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Case Series

Unexpected clinical and functional recovery in patients with chronic traumatic chronic spinal cord injury: a case series

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ABSTRACT

Motor recovery in traumatic spinal cord injury (tSCI) is reported to reach its plateau by 1 year and maximum recovery period is reported to be 2 years. Acute rehabilitation is very well documented in literature with patients reporting for functional rehabilitation immediately after shock period is over. However, the scenario being a bit different in rural areas with comparatively less awareness about role of physiotherapy, patients with tSCI reports at later stages. Reported here is a series of chronic tSCI cases who showed remarkable clinical and functional recovery in short time. Aim of this study is to report recovery in patients with chronic tSCI and to compare the patient outcomes with expected outcomes. Conventional physiotherapy was given 5 days a week with minimum 45 mins treatment. Baseline assessment at admission and at discharge was recoded. Improvement was recorded with spinal cord independence at different time points. Nine patients below 40 years of age, average duration of injury 6.2 years were treated for average of 8 months. NLI did not change in 3 patients whereas in 6 patients NLI moved 2 segments down. Mean change in SCIM score was 10 between admission and discharge. Functional status was compared with expected parameters and was found to be improved by 70%, suggesting had they come at early stage, expected recovery could have been achieved. Clinical and functional recovery in patients with tSCI may occur even after 2 years post injury.

Keywords: Spinal cord injury, Rehabilitation, Functional recovery, Traumatic spinal cord injury, Chronic spinal cord injury

INTRODUCTION

Spinal cord injury (SCI) is a severely debilitating condition leading to neurological dysfunction, loss of independence, respiratory failure, psychological morbidities, and an increased lifelong mortality rate.[1]

Usually, the patients with SCIs are bothered about the maximum possible functional recovery as well as the duration of recovery. The potential to recover from SCI is primarily related to the level and type of lesion; whether complete or incomplete along with duration of injury.[2]

A person with cervical spine injury can maximally perform wheelchair propulsion and independent activities of daily living. Whereas person with thoracic spine injury will perform bed activities and self care activities without use of adaptive devices. A person with lumbar level of injury may ambulate independently with 4 point gait.[3]

Physiotherapy helps individuals with SCI to be able to function with their injuries in a day-to-day situation. It involves exercising for mobilisation and for stimulation of the nerves and muscles below level of injury.[4,5]

Besides, it may also help in restoring the functioning of atrophied muscles.[6,7] Though largely helpful, it only helps the patients with SCI to live with their injury and to prevent further deterioration.

Various studies showed that the administration of current SCI treatments such as drugs, neuronal implants and stem

cells induced the following improvements: (i) decrease neuro-inflammation, (ii) promote axonal growth, (iii) enhance myelination and (iv) reduce cavity size. However, the current treatment strategies can aid for only a short duration and fail to completely overcome the detrimental effects of SCI.[8]

According to the previous studies, recovery in patients with SCI largely occurs in first 6 months and is complete by 2 years.[9] Delayed recoveries also occur, but to a lesser extent. Major recoveries occur within 1 to 6 months post injury.[9] Literature says that the rate of motor recovery rapidly declines in 1st 6 months and then approaches plateau. Small improvements can occur after periods longer than 2 years but typically occur in individuals with incomplete injuries.[10,11]

However, being located in rural setup, patients are often referred or report to physiotherapy department in chronic phase. Despite of relevant counselling patients are willing to undertake physiotherapy intervention along with vocational rehabilitation. This case series reports chronic patients of SCIs who were provided rehabilitation after more than 3 years of injury. The patients were evaluated on the neurological level of injury as well as SCI measurement (SCIM) index before and after rehabilitation and the changes in these outcomes was measured along with functional activities.

Table 1: Demographic details of patients included in case series.

Age (in years)/ gender	Duration of injury (in years)	Level of injury	Complete/ incomplete	Cause
22/M	3	C6-C7	Complete	Car accident
23/M	6	T3	Incomplete	Bike accident
45/M	13	C5-C7	Incomplete	Bike accident
23/M	3	T11	Incomplete	Bike accident
29/M	10	C2-C3	Complete	Fall in the well
29/M	3	T12	Complete	Fall of ceiling bricks on back
35/M	3	T11	Incomplete	Machine fall on back
32/M	10	C8	Incomplete	bike accident
34/M	3.5	L2	Complete	Fall from 40 feet height

Table 2: SCIM and NLI scores throughout treatment period.

