# Early Care following Traumatic Spinal Cord Injury (TSCI) in a Rehabilitation Centre in Bangladesh - An Analysis

Abu Toha Md A Razzak*


## *ABSTRACT*

***Purpose:*** *The study aimed to explore the outcome of current practices in the treatment of persons with traumatic spinal cord injuries (TSCI) in Bangladesh, through the stages of rescue and first contact with physician, transportation to the tertiary hospital and intermediate admission.*

***Method:*** *This observational study was conducted between June and August 2011, at the Centre for the Rehabilitation of the Paralysed (CRP), in Dhaka, Bangladesh. From the 113 persons with SCI admitted at CRP during this period, 56 persons with TSCI were selected. With the help of a questionnaire, data were collected from these persons or their attendants by trained staff, and also taken from hospital records. Data were processed and analysed by SPSS software version 16.*

***Results:*** *The male-female ratio among the study participants was 5.25: 1, with a mean age of 33.02 years. 55.3% of them were paraplegic, while 44.7% were tetraplegic. About 70% of the injuries were complete according to ASIA impairment scale (AIS) during admission at CRP.*

*The most common causes of injury were falls (50%), followed by road traffic accidents (RTA) and carrying loads on the head. 74.8% of the injured persons had been rescued from the accident site by local people but only 16.1% had been transported by ambulance. The spine board had never been used. More than half of the injured received initial treatment only at a sub-district or district hospital where none of the requisite facilities were available.*

*While being transported from one hospital to the other, 10.7% experienced neurological deterioration of some sort. Significant statistical correlation was found between mode of transfer (P <0.03) and intermediate admission (P<0.001) with neurological deterioration.*


* **Corresponding Author:** Consultant–Spine Surgeon, CRP, Savar, Dhaka, Bangladesh.
Email:mabegum1971@gmail.com

***Conclusions:*** *There is an urgent need to implement pre-hospital trauma care in Bangladesh. Since resources and places for the rehabilitation of persons with TSCI are scarce, regional and national spinal injury centres should be established without delay.*

***Limitations:*** *The study focussed only on a small sample of persons with TSCI undergoing treatment at a single centre.*

***Key words:*** *paraplegia, tetraplegia, developing country, traumatic spinal cord injury, pre-hospital care, Bangladesh*

## INTRODUCTION

Traumatic spinal cord injuries are life-changing events. The combination of consequent general physiological impairment, multisystem malfunction, disabilities, a wide range of potential complications, and sensory impairment, together with the non-medical effects, presents challenges to affected persons, carers, and clinicians (El Masri(y), 2006). Early care of TSCI includes safe evacuation of the injured from the site, examination and spinal immobilisation, careful airway management and cardiovascular support, followed by speedy transfer to a definitive care centre.

The treatment of spinal cord injury (SCI) spans multiple disciplines, from pre-hospital immobilisation through surgical care to rehabilitation strategies. Those with acute SCI face the risk of neurological deterioration due to secondary injury to the spinal cord. Any advances in the spectrum of care, from pre-hospital stabilisation to long-term rehabilitation, will greatly improve the quality of their lives. Identifying inconsistencies and integrating advances along this spectrum of care will certainly benefit the long-term outcome of persons with SCI (Fehlings et al, 2011).

The cause of the trauma, mode of transportation, time taken to reach the hospital and the resources available for treatment chiefly determine SCI outcome. Pre-hospital trauma care, first aid at site and infrastructure for transport of persons with spinal trauma are inadequate in most of the developing countries (Nguyen et al, 2008).

Bangladesh is a densely populated developing country in Asia, with 964 persons per square km (Bangladesh Bureau of Statistics, 2011). There is no established pre-hospital trauma care and no published data yet regarding the magnitude

of TSCI in the country. However, a total of 407 persons with SCI were admitted in the Centre for the Rehabilitation of the Paralysed (CRP) during the period between July 2011-June 2012 (CRP, 2012). For the last 33 years, CRP has been the only centre to offer rehabilitation services for persons with SCI in Bangladesh. This study aimed to explore the current methods employed in the rescue and pre-hospital care of the injured, such as the mode of transportation from the site of injury, the first contact with a physician, the time taken to reach the tertiary hospital, intermediate admission and its outcome for persons with traumatic SCI in Bangladesh.

