

Correlation of Pain and Spasticity with the Quality of Life in Individuals with Spinal Cord Injury

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ABSTRACT

Introduction: After Spinal Cord Injury (SCI), life is associated with risks of many musculoskeletal problems which affect the life of an individual. There is a need for an early assessment for neurological functions and physical activities.

Aim: To assess the correlation of pain and spasticity with Quality of Life (QoL) in individuals living with SCI.

Materials and Methods: This cross-sectional study was conducted at Axon Spine Hospital, Ahmedabad, Gujarat, India, from January 2022 to April 2022, which comprised of 54 participants. Demographic details, American Spinal Injury Association (ASIA) scale, pain with Numeric Rating Scale (NRS), spasticity with NRS and World Health Organisation Quality of Life Brief (WHOQoL-BREF) had four domains, 26-items questionnaire regarding different aspects of life were recorded. Categorical data has been presented as frequencies and percentages and quantitative data as means and standard deviations. Linear

correlation analysis of WHOQoL-BREF with pain and spasticity respectively has been done. Level of statistical significance was 5%.

Results: The mean age of participants were 30.54 ± 7.6 years and the male to female was 39:15. Out of 54, total 39 (72.22%) had complain of pain and total 38 (70.38%) reported spasticity. Mean score of pain intensity is 4.1 ± 3.4 and spasticity is 2.7 ± 2.4 . WHOQoL-BREF means of 4 domain score-physical health domain 54.05 ± 18.56 , psychological health domain 58.14 ± 11.95 , social relationship domain 59.14 ± 13.59 , and environmental domain 56.29 ± 18.58 . There was a negative linear correlation between pain (r -value=-0.489) and spasticity (r -value=-0.063) with WHOQoL-BREF.

Conclusion: Pain is correlated with QoL, which was lower in people living with SCI along with some associated conditions like spasticity affecting physical activities.

Keywords: Muscle spasticity, Neurogenesis, Paraplegia, Physiopathology, Quadriplegia

INTRODUCTION

Any trauma to the spinal cord can cause permanent or temporary changes in its function, leading to loss of locomotors, bladder and bowel, sexual and autonomic function with several disabilities [1]. International conference on Spinal Cord Injury (SCI) management held at New Delhi, India in 1995, showed prevalence of SCI as fifteen cases per million per year in India [2]. As per World Health Organisation (WHO) estimates road traffic trauma is the leading cause of SCI. Post-SCI life is associated with the risk of developing secondary problems like deep vein thrombosis, urinary tract infection, muscle spasm, spasticity, osteoporosis, pressure ulcer and respiratory complications which affects the physical, mental, social and psychological aspects of patients' life [3]. Life expectancy of the patients has been increased by reducing risk of developing secondary complications and improvement in condition because of advanced medical care in specialised units [4].

Most common type of pain was musculoskeletal pain, 50-60% neuropathic and 30% visceral pain were associated with standard of living but research on long-term effects with different stages of rehabilitation with different type of pain has to be done yet [5-7]. Spasticity is velocity dependent increasing muscle tone, present in 70% of all SCI. Mild spasticity helps in walking during recovery. Severe form of spasticity may cause physical function impairment, contracture and deformities which significantly lowers the standard of living in SCI [8-10].

Quality of Life (QoL) after severe disability differs from person to person. It is often found to be significantly lower after SCI as compared to without it [11]. Many important factors like adequate facilities for medical care, adaptive equipment, supportive relationships, getting enough social and economic support to live a

social life in towns with accessible housing, public spaces, building and transport facilities, predict and correlate with the standard of life [12]. Enhancement in standard of life improves by the presence of supportive friends and family, marriage, employment, mobility circumstances and community integration. People with SCI disabilities can live a satisfied life in developed countries due to availability of adequate facilities for activities of daily living [13,14].

International Standards for Neurological Classification of SCI (ISNCSCI) has been developed by the American Spinal Injury Association (ASIA) examination as a universal classification tool based on standardised sensory and motor assessment [15].