Duration of injury (in years)	Duration of treatment (in months)	NLI, pre	NLI, post	SCIM, pre	SCIM, post	% improvement in SCIM
3	8 m	C7 (C)	C7 (C)	18	30	12
6	3 m	T3 (I)	T3 (I)	41	49	8
13	6 m	C6 (I)	C8 (I)	67	73	6
3	5 m	L1 (I)	L2 (I)	45	63	18
10	8 m	C4 (I)	C7 (C)	32	42	10
3	1 m	T12 (C)	T12 (C)	67	79	12
3	2 m	T12 (I)	T12 (I)	64	69	5
10	12 m	C7(I)	C7 (I)	45	61	16
3.5	9 m	L2(C)	L2 (C)	86	90	4
Mean				51.64	61.17	10.1

CASE SERIES

First patient presented in the series is a 22-year-old male who visited us for physiotherapy treatment 2.5 years post-accident in a car injury. He had a complete SCI at C6-C7 spinal level. He received treatment for 8 months and there was 12% improvement in the functional performance post intervention.

Second patient is a 23-year-old male, who, after 6 years of incomplete SCI at T3 level in a bike accident who received physiotherapy treatment for 3 months and there was 8% improvement in functional performance.

Third patient is a 45-year-old male who received physiotherapy treatment for 6 months; 13 years post injury in a bike accident, still he had 6% improvement in his functional independence post treatment.

Fourth patient, 23-year-old male with T11 level of Incomplete injury through bike accident 3 years back received physiotherapy treatment for 5 months and had 18 % improvement in his functional independence.

Fifth patient is a 29-year-old male with T12 complete injury after fall of ceiling bricks on his back visited for physiotherapy treatment 3 years post injury and continued the treatment for 5 months. He had 18% recovery in his functional performance.

Sixth patient is again a 29-year-old male with C2 complete injury after a fall in the well. He received physiotherapy treatment 3 years post injury for 1 month. His functional performance improved by 12%.

Seventh is a 35-year-old male; with T11 level complete injury with machine fall on the back. He visited for Physiotherapy treatment 3 years post injury for almost 3 months and had 5% improvement in functional performance.

Eighth patient visited for physiotherapy treatment for 10-year post injury in a bike accident. This 32-year-old male with C8 level incomplete injury, had 16% improvement in functional performance post treatment of approximately 1 year.

Last patient is a 34-year-old male patient. He had a fall from 40 feet height. After 9 months of rehabilitation, he had 9% improvement in functional performance. He had a complete injury at L2 level.

Physiotherapy intervention

Patients were treated with manual physiotherapy techniques focusing on the individual impairment and the expected outcome on the basis of expected level of recovery. In patients with cervical level of injury, rehabilitation primarily focused on the trunk training activities and improvement of hand function.

Pelvic control was the focus of recovery in patients with thoracic level of injury. In patients with lumbar level of rehabilitation was directed towards standing and walking activities. Manual techniques along with Brunnstorm, MRP and Bobath were mainly used for rehabilitation. Along with this assisted and resisted PNF patterns and individual muscle strengthening was also applied.

Table 3: Expected and actual level of recovery according to the level of injury.[15]

Duration of injury (in years)	Duration of treatment	NLI pre	NLI post	SCIM pre	SCIM post	% improvement in SCIM	Expected level of recovery[15]	Actual level of recovery	% recovery achieved
3	8 m	C7 (C)	C7 (C)	18	30	12%	All independent, uneven transfers over greater distances.	No	50%
							All independent mat and bed activities.	Yes	
							All self-care activities.	Yes	
							Manual wheelchair propulsion on steeper ramps and 4-inch curbs.	No	
6	3 m	T3 (I)	T3 (I)	41	49	8%	Can negotiate steep ramps, rough terrain, stairs, doorways that are narrower than wheelchair.	Yes	66.67%
							May negotiate 8-inch curbs or higher.	No	
							Can achieve ambulation, with difficulty, on even surfaces with KAFOs and crutches or a walker. Full function of the upper extremities and the spine above the level of lesion.	Yes	
13	6 m	C6 (I)	C8 (I)	67	73	6%	Can achieve independent level transfers (with/ without sliding board) and some uneven transfers.	Yes	100%
							Roll over.	Yes	
							Come to sitting	Yes	
							Gross movement on a mat or bed without adaptive equipment.	Yes	
							All self-care activities, such as dressing, personal hygiene, eating, drinking, and cooking.	Yes	
							Can perform manual	Yes	

Continued.