## METHOD

### Study Sample

This was an observational study conducted from June to August 2011, focussed on persons with TSCI from all over Bangladesh who were admitted at CRP, either directly or referred from other hospitals. Interviews were conducted by the trained resident medical officer and the research assistant, and information was subsequently recorded in a questionnaire. Base-line information was collected at the time of admission, followed by data collection every week and again at the time of discharge. The demographic, etiological and other data were supplied by the study participants or their attendants. Neurological findings and clinical data were gathered from the hospital records. The data was cross-checked for any ambiguity by the author.

### Definition and Classifications

Traumatic SCI (TSCI) is defined as an acute, traumatic lesion of the spinal cord, with varying degrees of motor and/or sensory deficit or paralysis (Kraus et al, 1975). Although injuries of cauda equina were included, the definition excluded isolated injuries of other nerve roots.

The study sample consisted of 56 persons with TSCI, selected from among 113 persons with SCI who were undergoing treatment at CRP during this period. The inclusion and exclusion criteria were:

Inclusion criteria: (1) Persons of any age and sex; (2) Persons with acute traumatic spinal cord or cauda equina lesion; (3) Persons with neurological impairment lasting more than 1 week; and (4) Persons who gave informed consent to participate in the study.

Exclusion criteria: (1) Persons readmitted or with chronic SCI; (2) Persons with non-traumatic injuries; (3) Persons with isolated nerve root injuries; (4) Persons who were brought dead to hospital; (5) Persons with impairment lasting less than 1 week; and (6) Persons with SCI who had traumatic brain injury (TBI).

The causes of injury were defined according to the International SCI core data set (DeVivo et al, 2006). The level and extent of SCI was defined according to the International Neurological Classification of Spinal Injury using the American Spinal Injury Association Impairment (ASIA) scale (Maynard et al, 1997). The scale measures 5 levels of sensory and motor impairments, between A (showing complete impairment with no sensory or motor functioning) and E (no impairment, normal sensory and motor functioning).

### Statistical Analysis

Descriptive data were presented as n (%), mean, median and standard deviation (s.d). The level of significance was set at $P<0.05$. Statistical mean differences between variables were determined by Chi-Square test. For ordinal variables or in cases of non-normal distribution, the Mann–Whitney test was used. All statistical analyses were performed using the SPSS software version 16.

## RESULTS

### Demographic Details

Of the 56 participants, 84.0% were male and 16.0% were female, with a male-female ratio of 5.25:1. Mean age at injury was 33.02±13.5 years (range of 13–70 years). The age distribution peaked at the 16-30 years group which accounted for 46.43%. Children comprised 5.4% of the participants. Almost half (48.3%) of the participants were day labourers/farmers and 55.4% had very low monthly incomes (less than 5000 Tk. <62 $) (Table 1).

