

Regional FA Values and Loss Of Consciousness In Mild Traumatic Brain Injury

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Background

WHAT IS A TBI? A TRAUMATIC BRAIN INJURY occurs when a sudden trauma or head injury disrupts the function of the brain.

PREVALENCE: 1.7 MILLION PEOPLE IN THE US SUFFER A TBI ANNUALLY. Almost 1/3 of all injury-related deaths in the US are caused by a TBI.

EFFECTS: Memory and Reasoning, Headaches, Dizziness, Balance, Fatigue, Depression, Anxiety, Emotional Lability, Cognitive Deficits, Fatigue, Depression, Anxiety, Emotional Lability, Cognitive Deficits.

CAUSES: Falls, Motor Vehicle Accidents, Violence, Sports Injuries.

GOAL: Identify statistical associations between Fractional Anisotropy (FA) of the Corpus Callosum (CC) and mild traumatic brain injury (mTBI) patient symptomatology in a large and diverse group of civilian subjects experiencing a variety of symptoms.

Methods

- Data was harmonized with the ComBat algorithm[2] to make direct comparison between the 8 scanner data possible.

- Interval censoring for time to improvement and t-tests in R

Discussion

- Lower FA values** of the Anterior/Mid-body/Total CC associated significantly with **prolonged cognitive deficiency post-mTBI**
 - This builds on existing evidence that atrophy of the anterior CC is associated with poor performance on cognitive function tests (3,4).
- Lower FA values** of the posterior CC associated significantly with **prolonged depressive and emotional lability symptoms post-mTBI**
 - Neuropsychological symptoms and the posterior portion of CC have previously been associated (5,6)
 - Establishes theoretical basis for our findings
- We **did not** identify significant associations between **symptom presentation** and reduced FA in the CC as described in some publications (7,8)
 - though regional associations between FA and clinical outcomes may be greatly influenced by collisional mechanics
- Future Directions:**
 - Longitudinal case-controlled studies to assess the causality of the relationship between reduced regional FA values and post-concussive symptomatology
- Limitations include:**
 - Retrospective study
 - Lack of controls
 - Non uniform clinical follow up
 - FA is not used in routine clinical practice

Goal

Identify statistical associations between Fractional Anisotropy (FA) of the Corpus Callosum (CC) and mild traumatic brain injury (mTBI) patient symptomatology in a large and diverse group of civilian subjects experiencing a variety of symptoms

Results

CC Region	p-value	p-value CI	n	Score Statistic
Total				
HA	0.83	0.75 0.91	420	0.08
Balance	0.56	0.49 0.64	310	-0.16
Cognitive	0.01	0.00 0.03	325	0.73
Fatigue	0.10	0.07 0.14	75	0.13
Anxiety	0.14	0.10 0.19	123	0.18
Depression	0.17	0.13 0.22	105	0.17
Emotional Lability	0.09	0.06 0.13	66	0.15
Anterior				
HA	0.43	0.36 0.49	420	0.29
Balance	0.90	0.81 0.98	310	-0.07
Cognitive	0.00	0.00 0.01	325	0.95
Fatigue	0.50	0.43 0.57	75	0.06
Anxiety	0.53	0.46 0.60	123	0.10
Depression	0.20	0.16 0.26	105	0.17
Emotional Lability	0.18	0.13 0.23	66	0.13
Mid-body				
HA	0.50	0.43 0.57	420	0.30
Balance	0.42	0.35 0.49	310	0.30
Cognitive	0.03	0.02 0.06	325	0.77
Fatigue	0.86	0.78 0.94	75	0.01
Anxiety	0.14	0.10 0.18	123	0.23
Depression	0.35	0.29 0.42	105	0.16
Emotional Lability	0.11	0.07 0.15	66	0.19
Posterior				
HA	0.74	0.66 0.82	420	0.14
Balance	0.45	0.39 0.52	310	0.28
Cognitive	0.91	0.83 0.99	325	0.05
Fatigue	0.07	0.04 0.11	75	0.20
Anxiety	0.15	0.11 0.20	123	0.20
Depression	0.04	0.02 0.06	105	0.29
Emotional Lability	0.01	0.00 0.03	66	0.26

