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OUTCOME OF PHYSICAL REHABILITATION IN PATIENTS WITH SPINAL CORD INJURY

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ABSTRACT

Introduction: Spinal Cord Injury (SCI) results in long-term disability and can dramatically affect quality of life. The effects of SCI have an impact not only on the lives of the client and family but also on society as a whole. Patients with SCI need a well coordinated, specialized rehabilitation program consisting of a team of physicians and health care professionals to provide the tool necessary to develop a satisfying and productive post injury life style.

Objective: To assess effectiveness of physical rehabilitation in patients with spinalcord injury (SCI) and also to assess the functional improvement in patients with SCI with physical therapy.

Methodology: In this study 30 paraplegic patients were selected, whose fracture level was below D9 vertebrae. Physical rehabilitation was started depending on the patient's assessment. In general physical rehabilitation includes ROM exercises and positioning, strengthening, mat activities, transfer training, wheelchair skills, gait training, etc. Patients were reevaluated after six weeks of rehabilitation. Outcome measures were ASIA motor score, ASIA sensory score and FIM to assess motor function, sensory function and level of independence respectively.

Result: The result shows highly significant improvement in ASIA motor score, ASIA sensory score, motor score of FIM following six weeks of physical rehabilitation in paraplegics at 5% significance level except cognitive score of FIM.

Conclusion: The conclusion of the study is that physical rehabilitation plays very important role in improving physical capacity of patients as well as in making them functionally as much independent as possible.

Keywords: Rehabilitation, Paraplegia, FIM, ASIA, Physical Therapy

INTRODUCTION

Spinal Cord Injury (SCI) typically results in impaired motion and loss of function, both of which are associated with a decrease in quality of life.[1] Spinal Cord Injury (SCI) is a low incidence, high cost disability requiring tremendous changes in an individual lifestyle.[2] The effect of SCI have an impact not only on the lives of the client and family but also on society as a whole.[3]

Spinal injury units now exist worldwide and international symposia on the treatment of those with spinal cord lesions take place regularly.[4] Improvements in administering care at the time of accident, technological advances in diagnosis and in management have contributed to a continuing fall in mortality and morbidity rates over recent years.[5]Spinal cord injuries can be grossly divided into two broad etiological categories: Traumatic injuries and non-traumatic damage.[2]

Statistics from the NSCID (National Spinal Cord Injury Database) indicate that accidents involving motor vehicles are the most frequent cause of traumatic SCI (45.6%), followed by falls (19.6%), acts of violence (17.8%), recreation sports injuries

(10.7%) & other etiologies (6.3%).[6] Non-traumatic conditions that damage spinal cord are vascular malfunctions, vertebral subluxations secondary to rheumatoid arthritis, transverse myelitis, spinal neoplasm etc. They account for 30% of all spinal cord injuries.

The areas of spine that demonstrate the highest frequency of injury are between C5 and C7 in cervical region and between T12 and L2 in the thoracolumbar region.[2]The International Standards for Neurological and Functional Classification of Spinal Cord Injury (ISNCSCI) provide a straightforward, internationally accepted procedure for classifying spinal cord injury based on a systematic motor and sensory examination of neurological function.[7] Functional Independence Measure (FIM) is devised to measure function for any disability. Each area of function is evaluated in terms of independence using a seven point scale.[4]

Patients with SCI need a well coordinated, specialized rehabilitation program consisting of a team of physicians and health care professionals to provide the tool necessary to develop a satisfying and productive post injury life style.[8,9] The rehabilitation team for SCI is composed of the physician, orthopedic surgeons, physical therapist, occupational therapist, orthotist, nurses, speech language pathologist, dietician, psychologist, vocational counselor, social worker, engineer etc.[10,11,12,13] The patients, their family members and NGOs are also the important part of rehabilitation team. A coordinated system of care shortens hospital stays and improves efficiency of functional gains during rehabilitation.[14, 15]

SCI usually happens to active, independent people who at one moment are in control of their lives and in the next moment are paralyzed, with loss of sensation and loss of body function and dependence on others for their basic needs so this study was chosen to assess effectiveness of physical rehabilitation in patients with spinal cord injury and also to assess the functional improvement in patients with SCI with physical therapy.