A previous study on factors associated with Leisure Time Physical Activity (LTPA) for ambulated SCI participation found that rehabilitation specialists can use list to suggest such wide range of LTPA for patients [16]. Holistic approaches towards the patients were used rather than new surgical techniques, tools and drugs as an advanced management of SCI patients. Physical activity includes training with assistive devices to improve mobility, environmental adaptation and modification in self-care tasks during rehabilitation at different levels. Rehabilitation begins in acute phase which increases function of daily living through compensatory training with adaptive devices, facilitates neurogenesis and neuro-reorganisation to increase functions and tasks, which are significant predictors of improvement in general standard of life [17]. The present study has been designed to assess the correlation of pain and spasticity with QoL in individuals living with SCI.

MATERIALS AND METHODS

The present study was conducted at Axon Spine Hospital, Ahmedabad, Gujarat, India, from January 2022 to April 2022. SCI patients who fulfilled the inclusion criteria, were enrolled for the study

from different areas of Gujarat, India. The patients were recruited by consecutive sampling method. The procedures followed were in accordance with the ethical standards and Institutional Ethical Committee approval was taken from Sangini Hospital Ethics Committee (20220113/ECR/147/Inst/ GJ/2013/RR-19).

Inclusion criteria: People with SCI either quadriplegia or paraplegia with stable vitals, traumatic/non traumatic, SCI from the Inpatient Department (IPD) and outpatient rehabilitation at rehabilitation institute of both genders in the age group 20-50 years, patients with ASIA Grade-A, B, C, D were included in the study [18]. Both conservatively managed or surgically operated patients with pressure ulcer Grades 1 and 2 were included after being allowed by the physician [19]. Individuals with SCI with postinjury duration from two weeks to 25 weeks and patients who were willing to participate were also included in the study.

Exclusion criteria: Patients with known psychiatric problems, progressive disease, additional musculoskeletal problems like recent non vertebral fractures and recent pressure sore of grade 3 and 4 were excluded from the study [20]. Also, individuals completely dependent on an electric wheelchair and completely ambulatory people were also excluded from the study.

Study Procedure

Patients were explained about the nature of the survey and informed that participation was completely harmless. Written consent was obtained either from subject or from their relatives who were willing to participate in the study.

Parameters

Pain: A 0-10 score Numerical Rating Scale (NRS) has been used as the outcome measure for neuropathic pain intensity after SCI [21]. Pain has been used to categorise patients into none (0), mild (1-3), moderate (4-6) and severe (7-10) according to the increasing levels of severity.

Spasticity: As spasticity interfered with daily activities, individuals were asked to rate spasticity on Numeric Rating scale (NRS 1-10) in the previous week [22,23]. Participants also experienced muscle spasm or stiffness along with spasticity.

Quality of Life: World Health Organisation QoL BREF (WHOQoL-BREF): A 26-item questionnaire consisting of four domains namely- health (7), psychological health (6), social relationships (3), environmental health (8) and (2) on overall QoL and general health was used. For that, enough time was given to the patients. Each individual item of the WHOQoL-BREF is scored from 1 to 5 ordinal scales. Domain scores are not averages; they are the total score for each question, the scores are then transformed linearly to a 0-100 within domains [24,25].

STATISTICAL ANALYSIS

Categorical data has been presented as frequencies and percentages. Means and standard deviations have been derived for quantitative data. Linear correlation analysis of WHOQoL-BREF with pain and spasticity, respectively has been done, data has been visually represented using scatter plots from data in excel sheets with the data analysis tool. A p-value <0.05 was considered statistically significant.

RESULTS

Total 70 participants were included, out of which 16 were excluded; 10 due to ulcer formation and six developed other secondary complications. So, the total 54 participants were considered for the study. The demographic profile of the studied population had the age range of 21-49 years with the mean age of participants 30.54±7.6 years. The male to female was 39:15 [Table/Fig-1].