**Table 1: Characteristics of participants (N=56)**

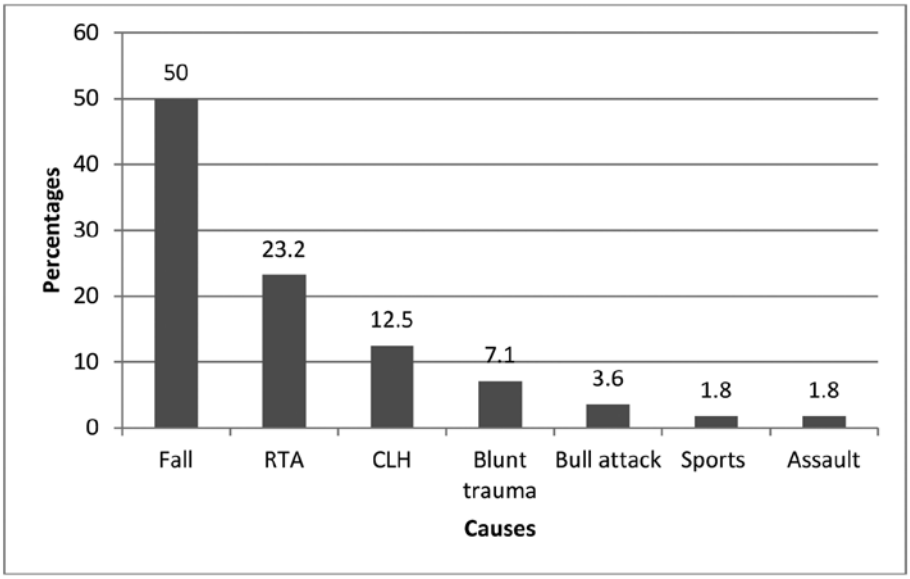
| Point | N | % |
|---|---|---|
| **Age at injury** (in years) | | |
| 0–15 | 3 | 5.4 |
| 16–30 | 26 | 46.4 |
| 31–45 | 16 | 28.6 |
| 46–60 | 10 | 17.8 |
| 61–75 | 1 | 1.8 |
| **Gender** | | |
| Male | 47 | 83.9 |
| Female | 9 | 16.1 |
| **Occupation before injury** | | |
| Farmer/Day labourer | 27 | 48.3 |
| Services/Business | 9 | 16.0 |
| Retired person | 2 | 3.6 |
| Housewife | 4 | 7.1 |
| Unemployed | 14 | 25.0 |
| **Monthly family income** | | |
| Less than 5000 Tk. | 31 | 55.4 |
| 5000 Tk-10000 Tk. | 18 | 32.1 |
| >10000 Tk. | 7 | 12.5 |

**Causes of Injury**

The leading causes of injury were falls, accounting for 50% of the injured. This included low falls (<1 m) for 10.7%, high falls (1-5m) for 7.1%, and high energy falls (>5 m) for 82.2%. High energy falls consisted of falls from trees (64.3%), from roofs (12.2%), and from electric poles/construction work (23.5%).

Road traffic accidents (RTA) were the second most common cause of TSCI at 23.2%, while carrying loads on the head was next at 12.5%. Some less common causes are shown in Figure 1.

**Figure 1: Causes of injury**

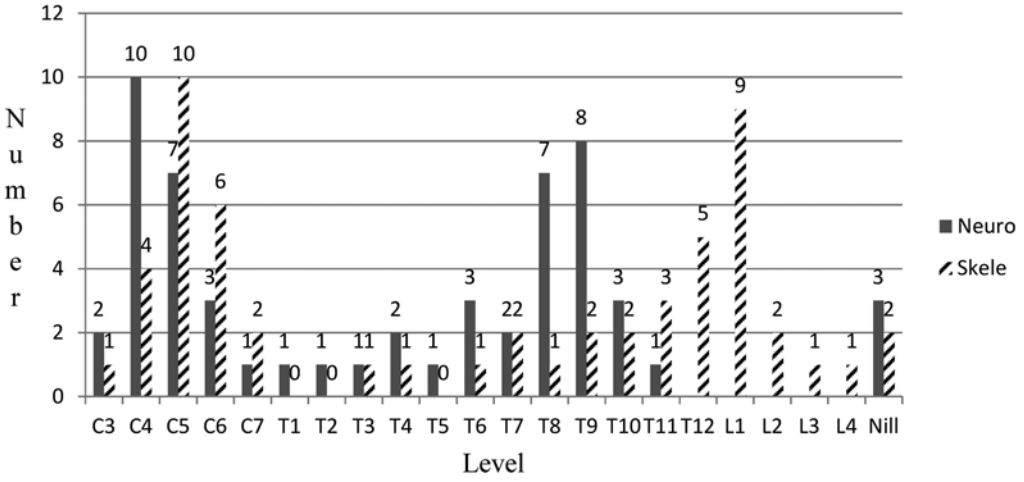



RTA- Road Traffic Accident; CLH – Carrying Load on Head

## Level and severity of injury

Out of 56 persons with TSCI, 44.7% had injuries at cervical, 17.85 % at thoracic, 30.35% at thoraco-lumbar and 7.14% at lumbar regions.

