VOLUME-8, ISSUE-1, JANUARY-2019 • PRINT ISSN No 2277 - 8160

Original Research Paper

Medicine

FUNCTIONAL OUTCOME AND ITS DETERMINANTS AMONG PATIENTS WITH SPINAL CORD INJURY

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ABSTRACT

INTRODUCTION: Spinal cord injury inpatient rehabilitation should have precise and purposeful goals which take into consideration variety of factors regarding the patient and the injury to direct the individual to the best of his available potential. Knowledge on functional outcome and significant associated factors contributes to better care and counsel to the patient and family.

OBJECTIVES: This study aims at finding that proportion of SCI patients who underwent inpatient rehabilitation with good functional outcome and to evaluate the factors determining the poor functional outcome.

METHODS: A cross-sectional study with case control design with 89 patients admitted for inpatient rehabilitation at Department Of Physical Medicine and Rehabilitation, Thiruvananthapuram Medical College were assessed for clinical, demographic, patient and injury related factors. Functional Independence Measure (FIM) score was used as outcome measure

RESULTS: An increase in functional outcome of FIM gain score of ≥13 was noted in fifty-six patients (62.9%) and FIM gain score of <13 found in thirty-three patients (37.1%). The factors significantly associated with poor functional outcome were age, educational status, conservative management, delayed period following injury and admission, level of lesions and secondary complications, especially spasticity and musculoskeletal complications.

CONCLUSION: The results of the study suggests better innovative multidisciplinary rehabilitation strategies, infrastructure, early rehabilitation initiation, improved staff expertise, financial resources, renewed efforts to prevent complications for all the SCI patients particularly the aged, the high level lesions and better communication to the less educated patients regarding SCI for good functional outcome.

KEYWORDS : Spinal cord injury, FIM Score, Tetraplegia, Paraplegia, ASIA Score

INTRODUCTION

Spinal Cord injury is one of the most brutal infirmity when it comes to the dictum prevention is better than cure as it occurs at a very early age and it causes heavy economic burden on the affected person and the family members. The disability that ensues is almost irreversible and permanent as no effective cure has been identified yet.

The functional capabilities of an injured person may depend primarily on type and level of injury sustained by the cord. Besides this, subsequent management, medical, educational, social and psychological factors can also influence the functional outcome. Furthermore, SCI can also lead to secondary complications.

An inpatient rehabilitation to be fruitful and meaningful should have these factors taken into consideration during prognostication, setting goals and guiding the individual to excel in maximum possible functionality.

The benefits of medical rehabilitation can be scrutinised by assessing the reduction in disability and adequate clinical restoration by gain in function of persons undergoing inpatient rehabilitation.

A distinct understanding of determining factors predicting functional outcome contribute to better care and counsel to patients and their family.

Moreover, it provides for organizing cost effective rehabilitation care.The awareness among people about the specific need for rehabilitation after a good initial resuscitation and surgical or conventional mode of management is lacking among the patients and health care delivery system in our state.

This lack of awareness has led to the scarcity of rehab resources provided to SCI patients. Studies have shown that management of SCI patients in spinal units with dedicated experts and facilities for comprehensive rehabilitation improves the outcome.

Hence it is prudent to study the factors affecting the functional outcome of rehabilitation in our setting. The aim of our study was to find out the proportion of patients with good functional outcome as obtained by a FIM gain score of ≥13 at discharge when compared to admission and to find out the factors significantly determining poor functional outcome.

MATERIALS AND METHODS

This was a cross sectional study with case comparison among 89 patients admitted following spinal cord injury who fulfilled inclusion and exclusion criteria in the department of PMR Govt. Medical College Thiruvanathapuram, a tertiary care centre.

INCLUSION CRITERIA

1) Patient with Spinal Cord Injury (1week to 42 months following injury)
consecutively admitted for SCI inpatient rehabilitation to the ward.
2) Age between 18 and 65 years of age;
3) Both Traumatic and non-traumatic cases included.

• EXCLUSION CRITERIA

1) Spinal cord injury due to progressive motor neuron disease.
2) Patients with cognitive impairment

METHODOLOGY

The following variables were collected using a prestructured proforma and at the start of inpatient rehabilitation.