Variables		n (%)
Gender	Male	39 (72.22)
	Female	15 (27.78)
Level of injury	Paraplegic	50 (92.59)
	Quadriplegia	4 (7.41)
Clinical inference	Pain	39 (72.22)
	Spasticity	38 (70.38)

[Table/Fig-1]: Characteristics of study participants.

Mean pain score of 54 participants were 4.1±3.4, out of which 39 participants (mild were 8, moderate were 16, and severe were 15) needed rest and pain management. Spasticity mean score was 2.7±2.4 [Table/Fig-2].

NRS score	Pain		Spasticity	
	Total (n)	Percentage (%)	Total (n)	Percentage (%)
0	15	27.77	16	29.6
1	3	5.55	5	9.25
2	2	3.7	8	14.81
3	3	5.55	5	9.25
4	4	7.4	6	11.11
5	6	11.11	6	11.11
6	6	11.11	1	1.85
7	4	7.4	6	11.11
8	3	5.55	1	1.85
9	5	9.25	0	0
10	3	5.55	0	0

[Table/Fig-2]: Pain intensity and spasticity with NRS scale score.

In physical domain, 37 (68.51%) participants out of 54 felt that physical pain had prevented them from their needs (question: 3) and 39 (72.22%) participants needed medical treatment for functioning in daily life (question: 4). Also, all domains of QoL were reduced in 39 participants, who had pain.

In psychological domain, 50 (92.59%) participants out of 54 were unable to enjoy their life (question: 5); 6 (11.1%) individuals had mood problems, anxiety and depression (question: 26); some had difficulty in acceptance of permanent disability and thought that life was meaningless and were dissatisfied with themselves.

In social domain, there was a personal decline in their social relationships, 8 (14.81%) were dissatisfied with their personal relationships (question: 20), 21 (38.88%) were dissatisfied with sex life (question: 21). They needed more support from friends and family, which was highest in all domains as in Indian culture by warmth and care.

In environmental domain, there were problems during hospital stay, home situation, and accessing to rehabilitation and health services. Out of 54 participants, 3 (5.5%) did not feel safe (question: 8), there were high chances of fall which required a provision of safe and healthy environment by increasing availability of transport facilities in public, whereas 10 (18.5%) individuals had financial problems (question: 12) [Table/Fig-3].

Q.	WHOQoL-BREF domains and questions	Min	Max	Mean score	SD
Overall Quality of Life (QoL) and general health					
1	How would you rate your Quality of Life (QoL)?	1	5	2.75	1.04
2	How satisfied are you with your health?	1	5	2.38	0.99
Domain 1- Physical health					
3	To what extent do you feel that physical pain prevents you from doing what you need to do?	2	5	3.74	1.10

4	How much do you need any medical treatment to function in your daily life?	2	5	3.72	1.25
10	Do you have enough energy for everyday life?	2	5	2.96	1.00
15	How well are you able to get around?	1	4	2.48	0.72
16	How satisfied are you with your sleep?	1	5	3.40	1.20
17	How satisfied are you with your ability to perform your daily living activities?	1	5	2.79	1.15
18	How satisfied are you with your capacity for work?	1	5	3.05	1.17
Domain 2- Psychological health					
5	How much do you enjoy life?	2	4	2.07	0.62
6	To what extent do you feel your life to be meaningful?	2	4	2.88	0.79
7	How well are you able to concentrate?	2	5	2.88	0.63
11	Are you able to accept your bodily appearance?	2	5	3.11	0.63
19	How satisfied are you with yourself?	2	5	3.48	0.74
26	How often do you have negative feelings such as blue mood, despair, anxiety, depression?	2	5	4.85	0.49
Domain 3- Social relationships					
20	How satisfied are you with your personal relationships?	2	5	3.55	0.81
21	How satisfied are you with your sex life?	2	5	2.87	0.82
22	How satisfied are with the support you get from your friends?	3	5	3.74	0.64
Domain 4- Environment					
8	How safe do you feel in your daily life?	1	5	3.27	0.99
9	How healthy is your physical environment?	2	5	3.24	0.84
12	Have you enough money to meet your needs?	1	5	3.12	0.97
13	How available to you is the information that you need in your daily-to-day life?	2	5	3.03	0.82
14	To what extent do you have the opportunity for leisure activities?	1	5	2.85	0.85
23	How satisfied are you with the condition of your living place?	2	5	3.00	0.97
24	How satisfied are you with your access to health services?	2	5	3.22	1.00
25	How satisfied are you with your transport?	2	5	3.46	1.11

