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Fatigue, Injury-Related Pain and Quality of Life after Spinal Cord Injury

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Abstract:

Objective: To investigate prevalence and significance of fatigue, injury-related pain and their association with Health-Related Quality of Life (HRQoL) among individuals with spinal cord injury.

Methods: A descriptive study involving individuals with up to one-year history of living with spinal cord injury and who were receiving rehabilitation services, including physiotherapy on outpatient basis. Fatigue Severity Scale (FSS), Spinal Cord Injury Quality of Life- 23 questionnaire (SCIQL-23) and Neuropathic Pain Symptom Inventory (NPSI) were used to assess fatigue, HRQoL and neuropathic pain respectively. American Spinal Injury Association (ASIA) Impairment scale was used to evaluate level of injury and severity of injury.

Results: Total of 56 patients (37 males, 19 females) participated in the study. Mean age at injury was 46.1±16.2 years with 55.4% of the SCI resulting from trauma. Half of the participants reported significant fatigue with the lowest mean score (30.3) in MOOD domain of SCIQL-23. Fatigue was associated with all domains on HRQoL- FUNC (r = 0.45, p= 0.001), MOOD (r = 0.30, p= 0.023), PROB (r= 0.44, p=0.001) and GQoL (r =-0.44, p= 0.001) including neuropathic pain (r= 0.29, p= 0.03).

Conclusions: Fatigue is a concern among half of the individuals with SCI and is associated with neuropathic pain and HRQoL. Level of injury and severity of injury were not associated with fatigue. Fatigue, pain and other clinical factors should receive focused attention from attending clinicians to improve quality of life post spinal cord injury.

Keywords: Fatigue, Health-related Quality of life (HRQoL), Spinal Cord Injury; Pain

1. Introduction:

Spinal Cord Injury (SCI) is a devastating injury that negatively impacts an individual's physical, mental and social life. It often affects young persons and represents a considerable financial cost to the family and society **(**1**).** The SCI is usually a sudden, life-transforming condition with consequential devastation resulting in overall affectation of physical functioning **(**2**).**. It causes long-lasting dysfunction in many organ systems thereby precipitating increased risk of secondary complications such as fatigue, chronic pain, affectation of quality of life and higher morbidity. SCI-related complications such as fatigue and chronic pain are reported to act independently to decrease well-being of individuals with SCI **(**3**).**

Fatigue is a complex phenomenon involving physical, psychosocial, and behavioural processes including feelings of mental and physical tiredness which invariably have influence on perceived health status of an individual as it relates to Quality of life.

Fatigue after SCI is yet to be fully understood. However, some spinal cord injury-related characteristics such as neurological level of injury, completeness of injury, year(s) since injury and pain

have been reported to influence fatigue and HRQoL (4,5,6) Some researchers reported worse fatigue among those with complete tetraplegia(7,8,9) whereas others associate fatigue with incomplete lesions and paraplegia(10,11). Wijesuriya et al (12) observed that over 50% of individuals with SCI, with a mean time since injury of 16 years had severe levels of fatigue and substantial affectation of HRQoL.

With improvement in life-expectancy for persons with SCI (5), those who suffered this injury face complex, extraordinary and lifelong challenges. One of these challenges is poorly understood fatigue which magnifies the physical consequences of SCI by further compromising the ability to participate in life activities. Yet, little is known about the nature and clinical characteristics that exacerbate fatigue thus affecting HRQoL. The peculiarity of the environment or community of an individual with disability such as SCI resides plays a determinant role in outcomes related to QoL, thus the need to factor environmental complexities.

Arton (13) had observed that there are important gaps in the understanding of fatigue after SCI and there is need for more information about the prevalence and significance of its risk factors. There is also dearth of information on prevalence and significance of fatigue among Nigerians with SCI. We investigated frequency and significance of fatigue among people with SCI and assessed its association with their HRQoL and injury-related pain.

