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Identification of Factors on Recovery and Quality of Life in Spinal Cord Injury

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Abstract

Objective: To identify factors related to recovery and quality of life in spinal cord injury.

Research design: Non-experimental.

Setting: SVNIRTAR and Regional Spinal Injury Centre (RSIC), Cuttack.

Participants: 150 SCI subjects.

Outcome measures: Questionnaire based on history, WHOQOL-BREF scale, Perceived stress scale (PSS), the satisfaction with life scale (TSWLS).

Results and conclusion: Subjects with better functional recovery included those who underwent surgical treatment, spent less time at injury site, and had not lost consciousness and no neurological deterioration at site of injury. Also, QOL domains, perceives stress, satisfaction with life are not related. QOL and life satisfaction with complete and incomplete SCI are different. Similarly, satisfaction with life among married and unmarried subject is different.

Keywords: Spinal cord injury; Demographics; Epidemiology; Recovery; Quality of life

Introduction

Spinal cord injury (SCI) can disrupt upper or lower-motor sensitive pathways and can result in either a complete or an incomplete lesion. Although recent advances in primary damage healing, rehabilitation and prevention of complications have improved the prognosis of SCI, the consequences are still traumatic and disabling [1].

The incidence as well as the prevalence of spinal injuries has been on the rise with the incidence rate being estimated to be from 15 to 40 cases per million worldwide. There is extensive on-going research on epidemiological aspects of SCI from different parts of the world [2]. The differences reported, relate to mechanism of injury (MOI), age group, gender distribution, race and ethnicity, morbidity and mortality rates. The trend in demographics [3] as well as recovery [4] in spinal injury patients has been reported to be changing in recent times.

In the Indian setup, as in most developing countries, very little is known about the exact incidence of spinal cord injuries (SCI). Approximate 20,000 new cases of SCI are added every year. 60-70% of them are illiterate, poor villagers. Most of them sustain this injury by fall from unprotected roofs, trees or fall into uncovered wells, which in fact are preventable causes [5].

Studies had shown that the commonest cause of spinal injuries was fall from trees. Rescue and retrieval systems for the patients were inadequate. By examining trends prevalent at that time, the authors opined that prevention strategies should be targeted at persons who were at the greatest risk for injury [2].

A Study [6] had shown that only 1.86% of patients were accompanied by trained personnel during transfer. About 23% of patients were transported by ambulance, whereas 77% of patients were transported by vehicles unsuitable for spinal patients such as car, jeep or maxi cabs.

Early treatment of patients with acute spinal cord injury is very important to prevent secondary spinal cord injury. Studies from India have shown that out of 81 patients with SCI, only 4 (4.9%) were admitted within <8 hours. Moreover, 2 of these patients had sustained injury at a site 3-4 km from the hospital, signifying that timely treatment could be administered only if they were within the vicinity of the hospital. On the other hand, reports obtained from USA showed that almost 50.2% of patients were admitted within the first hour of the accident[6]. Studies have shown that of the total number of accident cases, <10-15% of patients are given adequate first aid treatment.

Spinal cord injury (SCI) affects many facets of an individual's life. Often spinal cord injured patients are of the younger age group. Most of these patients are managed at centres without comprehensive spinal trauma units. The physical, personal, financial and social impact of spinal cord injury is such that most patients are lost in follow-up or succumb to life-threatening complications associated with spinal cord injury. However, inadequate precautions during transportation can cause further injury to the already compromised spinal cord in spinal injured patients. Early surgery and comprehensive rehabilitation markedly reduces the overall morbidity of spinal cord injured patients by enabling the patient to lead an independent life. The tertiary, regional spinal centres with the assembly of specialized trained personnel and specialized technology to provide a comprehensive rehabilitation. The larger number of patients managed in these centres permit the staff to develop greater expertise and allow more cost-effective use of resources [7].

Quality of life assessment approaches being used to determine both the effectiveness of rehabilitation efforts and the impact of disabilities. These evaluations of the human condition seem especially relevant to the rehabilitation process, which is holistic in nature. The growing interest throughout the rehabilitation field is reflected in the appearance of published studies in rehabilitation-related journals. Potential uses include measurement of rehabilitation progress and program outcome,

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identification of factors that underlie differences in the quality of life of persons with disability, long term monitoring of the status of individuals with disabilities, and ranking the life quality of various disability groups to establish priorities for program development and allocation of resources [8].