**Figure 2: Neurological (neuro) and skeletal (skele) level of TSCI**



Cervical 5 was the most common (18.5%) and Lumbar 1 was the second common (16.2%) single vertebral level. This study found thoraco-lumbar junction (T11-L2) had the highest (54%) skeletal involvement (Figure 2). However, overall 69.7% of the persons had complete and the rest 30.3% had various grade of incomplete injury (Table 2) according to ASIA impairment scale (AIS) on admission.

**Table 2: ASIA scale on admission (N=56)**

| Neurological Level | ASIA-A N (%) | ASIA-B N (%) | ASIA-C N (%) | ASIA-D N (%) | Total N (%) |
|---|---|---|---|---|---|
| C1-C4 | 10 (17.8) | 1 (1.8) | 2 (3.6) | 2 (3.6) | 15 (26.8) |
| C5-C8 | 4 (7.2) | 2 (3.6) | 3 (5.3) | 1 (1.8) | 10 (17.8) |
| T1-S5 | 25 (44.7) | 2 (3.6) | 3 (5.3) | 1 (1.8) | 31 (55.4) |
| Total | 39 (69.7) | 5 (8.9) | 8 (14.3) | 4 (7.1) | 56 (100) |

**Mode of Early Care**

None of the persons with TSCI were rescued from the accident site by trained health personnel. 74.8% of the injured were rescued by their relatives or by local people, 17.9% by co-workers and 7.1% by others. 71.4% were conveyed from the site to their first contact physician by conventional three-wheeler transport (7.1% by rickshaw, 17.9% by van, 21.4% by easy bike and 25% by motorised rickshaw or *tempu*). Only 16.1% of the injured were transported by ambulance and 12.5% either by private car or public transport. The spine board had not been used while the injured were being moved.

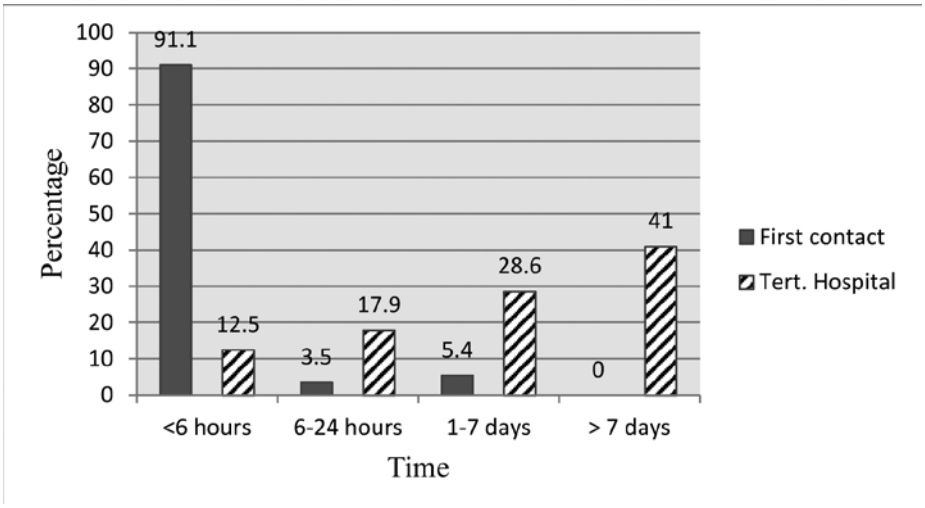
It was found that 55.4% of the injured received their first treatment at either a sub-district or district hospital where none of the required facilities were available. Only 32.1% were taken to tertiary hospitals where SCI management was available but there was no provision for rehabilitation. 12.5% of the injured were first treated by quacks or traditional healers who employed methods of heat treatment to recover sensation and muscle power, resulting in burnt skin.

