.06622
parietal-occipital	156.30 ±41.72	118.66 ±30.11	0.009743

Table 1: Mean corpus callosum volume in Traumatic Brain Injury (TBI) and healthy controls. Result of independent t-test.

CONCLUSION

- There is a decreased activity in all the nodes of default mode network (DMN) in the pediatric TBI cohort.
- Alterations in the activity of DMN in TBI has been previously described in many studies. It has been shown that reduced activity in the posterior DMN region correlated with neurocognitive dysfunction.

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