Studies [8] have shown that life satisfaction appeared to be associated with factors such as social integration, mobility, perceived control, and self-assessed health, no significant correlation was found between life satisfaction and extent of paralysis. Similarly, coping effectiveness and perceived quality of life were found to be correlated, but no difference between quadriplegic and paraplegic persons was found with regard to their perceived quality of life.

There is some research that has investigated how the associated and secondary conditions impact health status and QOL. Many studies report a relationship between the SCI associated conditions neuropathic pain, motor dysfunction, spasticity, bowel, bladder, and sexual dysfunction and patient outcomes including SF-36, Sickness Impact Profile, and QOL. However, the effects of confounding personal factors such as age, sex, education, and co-morbidities have not always been adjusted for when estimating the effect of associated SCI conditions on health and QOL. It has been shown that once factors associated with the SCI and other personal factors are controlled for, there is no remaining association between sex and medical complications, contrary to what was reported previously. In determining the relationship between a health condition and patient outcome, personal factors are potential confounders and by adjusting for them, we will be able to obtain a more accurate estimate of effect. In addition, time since injury should be considered in the analysis, because it has been reported to influence many of the associated conditions following SCI, as well as health status and QOL [9].

Cross-sectional studies [10] have suggested that persons who are younger at the onset of their injuries are more likely to have superior long-term adjustment. These differences have been noted on ratings of adjustment, distress, and employment. Time since injury has been found to be positively related to acceptance of disability, life satisfaction, and similarity of actual life to ideal life.

Abbey and Andrews [11] studied the role of psychological variables on the subjective perception of quality of life. The appraisal of quality of life can be established according to objective criteria (environmental factors) and subjective criteria, these being the individual's perceptions of the quality of his or her own life.

Gagnon performed a study in SCI between the age of 18 and 59. The study was designed to circumscribe the different environmental and personal factors influencing quality of life. The findings showed a significant impact of three variables: parental behaviour and attitude toward an individual in childhood and adolescence, the degree of self-esteem, and the level of physical activity [11].

Several studies [11] have shown that satisfaction felt with the moral and social support provided was more important than the effective or potential quantity of the support. Gagnon showed a positive impact of satisfaction on the adjustment to spinal cord impairment: the better the quality of the emotional and moral support, the greater the level of activity of the subject. A social network, supportive relationships, and group integration had beneficial effects on health.

Spinal cord Injury (SCI) often results in significant changes in function that require people to modify their ways of life. Adjustment to disability can be difficult, and individuals with SCI may be at risk for developing a number of psychological disorders, such as depression and anxiety [12]. The likelihood of developing depression after injury is higher in women, and perceived stress has been shown to be a predictor of depression after SCI [13-16].

The experience of stress refers to the extent to which a situation is perceived to be demanding and beyond one's ability to cope [17]. Previous research suggests that individuals with restrictions such as those caused by SCI may experience higher levels of stress than do members of the general population [18]. Perceived stress has also been found to be associated with poorer life satisfaction in long-term SCI. This association between perceived stress and life satisfaction has been found repeatedly in both cross-sectional and longitudinal studies among individuals with SCI [16].

The need to predict outcome on the basis of expected neurologic recovery and associated functional recovery has been emphasised as essential for health care planning. This knowledge makes it possible to answer questions regarding function that patients usually ask after SCI. Finally, better knowledge of the course and prognosis of recovery after SCI and an understanding of the underlying mechanisms would help in the development of the strategies and treatment to enhance neurologic recovery [1].

This study is done to identify different factors (especially pre-hospital and initial management) related to recovery and quality of life (QOL), perceived stress and satisfaction with life of persons with traumatic spinal cord injury (SCI).

Procedure

Inclusion Criteria

Traumatic SCI patients

Complete data availability for the questionnaire,

Sufficient cognitive ability to participate in the study.

Exclusion Criteria

Patients without exact lesion level,

Any incomplete or missing data,

Patients with associated significant traumatic brain injury, multiple fractures,

Patients with psychiatric disorders.

