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Prevalence and risk factor of spinal cord injury among adult population in Bangladesh

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Abstract

Spinal cord injury (SCI) is a life-threatening condition with profound physical, psychological, and socioeconomic consequences. Globally, young and middle-aged adults are most affected, primarily due to road traffic accidents and falls. In Bangladesh, limited evidence exists on patient profiles. This study examined the prevalence, risk factors, and clinical characteristics of SCI among adults. A cross-sectional study was conducted among 200 patients with traumatic SCI admitted to specialized rehabilitation centers in Bangladesh. Data on demographics, lifestyle, driving behaviors, and clinical features were collected using structured questionnaires and medical records. Descriptive and inferential statistics were applied. SCI predominantly affected men (72.5%), especially those aged 28–37 years. Students (23.0%) and service holders (21.0%) were the most affected occupational groups, and 60.5% were married. Lifestyle risks were frequent, with 59.5% smoking and nearly half exercising irregularly. Road safety issues were common, with over half lacking helmets or valid licenses. Clinically, 43.5% had chronic diseases, 44.5% experienced widespread pain, and 57.5% reported pain moving across the body. SCI in Bangladesh disproportionately affects men in their most productive years, driven by unsafe driving, lifestyle risks, and limited rehabilitation access. Strengthening road safety enforcement, promoting lifestyle modification, and expanding integrated rehabilitation services are critical to reducing disability and improving quality of life.

Keywords: Spinal cord injury; Bangladesh; Risk factors; lifestyle; Road safety; Rehabilitation

1. Introduction

In the South-Asia region, Bangladesh is a developing country with a population of about 169.8 million, according to the Population and Housing Census 2022 by the Bangladesh Bureau of Statistics (BBS). Spinal cord injury (SCI) is a devastating condition with life-threatening implications, contributing significantly to premature mortality, long-term disability, and reduced quality of life worldwide [1-3]. SCI affects mostly young and middle-aged adults, and recovery depends on the type and severity of the lesion, rehabilitation time, and individual performance in completing everyday tasks [4, 5]. The most traumatic spinal cord injuries (SCIs) are caused by falls from height or road traffic accidents, a trend consistently observed across epidemiological studies [6, 7]. In 2019 there were approximately 0.9 million new SCI cases, with more than 20 million people living with SCI worldwide, and over 6 million years lived with disability (YLDs) [1]. Similarly, Liu et al. [8] confirmed that falls remain the predominant cause of SCI globally, surpassing road traffic accidents in most regions. Looking forward, Qin et al. [3] projected that the global prevalence and disability-adjusted life years attributable to SCI will continue to rise through 2036, underscoring the urgent need for preventive strategies and stronger health system responses.

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SCI has a profound impact on many aspects of life, including physical, mental, domestic, and social functions [9]. Spinal cord injured patients usually suffer from various secondary complications. Among them, pressure sores, urinary issues, sexual dysfunction, and bowel and bladder problems are most common. Some are preventable, while others require re-hospitalization, leading to disability, dependence, morbidity, and mortality [9].

Different studies have been conducted in both developing and developed countries to find out the causes and characteristics of SCI, and it seems that these depend on geographic area and socioeconomic status. For example, Barbiellini Amidei et al. [9] reported a stable incidence rate of ~26.5 per million in a European cohort, while in Bangladesh, Uddin et al. [10] found that falls (42.1%) and road traffic accidents (27%) were the leading causes of SCI among 3,035 patients, with an average age of 38.3 years and a strong male predominance (2.5:1). Life expectancy after SCI is markedly reduced due to secondary complications, severity of injury, social deprivation, and lack of proper rehabilitation [11, 12]. Evidence from Cripps et al. [13] showed that the global prevalence of SCI was between 236 and 1,009 per million, which was similar to a result found in 1995 by Bulmer and Quince (about 110–1,120 per million of population). More recently, studies from Bangladesh demonstrate the ongoing rehabilitation challenges. Das et al. [14] found that rehabilitation at the Centre for the Rehabilitation of the Paralyzed (CRP) significantly improved functional independence, though outcomes were better for incomplete injuries, while Ullah et al. [15] highlighted barriers to work reintegration for SCI survivors, ranging from physical limitations to social discrimination. At the same time, innovative therapeutic approaches, including regenerative strategies, are being explored globally [16], pointing toward the need for integrating both conventional and advanced solutions in SCI management.

