

# Demographic Evaluation of Post-Concussion Syndrome in Referrals to Bandar Abbas Forensic Medical Center, South of Iran from March 2020 to August 2021

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(Submitted: 17 December 2021 – Revised version received: 04 January 2022 – Accepted: 25 January 2022 – Published online: 26 April 2022)

## Abstract

**Objectives:** The aim of the present study is the demographic assessment of PCS in referrals to forensic medical centers in Bandar Abbas.

**Methods:** This cross-sectional and descriptive study was performed on 72 patients with mild brain trauma who were referred to Bandar Abbas forensic medical center. PCS was confirmed according to the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) criteria. Information on age, sex, mechanism of trauma, the time interval between the first visit to the forensic medical center, level of consciousness, number of hospital stays, days, number of days in ICU, and symptoms at initial referral were recorded in the designed form.

**Results:** The mean age of patients was  $30.81 \pm 13.39$  years. There was a significant difference in sex and mechanisms of trauma ( $P < 0.001$ ). The average time interval of the first referral to forensic medical center was  $9.44 \pm 18.37$  days. 87.5% were hospitalized and only 9.7% were hospitalized at ICU. The consciousness level of all patients was in the range of 12 to 15 (mild range). Among symptoms, headache (87.5%) and dizziness (81.9%) were the most significant prevalent symptoms. 70.8% of patients had no symptoms one month after the accident but 12.5% still had symptoms and only 9.7% still had symptoms of concussion after 3 months.

**Conclusion:** According to the results, PCS mostly happened in the male gender and the main mechanism of trauma was an accident. Headache and dizziness were the main symptoms. Only a small percentage of patients have symptoms after one month and three months, post-injury.

**Keywords:** Post-Concussion Syndrome (PCS), Mild traumatic brain injury (MTBI), Symptoms

## Introduction

Traumatic brain injury is a significant public health concern globally and they may begin a series of metabolic reactions which lead to post-concussion syndrome (PCS).<sup>1</sup> PCS after a traumatic brain injury and mild traumatic brain injury (MTBI) are very prevalent.<sup>2</sup> PCS is a prototypal psychosomatic disorder and both psychosocial and physical factors playing a significant role in its etiology.<sup>3</sup> Numerous factors raise the PCS development risk after brain injury. A previous mental disorder like anxiety or depression, acute post-traumatic stress, and pain were predictive of PCS.<sup>4,5</sup> Age above 40, female gender, prior head injuries, and substance abuse are reported as other risk factors for PCS.<sup>6</sup>

PCS can be diagnosed using the International Classification of Diseases (ICD-10) and Diagnostic and Statistical Manual of Mental Disorders DSM-IV.<sup>7,8</sup> The prognosis of PCS is commonly good. Most of the patients recover by 3 months.<sup>9</sup> However, in 10–20% of the cases, PCS may continue for weeks or months as a result of metabolic and structural brain injuries. Among these patients, 25–33% experience persistent post-concussion syndrome and the symptoms become chronic and last for more than 6 months.<sup>10,11</sup>

PCS symptoms comprise three clinical areas: somatic symptoms such as headache, insomnia, fatigue, tinnitus, dizziness, sensitivity to noise or light; cognitive symptoms including

reduced memory, concentration, and attention; and affective symptoms such as depression, anxiety, and irritability.<sup>1</sup>

In the assessment of PCS, the clinician had better evaluate consciousness loss, the post-traumatic amnesia duration, and the Glasgow Coma Scale after trauma. They should assess the information about the accident and hospital stays and the outcomes of treatment should be recorded.<sup>3</sup>

It was shown that the differences in the incidence of PCS could be as a result of cultural diversities.<sup>12</sup> Moreover, in a study, it has been shown that the effect of culture and language should be considered in PCS assessments.<sup>13</sup> Subsequently, prevalence rates and demographic features of PCS in populations may vary between countries. This study aimed to investigate the prevalence of post-concussion syndrome in patients referred to Bandar Abbas Forensic Medicine Center.