After satisfying the inclusion and exclusion criteria, all SCI patients were recruited from SVNIRTAR outpatients and inpatients and also from Regional Spinal Injury Centre (RSIC), Cuttack of the duration 2014-2015.

Frequency of data collection: once per subject.

Subjects were examined and enquired about their marital status, employment status, education level, monthly income, personal habits, cause of trauma, loss of consciousness and neurological deterioration at injury site, duration spent at site of injury, rescuing person, presence of any trained personnel during transfer, any precautions taken during transfer, mode of transfer to the 1st treatment site, any delay to reach 1st treatment site, cause of delay, kind of treatment received initially, any intermediate admissions, presence of any complications during hospital course, length of stay in hospital, approximate expenditure.

Subjects were also given WHOQOL-BREF, Perceived Stress Scale (PSS), The Satisfaction with Life Scale (TSWLS); and the responses were marked and scored.

However, for studying the functional recovery (>6 months duration) 123 subjects were included in the study, 27 subjects were excluded.

Also, for studying married v/s unmarried QOL and Satisfaction with life 48 subjects were included and for complete v/s incomplete QOL and Satisfaction with life 60 subjects were taken and rest were excluded for maintaining equality among the groups.

Data Analysis

The data recorded using questionnaire related to their trauma was analysed using descriptive statistics (frequency in relation to functional activities).

The Kendall's tau co-relation between Quality of life, Perceived stress and Satisfaction with life was analysed.

The Mann Whitney U for Quality of life (QOL) and Life satisfaction between married v/s unmarried and complete v/s incomplete SCI subjects.

P was set as 0.05 for all statistical tests analysed using SPSS software.

Results

The results are given in the Tables 1-7.

Discussion

Recovery in surgical and non-surgical cases

Cervical: Surgery cases: More (6%) sitting, More (0.92%) walking; Non-surgery cases: More (46.02%) dependent, More (8.57%) rolling.

Thoracic: Surgery cases: More (23.21%) standing, Non-surgery cases: More (23.21%) sitting.

Lumbar: Surgery cases: More (18.33%) walking, Non-surgery cases: More (1.67%) standing.

Kishan et al. [19] in his literature review emphasised that early surgical treatment is beneficial in terms of reducing complications, length of stay and hospital costs. Fehling and Perrin suggested that urgent decompression in acute cervical SCI remains a reasonable practice option and can be performed safely. Early decompression and stabilization of injured spinal cord is an area that is still overlooked in the Indian setup. Similarly, Weinshel et al., [20] supporting decompression in his study(90 patients) on neurologic recovery in quadriplegia following operative treatment showed that 71% patients undergoing decompressive procedures showed neurological improvement while 16% patients with fusion and no root decompression had improvement ($p<0.05$). All patients with dislocations underwent closed or open reduction as part of their operative procedures; this did not appear to improve the likelihood of nerve root recovery. Since independence and quality of life may be improved by cord or root recovery, decompression of all neural structures should be considered in cervical spinal cord injury.

Recovery and duration spent at injury site

Cervical: <2 hours: More (16.66%) rolling, Walking; >2 hours: More (14.58%) dependent, More (8.33%) sitting.

1	Total no. of cases	150
2	Sex	136 (90.67%) male, 14 (9.33%) female.
3	Age group	18-82 years.
4	Educational level	19 (12.67%) illiterate, 131 (87.33%) literate. Before injury some vocation (farming)
5	Vocation	Post injury no vocation.
6	Socio-economic status	81 (54%) poor /BPL, 69 (46%) middle class.
7	Personal habits	45 (30%) alcoholics, 105 (70%) non- alcoholic but eat pan, tobacco.
8	Cause of injury	97 (64.67%) fall, 48 (32%) Road traffic accident (RTA).
9	Loss of consciousness at injury site	78 (52%) lost at injury site.
10	Level of injury	84 (56%) cervical, 42 (28%) thoracic, 24 (16%) lumbar
11	Duration spent at injury site	Immediate transfer to maximum 5 hour delay.
12	Trained Personnel and precautions taken during transfer	None.
13	Mode of transfer	51 (34%) via ambulance, 99 (66%) via other modes e.g. auto, bike, and bolero.
14	Neurological deterioration at injury site	130 (86.67%) present, 20 (13.33%) absent.
15	First treatment site	20 (!3.33%) reported at PHC, 98 (65.33%) reported government hospital, 25 (16.67%) reported at private
16	Initial treatment received	102 (68%) conservative, 48 (32%) surgical.
17	Intermediate admissions	127 (84.67%) present, 23 (15.33%) absent.
18	Causes of delay (as many admissions)	Lack of awareness about hospitals, lack of facility and finances.
19	Complications	67 (44.67%) pressure sore, 19 (12.67%) Urinary tract infections (UTI).
20	Length of stay	Ranged from 5 days to 1 year. Length of stay more in patients with complications.
21	Expenses	Ranged from 8,000 to 24,00,000. Patients with complications had greater expenses

