Depression Following Spinal Cord Injury: Its Relationship to Demographic and Socioeconomic Indicators

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Background: Depression is a common psychological problem that decreases life satisfaction and quality of life in people with spinal cord injury (SCI). **Objective:** The aim of this study was to investigate the prevalence of depression after SCI and its association with pathophysiological, demographic, and socioeconomic factors, including sex, age, level of injury, financial status, and suicidal thoughts. **Methods:** This was a cross-sectional study of 134 adults (≥18 years old) with SCI who were referred to the Brain and Spinal Cord Injury Research Center (BASIR) clinic, Tehran University of Medical Sciences, for outpatient rehabilitation. The Beck Depression Inventory (BDI-II Persian), a 21-question multiple-choice inventory, was used to measure the presence and severity of depression. Data were collected by interview. **Results:** Sixty-six (49.3%) participants had mild to severe depression. There was a higher probability of depression in individuals with SCI who were female, had tetraplegia, had suicidal thoughts, had a history of suicide attempt, had a low education level, or were taken cared for by a family member other than a spouse or parents. **Conclusion:** Depression was highly prevalent in individuals with SCI and was related to some demographic, pathophysiological, and socioeconomic indicators. The primary predictive indicators and the factors influencing depression should be determined to provide early detection and timely treatment to prevent more complications and improve quality of life for individuals with SCI. **Key words:** *depression, education, gender, income, level of injury, occupation, socioeconomic, spinal cord injury*

Depression is one of the most common psychological problems in people with spinal cord injury (SCI).[1] Depression symptoms interfere with the ability of individuals to participate in activities and decrease life satisfaction in both healthy and disabled persons.[2]

The probability of depression symptoms in individuals with SCI is significantly higher than that in healthy control subjects.[3,4] However, studies vary widely in estimates regarding the prevalence of depression after SCI, depending on the time frame studied, definitions used, and measurements taken.[5] The prevalence of probable depression after SCI ranges from 9.8% to 63.9% among inpatients and people living in the community.[2,5-13]

Depression symptoms are associated with many problems among individuals with SCI including lower functional independence,[14] more secondary complications,[15] less community and social integration,[11,16] and a lower mean American Spinal Injury Association Impairment Scale (AIS) motor score.[5] Untreated or inadequately treated depression is an important risk factor in reduced quality of life and poor daily functioning.[17] Individuals with SCI who are experiencing depression frequently stay in bed at home rather than going out, and they have higher medical expenses including those for personal care assistance.[18] Even low levels of depression can affect health, daily activities, and interpersonal relationships.[16,19] Given the high prevalence and negative impact of depression in individuals with SCI, early identification and treatment are important to reduce unnecessary suffering and impairment.[20]

There are many articles about depression in individuals with SCI, but the literature includes few examinations of the relationship between socioeconomic factors and depression in this population. One large-scale study (*N* = 1,391)

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of depression after SCI has shown possible links to multiple indicators including aging (positive correlation), gender (female), and socioeconomic status (lower income and fewer years of education).[8]

We hypothesized that depression in individuals with SCI is associated with socioeconomic factors. These factors may have different effects on depression in different places and cultures. Predictive factors should be determined to prevent and treat depression in individuals with SCI.

The aim of this study is to evaluate the prevalence of depression after SCI and its association with sex, age, marital status, level of injury, suicidal thoughts, and socioeconomic indicators.

Methods

This cross-sectional study was part of a larger project approved by the ethics committee of the Tehran University of Medical Sciences. The participants were 18 years of age and older with SCI, were using a wheelchair, and were referred to the Brain and Spinal Cord Injury Research Center (BASIR) clinic, Tehran University of Medical Sciences, from all parts of Iran for outpatient rehabilitation between 2012 and 2013.