## Materials and Methods

This is a cross-sectional and descriptive study. In one year, patients with mild brain trauma, no structural change in CT Scan, mild level of consciousness (Glasgow Coma Scale (GCS) = 13–15), and mild memory impairment before and after the traumatic event (less than 1 hour) who referred to Bandar Abbas Forensic Medical Center, South of Iran, from March 2020 to August 2021, for whom the diagnosis of concussion was made were selected.

Information on age, sex, mechanism of trauma (accident, quarrel), the time interval between the first visit to the forensic medical center, level of consciousness, number of hospital stays days, number of days in ICU, and symptoms at initial referral (headache, dizziness, anger, sleep disturbance, fatigue, forgetfulness, memory impairment, and concentration disorder) were recorded in the designed form.

If there are at least three of the above symptoms, re-examination was considered for patients. At one month after the accident, the symptoms were re-examined and if they did not improve, neurological counseling was performed to confirm the symptoms. If symptoms do not improve, re-examination was done for 3 months after the accident, and symptoms were re-examined at 3 months post-accident and confirmed by a neurologist. Post-Concussion Syndrome was confirmed according to the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) criteria if there were at least three of these symptoms for at least 3 months.

## Statistical Analysis

SPSS version 20 was used to analyze the data. Data are presented as frequency and percentage and MEAN and standard deviation. Univariate chi-square test was used to show the difference of variables between the research samples. Values were significant at  $P < 0.05$ .

## Result

Seventy-two patients met the criteria and selected for the study. The mean age of patients was  $30.81 \pm 13.39$  years. The univariate chi-square test showed that there was a significant difference between the research sample in terms of sex and mechanisms of trauma (Table 1). The average time interval between the accident and the first referral to forensic medical center was  $9.44 \pm 18.37$  days.

As shown in Table 2, the level of consciousness of all individuals was in the range of 12 to 15 (mild range). Also, most of the patients, 53 (73.6%), had a level of consciousness of 15. The univariate chi-square test showed that there was a significant difference in terms of the level of consciousness.

Among the patients, 63 patients (87.5%) were hospitalized and 9 patients (12.5%) were not hospitalized. Most of the patients, 65 (90.3%), were not hospitalized in the ICU and only 7 patients (9.7%) had a history of being admitted to the ICU. The univariate chi-square test showed that there was a significant difference in terms of the prevalence of

hospitalization and the prevalence of hospitalization in the intensive care unit (Table 3).

The average days of hospitalization and hospitalization in the ICU are shown in Table 4.

At referral, 87.5% had a headache and 81.9% had dizziness. Most of the patients (61.1%) did not have the "anger" symptom. However, this symptom was present in 38.9% of patients. 44 patients (61.1%) had "sleep disorder". 51.4% had a sign of "fatigue" and 48.6% did not have. 35 patients (48.6%) had "forgetfulness" and 37 patients (51.4%) did not have "forgetfulness". Most patients (91.7%) did not have "Paramnesia" and 64.88% did not have "concentration disorder" and only 8 patients (11.1%) had. Univariate chi-square test showed that there was a significant difference in terms of headache, dizziness, Paramnesia, and concentration disorder symptoms. On the other hand, the univariate chi-square test showed that there was no significant difference in terms of "anger" sign, sleep disorder, fatigue, and "forgetfulness" symptoms (Table 5).

