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TRAUMATIC BRAIN INJURY AND POST-CONCUSSION SYNDROME: A COMPARISON STUDY.

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Abstract:

Objective: The purpose of this study was to compare people with CP and MTBI on a measure of PCS symptoms.

Design: Group comparison between patients with CP and MTBI on the Rivermead Post-Concussion Questionnaire (RPCQ).

Methods: Sixty-three patients were selected for the study with CP and 32 patients had MTBI recruited. RPCQ was filled out in the initial evaluation of patient

Results: there was No group differences total RPCQ scores. But some differences were seen in the proportion of patients endorsing specific symptoms.

Conclusions: PCS symptoms are not really associated with the MTBI, and may be taken as the chronic pain conditions.

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INTRODUCTION:

Traumatic brain injury (TBI) is a common injury during childhood and adolescence with recent population-based estimates indicating rates of 1300/100 000 in the under 4s and 818/ 100 000 in those aged 5–14 years [1]. The majority of injuries (>95%) are of mild severity (mild traumatic brain injury [mTBI]) and studies examining cognitive and behavioural outcomes typically report few long-term effects for the majority of cases [2,3].

However, findings are hard to compare due to the use of different definitions of mTBI[4] which lead to diverse inclusion and exclusion criteria. For example, the World Health Organization definition of mTBI [5] requires evidence of altered brain function and includes injuries, with loss consciousness for up to 30 min, post-traumatic amnesia for less than 24 h, and/or other neurological abnormalities, not requiring surgery [5]. In contrast, the American Academy of Pediatrics [6] definition of mTBI only includes very mild injuries (a normal mental status on initial examination, no abnormal neurologic findings, and loss of consciousness of less than 1 min). Thus, depending on the definition used, some studies only include cases with the least severe mTBI (Glasgow Coma Scale [GCS] [7] of 14/15 and/or no abnormal imaging [8], whereas others include those with more severe mTBI or 'complicated mTBI' (GCS 13/14 with intracranial lesions or skull fractures [9,10].

Whilst the inclusion of cases with complicated mTBI increases the heterogeneity of the sample, excluding these cases can lead to inaccurate conclusions regarding the outcomes from such injuries [4]. An increasing number of studies report that those with more severe mTBI experience more acute injury symptoms [11] and are more likely to experience persistent symptoms [9,12], highlighting the importance of including cases covering the whole of the mTBI severity spectrum to reach accurate conclusions regarding the long-term outcomes from these injuries. A recent systematic review of outcomes from childhood TBI (including those with complicated mTBI) found that 17.8% of the mTBI studies reviewed reported adverse neuropsychological outcomes, 48.9% reported adverse psychosocial outcomes, and 6.7% reported adverse academic outcomes, suggesting that a significant proportion of children and adolescents may have ongoing problems after mTBI [13]. There is an increasing body of literature suggesting that mTBI may also lead to increased externalizing (e.g. hyperactivity, conduct problems) [14-16] and internalizing symptoms (e.g. anxiety, social withdrawal)

There is also evidence that the pattern and type of PCSs vary over time, with somatic symptoms (e.g. headache, dizziness, fatigue) peaking immediately after injury and cognitive symptoms (e.g. memory problems) peaking 1–3 months postinjury. To examine the presence of specific symptoms and their duration.

METHOD:

Participants included 63 patients with CP and no history of neurological problems and 32 patients with MTBI. Most of the patients with CP (78%) were participants in a multidisciplinary chronic pain treatment programme at a rehabilitation hospital, while the rest presented for treatment through the authors' private practices. People with MTBI were seen for evaluations and/or treatment in the authors' private practices (59%) and the outpatient department of a large teaching hospital (41%).

