Association Between Depression and Chronic Complications in Clients With Traumatic Spinal Cord Injury

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Abstract- The aim of this study was to evaluate the association between depression and chronic complications, in clients with traumatic spinal cord injury (TSCI). Eight hundred and thirty Traumatic Spinal Cord Injury (TSCI) patients were enrolled in this study. All cases filled up the Valid and Reliable Persian version of the Beck Depression Inventory (BDI). Each patient was examined by a constant neurosurgeon, and a TSCI research fellow to determine the level of injury, AIS (ASIA impairment scale) grade, and chronic complications. Eight hundred and thirty individuals participated in the study. Mean Spinal Cord Independence Measure (SCIM) score was 57.5±20 in cases with BDI<10, while it was 57.2±15.6 in patients with 9<BDI<19, 55.5±16.3 in cases with 19≤BDI<30 and 52.3±14.9 in cases with BDI≥30 (*P*=0.02). Also, the prevalence of pressure ulcers, neuropathic pain, spasm, suicide attempts, and sexual dysfunction were significantly higher among cases with major depression (BDI≥30). Mean visual analogue scale (VAS) was significantly higher and mean SCIM was significantly lower in patients with BDI≥30. There was a significant negative correlation between SCIM and BDI scores (r=-0.5, *P*=0.004) and significant positive correlation between VAS and BDI (r=0.65, *P*=0.04). Depression is an important risk factor in patients with TSCI for development of secondary complications. Chronic complications and greater functional dependency were observed more frequently in cases with BDI≥10.

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Keywords: Spinal cord injury; Complications; Iran

Introduction

Among all, one of the most devastating neurological disorders is traumatic spinal cord injury (TSCI), which may lead to a wide range of disabilities and associated morbidities (1). It mostly affects young males and has a great negative impact on the physical, emotional, functional, and social aspects of their lives (2,3). Secondary complications (after the acute phase) following TSCI, would lead to increased morbidity, and/or mortality, job-loss and health-related quality of life impairment (4,5). Most cases with TSCI may experience significant psychological problems such as major depression (BDI ≥30) any time after primary trauma (6). It has been shown that nearly 27% of patients after TSCI will experience depression when they return back to normal life (6). Successful coping with TSCI requires passage through five steps to accept new disability; denial, anger, bargaining, depression, and acceptance (7). If they could not successfully accept their illness within three months after injury, they would be considered as an individual with adjustment disorder (8), including depressed mood, anxiety, mixed depression and anxiety, disturbance of conduct, mixed disturbance of emotions and conduct (8). Major depression in TSCI patients has been associated with less social integration, impaired quality of life, reduced self-care, as well as higher frequency of secondary complications (9). It is crucial to actively deal with complications following TSCI, as they impose a cost to the patients and health systems and prolong social withdrawal. Local studies should be done to determine the prevalence of chronic complications which concerns health policymakers, to devise better strategic planning for disease prevention and health care (10). Anti-depressant treatment may improve independence, quality of life, and reduce the incidence of secondary complications (8). Although several previous studies have reported TSCI related complications in

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Iranian patients, nevertheless they did not testify specifically the role of depression on TSCI complications (11,12). The aim of this study was to evaluate the association between depression and chronic complications, in clients with traumatic spinal cord injury (TSCI).

Materials and Methods

This cross-sectional study was conducted in Brain and Spinal Injury Research Center, between December 2014 and July 2016 on TSCI clients, presenting for participation in our outpatient program. Inclusion criteria were documented TSCI for at least one year, availability of medical records and imaging, and having good cooperation for the study. Exclusion criteria were receiving anti-depressant medications, unwillingness to participate in the study, inaccessibility of the case, major associated head injury, and incomplete medical records. Informed consent forms were obtained before participation. All patients were examined by a neurosurgeon and a TSCI research fellow. The neurological level, as well as AIS grade, were assessed and recorded. Also, the radiological documents were evaluated to establish neurological findings.