Table 1: Patient's background data.

Cervical	Total cases (69)	Dependent	Rolling	Sitting	Walking
Surgery	20 (28.99%)	1 (5%)	4 (20%)	14 (70%)	1 (5%)
Non-Surgery	49 (71.01%)	25(51.02%)	14 (28.57%)	8 (16.33%)	2 (4.08%)

Table 2a: Functional status (cases >6months) of Cervical SCI and surgery and non-surgery.

Thoracic	Total cases (37)	Sitting	Standing
Surgery	16 (43.24%)	10 (62.5%)	6 (37.5%)
Non-Surgery	21 (56.76%)	18 (85.71%)	3 (14.29%)

Table 2b: Functional status (cases>6 months) of Thoracic SCI and surgery and non-surgery

Lumbar	Total cases (17)	Sitting	Standing	Walking
Surgery	5 (29.41%)	-	2 (40%)	3 (60%)
Non-Surgery	12 (70.59%)	2 (16.67%)	5 (41.67%)	5 (41.67%)

Table 2c: Functional status (cases>6 months) of Lumbar SCI and surgery and non-surgery

Table 2: Functional status versus surgery and non-surgery.

Cervical	Total cases (69)	Dependent	Rolling	Sitting	Walking
<2 Hours	48 (69.57%)	17 (35.42%)	16 (33.33%)	12 (25%)	3 (6.25%)
>2 Hours	6 (8.70%)	3 (50%)	1 (16.67%)	2 (33.33%)	-
Not Known- 15 (21.74%)					

Table 3a: Functional status (cases>6 months) of Cervical SCI and duration spent at injury site.

Thoracic	Total cases (37)	Sitting	Standing
<2 Hours	26 (76.92%)	20 (76.92%)	6 (23.08%)
>2 Hours	3 (100%)	3 (100%)	-
Not Known- 08 (21.62%)			

Table 3b: Functional status (cases>6 months) of Thoracic SCI and duration spent at injury site

Lumbar	Total cases (17)	Sitting	Standing	Walking
<2 Hours	11 (64.71%)	2 (18.18%)	4 (36.36%)	5 (45.45%)
>2 Hours	1 (5.88%)	-	1 (100%)	-
Not Known- 05 (29.41%)				

Table 3c: Functional status (cases>6 months) of Lumbar SCI and duration spent at injury site

Table 3: Functional status versus Duration spent at injury site.

Cervical	Total cases (69)	Dependent	Rolling	Sitting	Walking
LOC	41 (59.42%)	17 (41.46%)	11 (26.85%)	13 (31.71%)	-
NO LOC	28 (40.58%)	9 (32.14%)	7 (25%)	9 (32.14%)	3 (10.71%)

Table 4a: Functional status (cases>6 months) of Cervical SCI and Loss of consciousness (LOC) and No LOC at injury site.

Thoracic	Total cases (37)	Sitting	Standing
LOC	19 (51.35%)	17 (89.47%)	2 (10.53%)
NO LOC	18 (48.65%)	10 (55.56%)	8 (44.44%)

Table 4b: Functional status (cases>6 months) of Thoracic SCI and Loss of consciousness (LOC) and No LOC at injury site.

Lumbar	Total cases (17)	Sitting	Standing	Walking
LOC	8 (47.06%)	3 (37.5%)	3 (37.5%)	2 (25%)
NO LOC	9 (52.94%)	-	6 (66.67%)	3 (33.33%)

Table 4c: Functional status (cases>6 months) of Lumbar SCI and Loss of consciousness (LOC) and No LOC at injury site.