**Table 3: Mode of early care (N=56)**

| Topics | N (%) | P value |
|---|---|---|
| **Transportation** | | 0.023 |
| By ambulance | 9 (16.1) | |
| Other than ambulance | 47 (83.9) | |
| **First contact physician** | | 0.22 |
| Tertiary hospital | 18(32.1) | |
| Sub-district/District hospital | 31(55.4) | |
| Others (quack, traditional healer) | 7(12.5) | |
| **Intermediate admission** | | 0.001 |
| Direct at CRP | 6 (10.7) | |
| Single admission | 23 (41.1) | |
| Double admission | 15 (26.8) | |
| Triple or more | 12 (21.4) | |
| **Neurological deterioration** | | -- |
| Yes | 6 (10.7) | |
| No | 50 (89.3) | |

Only 10.7% of the injured were admitted directly to CRP where comprehensive SCI management was available. Most of them (89.3%) were admitted elsewhere before they were brought to CRP (Table 3). While being transported from one hospital to the other, 6 persons (10.7%) experienced some neurological deterioration.

**Figure 3: Time lapse between first contact with physician and tertiary hospital**



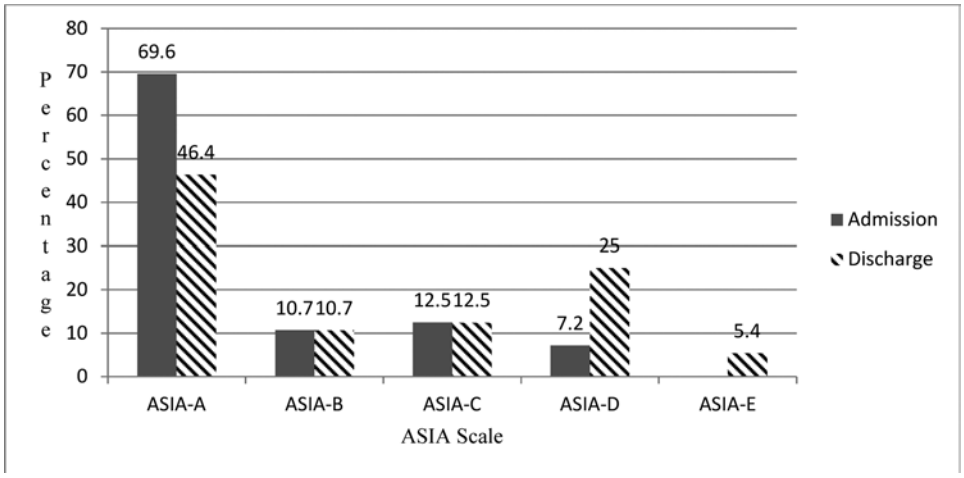
## Time lapse between first contact with physician and specialised hospital

Within 24 hours of injury, 94.6% of the injured reached their first contact physician, whereas only 30% reached a tertiary/specialised hospital for treatment (Figure 3). There was an average delay of 22 days in presentation to the spinal rehabilitation centre after trauma.

## Outcome of rehabilitation

One of the participants died at this centre during the course of the treatment and 2 others were referred to another hospital for management of uncontrolled complications. The remaining 53 participants completed their comprehensive rehabilitation over an average of 114 days, by which time 28.6% had achieved neurological improvement of various grades (Figure 4).

**Figure 4: Admission and discharge ASIA scores**




Discharge neurological status (ASIA scores) showed statistical significant association with mode of transport ($P<0.023$), number of intermediate admissions ($P<0.001$) and monthly income ($P<0.001$).