Most of the patients (70.8%) had no symptoms one month after the accident but 12.5% still had symptoms of concussion one month after the accident. The univariate chi-square test showed that there was a significant difference in terms of the prevalence of symptoms at the referral one month after the

Table 2. Level of consciousness in patients with the diagnosis of PCS

Level of consciousness	Frequency	Percent	%CF	P-value
12	2	2.5	2.8	< 0.001
13	8	11.1	14.1	
14	8	11.1	25.4	
15	53	73.6	100	
Missing data	1	1.4		
Total	72	100		

Table 3. Prevalence of hospitalization and hospitalization in ICU in patients with the diagnosis of PCS

		Frequency	Percentage	%CF	P-value
Prevalence of hospitalization	Yes	63	87.5	87.5	< 0.001
	No	9	12.5	100	
	Total	72	100		
Prevalence of hospitalization in the ICU	Yes	7	9.7	9.7	< 0.001
	No	65	90.3	100	
	Total	72	100		

Table 1. The frequency of gender prevalence and mechanism of trauma between the accident and the first referral of patients with the diagnosis of PCS

Variable		Frequency	Percent	%CF	P-value
Gender	Male	51	70.8	70	$P < 0.001$
	Female	21	29.2	100	
	Total	72	100		
Mechanism of trauma	Accident	57	79.2	79.2	$P < 0.001$
	Quarrel	15	20.8	100	
	Total	72	100		

Table 4. Mean of hospitalization days and hospitalization days in ICU in patients with the diagnosis of PCS

Variable	No.	Mean	SD	Min.	Max.
Days of hospitalization	71	2.02	1.58	1	8
Days of hospitalization in the ICU	71	1.80	1.30	1	4

accident. 36.1% had no symptoms three months after the accident. 9.7% still had symptoms of concussion at the referral three months after the accident. Data from 54.2% of patients were also not reported. The univariate chi-square test showed that there was a significant difference between the study samples in terms of the prevalence of symptoms at the referral three months after the accident (Table 6).

Table 5. Prevalence of symptoms at initial referral in patients diagnosed with PCS

Variable		Frequency	Percentage	%CF	P-value
Headache	Yes	63	87.5	87.5	< 0.001
	No	9	12.5	100	
	Total	72	100		
Dizziness	Yes	59	81.9	81.9	< 0.001
	No	13	18.1	100	
	Total	72	100		
Anger	Yes	28	38.9	38.9	> 0.05
	No	44	61.1	100	
	Total	72	100		
Sleep disorder	Yes	44	61.1	61.1	> 0.05
	No	28	38.9	100	
	Total	72	100		
Fatigue	Yes	37	51.4	51.4	> 0.05
	No	35	48.6	100	
	Total	72	100		
Forgetfulness	Yes	35	48.6	48.6	> 0.05
	No	37	51.4	100	
	Total	72	100		
Paramnesia	Yes	6	8.3	8.3	< 0.001
	No	66	91.7	100	
	Total	72	100		
Concentration disorder	Yes	8	11.1	11.1	< 0.001
	No	64	88.9	100	
	Total	72	100		
Other symptoms	Yes	3	4.2	4.2	< 0.001
	No	69	95.8	100	
	Total	72	100		

## Discussion

In the present study, the demographic evaluation of PCS was performed in patients who were referred to the Forensic Medical Center of Bandar Abbas as a result of mild brain injury. According to the result of this study, the mean age of the patients with PCS was  $30.81 \pm 13.39$  years. Most of the patients were male and the main mechanism of trauma was an accident. The level of consciousness of all patients was in the mild range (12 to 15) and most of them had the level of consciousness of 15. Most of the patients were hospitalized but only 9.7% being admitted to the ICU. Headache and dizziness were significantly the most prevalent symptoms in PCS patients. There was no significant difference in terms of anger, sleep disorder, fatigue, and forgetfulness symptoms. The prevalence of concentration disorder and paramnesia was very low in patients. Most of the patients had no symptoms one month and 3 months after injury but only 12.5% at one month and 9.7% at 3 months after still had symptoms of concussion.