Table 4: Functional status versus Loss of consciousness (LOC) and No LOC at injury site.

Cervical	Total cases (69)	Dependent	Rolling	Sitting	Walking
ND	57 (82.61%)	23 (40.35%)	15(26.32%)	18 (31.58%)	1 (1.75%)
NO ND	12 (17.39%)	3 (25%)	3 (25%)	4 (33.33%)	2 (16.67%)

Table 5a: Functional status (cases>6 months) of cervical SCI and Neurological deterioration (ND) and No ND at injury site.

Thoracic	Total cases (37)	Sitting	Standing
ND	34 (91.89%)	26 (76.47%)	8 (23.53%)
NO ND	3 (8.11%)	2 (66.67%)	1 (33.33%)

Table 5b: Functional status (cases>6 months) of Thoracic SCI and Neurological deterioration (ND) and No ND at injury site.

Lumbar	Total Cases (17)	Sitting	Standing	Walking
ND	13 (76.47%)	2 (15.38%)	8 (61.54%)	3 (23.08%)
NO ND	4 (23.55%)	-	2 (50%)	2 (50%)

Table 5c: Functional status (cases>6 months) of Lumbar SCI and Neurological deterioration (ND) and No ND at injury site.

Table 5: Functional status versus Neurological deterioration (ND) and No ND at injury site.

Non parametric correlations	Kendall's tau_b	Significance p
1) QOL total with Perceived stress	-0.465	0.000
2) QOL Total with Satisfaction with life	0.412	0.000
3) Environment with perceived stress	-0.394	0.000

4) Environment with Satisfaction with life	0.285	0.000
5) Satisfaction with life with Overall QOL	0.452	0.000
6) Overall QOL with Perceived stress	-0.403	0.000
7) Physical health with Perceived stress	-0.332	0.000
8) Perceived stress with Psychological domain of QOL	-0.431	0.000
9) Psychological domain of QOL with Satisfaction with life	0.326	0.000
10) Social relations domain of QOL with Perceived stress	-0.116	0.069
11) Social relations domain of QOL with Satisfaction with life	0.231	0.000
This table shows low correlation between various domains of QOL, Perceived stress and satisfaction with life.		

Table 6: Correlation among QOL domains of WHO-QOL BREF scale, Perceived Stress Scale (PSS) and the Satisfaction with Life Scale (TSWLS).

Group (1 and 2)	Domain	Mann-Whitney U	Asymp sig (2 tailed)
Married v/s unmarried	QOL	1.060E3	0.500
Married v/s unmarried	Satisfaction with life	743.000	0.003
Complete v/s incomplete	QOL	1.368E3	0.023
Complete v/s incomplete	Satisfaction with life	1383.500	0.028
This table shows: 1) QOL- no significant difference between married and unmarried subjects p (0.500) 2) Satisfaction with life- significant difference between married and unmarried subjects p (0.003) 3) QOL- significant difference between complete and incomplete subjects p (0.023) 4) Satisfaction with life- significant difference between complete and incomplete subjects p (0.028)			

Table 7: Mann- Whitney and significance among group 1(married v/s unmarried) and group 2 (complete v/s incomplete) SCI subjects.

Thoracic: <2 hours: More (23.08%) standing, >2 hours: More (23.08%) sitting.

Lumbar: <2 hours: walking, >2 hours: only standing.

This study has shown that early treatment resulted in better functional outcomes. Studies have supported that less duration spent at injury site or early treatment leads to a better recovery. For e.g. Giorgio Scivoletto et al., [21], has studied on 150 SCI patients and divided three comparison groups- short (<30d), medium (31-60d), long (>60d) time to admission (TTA)–were evaluated for rehabilitation outcomes. The groups were comparable for all medical and demographic characteristics as well as neurologic recovery. The three subgroups differed significantly in activity of daily outcomes, with the short TTA group exhibiting higher Barthel Index discharge scores, score increases, and score efficiencies ($p<0.003$ for short v/s medium group, $p<.001$ short v/s long group). Early rehabilitation seems to be relevant prognostic factor of functional outcome. Rehabilitation intervention in patients with SCI should begin as soon as possible, in a specialised setting, because delay may adversely affect functional recovery.