The current study was aimed at examining the demographic profile of spinal cord injury (SCI) patients and identifying the factors influencing the causes of injury across different divisions of Bangladesh. This will help to determine the etiology, risk factors, and preventive measures. Approximately 80% of patients with an A-type injury remain within this classification; 10% convert to a B-type injury, and another 10% to a C-type injury [17]. Among these, only about 14% achieve some aided gait capacity. Patients with B-type injury are considered to have a 33% chance of gaining gait capacity, C-type patients approximately 75%, while D-type patients generally have a very good prognosis, with most able to walk within one year post-injury [4, 5].

Studies have further observed that range of movement exercises significantly improve daily functional capacity [18], prevent contractures, protect the tenodesis effect [19], strengthen paralyzed muscles, promote nerve and cerebral remodeling, and enhance the spinal microenvironment and functional prognosis [20]. Exercise also plays an important role in strengthening the muscles of the upper limbs, with particular emphasis on shoulder rotation for the use of crutches or a wheelchair. Such exercises contribute to mobility and independence in daily life. For patients with incomplete SCI, the walking potential is high, and activities such as sitting balance training, parallel bar exercises, and other balance-focused exercises are strongly encouraged [19].

Kang et al. [21] stated that SCI is a highly disabling injury; it not only can lead to damage or loss of sensation and motor function, but also may result in multiple organ dysfunction. The traumatic SCI is characterized by an immediate, irreversible loss of tissue at the lesion site, followed by secondary expansion of tissue damage over time [22]. No effective treatment options currently exist to prevent secondary injury. Excessive release of the chemical ATP at the time of injury plays a role in secondary injury. Peng et al. [22] and Cadotte and Fehlings [23] noted that epidemiologic research has demonstrated that SCI affects 10 to 40 persons per million population per annum in developed countries such as the United States. In either case, the consequence of neurologic injury is overwhelming and has prompted intense research to understand the pathophysiological mechanisms and discover potential therapeutic strategies [23].

Chevalier et al. [24] reviewed the literature concerning psychological adjustment to SCI, focusing on recent methodological developments and new directions in research. People with SCI are also found to be more vulnerable to suicide than the general population [24]. Peter et al. [25] noted that SCI involves severe physical, social, and psychological consequences. The study aimed to examine the demographic and clinical profile of SCI patients to identify the key risk factors and causes of injury across divisions, in order to inform preventive and rehabilitative strategies.

2. Methodology

The study population consisted of adult patients with clinically confirmed spinal cord injury, and purposive sampling was used to recruit those who met the eligibility criteria and were available during the study period. Patients aged 18 years and above with a diagnosis of traumatic SCI were included, while those with non-traumatic SCI, severe cognitive impairment preventing communication, or unwillingness to provide informed consent were excluded. A total of 200 patients participated in the study. Data were collected using a structured questionnaire that obtained information on socio-demographic characteristics such as age, sex, marital status, education, occupation, and residence, along with

lifestyle and behavioral factors including smoking, physical activity, and use of protective measures such as helmets. Clinical information regarding the type and severity of injury, level of lesion, and secondary complications was also collected, and this was supplemented with data from medical records where available. The questionnaire was pre-tested prior to the study to ensure clarity, reliability, and validity, and necessary adjustments were made before final use. Ethical approval was obtained from the appropriate institutional review board, and informed consent was taken from all participants after explaining the study purpose, procedures, and confidentiality assurances. Participation was voluntary, and respondents were assured of their right to withdraw at any stage without consequence.

3. Data Analysis

Collected data were coded, entered, cleaned and analyzed using statistical software SPSS. Descriptive statistics such as frequencies, percentages, means, and standard deviations were calculated to summarize socio demographic and clinical characteristics of the respondents.

4. Ethical Aspects

Informed consent was taken by discussing the purpose, objectives, and procedures of the study, and written informed consent was obtained. Participation of respondents was voluntary and they were assured of their right to withdraw at any stage without penalty. Privacy and confidentiality were maintained properly by assigning identification codes instead of names and by securely storing both hard copy and electronic data. Sensitive information was handled with care, and data were used exclusively for research purposes. The study ensured that there was no physical or psychological harm to participants, and interviews were conducted in a respectful and non-intrusive manner.

5. Result

The socio-demographic distribution of the 200 respondents is presented in Table 1. The age of participants ranged from 18 to 67 years, with a mean score of 2.57 ± 1.11 on the coded scale. The largest proportion of respondents (34.5%) were aged between 28 and 37 years, followed by 27.0% in the 38–47 years group, indicating that SCI was most prevalent among individuals in their prime working and economically productive years. With respect to gender, the majority of respondents were male (72.5%), while females accounted for 27.5%, with a mean coding score of 1.28 ± 0.45 . This suggests that men are more vulnerable to spinal cord injury, which may be linked to higher engagement in outdoor activities, occupational hazards, and road traffic exposure.