MATERIAL AND METHODOLOGY

Study Design: Prospective longitudinal follow up study

Study Setting: Physiotherapy department of Govt. Physiotherapy College, Ahmedabad.

DURATION OF STUDY: 4 months. The duration of treatment program for each subject was 6 weeks.

INCLUSION CRITERIAS

- Traumatic Spinal Cord Injury
- Operated cases
- Fracture below D9 vertebrae
- Duration since injury not more than 2 months
- Age 18 – 50 years
- Sex: Both males and females
- Willing to participate

EXCLUSION CRITERIA

- Non traumatic cause of spinal cord injury
- Fracture above D9 vertebrae
- Patients treated conservatively
- Any other associated major neurological, musculoskeletal or cardiopulmonary condition
- Subject mentally unstable in the judgment of the investigator
- Subjects whose Modified Ashworth Scale is 3/4 or 4/4 at hip or knee at any time during the study

DATA COLLECTION AND PROCEDURE:

MATERIALS

- Plinth, Tilt table, Push up blocks
- Medicine ball, dumbbells
- Floor Mat, Wheelchair
- Parallel bars with mirror
- Posterior knee guard and Toe raising splint
- Walker, stick
- Evaluation format including ASIA motor form, ASIA sensory form, FIM
- Hammer, cotton, pin, pen

OUTCOME MEASURES

- American Spinal Injury Association (ASIA) motor score
- American Spinal Injury Association (ASIA) light touch score
- American Spinal Injury Association (ASIA) pinprick score
- Functional Independence Measure (FIM)

PROCEDURE

For this study, a convenient sample of 30 paraplegic patients was taken from Paraplegia Hospital, Civil Hospital, Ahmedabad. All of them took part in the study on a voluntary basis after signing consent form.

All the subjects were assessed as per the evaluation format. Those who fulfilled inclusion criteria were taken up for the study. The procedure was explained to all the subjects. Physical rehabilitation program was tailored for each subject depending on their evaluation. Orientation to vertical position was given by use of tilt table and by slowly elevating the head of the bed. Vitals were monitored during this period.[2]

To maintain R.O.M. in lower limbs, passive movements were given to hip, knee, ankle joints. Stretching exercises were also used mainly for gastro soleus and hamstring muscle. Hamstring stretching is given more emphasis to achieve a straight leg raise of 100 degrees.

All upper extremity muscles were strengthened by progressive resistive exercises using manual resistance, weight cuffs or dumbbells. Mainly emphasis was given to shoulder depressors, triceps, and latissimus dorsi, which are required for transfers and ambulation. All the muscles of trunk and lower extremity which remain innervated were strengthened in similar manner.[2]

Mat activities[2] constitute a major component of treatment during rehabilitation phase. Following activities were taught on mat. Rolling, Prone on forearm (photograph 1), Prone-on-hands position , Supine on elbows position, sitting, Balance exercises in sitting, Sitting push-ups using push-up blocks (photograph 2), Quadruped position (photograph 3) and Kneeling.

Basic movements within the wheelchair like to manipulate the brakes, to remove the armrest, to pick up objects from the floor, to reach down to the foot plates; to lift the buttocks forward in the chair were taught. 10 to 15 seconds of pressure relief for every 10 minutes of sitting should become part of the patient's daily routine. Techniques include wheelchair push-ups, hooking elbow or wrist around the push handle and leaning toward the opposite wheel.[4]

Transfer training was initiated after achievement of good sitting balance. Training was given on different surfaces such as bed, toilet, and chair to floor etc (Photograph 4-6).

For standing and walking, basic requirements are to fix the knee joints and to hold the feet in dorsiflexion.[4] To fix the knee joints and to maintain dorsiflexion of feet, posterior knee guard and toe raising splint were used respectively. With the use of necessary orthoses, standing between the parallel bars (Photograph 7) was given. Balance exercises in standing were given in parallel bar. Patient should learn to tilt his pelvis by using latissimus dorsi. Even pelvic side tilting was taught.

Gait training was also given in parallel bars. Progression was made by making pt. walk with walker. Balance exercises in walker (Photograph 8) were also given.

Patients were reevaluated after six weeks of rehabilitation for ASIA motor score, ASIA light touch score, ASIA pin prick score, Functional Independence Measure. In FIM, score of self care, sphincter control, transfers, and locomotion were considered as motor score and score of communication and social cognition were considered as cognitive score.