[Table/Fig-3]: WHOQoL-BREF four domains and each question with mean and SD values.

Min: Minimum; Max: Maximum; SD: Standard deviation

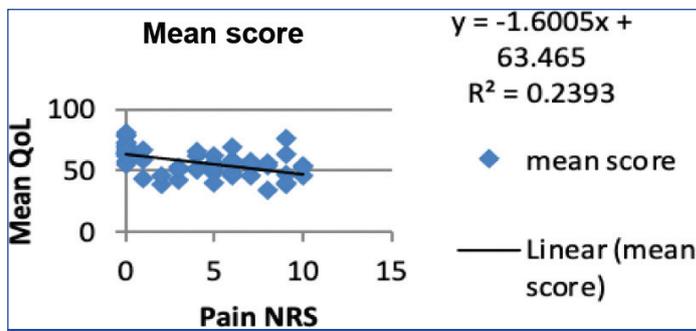
WHOQoL-BREF total mean score was 56.91±11.17. WHOQoL-BREF means of four individual domain score were physical health domain 54.05±18.56, psychological health domain 58.14±11.95, social domain 59.14±13.59 and environmental domain 56.29±18.58 [Table/Fig-4].

Domains score	Sum	Mean	Min	Max	SD
Physical health	2919	54.05	19.00	94.00	18.56
Psychological health	3084	58.14	19.00	81.00	11.95
Social relationship	3194	59.14	19.00	100.00	13.59
Environmental	3040	56.29	13.00	94.00	18.58

[Table/Fig-4]: Four domains score of WHOQoL-BREF (N=54).

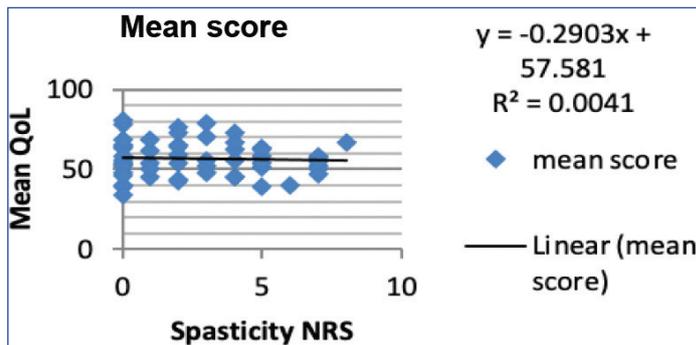
Min: Minimum; Max: Maximum; SD: standard deviation

Linear correlation between pain with QoL and spasticity with QoL are given in [Table/Fig-5,6]. There was a moderate negative linear correlation between pain and WHOQoL-BREF (r-value=-0.489) which was significant (p-value=0.00017) by regression analysis [Table/Fig-5]. Pain showed negative correlation as increase in pain leads to a deterioration of WHOQoL due to reduced physical activity.



[Table/Fig-5]: Scatter plot between pain NRS score and WHOQoL-BREF showing linear correlation.

Spasticity and WHOQoL-BREF showed a very weak negative correlation with r-value=-0.063 which was not significant (p-value=0.64) [Table/Fig-6].



[Table/Fig-6]: Scatter plot between spasticity NRS score and WHOQoL-BREF showing linear correlation.