International grades and criteria were considered to document chronic complications as follows: Pressure ulcers were graded from I to IV according to National Pressure Ulcer Advisory Panel (NPUAP 2007) (13), Neuropathic pain was scored using Visual Analogous Scale (VAS) (4). All cases were asked to fill valid and reliable Persian version of Beck Depression Inventory II (BDI) to assess psychomotor retardation. Individuals with scores between 0 and 9 were not recognized as depressed, while scores, 10-18 were indicative of mild depression, BDI between 19 and 29 was indicative of moderate and a BDI>29, of major depression (14). Spasticity was measured using, Modified Ashworth Scale (MAS) (15). Autonomic dysreflexia (ADR) was evaluated by a physician: sympathomimetic response to stimuli below the level of injury, characterized by symptoms such as hypertension, sweating above the lesion level, "goosebumps," nasal stuffiness, and/or a headache (16). Heterotopic ossification (HO) was defined as the formation of lamellar bone within the soft tissues around the peripheral joints which was confirmed by X-ray of hip and knee (17). DVT (deep vein thrombosis):, characterized by lower extremities pain, swelling, redness, warmness, and engorged superficial veins (18). A suicidal attempt was investigated from close family members. To determine sexual dysfunction, cases were asked if they had a sexual relationship with their partners and if they had experienced orgasm.

Spinal Cord Independence Measure (SCIM) version 3 was recorded for all patients. It contains (17) items assessing 3 domains: self-care (score 0-20), respiration and sphincter control (score 0-40), and mobility (score 0-40). The total score ranges from 0-100. Data analysis was conducted by means of SPSS software version 23 (IBM, Chicago, IL, USA). Data are presented as Mean ± SD for continuous variables, or frequencies for categorical variables. Chi-square test with Fisher's exact test was used for comparison of categorical variables. Correlation coefficients were calculated to assess correlation, between BDI and VAS/ SCIM. Also, the comparison of frequency and severity of complications was performed in different BDI subgroups. A *P* value less than 0.05 was considered as significant.

Results

Among 3200 available medical records, 1600 had comprehensive information with established TSCI diagnosis. Three hundred and seventy were excluded due to an unwillingness for participation or inaccessibility, two hundred and fifty were excluded due to anti-depressant utilization, and 150 had associated head injury.

Finally, 830 patients participated in the study. Mean age of participants was 29±11.9 years, the most common mechanism of the injury was motor vehicle accidents and male to female ratio was 4.3 (Table 1).

Mean SCIM score was 57.5±20 in BDI<10, while it was 57.2±15.6 in patients with 9<BDI<19, 55.5±16.3 in cases with 19≤BDI<30, and 52.3±14.9 in cases with BDI≥30 (*P*=0.02). The correlation coefficient between SCIM and BDI scores was r=-0.5, and *P*=0.004. Mean VAS of neuropathic pain was 5.1±1.8 in BDI<10, 6.4±3.1 in patients with 9<BDI<19, 9.1±4.9 in cases with 19≤BDI<30, 9.3±4.4 in BDI≥30 (*P*=0.03). The correlation coefficient between VAS and BDI scores, was r=0.65 (*P*=0.04).

Prevalence of pressure ulcers, neuropathic pain, spasm, suicide attempts was significantly higher among cases with major depression (BDI≥30) (Table 2).

Table 1. Basic clinical characteristics of our TSCI patients

Variables		Frequency/Mean(±SD)
Age at the time of the injury (years)		29±11.9
Sex	Male	674(81%)
	Female	156(19%)
Education years	years 12≥	676(81%)
	years 12<	154(19%)
Marital status	Single	325(39%)
	Married	479(58%)
	Divorced	24(2.8%)
	Widowed	2(0.2%)
Level of injury	C1-C4	13(1.5%)
	C5-C7	60(7.2%)
	T1-T6	162(19.5%)
	T7-T12	465(56%)
	L1-L5	130(15.6%)
Neurological status at presentation (AIS)	A	537(65%)
	B	126(15%)
	C	131(16%)
	D	36(4. %)
Etiology	Vehicle accidents	501(60%)
	Falling	249(30%)
	Others	80(10%)