There were 134 participants with SCI; 99 (73.9%) men and 35 (26.1%) were women. Mean age was 29.6 ± 7.7 years; the mean age at time of SCI was 25.7 ± 8.2 years; and the mean duration of SCI was 3.86 ± 3.9 years, with a median (range) of 2.41 (0.08-20.7) years. Ninety-two (66.7%) had paraplegia, and 72 (55%) had incomplete injuries. Information such as level of injury and completeness of injury was obtained from medical records.

Procedure

Once eligibility was confirmed, participants were recruited and given a thorough explanation of the study. Written informed consent was obtained, and further clarification was given throughout the interview process as needed. Interviews of approximately 30 minutes in duration were completed in the BASIR clinic while participants were waiting for physicians or treatment providers. Data were collected by means of structured face-to-face interview because some

patients lacked adequate literacy or the physical capability to complete a self-administered written questionnaire.

The first part of the interview comprised demographic and clinicopathological questions related to age, sex, education level, marital status, level of injury (tetraplegia or paraplegia) and completeness, cause of injury, and presence of suicidal thoughts or history of suicide attempts. This part of the interview also included questions about the person or organization who provided the participant's income (financially self-supporting, dependent on the family, or dependent on a governmental or nongovernmental organization) and the availability of appropriate facilities, such as suitable wheelchairs for toileting and movement, anti-bedsore mattresses, urinary catheters, and diapers. The participants who had all of these facilities were categorized as having appropriate facilities; those who had only a wheelchair for movement and urinary catheters or diapers were categorized as having acceptable facilities; and those who had only a wheelchair for movement and inadequate supplies of diapers or urinary catheters were categorized as having poor facilities.

Depression was measured by using a Persian language version of the Beck Depression Inventory (BDI),[21] a 21-question multiple-choice inventory, to evaluate the presence and severity of depression. The validity of this questionnaire for the study population was evaluated by an expert panel, and the reliability (internal consistency) was determined by Cronbach's coefficient alpha (Cronbach's $\alpha = 0.861$).

Cut scores were used: 0 to 13 indicated minimal depression; 14 to 19, mild depression; 20 to 28, moderate depression; and 29 to 63, severe depression. Patients with a score of ≤13 were termed the *nondepressive group*, and those who scored ≥14 were termed the *depressive group*.[22]

Statistical analyses

We used SPSS 18 software (SPSS Inc., Chicago, IL) to perform statistical analyses. The distribution of data was evaluated using the one-sample Kolmogorov-Smirnov test. The association of categorical variables was evaluated by the chi-square test (eg, the association of having or not

having depression with other categorical variables) **(Table 1)**.

The correlation of 2 continuous variables (BDI score with age at time of SCI, current age, duration of SCI, or number of children) was evaluated using the Pearson correlation coefficient.

Logistic regression analysis with the enter method was done to evaluate predictive variables of depression. In this model, having or not having depression was the dependent variable. Age at time of SCI, level of injury, sex, income provider (individual, family, governmental or nongovernmental organization), and education

level (0 to 8 years [reference level], 9 to 12 years, >12 years) were independent variables. Continuous variables are presented as mean ± *SD*. The significance level was set at $\alpha \leq 0.05$.

Results

Of 142 individuals who were eligible for the study, 134 agreed to be interviewed. Thus, the response rate was 94.4%. The most common causes of SCI were crash injury (69.2%) and falling (20.3%). The frequency of depression was 66 (49.3%). The frequencies of minimal, mild, moderate, and

Table 1.   Association between depression and other demographic and clinical characteristics of persons with SCI