In terms of occupational status, students represented the highest proportion (23.0%), followed by service holders (21.0%) and housewives (17.0%), with a mean coding score of 3.56 ± 1.89 . The notable proportion of students indicates that young adults are a particularly vulnerable group. Regarding marital status, 60.5% of respondents were married and 39.5% were single, with a mean coding score of 1.61 ± 0.49 . Married individuals appeared to be more affected, possibly reflecting broader age coverage and household responsibilities.

Religious affiliation showed that 85.5% of respondents were Muslim, 14.0% were Hindu, and only 0.5% were Christian, which corresponds with the overall demographic distribution of religion in Bangladesh. The mean score for religion was 1.15 ± 0.37 . Educational attainment revealed that the majority of respondents were graduates (40.5%), followed by higher secondary certificate (HSC) holders (22.5%), while 13.0% had only primary-level education. The mean coding score was 3.27 ± 1.21 , indicating that SCI affected people across all education levels, with a higher representation among those with graduate-level education.

Table 2 shows the lifestyle and behavioral characteristics of the respondents. Nearly half of the participants (49.5%) reported doing exercise sometimes, while 36.5% never exercised and only 14.0% exercised regularly, suggesting that lack of consistent physical activity is common among SCI patients. More than half of the respondents (59.5%) were smokers, which may increase vulnerability to complications and slow recovery. Regarding posture, over half (56.0%) reported leaning forward sometimes in daily activities, while 19.0% did so regularly and 25.0% never, indicating a common physical strain pattern. In terms of driving behavior, about half (49.5%) reported going on long drives sometimes, 18.5% regularly, and 32.0% never. These findings highlight that irregular exercise, high smoking prevalence, frequent leaning forward, and long driving practices may act as contributing lifestyle factors to spinal cord injury.

Table 1 Socio-demographic characteristics of respondents (n = 200).

Variable	Category	Frequency (%)	Mean ± SD
Age (years)	18-27	35 (17.5)	2.57 ± 1.11
	28-37	69 (34.5)	
	38-47	54 (27.0)	
	48-57	31 (15.5)	
	58-67	11 (5.5)	
Gender	Male	145 (72.5)	1.28 ± 0.45
	Female	55 (27.5)	
Occupation	Service holder	42 (21.0)	3.56 ± 1.89
	Housewife	34 (17.0)	
	Teacher	20 (10.0)	
	Worker	24 (12.0)	
	Business	34 (17.0)	
	Student	46 (23.0)	
Marital status	Single	79 (39.5)	1.61 ± 0.49
	Married	121 (60.5)	
Religion	Islam	171 (85.5)	1.15 ± 0.37
	Hinduism	28 (14.0)	
	Christian	1 (0.5)	
Education	Primary	26 (13.0)	3.27 ± 1.21
	SSC	24 (12.0)	
	HSC	45 (22.5)	
	Graduate	81 (40.5)	
	Masters	24 (12.0)	

Table 2 Lifestyle and Behavioral Characteristics of Respondents (n = 200).

Variable	Category	Frequency (%)	Mean ± SD
Daily Exercise	Sometimes	99 (49.5)	1.87 ± 0.92
	Regular	28 (14.0)	
	Never	73 (36.5)	
Smoking	Yes	119 (59.5)	1.41 ± 0.49
	No	81 (40.5)	
Lean Forward Everyday	Sometimes	112 (56.0)	1.69 ± 0.85
	Regular	38 (19.0)	
	Never	50 (25.0)	
History of Long Drive	Sometimes	99 (49.5)	

	Regular	37 (18.5)	
	Never	64 (32.0)	1.83 ± 0.89

Table 3 presents the driving and road safety characteristics of respondents. A majority of participants (61.5%) reported not having a valid driving license, while 38.5% did. Similarly, just over half of the respondents (51.5%) reported not wearing helmets during driving, and an equal proportion (51.5%) had no driving experience. Awareness of traffic rules was relatively higher, with 55.0% reporting knowledge of traffic rules compared to 45.0% who did not. In addition, 41.5% of respondents reported having a history of accidental injury. These findings suggest that limited driving experience, lack of license use, and poor adherence to helmet use may contribute to the increased risk of spinal cord injury, while a considerable proportion of patients also reported accident-related trauma.