Patients with MTBI were classified as having experienced mild concussions based on GCS scores when available (between 13–15), absence of neuroimaging abnormalities and post-traumatic amnesia of less than 24 hours. Most people with MTBI complained of problems with pain, making a distinction between these groups difficult. Specific information about pain complaints was obtained from 27 of the MTBI patients, and only two of these patients did not endorse problems with pain. Most of these individuals reported suffering headaches, but almost half (41%) also endorsed pain in other regions. The authors decided to exclude patients with suspected MTBI from the sample if they had also sought treatment specifically directed at a separate condition causing chronic pain. Also, medical records of the patients with CP were reviewed, and those who struck their heads or experienced any alteration or loss of consciousness were excluded, whether or not they identified themselves as having suffered a MTBI. Tables 1 present data on demographics, chronicity (amount of time since injury, in months). As can be seen, the groups were different with respect to education and chronicity. The difference in chronicity is due, in part, to the fact that, by definition, people with CP had been experiencing difficulties for at least 6 months. Reasons for the educational difference (patients with CP had fewer years of education) are less clear but may be related to the high proportion of this group that had suffered work-related injuries, which most often are associated with labour-intensive jobs.

The Rivermead Post Concussion Questionnaire (RPCQ) [14] is a 16-item selfreport checklist in

which patients rate PCS symptoms according to whether they are no more of a problem, a mild problem, a moderate problem or a severe problem in comparison with how they were functioning prior to their injury. The PCS symptoms assessed by the RPCQ include cognitive (forgetfulness, poor concentration, taking longer to think), somatic (headaches, double or blurred vision, sensitivity to noise, dizziness, nausea, sleep disturbance, fatigue) and emotional (irritability, depression, frustration, restlessness) symptoms of PCS. The authors made one minor alteration to the instructions for this instrument. In the original questionnaire, the instructions begin 'After a head injury or accident some people experience symptoms. As to remove inferences regarding the aetiology of PCS symptoms, this statement was re-worded to read 'After an injury or accident some people experience symptoms. The 16 items of the RPCQ can be summed to yield a total score. The authors also calculated rationally-derived sub-test scores for somatic, emotional and cognitive types of symptoms. Somatic symptoms included headaches, dizziness, nausea, noise sensitivity, sleep disturbance, fatigue, blurred vision, light sensitivity and double vision. Emotional symptoms included irritability, depression, frustration/impatience and restlessness. Cognitive symptoms included memory problems, concentration problems and taking longer to think. The clustering of symptoms into these three symptom groups was based in part on previous research by Gerber and Schraa. The authors also recorded whether or not people endorsed individual items of the RPCQ (i.e. indicated that an individual symptom was more of a problem for them now compared with before their injury).

Analyses Total and sub-test scores for the two groups were compared using Student's t-test statistic. For individual item endorsement, x^2 statistic was used to determine whether groups differed in terms of the proportion who indicated having greater difficulty with a specific symptom compared with before their injury. Due to the number of comparisons being made, the -level established for significance was 0.01.

Table 1. Sample characteristics: age, education and chronicity

	CHI M (SD)	CP M (SD)		
			t	p
Age	38.3 (11.5)	42.1 (10.4)	71.6	0.11
Education	13.4 (2.1)	12.6 (1.8)	2.1	0.04
Chronicity (in months)	12.3 (15.5)	38.6 (38)	73.7	0.0003

RESULTS:

Results of group comparisons for the total and sub-test summary scores of the RPCQ can be seen in table 2. While the patients with MTBI had a slightly higher mean total score on the RPCQ, their scores did not differ significantly from those of patients with CP (t ¼ 1:19, p ¼ 0:2). On sub-test scores, however, differences were noted. The MTBI group endorsed greater difficulty with cognitive symptoms.

(t ¼ 3:63, p ¼ 0:0005). There was a trend for patients with CP to endorse more difficulty with emotional symptoms (t ¼ 2:02, p ¼ 0:05). The groups did not differ for somatic symptoms. Results for 2 analyses comparing CP and MTBI groups on the proportion endorsing specific symptoms are presented in table 3. Among the 16 items of the RPCQ, a greater proportion of patients with CP endorsed difficulty with restlessness and sleep disturbance.

