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Goal-oriented physiotherapy program in a young patient with traumatic spinal cord injury: A case study

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ABSTRACT

SCI (Spinal cord injury) is a strong injury that typically causes paralytic muscles below the level of the lesion, resulting in limited, altered mobility and dependence on others. Injury sustained can be a total or partial injury. Here we present a case report of a 20-year-old male, who came to physiotherapy OPD in October 2021 for physiotherapy, is a case of TSCI (Traumatic Spinal cord injury) and was under rehabilitation since February 2021. He came with complaints of inability to stand unsupported, inability to walk without assistance, and lack of bladder and bowel control. MRI and X-RAY investigations were done. The patient is diagnosed with SCI at D12-L1 Level – Paraplegia. The patient was managed surgically with D12-L1 laminectomy and D11-L3 pedicle screw fixation. This case shows how a TSCI patient with paraplegia shows significant improvement in balancing and functional activities and is still undergoing rehabilitation.

Keywords: Traumatic Spinal cord injury (TSCI), Paraplegia, Rehabilitation, Laminectomy, Pedicle Screw Fixation.

1. INTRODUCTION

SCI is a relatively uncommon yet rising injury that has a substantial impact on a person's life. Muscle paralysis beneath the level of the lesion might result in limited and changed mobility, self-care, and the capacity to participate in preferred social activities (Bennett et al., 2021). Body image and sexual performance changes, incontinence, with the need to depend on others to complete daily duties are all things to think about (Ahuja et al., 2017). A total or partial spinal cord injury (SCI) can happen (Ahuja et al., 2017). The most frequent cause of SCI is trauma - traffic accidents, assault, slips, degenerative spinal illness, circulatory damage - neoplasm, and infection. Injury to the dorso-lumbar area of the spinal cord or the cauda equina leads to "Paraplegia," or full trunk and both lower extremities are paralyzed. The arm operates normally, but the trunk, legs, and pelvic organs may be compromised depending on the degree of the injury (Nas et al., 2015). There

can be bowel and bladder involvement or may not be, if involved they have neurogenic bowel & bladder- spastic/flaccid depending on the type of lesion.

Limited and altered mobility, self-care, and ability to participate in treasured social activities can all be detrimental to a patient's quality of life if muscles below the level of damage are paralyzed. Furthermore, different systems are impacted, resulting in a variety of impairments (Mazwi et al., 2015). The grade of injury is critical in defining the patient's quality of life, the higher the level of injury, the more compromised is the quality of life and poses more complications, decreasing the chances of survival in severely affected cases (Mazwi et al., 2015).

2. PATIENT INFORMATION

A 19-year-old male resident of Mandgaon of Wardha was taken to Sewagram hospital by relatives in the ambulance on 9th July 2020 with a history of falls from a height of approximately 15 feet on 9-07-2020 at 1:30 am and sustained an injury to the back with a complaint of low backache and inability to move both the legs. The patient's blood pressure was 110/70 mmHg, his pulse rate was 80 beats per minute, and his rate of respiration was 20 beats per minute on physical examination.

On CNS examination, there was paraspinal discomfort at the thoracolumbar junction and complete paraplegia with bowel and bladder involvement. The patient presented with a history of falls from height (15 feet) 15 months ago, leading to fracture of L1 vertebrae with anterior wedge compression and was surgically managed with pedicle screw fixation surgery for D12-L3 along with D12-L1 laminectomy, for intervertebral disc compression over spinal cord due to the fracture on 10th July 2020. The patient's sleep cycle and appetite are normal; there is no history of addictions. There is bladder and bowel involvement with a lack of control. The patient uses intermitted catheterization for lack of control and ankle-foot orthosis, a walker for ambulation.

Diagnostic Assessment

X-ray revealed an L1 wedge compression fracture. During the neurological evaluation, the patient had 0/5 motor power in both lower extremities, reduced tone in both lower limbs, & no bilateral deep tendon reflex. Below L1, there was a full sensory loss. The upper limbs were neurologically normal. Surgery was planned for L1 wedge compression fracture on 10th July 2020 and the MRI Investigation of dorso-lumbar spine showed anterior wedge compression fracture of L1 vertebral.