At the time of discharge, 11 persons (20.8%) did not need any assistive device, 26 (49.1%) needed wheelchairs, and 5 (9.4%) needed wheelchairs along with back slabs for mobility. Minimal support for locomotion was needed by 11 persons (20.8%), in the form of elbow crutches for 8 (15.1%) and walking frames for 3 (5.7%) of them.

45 participants (84.9%) reported having at least one complication during the rehabilitation period. Table 4 shows the frequency of common medical complications.

**Table 4: Common medical complications during rehabilitation (N=53)**

| Complications | No. of persons | % |
|---|---|---|
| Spasticity | 28 | 52.8 |
| UTI | 12 | 22.6 |
| Pressure ulcer | 4 | 7.5 |
| Pain | 24 | 45.2 |
| Depression | 9 | 16.9 |
| Dependent edema | 16 | 30.1 |
| No complication | 8 | 15.0 |

UTI-Urinary tract infection

## DISCUSSION

SCI may occur within seconds but the devastating effects can last a lifetime. In Bangladesh, people live under conditions that make them vulnerable to TSCI. Though the burden of TSCI is not known, different studies have explored the many epidemiological characteristics (Islam et al, 2011; Razzak et al, 2011; Hoque et al, 2012). This study found that males (84%) are predominantly affected by TSCI. Three-fourths (75%) of the injured were in the economically productive age group of 16-30 and 31-45 years. As a result, SCI has a negative impact on families as well as the national economy of Bangladesh. Both age and gender have nearly the same distribution as seen in other studies on developing and developed countries (Pandey et al, 2007; Rathore et al, 2008; Islam et al, 2011; Ning, 2011; Razzak et al, 2011; Hoque et al, 2012).

Falling from heights was found to be the leading cause of injury (50%) in this study. Other studies on SCI in Bangladesh (Islam et al, 2011; Razzak et al, 2011; Hoque et al, 2012) and in many developing countries also showed fall as the prime cause of injury: 56.9% in China (Ning, 2011), 48.33% in India (Pandey et al, 2007) , and 48% in Pakistan (Rathore et al, 2008). This study found road traffic accidents (23.2%) to be the second most common cause of TSCI. The reverse is

true for developed counties where RTA is the leading cause of TSCI followed by fall (Divanoglou et al, 2010). All the earlier studies in Bangladesh (Islam et al, 2011; Razzak et al, 2011; Hoque et al, 2012) found carrying loads on the head was the second most common cause of injury, but in this study it was the third (12.5%) most common cause. However this etiological change reflects the fact that the road safety situation in Bangladesh has been deteriorating, with an increasing number of road accidents in recent years (Biswas et al, 2012).

It was found that none of the participants were rescued by trained health personnel and no spine board was used during their transfer from the site of injury. This finding was almost similar to the finding of Cripps et al (2011) about Africa, where 80% of persons with SCI are brought to the emergency department by untrained personnel, and Rathore et al (2008) about Pakistan, where no injured person was provided with spinal board during transfer. In Western countries, according to Peter et al (2008), it is mandatory for trained health personnel to immobilise the spine before persons with potential spinal injuries are transported from the accident site to definitive care.

This study found that 71.4% of the injured were taken to their first contact physician by conventional transport and only 16.1% travelled by ambulance. Though 96.4% arrived at the first contact physician within 24 hours, there was no provision for management of their injuries. Only 30.4% reached the tertiary health facilities within 24 hours. On an average, there was a delay of 22 days before presentation to the specialised spinal centre. Some of the factors responsible for the delay are lack of awareness, poverty, and the poor national health referral system.