RESULTS

In this study 30 paraplegic patients were selected and evaluated by the physical therapist. Then physical rehabilitation was started depending on

the patients' assessment. Patients were reevaluated after six weeks of physical rehabilitation. Here paired t-test was used for statistical analysis of outcome measures. Outcome measures were ASIA motor score, ASIA light touch score, ASIA pin prick score, motor score of FIM and cognitive score of FIM.

Results of ASIA motor score (Table–1), ASIA sensory score (Table–2 & 3), motor score of FIM (Table–5) showed highly significant improvement after six weeks of physical rehabilitation at 5% level of significance. Results of cognitive score of FIM (Table–6) showed no statistically significant improvement after 6 weeks of physical rehabilitation.

DISCUSSION

Data collected through this study showed highly significant improvement in ASIA motor score, ASIA sensory score, motor score of FIM following six weeks of physical rehabilitation in paraplegics except cognitive score of FIM.

In this study, standing and Gait training was given with the use of posterior knee guard and toe raising splint than Knee Ankle Foot Orthosis (KAFO) because of their cost effectiveness. Walker was used for gait training than forearm crutches because it increases base of support so patient feels secure. The other important reason is that all patients were coming from towns and residing on ground floor so they don't have to climb stairs in their routine.

In FIM transfer to bath, shower was taken as whether pt was able to transfer from wheelchair to floor because patients take bath on floor. Transfer to toilet was taken as whether pt was able to transfer to same level stool or chair because they didn't have facility of western commode so they are going to use such modification.

In this study 22 patients were men and 8 were women so 73% were men and 27% were women. This finding is nearer to finding of National Spinal Cord Injury Database in which 81% pts were men.[6] The age of patients was ranging from 18-50 years with mean age of 27.83 years.

At the starting of the study ASIA impairment scale was A for 17 patients, B for 7 patients, C for 7 patients so 53.33% had A scale, 23.33% had B scale and 23.33% had C scale. The mode of injury was fall from ht. in 13 pts. (43.33%), fall of heavy wt on back in 10 pts (33.33%), RTA in 7 pts. (23.33%).

Muslumanoglu L, Aki S, Ozturk Y, et al 1997, Bode RK, Heinemann AW 2002, Jongjit J, Sutharom W, et al 2004, Hall KM, Cohen ME, et al 1999 , all these studies support the results found in this study but the follow up of pts was for a long duration. All these studies have shown improvement in ASIA motor score, ASIA light touch score and FIM motor score. They also didn't find improvement in cognitive score of FIM.[17, 18, 19, 20]

M J De Vivo, J S Richards, S L Stover et al 1991 also found improved independence in activities of daily living following acute care and rehabilitation in pts with spinal cord injury.[21]

Sandy Stevens, Don Morgan, Ph.D.2 et al 2008 found strong positive association ($r = .75$; $p<.05$) between level of physical activity and quality of life so interventions aimed at promoting physical activity may be effective in improving quality of life in adults with spinal cord injury.[22] This study also supports the role of physical rehabilitation in improving productivity of patients life.

Rehabilitation should be continued after six weeks because interventions aimed at promoting physical activity beyond tradition rehabilitation period may be effective in improving quality of life in adults with spinal cord injury.[22]

Ota T, Nagata M et al 1996 found that FIM score reached the plateau in approximately 10 months, 6 months and 3 months post injury, in tetraplegia, paraplegia above T5 and that below T6 respectively.[23]

Ditor DS, Latimer AE et al 2003 concluded that findings of their study emphasize the importance of continued exercise adherence to the

maintenance of exercise-related increases in psychological well-being among individuals with SCI.[24]

Bizzarini E, Saccavini M et al 2005 found that strengthening and aerobic rehabilitation programs for patients with subacute SCI should be limited to 4 weeks, followed by an independent maintenance exercise program. The strengthening program is safe for this patients.[25]

Noreau L, Shephard RJ 1995 concluded that quality of life is closely associated with independent living and, increasingly, it is a key outcome when measuring the success of rehabilitation. Consequently, research designs that examine the impact of exercise upon individuals with disabilities should not only include objective outcome measures, but also subjective measures relating to life-satisfaction and quality of life.[26]

Spinal Cord Independence Measure (SCIM) can be used which is a reliable disability scale and is more sensitive to changes in function in spinal cord lesion patients than the FIM.[27]

Limitation of the Study

- Small sample size
- Limited time duration of rehabilitation (6 weeks)
- Modification in the assessment of FIM score was required
- Patients treated conservatively were not selected.
- Quality of life was not assessed

Future Suggestion

- The same study can be carried out by using SCIM than FIM which is more sensitive and more reliable to functional change in patients with spinal cord injury.
- Study can be carried out in patients with traumatic and non traumatic SCI as well as patients with any level of lesion.