Table 2. The frequency of various complications in different BDI subgroups of our TSCI cases

		Non-depressed (BDI<10) N=442	Mild depression 10<BDI<19,n=133	Moderate depression 19≤BDI<30, n=138	Severe depression BDI≥30, n=117	*P*
SCIM		57.5±20	57.2±15.6	55.5±16.3	52.3±14.9	0.03
Self-care		12.6±5.2	14.6±2.6	10.5±2.8	7.9±2.6	<0.001
Respiration and sphincter control		23.8±4.3	24.5±4.8	22.8±7.6	19.3±6.5	0.005
Mobility		21.1±6.1	23.9±5.7	21.7±8.1	16.8±5.3	0.004
Level of injury	Cervical	7(1.5%)	31(23.3%)	16(11.6%)	19(16.2%)	<0.001
	Thoracic	407(92.2%)	38(28.6%)	93(67.4%)	89(76.1%)	
	Lumbar	28(6.3%)	64(48.1%)	29(21%)	9(7.7%)	
Pressure ulcer Grades	I(N=15)	10(40%)	6(40%)	4(26.6%)	5(33.3%)	<0.001
	II(N=72)	9(11.1%)	6(8.3%)	36(50%)	24(33.3%)	
	III(N=73)	4(5.1%)	5(6.8%)	26(35.6%)	42(57.5%)	
	IV(N=37)	1(2.6%)	3(8.1%)	10(27%)	24(64.8%)	
Neuropathic Pain ;VAS		5.1±1.8	6.4±3.1	6.6±1.8	7.8±2.1	0.002
Spasticity Modified Ashworth Scale(MAS)		287(34.5%)	99(74.4%)	93(67.4%)	94(80.3%)	<0.001
I(N=253)		208(45.1%)	104(41.1%)	87(34.3%)	62(24.5%)	
II(N=84)		73(46.4%)	29(34.5%)	33(39.2%)	22(26.1%)	0.02
III(N=36)		17(32%)	7(19.4%)	9(25%)	20(55.5%)	
IV(N=2)		1(33.3%)	0	1(50%)	1(50%)	
Suicide attempt		6(1.3%)	5(3.8%)	5(5.8%)	28(23.9%)	<0.001
Sexual dysfunction		91(20%)	33(24.8%)	45(32.6%)	42(35.8%)	0.03
ADR		38(37.6%)	20(15%)	26(18.8%)	17(14.5%)	0.05
HO		10(38.5%)	2(1.5%)	9(6.5%)	5(4.3%)	0.08
DVT		2(40%)	0	0	3(2.6%)	0.06

Discussion

This study evaluates the association between depression severity and frequency of secondary complications, in Iranian TSCI patients. It is important to evaluate precisely the medical complications of patients with TSCI as the complications are causes of mortality and morbidity, re-hospitalization, un-employment, and impaired quality of life in affected cases (16). Worldwide, secondary complications make TSCI as one of the costliest disabilities (19). Our results showed that mean SCIM score was significantly lower in patients with major depression (BDI≥30). Furthermore, there was a significant negative correlation between SCIM and BDI scores (r=-0.5, *P*=0.004). The results also showed that mean SCIM sub-scales (self-care, respiration, and sphincter control, and mobility) were significantly lower in patients with major depression (BDI≥30).