STUDY VARIABLES:

- Clinicodemographic characteristics: age, gender, educational

status, occupation,pre-existing comorbidities and addictions.
- Injury variables: etiology: traumatic or non-traumatic, mechanism, associated injuries, period following injury or interval between onset and admission
- Lesion Characteristics: The American Spinal Injury Association (ASIA)
- Impairment Scale (AIS) classifications according to the International Standards for Neurological Classification of Spinal Cord Injury were used mainly for assessing the neurological level of injury and completeness of the lesion. Accordingly, AIS A and B were defined as motor complete, AIS C and D as motor incomplete, and neurological lesion levels below T1 defined as paraplegia, while lesion levels at or above T1 defined as tetraplegia. Also, clinical syndromes of spinal cord injury-Central cord syndrome, Brown- Sequard syndrome, Anterior cord syndrome, Conus medullaris syndrome, Cauda equina syndrome mentioned were also taken for the study.
- Secondary complications that were included were:-
- Pressure sores
- Spasticity (measured using Modified Ashworth Score)
- Urinary tract infections (UTIs)
- Respiratory tract infections.
- Deep vein thrombosis (DVT)
- Autonomic Dysreflexia (AD)
- Orthostatic Hypotension
- Bowel dysfunction
- Heterotrophic calcification (HO)
- Musculoskeletal complications (MSK)

- Functional status measures

Functional Independence Measure (FIM) was used as the functional status measure. The FIM (Functional Independence Measure) is the most widely used standardized functional outcome measure in medical rehabilitation. FIM score, which has 18 items was collected at the beginning (admission FIM) and at the end (discharge FIM) of inpatient rehabilitation. Each item was scored from 1 (total dependence) to 7 (total independence). Scores of 18 items were summed up for the final score and the maximum score of 126 indicated total functional independence.Difference between admission FIM and discharge FIM called FIM gain was calculated. The FIM gain score of ≥13 at discharge, when compared to admission was taken as the good functional outcome. The FIM gain score of <13 at discharge, when compared to admission was taken as the poor functional outcome. The proportion of good functional outcome and poor functional outcome after inpatient rehabilitation was found out from the data collected.

Statistical analysis was performed using the software, SPSS 16.0 version. Chi square test was used for analysis of relations between binary outcomes and potential predictor variables collected as per the proforma.

DISCUSSION

The study consisted of 89 patients and all underwent inpatient rehabilitation in PMR department, Thiruvananthapuram Medical College. This outcome study has revealed significant factors and observations of which some may need improvement, others may require vigilant attention, yet others invite essentiality of awareness and education to the patient, family, community, health care providers and policy makers.

Regarding the distribution of SCI patients, majority of patients belonged to the productive age, lower economic strata and physically hard working and productive manual labourer group. In this study, males were more than females. Females had SCI due to nontraumatic causes and majority were housewives. Since the males were more of manual labourers, this is evident from the study that more traumatic cases occurred in the males. The causes of traumatic SCI were mainly due to falls, road traffic accidents, weight falling on back, sports injury on wrestling, stab injury to the back, tossed by an elephant etc. This is quite different from the data of the western and developed countries which have common causes as RTA, violence etc[1,9,11,13,18]. Since falls were the majority their causes after analysis revealed 48% falls from buildings or construction sites, 27% from trees, followed by fall into canal, drainage, well and other causes This indicate importance of better protection for construction workers at work site like safety harnesses, working platforms etc.

Mode of transport to hospital were in a recumbent position in ambulance or car, but it is noticeable that patients were transported in a sitting position also. This signifies the need of education regarding proper spine immobilisation as well as a safe and hasty transport[5,6]. Associated Injuries were found to be less and consisted of long bone fractures, calcaneal fracture, two patients had below knee amputation, etc. Non-Traumatic cases in the study were due to schwannoma, myelitis, infectious/ Pott's disease of spine etc. In this study, majority of the patients were operatively managed. Period following injury to admission were mostly in 1 week to 12 months' time especially around the 6-8th month post injury. However 17% had inpatient rehabilitation post injury after 12 months only. The reasons can be a lack of bed availability, delay in reference to PMR, financial scarcity, lack of caregiver support, inadequacy of awareness of patients, professionals and family for the need and benefits of rehabilitation[1,2,6,9]. Number of patients with complete SCI was less than those with incomplete SCI. According ASIA score majority of patients belonged to the ASIA C group followed by ASIA A, D and

B.