Table 3 Driving and Road Safety Characteristics of Respondents (n = 200).

Variable	Category	Frequency (%)	Mean ± SD
Driving License	Yes	77 (38.5)	
	No	123 (61.5)	1.62 ± 0.49
Wearing Helmet	Yes	97 (48.5)	
	No	103 (51.5)	1.52 ± 0.50
Driving Experience	Yes	97 (48.5)	
	No	103 (51.5)	1.51 ± 0.50
Traffic Rules Known	Yes	110 (55.0)	
	No	90 (45.0)	1.45 ± 0.50
Accidental Injury	Yes	83 (41.5)	
	No	117 (58.5)	1.59 ± 0.49

Table 4 illustrates the clinical and health characteristics of the respondents. The majority (78.0%) reported no disability, while 22.0% had some form of disability. Similarly, 56.5% had no chronic disease, whereas 43.5% did. Spinal cord-related pain was reported by 38.5% of respondents, and 38.0% acknowledged a history of spinal cord injury or hurt. Pain in the whole body was noted by 44.5%, and 57.5% indicated that pain often moved to different parts of the body. Regarding treatment-related characteristics, 43.0% of respondents reported having used steroids, 64.0% used calcium supplements, and 51.0% took other supplements. Overall, these findings indicate that a substantial proportion of patients face comorbid conditions, widespread pain, and reliance on supplements, which may complicate recovery and long-term management of spinal cord injury.

Table 4 Clinical and Health Characteristics of Respondents (n = 200).

Variable	Category	Frequency (%)	Mean ± SD
Disability	Yes	44 (22.0)	
	No	156 (78.0)	1.78 ± 0.42
Chronic Disease	Yes	87 (43.5)	
	No	113 (56.5)	1.57 ± 0.50
Spinal Pain	Yes	77 (38.5)	
	No	123 (61.5)	1.62 ± 0.49
Spinal Cord Injury	Yes	76 (38.0)	
	No	124 (62.0)	1.62 ± 0.49

Pain in Whole Body	Yes	89 (44.5)	
	No	111 (55.5)	1.56 ± 0.50
Pain Moves Location	Yes	115 (57.5)	
	No	85 (42.5)	1.43 ± 0.50
Steroid Use	Yes	86 (43.0)	
	No	114 (57.0)	1.57 ± 0.50
Calcium Supplement	Yes	128 (64.0)	
	No	72 (36.0)	1.36 ± 0.48
Other Supplements	Yes	102 (51.0)	
	No	98 (49.0)	1.36 ± 0.48

6. Discussion

Spinal cord injury (SCI) is a devastating condition that, while relatively uncommon compared to other spinal pathologies, carries severe health, social, and economic consequences. Earlier surveys of spinal surgeons have shown that most specialists treat fewer than ten acute SCI patients annually, and very few encounter more than one or two cases per month [23]. Despite its lower incidence compared to other injuries, the severity of the neurological deficits and the lifelong burden justify the need for comprehensive prevention and management strategies. The present study contributes to this need by describing the demographic, lifestyle, and clinical profiles of 200 SCI patients in Bangladesh.

The SCI predominantly affected individuals aged 28–37 years and mostly occurs during the most productive years of life. This is consistent with Uddin et al. [10], who analyzed 3,035 SCI cases in Bangladesh and reported an average age of 38.3 years, with the most affected group being 18–30 years (33.4%). They also found that males were 2.5 times more affected than females, and falls (42.1%) together with road traffic accidents (27%) were the leading causes of traumatic SCI.

This is consistent with global evidence showing that the majority of SCI cases occur among young and middle-aged adults in their most productive years [14]. For example, Cripps et al. [13] estimated global SCI prevalence at 236–1,009 per million, with higher risks among young people engaged in work or travel. Similarly, Grassner et al. [7] reported that occupational and road-related injuries are the leading causes among individuals in their late 20s and 30s. In Bangladesh, rapid urbanization and unsafe road conditions further expose this age group to heightened risks of traumatic injuries.

A striking male predominance (72.5%) was observed in this study, aligning with previous literature. Recent studies consistently demonstrate that men are disproportionately affected by SCI, largely due to their greater involvement in hazardous occupations, physically demanding labor, and risk-taking behaviors. A global meta-analysis found that men are more than three times as likely to sustain SCI as women, primarily due to exposure to risky work and unsafe practices [8]. Regional studies reinforce this pattern: in India, men were 4.3 times more likely to experience SCI, with agricultural and manual labor jobs being the main risk contexts [26], while a Chinese trauma center reported a 2.8:1 male-to-female ratio, highlighting unsafe driving and occupational hazards as dominant contributors [27].

