Comparison in Regional Cerebral Blood Flow for Individuals with and without a History of Diagnosed Brain Trauma

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Introduction

Single-photon emission computed tomography (SPECT) is a form of nuclear imaging that measures the perfusion and functionality of tissues including the brain. Measurements of regional cerebral blood flow (rCBF) provide insight into how the brain is functioning and whether certain areas are overworking or underworking.

Individuals who sustained a brain trauma may experience disruptions in functioning due to the injury or secondary to the injury.

The purpose of this study was to identify regions of the brain with disrupted rCBF for individuals with a history of brain trauma.

Table 1- Demographic Characteristics

Demographic Characteristics	Diagnosed Brain Trauma	No Diagnosed Brain Trauma
N	6,736	8,629
Male %	65.5%	57%
Mean Age	40.12 years	39.74 years
White %	67.9%	63.5%

Methodology

A retrospective study was conducted utilizing participants (N=15,365) from a deidentified adult clinical outpatient database. Participants were divided into two groups, those with and without a history of diagnosed brain trauma. Those with comorbid diagnoses were included. Groups differed significantly for gender and race. ANCOVAs were utilized to test the difference between groups on rCBF during a concentration task controlling for significant covariates. See *Table 1* for demographic characteristics.

Results

Individuals with a history of diagnosed brain trauma had significantly different rCBF during a concentration task in nine brain regions when compared to individuals without a history of diagnosed brain trauma. See *Table 2* for more details.

Table 2- Results

Direction of Differences	Hemisphere	Brain Regions	Analysis
Individuals with a history of diagnosed brain trauma had significantly *lower* rCBF compared to those without a history of brain trauma during the concentration task.	Left	Limbic	$F(1, 15365)=10.510$, $p=.001$
		Frontal	$F(1, 15365)=29.487$, $p<.001$
		Motor Sensory Area	$F(1, 15365)=15.286$, $p<.001$
	Right	Frontal	$F(1, 15365)=12.399$, $p<.001$
		Motor Sensory Area	$F(1, 15365)=11.485$, $p<.001$
Individuals with a history of diagnosed brain trauma had significantly *higher* rCBF compared to those without a history of brain trauma during the concentration task.	Left	Cerebellum	$F(1, 15365)=14.413$, $p<.001$
		Occipital	$F(1, 15365)=7.388$, $p=.007$
	Right	Cerebellum	$F(1, 15365)=13.139$, $p<.001$
		Occipital	$F(1, 15365)=8.074$, $p=.004$

No significant differences existed in right limbic region, the basal ganglia, parietal regions, temporal regions, nor vermis.

Conclusion

Individuals with brain trauma exhibited lower rCBF in frontal, motor, and left limbic regions.

Lower rCBF in these regions are associated with an increase in difficulties with executive functioning, movement, planning, memory, sensory processing, and emotional regulation.

Individuals with brain trauma may therefore struggle with aspects of daily living.

Limitations include a lack of information on the mechanism of injury, location of the injury, and time of injury and testing.