2.Materials and Methods:

This was a cross-sectional descriptive study. Purposive sampling was used to recruit participants. Eligible participants were individuals aged 18 years, with longer than one year duration of spinal cord injury and who were receiving care at the attended major physiotherapy and surgical out-patients' clinics in South-Western part of the country, who gave their informed consent. Individuals with SCI who had history of diabetes, cancer, endocrinology disease, acute infection, cognitive impairment or associated traumatic brain injury (sustained concurrently with SCI) were not eligible to participate. The study protocol was approved by the appropriate Research Ethics Committee of our institution.

Patients' socio-demographic variables and year(s) since injury were asked directly using a self-developed questionnaire. Completeness of injury was defined as no preserved sensory or motor function below injury level and incomplete as variable motor function preserved below the neurological level of injury (14). The level of injury was assessed by clinical examinations and confirmed by Neurosurgeon's diagnosis. Classification of participants according to ASIA Impairment Scale was as follows: ASIA-A indicates complete injury with no preserved motor or sensory function below the neurological level. ASIA-B describes incomplete injury in which only sensory function is preserved below the neurological level. ASIA-C illustrates preserved motor function in which more than half of key muscles below the neurological level have a muscle grade < 3. ASIA-D indicates preserved motor function in which at least half of key muscles below the neurological level have a muscle grade of 3 or more. Only ASIA-A represents complete injury.

Fatigue Severity Scale (FSS) was used to assess severity of fatigue. This is a 9-item measure of fatigue developed by Krupp et al (15), it asked questions relating to how fatigue interfered with certain activities and rates its severity. It is a self-report scale that requires participants to choose the degree of agreement on a 7-point ordinal scale ranging from 1 (strongly disagree) to 7 (strongly agree). The minimum score is 9 and maximum score possible is 63. Cut scores of over 4 are indicative of significant fatigue meaning individuals with sum score of 36 and over were classified as having significant fatigue.

Spinal Cord Injury Quality of Life -23 (SCIQL-23) questionnaires was used to assess HRQoL. It was developed by Lundqvist et al (16) to examine the HRQoL in people with spinal cord lesions. It consists of 23 questions with the first 22 items categorized into three main subscales of Functioning (FUNC) which assesses the physical and social limitations. Mood state (MOOD) which assesses the psychological situation, and the third domain being problems related to injury (PROB) which evaluates the level of independence and other issues related to SCI. The last question is the question that assesses the global quality of life (GQoL). All domains' scores were transformed to make a scale range of 0-100 and only in the GQoL section; a higher score is representative of a higher QoL.

Neuropathic Pain Symptom Inventory (NPSI) was used to assess the severity of pain. It was developed by Bouhassira et al (17) to evaluate the different symptoms of neuropathic pain. It includes 12 items and an 11-point severity rating scale (from 0 to 10) is shown under each question. The evaluation of the pain is divided into five subgroups of increasing frequency with total score of all 100. It is a self-report questionnaire which has been validated for inter-user reproducibility and for sensitivity to change (18). The questionnaires were explained to the participants and administered by the researcher in cases where the participant could not fill it themselves.

All statistical analyses were performed using SPSS for Windows (IBM SPSS Statistics 20). Descriptive statistics of mean, standard deviation and

percentages was used to summarize the socio-demographic variables, neurological and severity level of injury. Spearman's rank correlation was used to determine relationships between fatigue severity, and HRQoL, year(s) since injury, neuropathic pain intensity, completeness of injury. The Kruskal Wallis test was used to determine significant difference of fatigue severity across neurological and severity level of injury and also significant difference in the HRQoL across the neurological and severity level of injury. $p \leq 0.05$ was considered as level of significance.

3.Results:

Fifty-six individuals with SCI (37 males, 19 females) aged 25 to 77 participated in the study. The mean age at injury was 46.1±16.2 year with 55.4% of the SCI resulting from trauma. **Table 1** shows the socio-demographic and selected injury-related characteristics. Half of the participants reported significant fatigue with the lowest mean score (30.3) in the MOOD domain of SCIQL-23. The range of scores obtained from each domain of SCIQL-23 is presented in **Table 2**.