3. CLINICAL FINDINGS

A vertebral compression fracture is usually diagnosed by medical history, physical examination, and x-rays. On physical examination vital signs were normal; tenderness and swelling were present over the back area of pain. A plain x-ray demonstrated the wedge shape of the vertebral body on a lateral view. MRI of the whole spine reveals – Anterior wedge compression fracture of the L1 vertebral body involving right lamina, right pedicle, and right transverse process of l1 vertebrae with retropulsion of fracture fragments causing near-total obliteration of spinal canal at D12 - L1 intervertebral disc level causing compression of the spinal cord at the same level. Anterior reduced height of L1vertebral body. Bilateral paras interarticularis defect at L5 vertebral level without subluxation of vertebrae. Bony canal dimension (in mm) D2-L1: 6mm, L1-L2: 12, L2-L3: 14, L3-L4: 14.5, L4-L5: 16, L4-S1: 14

Therapeutic Interventions

Pre-intervention considerations: The patient uses intermitted catheterization and lacks bowel and bladder control. The patient uses ankle-foot orthosis and a walker for ambulation.

Interventions

Strengthening protocol for Upper limb, Core, Pelvic Floor, and Lower Limb (table 1 and 2)

Table 1 Physiotherapy Rehabilitation Protocol: Intervention details

Problem Identified	Goal Framed	Physiotherapy Intervention
0-14 Days: Lack of Trunk control, Tone-Flaccid, Pelvic floor Muscle Weakness	To Stabilize the trunk, normalize tone, and strengthen pelvic floor muscles	Lumbar Corset, Roods Facilitatory Technique, Pelvic Bridging exercises, Passive Range of Motion exercises
14days – 2Months: Pelvic floor Muscle Weakness,	To strengthen pelvic floor muscles, to improve Muscle	Pelvic Bridging exercises, Active-assisted ROM exercises, Bed

Generalised Muscle Weakness, Bed Sore	Strength, Bed Sore Management	Positioning, and Mobility
Months: Generalized Muscle Weakness, Core Muscles Weakness	To improve upper limb Muscle Strength, to strengthen core muscles.	Upper limb strengthening, with 500 grams weight cuff, Sit-Ups, Static Abdomen
2- 4 Months: Covid Lockdown	To maintain the achieved strength and ranges	The same treatment protocol was followed for 2 months.

Table 2 Physiotherapy Rehabilitation Protocol: Progression

Problem Identified	Goal Framed	Physiotherapy Intervention
Weakness of pelvic floor muscles	To strengthen pelvic floor muscles	Pelvic Floor Exercises: Bridging: Unilateral and Bilateral with 10 secs hold X 10reps- 1 set
Weakness of upper limb muscles, Core muscles, trunk muscles	To strengthen upper limb muscles for ADLs and use of Assistive device for ambulation. To strengthen core muscles for trunk stability and balance.	Upper Limb & Core Strengthening: Sit-ups X 15 reps – 1 set Trunk Rotational Exercises with 1 kg medicine ball – 10 reps each side – 1 set Push-ups on the swiss ball – 30 reps – 1 set Extension Exercises with 750 grams weight cuff -10 reps each side – 1 set Quadripod Reach outs – 10 reps on each side – 1 set
Weakness of lower limb muscles	To strengthen the lower limb muscles for ambulation.	Lower Limb Strengthening: Half-Kneeling – on both the sides for 30 secs – 1 set Knee Extension Exercise with 1 kg weight cuff – 10 reps on both sides – 1 set
Weakness of lower limb muscles. Lack of joint proprioception, due to lack of weight-bearing	To strengthen lower limb muscles. To improve weight-bearing	Parallel Bar Exercises: Tandem Standing – 10 reps with both the feet – 1 set One Leg Standing – 10 reps with both the feet with 10-sec hold – 1 set Abduction – 10 reps with both the feet with 10-sec hold – 1 set Standing Leg exercises (knee and hip flexion 900) – 10 reps both the legs with 5-sec hold – 1 set Lunges – 5 reps with both the feet – 1 set
Weakness of lower limb muscles. Lack of gait training	To ambulate the patient.. To improve ground clearance	Weight Bearing & Gait Training Exercises: Hurdle walking – 5 rounds Treadmill walking for - 3:30 mins with speed 1.

Follow-up and Outcomes

There is a significant improvement in the overall strength of the patient, assessed through MMT and ASIA (Fig 1, 2 & 3), shown in table 3.