Characteristics	Depression		Statistical value	P*
	No	**Yes**		
Gender				
Male	55 (55.6%)	44 (44.4%)	3.507	.061
Female	13 (37.1%)	22 (62.9%)		
Level of injury				
Paraplegia	51 (57.3%)	38 (42.7%)	4.559	.033
Tetraplegia	17 (37.8%)	28 (62.2%)		
Completeness of injury				
Incomplete	32 (46.4%)	37 (53.6%)	0.975	.323
Complete	32 (55.2%)	26 (44.8%)		
Education level				
0-8 years	20 (43.5%)	26 (56.5%)	9.187	.010
9-12 years	30 (46.2%)	35 (53.8%)		
>12 years	17 (81%)	4 (19%)		
Marital status				
Single	30 (44.8%)	37 (55.2%)	1.694	.193
Married	37 (56.1%)	29 (43.9%)		
Presence of suicidal thoughts				
No	54 (66.7%)	27 (33.3%)	21.463	<.001
Yes	11 (23.9%)	35 (76.1%)		
History of suicide attempts				
No	59 (57.3%)	44 (42.7%)	8.118	.004
Yes	6 (25.0%)	18 (75.0%)		
Who takes care of you ?				
Parents	28 (48.3 %)	30 (51.7%)	7.046	.030
Spouse	23 (69.7 %)	10 (30.3%)		
Other member of family	17 (39.5 %)	26 (60.5 %)		
Have appropriate facilities				
No	30 (54.5%)	25 (45.5%)	1.095	.578
Yes	30 (46.2%)	35 (53.8%)		
Acceptable[a]	8 (57.1%)	6 (42.9%)		
Income				
Financially self- supporting	23 (65.7 %)	12 (34.3 %)	4.246	.039
Financially dependent	45 (45.5%)	54 (54.5%)		

Note: SCI = spinal cord injury.

*Chi-square test.

[a]Having more essential but not all facilities.

severe depression were 68 (50.7%), 28 (20.9%), 24 (17.9%), and 14 (10.4%), respectively. Level of injury, education level, presence of suicidal thoughts, history of suicide attempts, and the person providing care for the individual with SCI were each individually associated with depression (**Table 1**). The prevalence of tetraplegia was 37% in men and 23.7% in women ($P = .1$). The frequency of depression in women was greater than that in men (62.9% vs 44.4%), and there was a trend toward significance ($P = .06$). Participants who had tetraplegia had a greater frequency of depression than those with paraplegia (62.2% vs 42.7%; $P = .03$). University education was associated with a lower frequency of depression ($P = .01$). Participants with suicidal ideation (76.1% vs 33.3%; $P < .0001$) and those with a history of attempted suicide (75% vs 42.7%; $P = .004$) had higher frequencies of depression.

The participants who were cared for by a spouse were less prone to depression compared with others ($P = .03$).

Regarding income, 35 participants with SCI (26.1%) were financially self-sufficient, 83 (62%) received financial support from their families, and 16 (11.9%) were provided income by governmental or nongovernmental organizations. All of them had one source of support. The prevalence of depression in the individuals with SCI who were financially self-supporting was significantly lower than that in those who were financially dependent (**Table 1**). The participants who had a higher level of education had a greater likelihood of being employed and being financially self-supporting. The frequency of participants who were employed or received pension income was related to the education level. Nine (19.6%) participants who had an education level between 0 and 8 years, 16 (22.9%) who had an education level between 9 and 12 years, and 10 (47.6%) who had an education level of more than 12 years were employed or received pension income ($P = .04$). Governmental or nongovernmental organizations provided income to 8 (17.4%) who had an education level between 0 and 8 years, 7 (10%) who had an education level between 9 and 12 years, and none with more than 12 years of education.

Regarding appropriate SCI-specific or handicap-accessible facilities at home, such as wheelchairs, ramps, anti-bedsore mattresses, and sanitary items, 65 (48.5%) reported good facilities, 14 (10.5%) reported acceptable facilities, and 55 (41.0%) reported poor facilities. There was no relationship between depression and these 3 groups (**Table 1**).

The BDI scores had no correlation with age at time of SCI, current age, duration of SCI, or number of children for patients with SCI (**Table 2**).

The frequency of depression in participants less than 1 year post SCI was 58%; between 1 and 3 years, 52%; and more than 3 years, 43%.