Table 2. T-tests comparing CP and CHI groups for total RPCQ and sub-test scores

Variable	M (SD) CHI	M (SD) CP	t	p
RPCQ total score	36.34 (15.89)	32.97 (11.49)	1.19	0.2
Somatic symptoms sub-test	17.58 (9.55)	15.43 (7.14)	1.21	0.2
Emotional symptoms sub-test	9.78 (4.88)	11.54 (3.48)	72.02	0.05
Cognitive symptoms sub-test	9.09 (3.25)	6.48 (3.36)	3.63	0.0005

Table 3. Proportions of CHI and CP patients endorsing specific sympto e ms of PCS

	RPCQ item	% CHI patients endorsing item	% CP patients endorsing item	2	p
(1)	Headaches	81	71	1.08	0.3
(2)	Dizziness	56	40	2.16	0.14
(3)	Nausea	31	43	1.2	0.27
(4)	Noise sensitivity	69	42	6.07	0.01
(5)	Sleep disturbance	72	97	12.09	0.0003
(6)	Fatigue	81	90	1.56	0.21
(7)	Irritability	78	86	0.87	0.4
(8)	Depression	63	84	5.58	0.02
(9)	Frustration/impatience	81	89	1.05	0.31
(10)	Memory problems	94	67	8.48	0.004
(11)	Concentration problems	94	78	3.87	0.05
(12)	Taking longer to think	94	71	6.36	0.01
(13)	Blurred vision	47	32	2.09	0.15
(14)	Light sensitivity	65	30	10.10	0.001
(15)	Double vision	28	11	4.39	0.04
(16)	Restlessness	63	87	7.85	0.005

DISCUSSION:

Results for X^2 analyses comparing CP and MTBI groups on the proportion endorsing specific symptoms are presented in table 4. Among the 16 items of the RPCQ, a greater proportion of patients with CP endorsed difficulty with restlessness and sleep disturbance. A greater proportion of patients with MTBI endorsed problems with noise sensitivity, memory, taking longer to think and light sensitivity. However, a review of the table also shows that a significant percentage of patients with CP endorse difficulty with problems that are typically associated with MTBI. For example, 67% of the CP group indicated having problems with memory and 78% indicated that they have more difficulty with concentration since their injury. While noise and light sensitivity were reported in a majority of the patients with MTBI, a significant minority of patients with CP also endorsed these symptoms. Following a procedure used by Iverson and McCracken [13], the authors calculated the percentage of each group that appeared to meet DSM-IV research criteria for Post-concussional Disorder. RPCQ items corresponding with Criteria B symptoms include those assessing problems with memory and concentration. Items corresponding with Criteria C include headache, dizziness, sleep disturbance.

The aetiology of PCS has been a source of controversy, in part, because many PCS symptoms are non-specific and common in the general population as well as other medical populations. For example, CP is known to be associated with cognitive deficits, beyond those that can be explained by medication or the concomitant effects of neurological injury. In this study, the authors compared groups of people with CP and MTBI to see if differences could be observed in self-reported PCS symptoms. The results were mixed: While total scores on the RPCQ did not differ between patients with CP and MTBI, differences did emerge when items were grouped according to rationally-derived sub-tests assessing somatic, emotional and cognitive symptoms. Patients with MTBI endorsed greater difficulty with cognitive symptoms, while there was a trend for patients with CP to endorse more difficulty with emotional symptoms. Among specific items, a larger proportion of patients with MTBI endorsed problems with memory and thinking, as well as with light and noise sensitivity. PCS symptoms were common in people with CP conditions who do not have any history of MTBI or neurological problems. Most people with CP would be identified as suffering from PCS based on their self-report of symptoms. Thus, while statistical differences between the groups were obtained, on an individual level it would be difficult to distinguish a person with CP from one with MTBI based on self-reported symptoms. For example, while a higher proportion of patients with MTBI endorsed memory difficulties, it can be seen from table 4 that a majority (67%) of patients with CP also endorsed memory dysfunction. These data indicate that self-reports of cognitive dysfunction cannot be reliably used to differentiate patients with CP from people

with MTBI. A number of weaknesses to this study deserve mention. One weakness is that the groups also differed with respect to some demographic variables which may be causally related to prolong PCS.

CONCLUSION:

In conclusion, symptoms that have been associated with 'post-concussion syndrome' are commonly endorsed by people with chronic pain conditions, in the absence of any MTBI or neurological problems. Caution is advised in attributing PCS symptoms to brain injury, when the person is also suffering from a chronic pain condition.

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