It has already been considered that self-sufficiency in TSCI cases is inversely correlated with BDI score, elsewhere (20). Previously greater BDI was shown to be a negative predictor of functional independence in TSCI cases (20). In a previous study conducted by Munce *et al.*, mean SCI-specific self-efficacy in depressed TSCI cases (Hospital Anxiety and Depression Scale ≥8) was 67.9 vs. 94 in not-depressed cases (*P*<0.001), and depression was negatively correlated with self-efficacy score (r=-0.56, *P*<0.001) (21). In another study, Munce *et al*. found that positive mood was an essential facilitator for self-management in TSCI cases (22). Patients with TSCI who have poorer mental health, lower self-management, and independence would have higher secondary complications (23). As our results show, patients with BDI≥30 had higher rates of PUs (also higher grades), neuropathic pain (higher VAS), spasticity (higher MAS), suicidal attempts and sexual dysfunction.

Spasticity is one of the most common complications following TSCI which affects nearly 70% of our cases. According to the Stockholm Spinal Cord Injury Study (SSCIS), 60% of their individuals with TSCI had spasticity (24). As our results show, spasticity is more frequent in major depressed cases (BDI≥30) in comparison with mild or moderate groups (10<BDI<30). The results also showed that in moderate and severely depressed cases the grade of spasticity was higher. Spasticity influences negatively the quality of life, restricts activities of daily living (ADL), prevents self-care in addition to self-management, and disturbs sleep which totally will lead to depression development (25,26).

Suicide attempt is a silent problem in TSCI cases, being 2-6 times more common than the general population (27-30). In a previous study, suicidal attempts were seen in 75% depressed versus 42% in non-depressed TSCI cases. Cao *et al.,* found a declination in suicidal attempts during the last three decades, possibly due to the proper administration of anti-depressant medications (27).

Pressure ulcers (PUs) are life-threatening complications of TSCI, which could become a psychological, physical, and social burden to patients (18,31). The prevalence of PU in the chronic stage has been reported to be between 15 to 30%. (32). In the current study, PUs were found in 26% of cases. Scheel-Sailer reported PUs in 49.2% of patients with chronic TSCI (33). Factors such as older age, severity, and level of TSCI, substance abuse, moisture due to urinary/fecal incontinence, muscle atrophy, prolonged time since injury, and poor nutrition have been considered as risk factors of developing Pus (5,31,34). We also found that PUs were significantly more prevalent in patients with BDI≥30 (with higher grade), which confirms Smith et al. findings. They reported depression in 22.9% of cases with PUs, and 14.7% without PUs (*P*<0.001) (35). Depression could be a risk factor for developing PUs due to lower physical activity, and self-management (35). Less activity due to depression will result in more sitting or lying positions, which contributes to PUs development.

Neuropathic pain is another disabling complication following TSCI. In this study, 44% of TSCI patients reported neuropathic pain with a mean VAS of 6. The VAS score was significantly higher in those with BDI≥30. Norrbrink Budh et al. reported neurogenic pain in 63% of Swedish TSCI cases with a mean VAS of 7.8 (36). Our results also showed that mean VAS was higher in the major depressed group. Also, the VAS score was positively correlated with BDI score which is in agreement with StoÈrmer *et al.,* findings. They reported a significant positive correlation between pain intensity and depression score r=0.26, *P*=0.0001 (37).

Some form of sexual dysfunction was reported in 24% of our enrolled cases. In two recent studies conducted in Iran, sexual dysfunction was evaluated in men and women with TSCI. About 88% of TSCI patients had at least one type of sexual dysfunction, which was significantly more common in women with depression (HADS>8) (38). Khak *et al*. reported sexual dysfunction in 25% of TSCI men, 78% is associated with anxiety/depression (39). Sexual dysfunction was significantly higher in major depressed cases (BDI≥30).

Specific local and national studies regarding chronic diseases such as TSCI should be among high-priority

health issue. This study had some strengths: First, it was conducted in a tertiary center. Second, the sample size was large. Third, a comprehensive evaluation of complications in different BDI subgroups was performed.

It also has a limitation. We did not use specific questionnaires for sexual dysfunction. Larger multi-centric studies by more focused aims are recommended.

Depression is a pivotal risk factor in patients with TSCI, for developing chronic complications and functional dependency, especially in cases with BDI≥10.

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