These findings are consistent with findings in developing countries but inconsistent with those of developed countries. In India, Pandey et al (2007) stated that 63.33% of the injured used their own conveyance and 25% went by ambulance. In Pakistan, Rathore et al (2008) reported that 22.2% were evacuated by ambulance and the rest travelled in cars, jeeps and transport vehicles. In Nigeria, Ahidjo et al (2012) found that only 5.4% of the injured were transferred by ambulance, while Nguyen et al (2008) found this to be only 4% in Vietnam. In contrast, 93% of the injured in Sweden used the services of an ambulance (Divanoglou et al, 2010), and in Canada 41% were transported by ground ambulance, 54% by helicopter, and 5% by fixed-wing aircraft (Burney et al, 1989). The basic difference in mode of transfer may be a key element responsible for the differing outcomes for persons with TSCI in the developing and developed countries.

This study found that 69.9% of the participants had single and double intermediate admissions. Divanoglou et al (2010) found that in Sweden only 17% had single or more intermediate admissions, while Upendra et al (2007) showed that 72.7% in India had double or more intermediate admissions. The study by Toscano et al (1988) found 10-26% pre-hospital neurological deterioration, which is similar to the figure of 10.7% found in the current study. Significant statistical correlation was found between mode of transfer ($P < 0.03$) and intermediate admission ($P < 0.001$) with neurological deterioration in this study. Neurological deterioration may eventually lead to complete paralysis (69.7% complete vs 30.3% incomplete) (Table 2). Islam et al (2011) also found that 78% of the cases in their study on Bangladesh were neurologically complete.

Most of the studies from developing countries showed more complete injury and the reverse was true for the developed countries. The number of cases of SCI manifested as complete injury (ASIA-A) during admission were: 77% in Nigeria (Igun et al, 1999), 66.8% in India (Upendra et al, 2007), 57.8% in Pakistan (Rathore et al, 2008). Hagen et al (2010) of Norway found 41.4% of cases were complete and Divanoglou et al (2010) in Sweden found 36% complete injury. However, this inconsistency in neurological severity between developing and developed countries may be due to the fact that the pre-hospital trauma care has been standardised and modernised in developed countries, whereas it is either lacking or in a primitive stage in developing countries like Bangladesh.

Neurological recovery is an important aspect of rehabilitation of persons with TSCI. In this study 69.7% of the injured had complete cord lesion (ASIA-A) on admission, but on discharge 46.4% were ASIA-A. The reason could be that the injured had spinal shock at the time of admission but it subsided with treatment during rehabilitation. One-third (28.6%) of them had neurological improvement of various grades. This finding is inconsistent with the study of Catz et al (2004) in which 51% had improved by the time of discharge. The factors responsible for this could be different etiologies of cord lesion, more completeness of the injury and longer time lapses before reaching the rehabilitation centre.

The most common complication reported during rehabilitation was spasticity (52.8%). Maynard et al (1995) reported that 32.2% of persons with TSCI developed spasticity before discharge from hospital. This study suggests that the frequency of spasticity may be due to different etiologies of the cord lesion, more completeness of the injury and fewer sessions of therapy.

Statistically significant relationship was found between neurological outcome (ASIA score at discharge) and mode of transport (P<0.023), number of intermediate admissions (P<0.001) and monthly income (P<0.001). This signifies the need for standardised pre-hospital care for TSCI in Bangladesh. Proper early care of persons with TSCI in an established pre-hospital trauma centre yields either better outcome or reduced length of stay, or at least minimises the number and severity of complications (Fehlings et al, 2011).

**Limitations**

This is a single centre based study. Though CRP is the only SCI rehabilitation centre for the whole of Bangladesh, the sample size was not truly representative of the general population. However, the study gives a glimpse of the prevailing scenario in the country and suggests the need for a wider multicentre based study to help formulate an effective national TSCI prevention and management policy.

## CONCLUSION

Traumatic SCI needs immediate multidisciplinary care in a tertiary hospital, not only for better outcome but also to lessen the number and severity of complications. Trauma evacuation protocols and pre-hospital care of suspected SCI need to be developed immediately in Bangladesh. Regional and national spinal injury centres, providing comprehensive treatment and multidisciplinary rehabilitation, should be established. There is a need for a large-scale epidemiological survey in the county to assess the disease burden and the factors responsible for this devastating condition.

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