The primary objective was to find the patients with good functional outcome as determined by the FIM gain score ≥13 at discharge when compared to admission and it was obtained as 62.9% and FIM gain score <13 was 37.1%.[3] Advanced age was found to be a significant factor of poor functional outcome ain this study. Gender was not a significant factor of poor functional outcome. Several studies[14,15,16,17] have found significant relationships and observed changes between male and female recovery. This study had a limitation of less number of female patients that could be analysed. Occupation was not found to be a significant factor for poor functional outcome. Educational status of the patients was established to be a significant factor poor functional outcome in this study. 64% of patients belonging to the primary standard education group had poor functional outcome. The educational status plays a paramount place when it comes to vocational rehabilitation of the patient. The retraining of an individual to be independent in earning can help them immensely both physically and psychologically. Moreover, rehabilitating the patients with good awareness regarding prognosis and treatment can be relatively uncomplicated. Considerably less number of nontraumatic cases were present in the study which was a limitation and no statistical significance was observed between poor outcome and etiology although 53% of non-traumatic patients had poor outcome when compared to 34% of traumatic patients with poor outcome. Studies have shown non-traumatic have distinct features from traumatic SCI and better chances of neurological improvement[19]. Completeness of the lesion was not a significant factor for functional outcome. 39% of incomplete SCI and 32% of complete SCI patients had poor functional outcome. Looking in the reverse, the good outcome percentage seems to be more in complete SCI in this study probably because sample size of complete SCI was lower.
Mode of transport and associated injuries were not found to be statistically significant factors for poor functional outcome. Yet, many studies have suggested the importance of safe transport and that it reduces mortality[5,6].

Associated injuries were not found to be a statistically significant factor for poor functional outcome in this study. Associated injuries like long bone fractures and peripheral nerve injuries can lead to stiffness and contractures[20]. This can negatively affect functional outcome of SCI patients[21].

Period following injury to rehabilitation admission was found to be statistically significant factor for poor functional outcome. It has

been proved by many studies that an early rehabilitation is an important predictive factor of functional outcome and provides the patient with improvement particularly in activities of daily living[8,9].

Distribution Of Patients According To Period Following Injury To Admission

PERIOD FOLLOWING INJURY	Frequency	Percent
1WEEK-12 months	73	82
>12 MONTHS	16	18
Total	89	100

57% of conservatively managed patients had poor outcome whereas only 31% operatively managed had poor functional outcome. Conservative management was found have significant poor outcome. Studies have showed operative to be superior and favoured the benefits in terms of early spine stabilisation and long term deformity prevention[7].

Distribution of SCI patients according to methods of treatment

Methods of Treatment	Frequency	Percent
Operative	68	76.4
Conservative	21	23.6
Total	89	100.0

According to level of injury patients were divided into cervical, thoracic and lumbar. Level of injury was obtained as statistically significant and lumbar SCI had only 16%, thoracic SCI had 49% and cervical had 41% poor functional outcome respectively clearly showing that the prognosis becomes poorer as the lesion ascends rostrally[3]. Patients with cervical lesion were less in number in this study. When patients were grouped into tetraplegics (level above T1) and paraplegics (level below T1), in the whole group no significance was obtained of poor outcome. The level of lesion were not obtained as significant because of the meagre sample of higher lesions, but the rates obtained clearly shows a predilection for poor outcome as the lesions occurs in the ascending levels of spinal cord. ASIA score was mainly used as a tool for finding the level and completeness of lesions, but no significance of ASIA levels were obtained as a poor prognosticator, even though conus medullaris and number of patients with poor outcome was 15,9,6,2,1 in ASIA C, A, D, conus medullaris, and cauda equina respectively showing distal and incomplete syndromes with less number of patients with poor outcome[3].

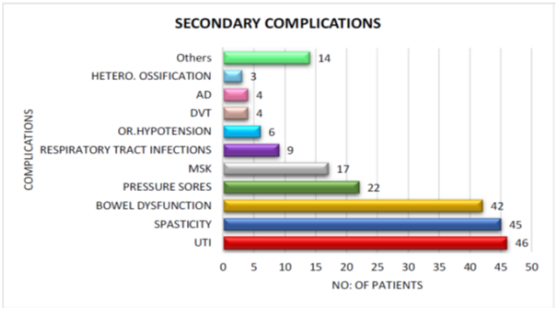
There was a limitation while considering this variable, as majority were ASIA C and very less number of patients was got in ASIA A, B, and syndrome groups[10].

Presence of comorbidities like diabetes mellitus, hypertension, coronary artery disease, pulmonary tuberculosis, seizure disorders and others like anemia, dyslipidaemia, peptic ulcer, lumbar disc disease, etc. was present among the patients.

In this study, presence of comorbidities was not obtained as significant factor for poor outcome. Studies have shown that in SCI patients, along with aging, coexisting morbidities can act as regressive factors in independence as the individual confronts further years of life[12].

The complications analysed in the study were urinary tract infections, spasticity, bowel dysfunction, pressure sores, musculoskeletal complications, respiratory tract infections, orthostatic hypotension, deep vein thrombosis, autonomic dysreflexia, heterotopic ossification and others like anemia,hydronephrosis, etc.

Distribution Of Secondary Complications Among Sci Patients



This study showed that the rate of poor outcome increased as the number of complications endured by the patient increased. Poor functional outcome was 63% in patients with >2 complications whereas it was only 21 % in patients with ≤2 complications.