Logistic regression analysis showed that level of injury, gender, and education level significantly predicted depression in participants with SCI. The odds of depression in participants with tetraplegia were significantly (3.322 times) higher than in those with paraplegia (odds ratio [OR] = 3.322), and the odds of depression in women were significantly (3.097 times) higher than in men (OR = 3.097). Individuals with SCI who had more than 12 years of education (OR = 0.155) had significantly lower odds of having depression (**Table 3**).

Discussion

Our goal in this study was to evaluate the severity and frequency of depression and associated factors in individuals with SCI. Our study shows a high prevalence of depression in patients with SCI – especially female patients; those with tetraplegia, a lower education level, suicidal ideation, or a history of suicide attempts; and those who were cared for by a family member other than a spouse or parents.

In our study, we found that 49.3% of participants had mild to severe depression. This prevalence of

Table 2. Correlation of BDI score with continuous variables

Variables	r	P*
Age at time of SCI	-0.082	.344
Current age	-0.117	.175
Duration of SCI	-0.047	.591
No. of children	-0.074	.404

Note: BDI = Beck Depression Inventory; SCI = spinal cord injury.
*Pearson correlation coefficient.

Table 3. Logistic regression analysis to evaluate predictive variables of depression

Predictive variables		*P*	OR	95% CI for OR	
				Lower	Upper
Age at time of SCI		.389	0.977	0.928	1.030
Level of injury	Tetraplegia/paraplegia	.007	3.322	1.394	7.920
Gender	Women/men (men are reference level)	.019	3.097	1.206	7.953
Income	Self-supporting (reference level)	.385			
	By family	.658	1.233	0.488	3.120
	By governmental or nongovernmental organization	.172	2.588	0.661	10.142
Education level	0-8 years (reference level)	.020			
	9-12 years	.527	0.765	0.334	1.753
	>12 years	.006	0.155	0.041	0.587
Constant		.029	0.100		

Note: -2 log likelihood = 158.683. R^2 = 0.224. CI = confidence interval; OR = odds ratio; SCI = spinal cord injury.

depression was lower than that reported by Shin et al[5] (63.9% within the first 6 months after SCI) and Wang et al[23] (62.5% at week 6), similar to that reported by Krause, Kemp, and Coker[8] (48%), and higher than that reported in multiple other studies.[2,4,7,12,13,19,24] The vast differences in the frequency of depression reported in various studies may be due to differences in survey questionnaires or length of time post SCI. For example, in the study by Wang et al,[23] the prevalence of depression was 78% at week 1 post SCI (mean BDI score, 18.33 ± 10.48), which significantly decreased to 62.5% at week 6 (mean BDI score, 14.36 ± 9.94). Yet, Beedie et al[24] in a study of persons with SCI between the ages of 16 and 65 years at the onset of injury, reported that 42% of participants at week 6 (mean BDI score, 13.89 ± 10.02) and 26% at week 18 (mean BDI score, 11.48 ± 8.86) had scores above the BDI cutoff score of 14 and were showing clinically significant symptoms of depression. The overall prevalence of depression in various SCI studies ranges from 11% to78%.[2,4,7,8,12,13,23-25]

Contrary to results of other studies,[9,26] our findings show that although the prevalence of depression was lower for longer durations of SCI, there was no significant correlation between the duration of SCI and BDI score. Unfortunately, in individuals more than 1 year after SCI, the prevalence of depression noted in our study was still high. This may be due to emotional factors such as feelings of dependency and uselessness, because many of the participants were financially

dependent on their family (62%) and only 11.9% were supported by governmental or nongovernmental organizations. It seems that the frequency of support provided by organizations in Iran is lower than that provided in some other countries. For example, in the study by Kruse et al[27] in the United States, 61% of the individuals with SCI received financial assistance, and 39% were supported by family members.

