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ORIGINAL ARTICLE

Survival in Persons With Traumatic Spinal Cord Injury Receiving Structured Follow-Up in South India

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Abstract

Objective: To assess the survival in persons with traumatic spinal cord injury (SCI) receiving structured follow-up in South India.

Design: Retrospective study.

Setting: Rehabilitation center.

Participants: Persons with traumatic SCI (N=490) residing within a 100-km radius of the institute who were managed and regularly followed up by the rehabilitation center between the years 1981 and 2011.

Interventions: Not applicable.

Main Outcome Measures: Survival rates and mortality risk factors. Measures were estimated using the product limit (Kaplan-Meier) method and the Cox model.

Results: The survival rate after SCI was 86% after 5 years, 71% after 15 years, and 58% after 25 years. Survival of persons with complete high cervical injury is substantially low compared with other levels of SCI. Level of injury and extent of lesion (Frankel classification and/or American Spinal Injury Association Impairment Scale) play a significant role in predicting survival of this population.

Conclusions: Survival rates of regularly followed-up persons with SCI from this study show promising results, though survival rates are lesser when compared with studies from developed countries. Better understanding of the predictors, causes of deaths, comprehensive rehabilitation, community integration, and regular follow-up could possibly assist in improving survival rates.

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Survival analysis is vital for any longstanding disabilities in order to assess survival at the individual and population level.[1] There are many studies on spinal cord injury (SCI) survival analysis, mostly from countries with advanced SCI care systems. SCI survival analysis is essential to understand the prognostic factors and to assess and compare treatment achievements. It can significantly impact future survival rates by improving treatment and rehabilitation options. Similarly, it can also influence policy making and utilization of available resources.[1]

SCI has significant impact on an individual's life in terms of physical impairment and related psychosocial issues.[2] Data about survival and life expectancy help in understanding the effects of SCI, not only for the individual but also for families, community, and society. Persons with SCI and their family members often have wrong assumptions and negative thoughts regarding life expectancy in persons with SCI. It is therefore important for clinicians to provide accurate evidence-based information and enable a more informed understanding of how to cope and live with spinal injuries.

Research about survival after SCI in developed countries has shown that life expectancy of persons with SCI is lower than that of the general population, though it has improved greatly in the last few decades.[3] Data on survival of the SCI population from developing countries are scarce because of the lack of proper SCI death registration systems and inadequate clinical follow-up. In

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India, there is no registry collecting data on persons with SCI at either the national or state level. The purpose of the present study was to determine the survival rates and mortality risk factors in persons with traumatic spinal cord injury (TSCI) who were registered with our hospital, underwent rehabilitation, and are undergoing follow-up in our center. The risk factors considered were age, sex, cause, level, and neurologic completeness of injury. It is assumed that survival of the SCI population will be less in India compared with developed countries because of inadequate rehabilitation facilities and the absence of protocol for management of SCI. Problems such as lack of knowledge about SCI and poor social support further complicate this issue. To our knowledge, this is the first study on survival analysis of persons with posttraumatic SCI in India.

Methods

The Christian Medical College and Hospital is a tertiary care, university teaching hospital in South India. This is a major referral center for rehabilitation from hospitals throughout the country. The rehabilitation center, which is a part of the hospital, has had 83 beds since 2004 (previously it had 35 beds) and is a specialized rehabilitation facility for individuals with SCI and acquired brain injuries. More than 2000 persons with SCI have been rehabilitated in our center over last 30 years. These persons were referred from the neurosurgery and orthopedics department of our institute and from other hospitals. Among these, 537 persons with TSCI were residing within a 100-km radius of the rehabilitation center. Of these, 490 persons with TSCI who were treated between 1981 and 2011 and received regular follow-up in our center were included in the study. This number does not include persons with SCI who were rehabilitated in other surrounding hospitals and centers. There is no central registry for persons with SCI that could account for the total number of persons with SCI in the 100-km radius. The remaining 47 persons had been lost to follow-up because they were shifted elsewhere; they were excluded from the analysis.

The intervention at the rehabilitation center included functional mobility, bowel and bladder management, sexual rehabilitation, caregiver training, and vocational training. Follow-up visits stressed the screening of bowel-bladder, evaluations of new-onset complications, assessment of functional status, and community reintegration of the person. Persons with SCI are followed up once annually in the outpatient department, during a home visit by the community liaison team, or during the annual follow-up program (Rehab Mela). Home visits by the community liaison team were started regularly in 1990; Rehab Mela was started in 1994. Before 1990, persons with SCI were followed up in the outpatient department. The community liaison team consists of a physician, social worker, physical therapist, occupational therapist, orthotist, psychological counselor, and rehabilitation nurse. The community liaison team kept an up-to-date record of any new-onset medical, physical, functional, social, vocational, and environmental issues.

Demographic and clinical data (eg, age at injury, cause of trauma, level and severity of injury) were collected by reviewing patient's hospital medical records. Mortality data were obtained from hospital and home visit records maintained by social workers of the rehabilitation center. This study was approved by the institutional ethics review board.

List of abbreviations:

AIS	**American Spinal Injury Association Impairment Scale**
IQR	**interquartile range**
SCI	**spinal cord injury**
TSCI	**traumatic spinal cord injury**

Data collection

The community liaison team reported date of death to the social workers in the course of their routine follow-up. The social workers later entered it into the SCI records. All persons were followed-up until death or until April 30, 2011. All persons under regular follow-up of our team of social workers, and not reported as deceased, were alive on April 30, 2011.

Data were analyzed by the statistical analysis software SPSS version 17 for Windows.[a] Survival rates were estimated using the product limit (Kaplan-Meier) method, and differences between subgroups (sex, age at injury, SCI level, severity of neurologic deficit, and year of injury) were analyzed by log-rank test. The Cox proportional hazard model was used to determine the probability of mortality (hazard) in the presence of specific risk factors and to create survival curves for various combinations of age and level of injury.

Neurologic examination was performed at the time of admission with Frankel classification[4] till the year 2001 and with the International Standards for Neurological Classification of Spinal Cord Injury from 2001 onward.[5,6] Neurologic level of injury was defined as the most caudal segment of the spinal cord with normative sensory and motor function on both sides of the body.

In this study, levels of injury were categorized as high cervical (C1-4), low cervical (C5-8), high thoracic (T1-6), low thoracic (T7-12), and lumbosacral (L1-S5). Severity of neurologic deficit was based on either the Frankel classification or the American Spinal Injury Association Impairment Scale (AIS) and divided into 4 groups: grades A, B, C, and D.

Results

Demographic and clinical data

Records of 490 persons with TSCI were studied. The median age (interquartile range [IQR]) at injury was 31 (IQR, 23−40) years (range, 7−70y). The number of admissions was 59 in the first decade (1981−1990), 212 during the 1990s, and 219 during the 2000s. The median interval from the date of injury till admission to the rehabilitation center was 69 (IQR, 9−240) days. Table 1 shows causes of trauma, and table 2 shows the distribution of persons with SCI in different subgroups.

In the high cervical group (C1-4), all persons (n=47) sustained C4-level injury. Table 3 shows the distribution of persons with complete (Frankel/AIS grade A) and incomplete (Frankel/AIS grade B−D) SCI in various subgroups. In our study, none of the injured persons were ventilator dependent.

Outcome

Out of 490 persons, 357 were alive at the end of the follow-up period. The 5-year survival rate was 86%, and the 25-year survival rate was 58% (table 4). A significant difference was found in the mean survival of higher neurologic levels and severity of neurologic impairment (see table 2). Figures 1 through 4 show the Kaplan-Meier survival curves of the study population.