Table 1: Socio-demographic and selected injury-related characteristics of the participants (N=56)

Variables	Frequency (n)	Percentage (%)
Gender		
Male	37	66.1
Female	19	33.9
Marital status		
Single	9	16.1
Married	46	82.1
Divorced	0	0
Separated	0	0
Widowed	1	1.8
Residential Area		
Urban	50	89.3
Rural	6	10.7
Educational Level		
No education	1	1.80
Primary	6	10.7
Secondary	13	23.2
Tertiary	36	64.3
Injury Level		
Cervical	26	46.4
Thoracic	14	25
Lumber	16	28.6
Severity of Injury (ASIA classification)		
ASIA A	21	37.5
ASIA B	4	7.1
ASIA C	12	21.4
ASIA D	18	32.1
ASIA E	1	1.8
Cause of Injury		
Traumatic	31	55.4
Non-traumatic	25	44.6

Table 2: showing range of scores of Health-Related Quality of Life

Variables	Minimum	Maximum	Mean	SD	Median
FUNC*	0.00	100	54.6	30.7	58.8
MOOD*	0.00	77.78	30.3	20.3	33.3
PROB*	5.55	100	61.6	24.5	66.7
GQoL	0.00	100	60.9	25.0	66.7

Key: * Higher number denotes low level of HRQoL
FUNC= Physical and social limitations
MOOD= Perception of distress or depressive feelings
PROB= Problem related to injury (such as bladder and bowel functions)
GQoL= Global Health-related quality of life

Correlation analysis between fatigue severity and each domain of SCIQL-23 as presented in **Table 3** revealed a significant correlation between fatigue severity and each of the domains of the Health-related Quality of life - FUNC ($r = 0.45$, $p= 0.001$), MOOD ($r = 0.30$, $p= 0.023$), PROB ($r= 0.44$, $p=0.001$) and GQoL ($r =-0.44$, $p= 0.001$). Furthermore, there was a significant correlation between fatigue severity and neuropathic pain ($r= 0.29$, $p= 0.03$); and between neuropathic pain and PROB ($r=-0.29$, $p=0.03$). Time since onset of injury and HRQoL in the domain of FUNC showed a positive correlation($r=-0.33$, $p= 0.01$). **Table 4** presents comparison of fatigue severity across the neurological levels and severities of injury and **Table 5** shows comparison of HRQoL across neurological levels and severities of injuries.

Table 3: the correlation between fatigue severity and Health-Related Quality of Life using Spearman's rank correlation analysis

HRQoL	R	P
FUNC	0.45	0.01*
MOOD	0.30	0.01*
PROB	0.44	0.01*
GQoL	-0.44	0.02*

***p value significant at < 0.05**

Table 4 showing Comparison of fatigue severity across neurological and severity level of injury using Kruskal Wallis test

Variables	Fatigue Severity	
	χ^2	p-value
Level of injury	0.68	0.71
Level of severity	5.13	0.27

Table 5 showing comparison of Health-related Quality of Life across neurological level of injury and level of severity of injury using Kruskal Wallis Test

Variables	FUNC	MOOD	PROB	GQoL
Level of injury				
P value	0.06	0.57	0.3	0.83
χ^2	5.67	1.13	2.10	0.66
Level of severity				
P value	0.04*	0.89	0.13	0.12
χ^2	10.2	1.13	7.22	7.24

***p is significant at < 0.05**

4. Discussion:

The findings from this study showed that half of the participants experienced fatigue that was significant enough to interfere with functional ability, thus making fatigue a major concern in half of the participants accessing physiotherapy on out-patient basis as part of their clinic rehabilitation programme. Our finding aligns with the findings in earlier descriptive studies(18,19,20) that that noted fatigue to be common and of considerable significance in daily living of people with SCI. Similar trend was also observed by Wijesuriya et al(12) who reported that people with SCI had significantly, and clinically elevated levels of fatigue compared with able-bodied controls. Furthermore, Fawkes-Kirby et al (11) observed that almost 60% of SCI outpatients have significant fatigue that interferes with function.