Duration of injury (in years)	Duration of treatment	NLI pre	NLI post	SCIM pre	SCIM post	% improvement in SCIM	Expected level of recovery[15]	Actual level of recovery	% recovery achieved
							wheelchair propulsion on level surfaces with hand-rims.		
5	5 m	L1 (I)	L2 (I)	45	63	18%	Can achieve ambulation with a four-point gait.	No	00%
10	8 m	C4 (I)	C7 (C)	32	42	10%	Can breathe independently without a ventilator.	Yes	100%
							Can use a hand-controlled power wheelchair, and, with adaptive equipment such as a mobile arm support.	Yes	
							May achieve self-feeding and facial hygiene.	Yes	
3	1 m	T12 (C)	T12 (I)	67	79	12%	Can perform ambulation with KAFOs and crutches on even surfaces, with some difficulty, and negotiate some obstacles.	No	50%
							Have varying degrees of function in the abdominal musculature.	Yes	
2	2 m	T12 (I)	T12 (I)	64	69	5%	Can perform ambulation with KAFOs and crutches on even surfaces, with some difficulty, and negotiate some obstacles.	Yes	100%
							Have varying degrees of function in the abdominal musculature.	Yes	
10	12 m	C7 (I)	C7 (I)	45	61	16%	Manual wheelchair propulsion on steeper.	Yes	75%
							All independent, uneven transfers over greater distances.	Yes	
							All independent mat and bed activities.	Yes	
							All self-care activities.	No	
3.5	9 m	L2 (C)	L2 (C)	86	90	4%	Can achieve ambulation with a four-point gait.	Yes	100%
Mean: 6.2	Mean: 6 months			51.64	61.17	10.1%			Mean: 72%

SCIM: Spinal cord impairment measure; NLI: Neurological level of injury

DISCUSSION

The ability to predict outcome after SCI is extremely important not only for individuals who sustained a tSCI and their families but also for the rehabilitation professionals charged with developing an appropriate plan of care. With complete lower lesions there is greater level of independence i.e., greater motor potential. With incomplete lesions there is greater functional potential and results in greater functional independence.[4]

Kirshblum et al after his study on chronic tSCI reported that the most rapid rate of neurologic recovery occurs in the first 3 months. The majority of neurologic recovery occurs within the first 6 months to 9 months. Although some late neurologic recovery has been reported 2 years to 5 years post injury.[14] In this study 997 patients with acute, chronic and sub-acute SCI were included. Of these

3.5% patients showed improvement in their neurological level of injury. Significant improvement was observed in the motor index. This study concluded that there is a small degree of neurological recovery post SCI.

Fisher et al in his study on 143 chronic tSCI patients concluded that Motor recovery does not occur below the zone of injury for patients with complete SCI.[15] Varying

degrees of local recovery can be expected in tetraplegic individuals.

Alcobendas-Maestro et al in her study compared walking reeducation program using Lokomat with conventional overground training among individuals with incomplete SCI of both traumatic and non-traumatic ethology. In our study, 9 chronic patients of SCIs were included who undertook rehabilitation after a mean duration of 6.2 years post injury. These patients did not receive any physiotherapy treatment or rehabilitation prior to reporting in our setup.in this study they included 80 patients from 3 to 6 months after onset of SCI. The study concluded that Robotic-assisted training was equivalent to conventional walk training in patients with a variety of nonprogressive spinal cord pathologies for walking speed, but the need for orthotics and assistive devices was reduced, perhaps because of greater leg strength in the robotic group.

Active rehabilitation of 45 minutes to 1 hour per day, for an average duration of 6 months; a mean of 72% of the expected recovery was achieved in these patients. These patients were treated with manual therapy techniques based on the functional level of individual patient. Caretakers were taught for home rehabilitation exercises, which were performed on the bed itself. The Neurological level of injury also improved in some patients. The SCIM score also improved by 10.1% post rehabilitation.

SCI in India face numerous challenges, which affect almost all aspects of comprehensive management. The number of SCI centres and the services available are often inadequate to meet the needs of the population. Acute care, bladder/bowel care and sexuality as well as fertility management all add to the challenges of SCI management. Lag in the post-discharge follow-ups, home-care services and community inclusion and vocation lead to further hindrance in SCI management. Numerous factors like lack of availability of trained manpower, inadequacy and inaccessibility of services, non-availability of multidisciplinary comprehensive care, lack of a barrier-free environment and financial barriers hinder comprehensive management of SCI and contribute to the challenge. Strong family, spouse and community support, positive attitude of the spinal cord injured, innovativeness and availability of cheap as well as abundant manpower are the main strengths that help to overcome the challenges of SCI.[16]

Along with the rehabilitation, active involvement of the patient during the treatment, the constant motivation to improve, the psychological belief and the strong family support also contributed greatly to the overall recovery process.

Recent studies have indicated significant improvement over time with the use of Robotic assisted devices but requires more funding and infrastructure This study being conducted in the rural setup, was performed with limited resources and the lack of infrastructure. Patients were treated using Manual techniques and approaches. Also, the awareness regarding rehabilitation is much less in the rural population compared to the urban ones. Limitation in the resources leads to less job or work opportunities among the sufferers which in turn leads to financial and psychological stress which may in turn affect the overall recovery process.

CONCLUSION

Patients with chronic SCI with average duration of 6 years post diagnosis have shown the potential and functional improvement and hence should be given an opportunity of functional recovery by providing appropriate physical rehabilitation service along with vocational rehabilitation if possible.

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