Recovery and Loss of Consciousness (LOC) and No LOC at injury site

Cervical: LOC: More (9.32%) dependent, More (1.85%) rolling; No LOC: More (0.43%) sit.

Thoracic: LOC: More (33.91%) sitting, No LOC: More (33.91%) standing.

Lumbar: LOC: More (37.5%) sitting, NO LOC: More (29.17%) standing, More (8.33%) walking.

This study showed that patients who did not lose consciousness at injury site had better functional recovery than those who lost consciousness at injury site.

Researchers have explained the possible relation of loss of consciousness and recovery, like study done by Davidoff G. et al., Michigan [22] on 101 patients and suggested that out of total trauma-related spinal cord injured patients 25% to 50% of these patients sustain a concomitant cranio-cerebral trauma. A loss of consciousness (LOC) of 20 minutes duration or a post traumatic amnesia (PTA) lasting 24 hours has been associated with deficits in concentration, attention, memory, and higher-level cognitive functions. These may present as significant factors influencing learning and adaptation during and after the formal rehabilitation process.

Recovery and Neurological Deterioration (ND) and No ND at injury site

Cervical: ND: More (15.35%) dependent, More (1.32%) rolling; No ND: More (1.75%) sitting, More (14.92%) walking

Thoracic: ND: More (9.8%) sitting, No ND: More (9.8%) standing.

Lumbar: ND: More (11.54%) standing, No ND: More (26.92%) walking.

This study has shown that no neurological deficit at injury site has better functional recovery.

Quality of Life, Perceived Stress and Satisfaction with Life

The **Kendall's tau-b correlation** between Quality of life with perceived stress was 0.465, QOL with Satisfaction with life- 0.412, Environment domain of QOL with Perceived stress- 0.39 Environment with Satisfaction with life- 0.285, Overall QOL with Satisfaction with life- 0.452, Overall QOL with perceived stress- 0.403, Physical health domain of QOL with Perceived stress- 0.332, Perceived stress with psychological domain of QOL- 0.431, Satisfaction with life with Psychological domain of QOL-0.326, Social relations domain of QOL with Perceived stress- 0.116, Social relations domain of QOL with satisfaction with life- 0.231.

This study showed that low correlation between various domains of QOL, perceived stress and satisfaction with life.

There was significant difference in QOL ($p<0.023$) and Satisfaction

with life ($p<0.028$) among complete and incomplete SCI patients, also a significant difference in Satisfaction with life ($p<0.003$) found among married and unmarried patients but the difference in QOL among married and unmarried ($p>0.500$) was not significant.

This study has shown low co-relation between stress and QOL, health, life satisfaction, psychological aspects of a person. Similarly, study done by Gerhart KA et al., [23] Colorado, USA on 187 subjects had found no associations between stress and any of the proxy variables that represented injury severity. Such common SCI related medical conditions as pressure sores and upper extremity pain were not related to stress, not even fatigue was significantly associated with stress in both time period studies. However, depressive symptoms, poorer life satisfaction and poorer perceived well-being were associated with future stress and were outcomes that appeared to be related to earlier stress.

However, many studies had shown variables associated with life satisfaction, quality of life. For e.g. study done by Karen S. Clayton et al., [8], Charleston, South Carolina on 100 subjects concluded that income, educational status, social activities are associated with the perceived life quality of persons with spinal cord injuries. Results of this study also provide further evidence that socialisation issues warrant a priority position in rehabilitation efforts. Rehabilitation specialists may need to explore and facilitate participation in social activities following discharge.

Conclusion

Subjects with SCI who underwent surgery had better functional recovery. Subjects who spent less time at injury site and received early treatment had better functional recovery. Subjects who had not lost consciousness and had no neurological deterioration at the site of injury had better functional recovery. The QOL domains, perceived stress and satisfaction with life in SCI subjects are not related. Though the subjects were literate but post SCI none of them could return to their/any occupation. QOL-significant difference present between complete and incomplete subjects, whereas no significant difference was found between married and unmarried. Regarding satisfaction with life-significant difference was noted between married and unmarried as well as complete and incomplete subjects.

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