It was observed that of the four domains of the SCIQL-23 questionnaire, the domain of mood had the lowest mean score (30.3), denoting that the participants had a low level of distress and depressive feelings. This is the same pattern as reported by Ebrahim Zadeh et al (21) who recorded a mean score 32.68. However, the impact of SCI on the emotional and mental health domains is arguable as Middleton et al (2) reported a significant reduction in all SF-36 domains including mental health and emotional well-being. This disparity may be related to differences in outcome measure used in assessing mental health. The mean scores in the domains of physical limitations were quite higher- 54.6 and 61.6 respectively suggesting that the participants had an above average level of physical limitations which in-turn signified poorer status in HRQoL. This observation confirms prior findings of a negative HR-QoL burden associated with SCI. Most studies (2,22,23,24) have found large reductions in HR-QoL domains in physical functioning, social function, general health and vitality.

There was a positive relationship between fatigue severity and all domains of HRQoL thus, implying that fatigue is associated with poorer status of HRQoL. This corroborates the trend observed by Wijesuriya et al (12) who reported fatigue feelings to be significantly associated with general health and vitality. It was also observed in this study that fatigue was positively correlated with neuropathic pain intensity implying higher level of fatigue severity results in higher neuropathic pain intensity. This may be related to interference of pain with falling asleep and staying asleep which may conceivably contribute to fatigue feelings. Fawkes-Kirby et al(11) and Javier et al(25) reported that incomplete SCI results in more fatigue, with the explanation that individuals with incomplete injuries may attempt to complete more activities resulting in less reliance on assistive devices and caregivers. However, our study found no relationship between fatigue severity and completeness of injury.

Neurological level of injury did not have any influence on fatigue severity. This agrees with earlier studies(5,11,12) However, Javier et al (25) reported that proportion of patients with neurological level of injury at the cervical suffered significantly higher fatigue than those at the thoracic and lumber levels. The heterogeneity of the injury-related characteristics of the participants may result in the disparity of these observations. Furthermore, severity of motor and sensory impairment did not have influence on fatigue severity further emphasizing the reason we observed no correlation between fatigue severity and completeness of injury.

HRQoL in the domain of PROB (problems related to injury) had a negative correlation with year(s) since injury suggesting that individuals with shorter year(s) since injury had a poorer problems related to SCI. This is in line with the earlier studies (26,27,28) who observed that shorter time since injury was related to poorer QoL. This may be because individuals with longer year(s) since injury may have developed some adaptability over time which positively affects HRQoL. We observed that neuropathic pain influences difficulties related to SCI such as bladder, bowel problems and being independent with daily tasks. This is in line with earlier study (29) that reported an association between neuropathic pain intensity and a number of HRQoL domains resulting in greater impairments.

It has been reported that individuals with complete injury are likely to have lost more muscle strength and function thus, functional disability. However, earlier studies (4,22,30,28,31,32,33) have reported conflicting results in the association between completeness of injury and HRQoL. Some studies (4,22,30) reported a relationship between completeness of injury and HRQoL while other studies

(28,31,32,33) reported no association. However, no relationship was observed in this study. This discrepancy may be related to a number of existing co-factors that may affect HRQoL such as sociodemographic and community characteristics.

Significant difference existed in the FUNC domain of HRQoL across severities of injury suggesting that severity of injury is a determinant of physical and social limitations. Lidal et al (5) observed that persons with ASIA A to C reported lower HRQoL in physical function compared with persons with less severe injury. However, we observed that neurological level of injury is not a determinant of HRQoL. Although, a lot of discrepancies exist in literature on the relationship between HRQoL and neurological level of injury, Some studies (4,33,34) observed that individuals with paraplegia had significantly higher scores in the domain of physical function compared to tetraplegia. Seyed et al (34) reported no difference in the mental health domain of the participants irrespective of the level of injury but observed a significant difference in the physical components while other studies (21,35) showed no association between injury level and HRQoL. This discrepancy may be related to other complex variables that affect HRQoL which may make it difficult in isolating the exact relationship between injury level and HRQoL. In addition, different outcome measures used in these studies may be responsible for the discrepancy.

5. CONCLUSION:

Fatigue is of clinical significance among half of the individuals with SCI attending out-patients' clinics for rehabilitation. It is associated with neuropathic pain and affectation of HRQoL. Also, neurological level of injury and severity of injury were not associated with fatigue. Neuropathic pain and year(s) since having SCI are associated with physical, social limitations and problems related to SCI (bowel and bladder dysfunction).

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