Spasticity was associated with significant poor outcome as seen in the study by Sasa Milicevic[3] This was also a significant poor outcome in patients with associated musculo skeletal disorders which consisted of musculoskeletal overuse syndromes, post traumatic stiffness due to fracture long bones and calcaneal fractures which occurred concomitant with spinal cord injury, peri arthritis shoulder etc. Hence studies have emphasised on the need for renewed efforts to enhance the methods of prevention and treatment of the complications of spinal cord injury despite the achievement of great improvements made in life expectancy[4].

RESULTS AND OBSERVATIONS

This study conducted at Physical Medicine and Rehabilitation Department at overnment medical college Thiruvananthapuram, had a total of 89 participants with spinal cord injury. The mean age of the study population was 40.4+/- 12.4. These 89 patients were distributed according to various study variables which included the clinical, demographic, patient related and injury related factors. The subjects were divided into two groups according to Functional Independence Measure (FIM) gain score. FIM gain score of ≥13 at discharge when compared to admission was considered good and FIM gain <13 as poor functional outcome. Primary objective of proportion of patients with good functional outcome was obtained. Statistical methods for analysis of relation between binary outcomes of FIM gain score and potential variables determining the outcome were done. The results have been represented as tables and graphs. Chi square test has been done for statistical analysis and derivation of results. These were done using the SPSS software.

PROPORTION OF SCI PATIENTS WITH GOOD FUNCTIONAL OUTCOME

Functional outcome	Frequency	Percent
FIM ≥13	56	62.9
FIM<13	33	37.1
Total	89	100.0

The primary objective of this study was to find out the proportion of patients with FIMgain score ≥13 or good functional outcome which was 62.9%. The proportion of poor functional outcome was (FIM<13) was 37.1%.

CONCLUSION

1. New strategies of managing patients with spinal cord injury at advanced age is needful besides preventive measures like falls prevention and environment modification. An improvement in life expectancy and associated comorbidities in a patient with advancing age also require rehabilitation programmes tailored to the individual requirements.
2. The manual labouring at dangerous heights and trees needs to

have adequate precautions like working platform with guard rails, provision of rope access to arrest falls.

3. Education being a significant factor for poor outcome creates barriers in understanding the nature of their illness and that no cure exists. To overcome this various visual, reading materials and audio can be provided because as soon as the patient copes with the injury he can be motivated for a successful rehabilitation programme and avoid consultation with quacks. This can be started from initial resuscitation itself by making the caregivers vigilant.
4. A delay in admission to rehabilitation following adequate initial resuscitation and management with surgical or conservative methods is to be avoided for a better outcome and reduction of complications. Specialised spinal units are required for the same which are lacking in our state.
5. Reduction of complications during inpatient rehabilitation and at home can be achieved by a well-coordinated multi-disciplinary team under the physiatrist, improving staff expertise, provision of patients with good nutrition, pressure relieving mattresses and early rehabilitation, exercises, bladder, bowel management, caregiver education and environment modifications.
6. A national registry or database for information on epidemiology, injury and measured rehabilitation outcomes using valid scales of SCI in a country can be of tremendous help in planning and developing resources to provide infrastructure development adequate treatment and rehabilitation
7. Policy makers and public needs to be aware and willing to take action on welfare of SCI pts and availability of rehab resources, early referral for better outcome and reduction of complications
8. Gender differences in recovery patterns can be studied in future with adequate sample sizes to find out factors advantageous to males and females respectively for a better functional outcome.

RELEVANCE OF STUDY

Spinal cord injury is a catastrophic condition resulting in significant morbidity and mortality. This accounts for limited number of bed availability and special spinal care project scarcity of manpower and infrastructure facilities in both government and private sectors of health care system in our state. This also accounts for the delay in admission to rehab centre and which can approach the patient in holistic way as rehab care not only means physiotherapy but also all realms of rehabilitation including bowel & bladder, pulmonary, cardiac, sexual, and vocational, psychological restoration. These aspects are taken into consideration as a process of rehabilitating the entire existence of and for safe healthy living of not only the patient but also their family as well, incorporating occupational therapy; appropriate exercises or use of assistive devices and orthotics as evaluated and prescribed by the physiatrist. The dearth of knowledge of outcome on effective rehabilitation among patients and health care workers including professionals and policy makers has led to the scarcity of rehab resources provided to SCI patients. This study can provide information on how an inpatient rehabilitation can provide a gain in function admitted at varying time periods after injury early or late (1/2 years) after injury because most patients are admitted primarily after 2-3 years as well due to varied reasons. This study can also shed light whether a late admission to rehabilitation can to how much extent benefit the patient. Patient-related predictors and injury related factors are studied which can help predict outcome and can help treating patients efficiently.

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