DISCUSSION

The present work aimed at assessing pain, spasticity and QoL while rehabilitating the functional and neurological status of patients with SCI. In the current study, male SCI patients were more than female patients but there was no significant relationship between the gender and pain. Pain management was needed in 39 (72.22%) participants. Physical health of all patients had the lowest score (mean=54.05) in motor relearning and neurogenesis phase, which indicates that during acute and subacute phase of hospital stay patients were not physically much active because of pain, spasticity and recent disabilities. Here, all domain scores of QoL, mainly physical than social, psychological and environmental domains were also reduced with the presence of pain. Total 39 participants with pain had a mean score of physical domain, psychological domain, social relationship domain and environmental domain were 45.43±13.64, 55.17±11.73, 56.43±13.03 and 52.64±17.72, respectively which showed reduced value in all domains of WHOQoL-BREF.

Barker RN et al., conducted a study on the relationship between disability and QoL for people with SCI in existence and pointed out that physical domain was affected the most, followed by psychological domain, social domain and environmental domain [26]. A person living with disability has less satisfaction with physical health due to spasticity, muscle weakness, stiffness and spasm, which further increased stress because of unemployment [27]. This study fills some gaps in the understanding of pain and WHOQoL-BREF in all domains in SCI.

The impact of pain interference, when also accounting for pain intensity may vary in important ways especially when the assessment is done in the chronic phase of the injury. The average pain intensity in this population was relatively moderate in postacute phase; participants with high pain levels may produce different findings, future studies with larger samples should be conducted. However, deterioration of functional condition and QoL are found

to be associated with factors such as attendant care, low source of income, transportation facilities, secondary health problems-pain, spasticity, reduced social relationships and feeling of loss in SCI patients [28]. In accordance with Barrett H et al., studied on pain characteristics in patients admitted to the hospital with complications after SCI concluded that pain is a common problem, it has a significant impact on activities with a reduction in global self-rated health and higher levels of psychological distress which support this study [29].

In acute phase due to internet access and social media, patients could interact with their family and friends during the hospital stay and virtual communication helped in pandemic, so they did not feel isolated. Psychological and environmental scores were second highest, as advanced medical help and transportation has made life easier in a new internet era. Many studies concluded that depression and anxiety are commonly found after 2-4 years of SCI and it was found that the different mechanisms responsible for the development of mood disorder and pain seems to be great impediment to good adjustment to SCI [30,31]. For example, individuals perceived more distress in accomplishing related demands such as self-care or sphincter management which affects negatively even without any actual functional deterioration.

Previous literature has shown that spasticity is established after 8-24 weeks (2-6 months) after SCI in upto 65-78% of individuals [32,33]. Spasticity may develop contracture, which can be prevented by the effective and timely rehabilitation. Furthermore, QoL and neurological recovery in SCI is not solely impacted by pain and spasticity, there could be other complications too [34].

Andresen SR et al., conducted a study in Denmark and concluded that the chronic pain and spasticity are common problems after SCI and high pain interference is associated with lower QoL, which supports the present study [35]. According to this data, both pain and spasticity affects SCI not only in chronic phase but also in subacute and postacute phases, pain interfered more with QoL than spasticity. Other consequences of SCI that have been found to impact QoL are hand function, bowel, bladder and sexual dysfunction and cardiovascular autonomic dysfunction too [36]. Awareness in community and social platforms plays a major role in disability with autonomic dysfunction.

Limitation(s)

All domain data has been provided during subacute phase only and relies on a self-reporting of participants. There is a future need for study in chronic phase in India.

CONCLUSION(S)

The present study concludes that the pain affects standard of living more than the spasticity. Pain interference in day-to-day activities was present in paraplegia and quadriplegia patients. There is a need for further studies to evaluate factors affecting QoL in SCI patients as suggested over the period of time and to examine the efficacy and effectiveness of collaborative approaches towards the treatment.

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