In our study, the odds of depression were higher in women than in men. This finding was consistent with results of the study by Beedie et al,[24] which showed women's scores to be approximately 5.5 to 7 points higher than men's scores, but was inconsistent with the findings of Fann et al[12] that men with SCI were significantly more depressed than women with SCI. Yet other studies revealed no significant differences between men and women.[4,26,28] Our results may be due to differences in social support or gender differences in expression of feelings.

Our study shows the frequency of depression in patients with tetraplegia to be significantly higher than that in patients with paraplegia, which can be explained by more limited physical ability in individuals with tetraplegia and more dependency on others to perform daily tasks. In other words, greater ability to move is associated with less depression. This was in contrast to the results of studies by Anderson et al[2] and Shin et al,[5] which showed no significant difference in depression between individuals with tetraplegia and those

with paraplegia. In the study by Shin et al,[5] persons with complete SCI had significantly higher mean BDI scores than persons with incomplete SCI (15.4 ± 8 vs 12.1 ± 8.7), but we found no relationship between completeness of injury and depression.

Our study shows that persons with SCI who have had suicidal thoughts have a higher frequency of depression; this was consistent with results of the study by Anderson et al[2] in which higher mean depression scores were reported for persons with suicidal thoughts.

We found that a higher level of education was associated with a lower frequency of depression. This result was consistent with the finding by Krause, Kemp, and Coker[8] that depression scores had a negative correlation with years of education ($r = -0.26$, $P < .001$). A higher education level may be associated with greater awareness, knowledge, and ability to collect information. We found that participants who had a higher level of education were more likely to have a job and be financially self-supporting. Conversely, most individuals with SCI who received financial support from governmental or nongovernmental organizations had an education level between 0 and 8 years ($P = .05$).

According to our findings, participants who were cared for by a spouse were less likely to have depression than those who were cared for by parents or another member of the family ($P = .03$). Perhaps a spouse is able to provide more emotional support than other family members.

Individuals with SCI who earned income by themselves had a lower frequency of depression than those who were provided with financial support from others. Unfortunately, we could not evaluate the association between amount of income and depression because we could not determine exact amounts of income. However, the study by Krause, Kemp, and Coker[8] negatively correlated income with depressive symptoms, and the study by Anderson et al[2] also negatively correlated depression with employment and income. These results may be due to feelings of independence and usefulness, and they emphasize the importance of employment and financial independence in persons with SCI.

We found no correlation between BDI scores and age at time of SCI, but Saikkonen et al[26] ($r = +0.35$, $P < .01$) and Krause, Kemp, and Coker[8] ($r = +0.11$,

$P < .001$) showed a positive correlation between the depression score and age at time of SCI, while Shin et al[5] showed that age at the time of injury did not differ between depressed and nondepressed groups.

Our study shows no correlation between BDI scores and current age, but in the study by Krause, Kemp, and Coker,[8] age was positively correlated with the depression score ($r = +0.09$, $P < .001$). These differences could be due to cultural differences. Perhaps the elderly in collectivist cultures have better coping skills for disabilities than those in individualistic cultures.

Limitations

Our participants were individuals with SCI who were referred for specialist assessment or rehabilitation from various parts of Iran. So individuals who could neither travel to Tehran nor find accommodations there could not participate.

We were not able to measure individual income because many participants in our study self-reported no income and stated that they received varying financial aid (no fixed amount) from others. It is also possible that in the hope of getting financial aid, some participants may have underreported their income.

Conclusion

We need to understand the factors influencing depression to improve quality of life for individuals with SCI and to provide early detection and timely treatment of depressive episodes and major depressive disorder. Further highly controlled studies of demographic and socioeconomic variables associated with depression are recommended to rule out conflicting results of multiple studies done to date. Longitudinal studies of individuals with SCI are also recommended for the evaluation of factors associated with depression to confirm which of the demographic and socioeconomic variables are the primary predictive indicators and which of them may be the result of depression.

Acknowledgments

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