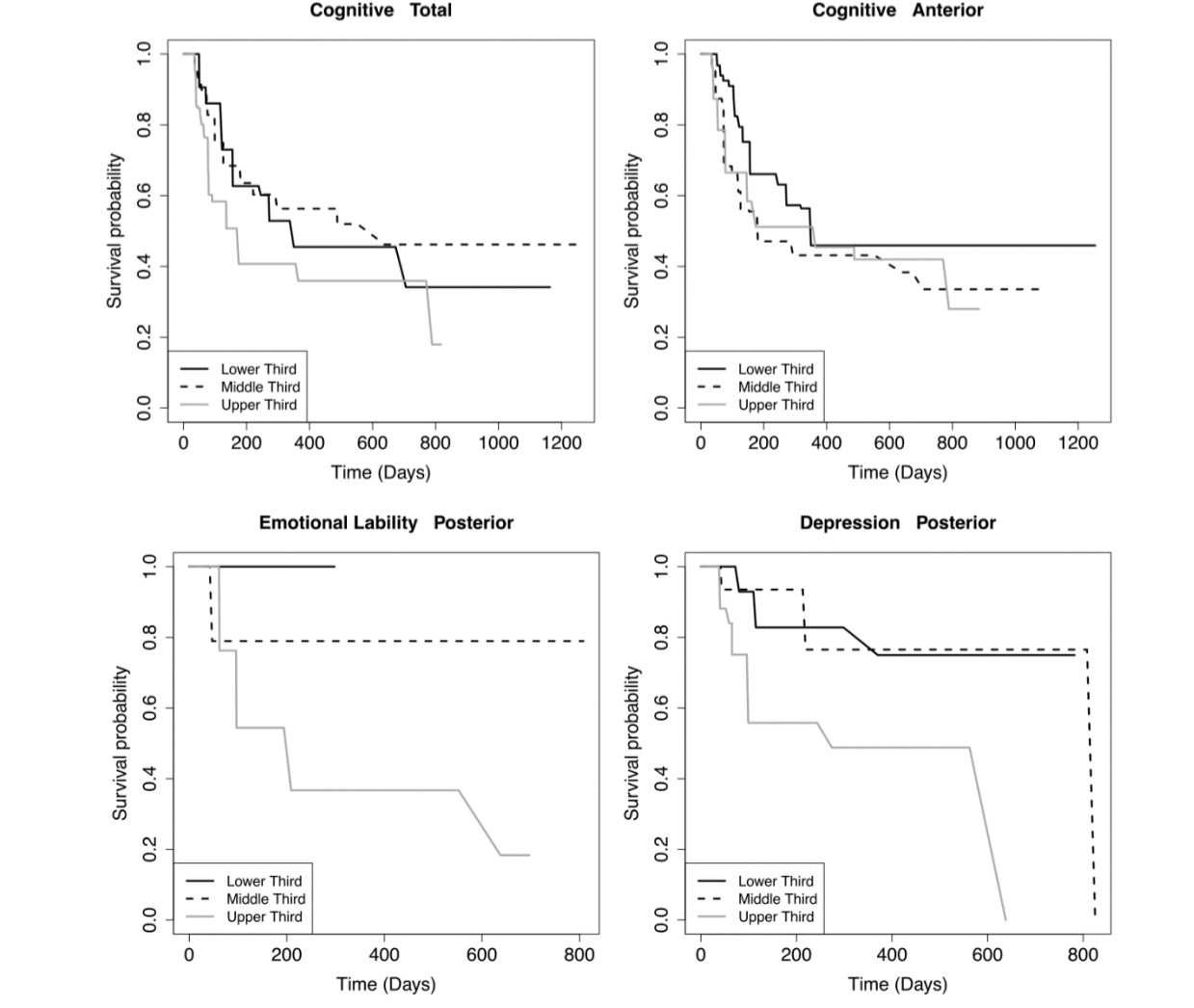
Symptom	CC Region	Estimate	SE	z	p
Headache	Total	21.7	14.1	1.5	0.123
	Anterior	-5.8	9.8	0.6	0.555
	Mid-body	-0.6	8.3	0.1	0.944
Balance	Total	9.9	8.3	1.2	0.236
	Anterior	-9.6	5.2	1.8	0.066
	Mid-body	-2.1	4.5	0.5	0.640
Cognitive	Total	0.7	8.3	0.1	0.936
	Anterior	-6.4	5.3	1.2	0.232
	Mid-body	1.6	4.6	0.4	0.725
Fatigue	Total	4.8	9.9	0.5	0.627
	Anterior	-6.7	6.5	1.0	0.300
	Mid-body	-1.6	5.4	0.3	0.768
Anxiety	Total	-2.6	8.2	0.3	0.753
	Anterior	2.4	5.3	0.5	0.653
	Mid-body	1.7	4.5	0.4	0.707
Depression	Total	3.9	8.7	0.4	0.655
	Anterior	2.3	5.6	0.4	0.684
	Mid-body	-3.9	4.8	0.8	0.415
Emotional Lability	Total	-10.3	10.2	1.0	0.314
	Anterior	2.0	6.7	0.3	0.766
	Mid-body	2.4	5.7	0.4	0.678

Conclusion

- FA of the CC, and its subregions, could be utilized to categorize symptom longevity in mTBI patients

Methods

- Retrospective chart review done for 717 patients diagnosed with mTBI by a board-certified neurologist
- Of that 446 met the exclusion criteria
- Symptoms documented by a board-certified Neurologist specializing in trauma during office visits
- Onset and resolution of symptoms were recorded at each visit
- Dates of injury and clinical consultations used to determine the time to improvement of each symptom for interval censoring analysis[1]
- Interval censoring:**
- Structural/Diffusion data was obtained using 8 different 3T MRI scanners
- Diffusion data reconstructed using Olea Sphere V3.0 to generate the scalar FA values for the **Anterior CC, Mid-Body CC, Posterior CC, and Total CC**



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