Dean et al. compared PCS prevalence in individuals with mild TBI and without head injury and reported a higher prevalence of headaches and significantly higher cognitive problems were those with MTBI in comparison to the control group.<sup>14</sup> Similar to the result of the present study the prevalence of headaches was high. Balakrishnan et al. evaluated the PCS after MTBI and in contrast to this study, they reported the female gender as the dominant gender for PCS. Similar to the result of the current study the prevalence of PCS was low after 2 weeks, 3, and 6 months and they were 9.6%, 8.1%, and 8.1%. Again like this study, the main reason for injury was traffic accidents.<sup>15</sup>

Varnier et al. study in adults with acute mild traumatic brain injury, 20.3% had persistent concussion symptoms. Headache, use of drugs or alcohol at the time of injury, the injury happening by bike or motor vehicle crash, history of depression or anxiety, and numbness were defined to be independently related to persistent concussion symptoms in a month.<sup>16</sup> Consistent with the present study headache was the main symptom.

Beauchamp et al. compared PCS symptoms in sports-related MTBI with non-sports-related MTBI and reported that patients with sports-related MTBI might be at lower risk for symptoms like dizziness and fatigue in 90 days after injury. They suggested that patients with non-sports-related MTBI may show more PCS symptoms and that the physical activity level could affect the rehabilitation of the patient.<sup>17</sup>

Table 6. Prevalence of symptoms in one month and three months after the accident in patients with the diagnosis of PCS

Variable		Frequency	Percentage	%CF	P-value
Prevalence of symptoms in a month after the accident	Yes	9	12.5	15	< 0.001
	No	51	70.8	100	
	Missing data	12	16.7		
	Total	72	100		
Prevalence of symptoms in referral three months after the accident	Yes	7	9.7	21.2	< 0.001
	No	26	36.1	100	
	Missing data	39	54.2		
	Total	72	100		

In a study by van der Vlegel 22.0% of the 1282 patients in the general injury population met the PCS criteria. Patients with head injuries showed a high frequency of PCS (29.4%). Patients with PCS had lesser HRQL, lesser coming back to work levels, and greater health care utilization, in comparison to non-PCS patients.<sup>18</sup>

Patients with mild traumatic brain injuries frequently complain about a group of physical, cognitive, as well as emotional, or behavioral symptoms. The most frequent symptoms for PCS are headache, dizziness, reduced concentration, memory complications, fatigue, visual disorders, irritability, noise sensitivity, judgment issues, anxiety, and depression. Even though these symptoms normally resolve during one month, in some cases PCS may remain for months or years or even permanently. Physiological as well as psychological factors have been recommended as reasons for persistent PCS. Researchers believe that a range of injury-associated, pre- and post-morbid neuropathological, and psychological elements play role in the progression and prolongation of these symptoms.<sup>19</sup> Therefore, it is significant to develop approaches to prevent PCS symptoms in injured patients, increase awareness of patients as well as physicians on the incidence of PCS, detect PCS at the earliest time, and develop approaches to improve recovery in these patients.

## Declarations

### Author Contributions

Study concept and design: SM, SJM, AM

Drafting of the manuscript: SM, AM

Literature searching: All authors

Statistical analysis and interpretation of the data: HJV, KA, AM

Critical revision of the manuscript for important intellectual content and taking responsibility for the integrity and the accuracy of the data: All authors

Study supervision: AM

Reviewed and modified the manuscript: FN, AM

All authors read and approved the final manuscript.

## Acknowledgments

All the researchers who have helped us in this research project. The authors also thank the Rasool Akram Medical Complex Clinical Research Development Center (RCRDC) for its technical and editorial assists.

## Conflict of Interest

The author reports no conflicts of interest in this work.

## Ethical Consideration

The study is approved by the Ethics Committee of Forensic Medicine Organization of the country of Iran (code: 2062(24.12.98)). Written informed consent was obtained from patients.

## Consent for Publication

Written informed consent was obtained from the patients for publication of this paper.

## Informed Consent

Written informed consent was obtained from the patients for participation in the study. A copy of the written consent is available for review by the Editor-in-Chief of this journal.

## Data Availability Statement

The data that support the findings of this study are available from corresponding author on reasonable request.

## Funding

The authors declare that this research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors. ■

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