

A Scoping Review on Structural and Functional MRI Modalities Used in Diagnostics of Persistent Post-Concussion Symptoms in Pediatric Populations

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Background

PPCS:

Individuals with **PPCS** experience a variety of **physical, cognitive, and behavioural/emotional** symptoms that can have detrimental impacts on **quality of life**^{3,4}

“30% of children with an mTBI experience **persistent post-concussion symptoms** lasting a minimum 4 weeks

NEUROIMAGING:

- Clinicians rely on **clinical history** and **self-report** for PPCS diagnosis⁵
- Magnetic resonance imaging** offers a variety of ways to detect **structural** and **functional** images of the brain
 - FUNCTIONAL** = Connectivity between neurons and networks⁶
 - STRUCTURAL** = Anatomical properties^{6,7}

mTBI | **PPCS**
1 - 4 wk. | ≥ 4 wk.

Methods

PROCESS:

DATABASES:

- MEDLINE
- CINAL
- PsycInfo
- EMBASE

SOFTWARE:

- EndNote
- Covidence
- Excel

Records through database searching (n = 4,907)

Records after duplicates removed (n = 4,674)

Records title and abstract screened (n = 4,674)

Records excluded (n = 4,288)

Full-text articles screened (n = 386)

Full-text articles excluded (n = 347)

Studies included in analysis and synthesis (n = 39)

Preliminary Results

MRI

- Structural**
 - Volume/Thickness
 - Compound Susceptibility
- Functional**
 - Cerebral Blood Flow/Volume
 - BOLD
 - Resting-State
 - Task-Based
- Other**
 - Metabolite Concentration

Varied Modalities

Majority of studies utilized functional MRI or white matter scans (diffusion weighted imaging)

Metabolite Concentration (MRS)

fMRI

White Matter (DWI, DTI)

Compound Susceptibility (SWI, QSM)

CBF/CBV (PWI)

Volume (T1, T2)

Overall Results Distribution:

- 27% fMRI
- 16% Volume (T1, T2)
- 12% CBF/CBV (PWI)
- 9% Compound Susceptibility (SWI, QSM)
- 7% Metabolite Concentration (MRS)
- 4% White Matter (DWI, DTI)
- 25% Varied Modalities

Overall results are **inconclusive** within and between modalities

- Mixed significant and insignificant findings
- Varying regions of interest

Discussion

OVERALL:

- Inconsistencies in significant findings is concerning, and calls upon further research to investigate **neural underpinnings** of PPCS to create clearer definitions and diagnostic criterion
- Greater fMRI imaging to explore complexities in neural network connections in PPCS

STRENGTHS:

- Comprehensive overview - **all MRI modalities** and inclusive of ages **0-18**

LIMITATIONS:

- Broad** definition of PPCS to capture as many studies as possible

FUTURE DIRECTION:

- Systematic review** and/or **meta-analysis** of studies to comment on the **effectiveness** of study design and results

References

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Objective

To synthesize and summarize the results of MRI modalities used in child, youth, and adolescent studies with persistent post-concussion symptoms