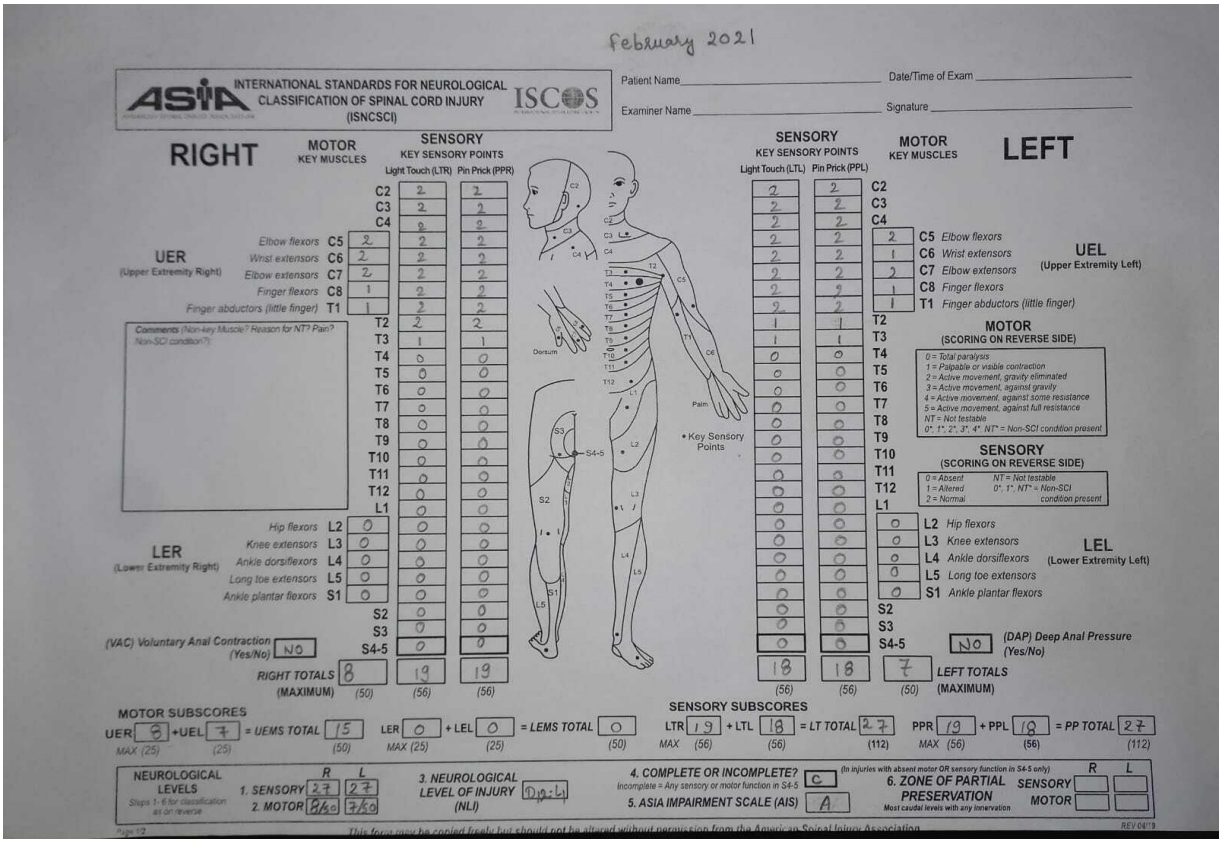

Figure 1 ASIA Score Feb'21

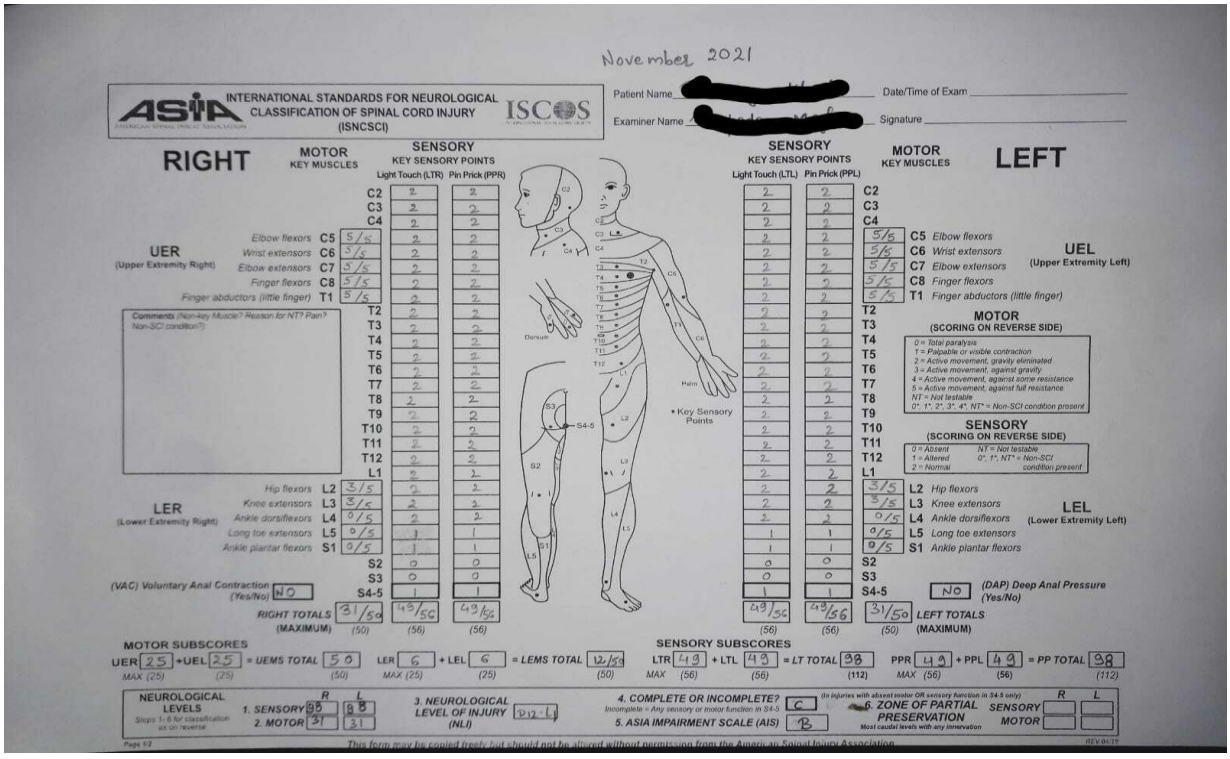

Figure 2 ASIA Score Nov'21

Table 3 Follow-up and Outcome Measures

ASIA SCORE	FEBRUARY'21	NOVEMBER'21
Level of Injury	D12-L1	D12-L1
Motor Score (MMT)	15/100	62/100
Sensory Score	54/224	196/224
ASIA Impairment Score	Complete	Sensory Incomplete

Figure 3 Patient on Treadmill and in Half-Kneeling position

4. DISCUSSION

This case study aims to explain how a patient with a severe spinal cord injury can be treated successfully with surgical and Physiotherapy care. The most critical goal for both complete and incomplete paraplegic patients during the chronic period is to achieve independent mobility. Soon after a TSCI, functional goals can be clearly defined, and patients can work toward achieving their goals through multidisciplinary care (Mazwi et al., 2015). Rehabilitation of Chronic TSCI patients requires an intensive and prolonged rehabilitation program. Prevention and management of subsequent problems should be aggressive and is critical for lowering the mortality rate owing to complications (Nas et al., 2015). Rehab Protocol should include weight-bearing mat exercise (Rahimi et al., 2020), orthosis for ambulation (Yang et al., 2017), and a home exercise program (Nightingale et al., 2016).

In contrast to a lifestyle -this control group, will investigate the possibility of home-based moderate-intensity exercise and determine its influence on metabolic and cardiovascular health (Mazwi et al., 2015). The findings of this study might be utilized to generate scientific facts for physical activity guidelines and to understand more about the physiological pathways by which exercise can benefit persons with chronic SCI. Future intervention studies in a range of at-risk populations will be based on the findings (Nightingale et al., 2016). FES and hybrid orthoses have a lot of promise for helping people with SCI regain their standing and walking