CONCLUSION

The conclusion of the study is that highly significant difference is found in ASIA motor score, ASIA sensory score and motor score of FIM following six weeks of physical rehabilitation in paraplegics. Hence physical rehabilitation plays very important role in improving physical capacity of patients as well as in making them functionally as much independent as possible.

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Table-1: Comparison of ASIA motor score in paraplegics (n = 30)

Pre Physical Rehabilitation Mean ± SD	Post 6 wks of Rehabilitation Mean ± SD	t value	p value	Results
50.5 ± 4.99	58.2 ± 9.03	8.08	< 0.001	Highly Significant

At 29 degrees of freedom, the observed 't' value is 8.08 which is suggestive of statistically highly significant ($p<0.001$) improvement in ASIA motor score after physical rehabilitation.

Table-2: Comparison of ASIA (light touch) sensory score in paraplegics (n = 30)

Pre Physical Rehabilitation Mean ± SD	Post 6 wks of Rehabilitation Mean ± SD	t value	p value	Results
85 ± 12.28	90.2 ± 14.11	4.46	< 0.001	Highly Significant

At 29 degrees of freedom, the observed 't' value is 4.46 which is suggestive of statistically highly significant ($p<0.001$) improvement in ASIA sensory (light touch) score.

Table-3: Comparison of ASIA pin prick sensory score in paraplegics (n = 30)

Pre Physical Rehabilitation Mean ± SD	Post 6 wks of Rehabilitation Mean ± SD	t value	p value	Results
84.3 ± 12.02	89.1 ± 14.14	4.68	< 0.001	Highly Significant

At 29 degrees of freedom, the observed 't' value is 4.68 which is suggestive of statistically highly significant ($p<0.001$) improvement in ASIA sensory (pin prick) score.

Table-4: Comparison of Functional Independence Measure (FIM) in paraplegics (n = 30)

Pre Physical Rehabilitation Mean ± SD	Post 6 wks of Rehabilitation Mean ± SD	t value	p value	Results
58 ± 7.26	96.2 ± 13.09	21.87	< 0.001	Highly Significant

At 29 degrees of freedom, the observed 't' value is 21.87 which is suggestive of statistically highly significant ($p<0.001$) improvement in FIM score after physical rehabilitation.

Table-5: Comparison of motor score of Functional Independence Measure (FIM) in paraplegics (n = 30)

Pre Physical Rehabilitation Mean ± SD	Post 6 wks of Rehabilitation Mean ± SD	t value	p value	Results
23.6 ± 6.95	62.1 ± 12.18	22.89	< 0.001	Highly Significant

At 29 degrees of freedom, the observed 't' value is 22.89 which is suggestive of statistically highly significant ($p<0.001$) improvement in FIM motor score after physical rehabilitation.

Table-6: Comparison of cognitive score of Functional Independence Measure (FIM) in paraplegics (n = 30)

Pre Physical Rehabilitation Mean ± SD	Post 6 wks of Rehabilitation Mean ± SD	t value	p value	Results
34.4 ± 0.62	34.5 ± 0.51	1.44	>0.05	Not Significant

At 29 degrees of freedom, the observed 't' value is 1.44 which is suggestive of statistically no significant ($p>0.05$) improvement in FIM cognitive score.

Photograph 1 - Prone on forearm

Photograph 2 - Exercise with push up blocks

Photograph 3 - Quadruped position to plinth

Photograph 4 - Transfer activity from wheelchair

Photograph 5 - Sitting on plinth

Photograph 6 - Transfer activity from plinth to wheel chair

Photograph 7 - Standing in parallel bar with PKG and TRS

Photograph 8 – Pt standing with walker