In low- and middle-income countries (LMICs) like Bangladesh, men are also more frequently involved in road traffic, which increases exposure to accidents—the leading cause of traumatic SCI [10]. Sociodemographic patterns revealed that students and service holders were disproportionately affected, and graduates represented the highest education group. This suggests that SCI does not only impact disadvantaged populations but also significantly affects educated, economically active individuals. This is concerning because it indicates potential long-term socioeconomic losses for families and communities, echoing findings from Tator and Koyanagi [11], who noted reduced life expectancy and productivity following SCI. Married individuals were also more commonly affected, which could be explained by their broader age coverage and involvement in work and family-supporting responsibilities.

Lifestyle behaviors were strongly linked to SCI outcomes in this study. Almost half of the respondents exercised irregularly, and more than half were smokers. These patterns are concerning, as physical inactivity contributes to muscle weakness and contractures, while smoking exacerbates secondary complications and impairs recovery [18, 20]. High rates of smoking and physical inactivity in our cohort align with findings from Haldemann et al. [29], who

documented clusters of poor lifestyle behaviors—including obesity, poor diet, smoking, alcohol use, and inactivity—among newly injured SCI patients.

Similar findings were reported by Gorgey [20], who emphasized the role of structured exercise in improving functional prognosis, and by Robertson et al. [19], who noted the protective role of activity in preventing contractures. Frequent forward-leaning posture and prolonged driving practices, reported by many respondents, may further exacerbate spinal stress and pain, aggravating the course of SCI. Driving and road safety characteristics also highlight critical concerns. The majority of respondents lacked a valid license, half reported not wearing helmets, and over half had no prior driving experience or awareness of traffic rules. Notably, 41.5% reported accidental injuries as a cause of SCI. These findings are consistent with data from the World Health Organization indicating that road traffic accidents are a leading cause of SCI in LMICs, including Bangladesh (WHO, 2013). Alizadeh et al. [28] also noted that traumatic SCI is often initiated by road accidents, followed by secondary damage. Poor enforcement of traffic safety laws, inadequate driver training, and low helmet use in Bangladesh exacerbate these risks.

Clinically, a significant proportion of respondents reported chronic diseases, widespread pain, and secondary complications such as spinal cord hurt and pain radiating to other body parts. Similar patterns were reported by Cadotte and Fehlings [4], who showed that long-term complications often outweigh the initial trauma in contributing to morbidity. The reliance on steroids, calcium, and other supplements among many respondents also highlights gaps in structured rehabilitation, with patients resorting to ad hoc treatments. Tardivo et al. [5] emphasized that while rehabilitation is central to recovery, inadequate access in LMICs leads to incomplete outcomes and prolonged disability. The psychosocial burden of SCI is equally significant. Although not directly measured in this study, earlier research demonstrates elevated levels of depression, anxiety, and maladaptive coping strategies among SCI patients [24]. Peter et al. [25] further noted that SCI increases risks for post-traumatic stress disorder, substance abuse, and suicide. These findings underline the importance of integrating psychological support with physical rehabilitation in Bangladesh.

In summary, the present study shows that SCI in Bangladesh disproportionately affects young, male, educated, and economically active individuals. Lifestyle factors such as smoking and inactivity, combined with unsafe driving behaviors, contribute significantly to injury occurrence. Clinically, patients face persistent pain, comorbidities, and widespread reliance on supplements, reflecting inadequate access to evidence-based rehabilitation. These findings align with global evidence but highlight country-specific concerns such as weak traffic enforcement and gaps in rehabilitation infrastructure. Addressing these issues requires a multifaceted approach, including injury prevention programs, road safety enforcement, lifestyle modification campaigns, and expanded access to structured rehabilitation services tailored to the Bangladeshi context.

7. Conclusion

Spinal cord injury (SCI) seriously influences life of patients and is an intractable global health problem nowadays. The long-term effects may be ameliorated by good medical, psychological, and rehabilitative care, but at great cost. SCI arises from an external physical force like a motor vehicle accident, fall, sports injury, or assault that causes acute injury to the spinal cord. The physicians caring experience in diagnosis and communication skills for dissemination of information is important to convey difficult prognostic information with compassion and clarity to patients and their families. The findings of this study contribute to effective planning and management of SCI cases.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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