abilities. However, improvements in their designs and functionality, as well as verifiable reviews are required to show that the devices help users reach their goals, higher levels of performance than passive, mechanical orthoses now allow (Nas et al., 2015). Patients with SCI can enhance their exercise capacity by doing short-term arm aerobic training (Akkurt et al., 2017). Longer rehabilitation regimens are required for these people to reap the full benefits of aerobic exercise training (McMillan et al., 2021). To attain the greatest potential training results, patients should be given appropriate warm-up and cool-down activities (Bongers et al., 2016).

Randomized Controlled Trials have not provided adequate evidence to get to the conclusion that one locomotor training technique improves walking capability in SCI patients better than another. Specific questions about what type of locomotor training is best for improving walking function in SCI patients must be investigated (Nas et al., 2015).

5. CONCLUSION

This case study concludes that proper physiotherapy intervention and exercises brought help the patient to function well to do activities of daily living. With significant improvement in the generalized strength of the patient, we plan to shift the patient to a crutch from a walker.

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Author's contribution

All the authors contributed equally to the manuscript.

Informed consent

Written & Oral informed consent was obtained from all individual participants included in the study. Additional informed consent was obtained from all individual participants for whom identifying information is included in this manuscript.

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Conflicts of interest

The authors declare that there are no conflicts of interests.

Data and materials availability

All data associated with this study are present in the paper.

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