

# Functional Outcome After Complete Spinal Cord Injury With Left Below Elbow Amputation, Medial Nerve Palsy at Right Hand: A Case Report

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## 국문 요약

척수손상과 좌측하박절단, 우측 손의 정중신경손상 등 복합장애를 가진 척수손상 환자의 재활치료: 증례연구

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본 증례연구는 복합손상을 가진 척수손상환자의 재활치료과정을 소개하여 유사한 사례의 치료에 도움이 되고자 하는 것이다. 증례연구의 대상자인 26세의 남자환자는 흉수 4번 완전손상과 사고 당시 전기화상에 의한 좌측하박 절단과 우측손의 정중신경이 마비되었다.

치료초기에는 일상생활동작 검사에서 MBI (Modified Barthel Index) 점수가 22점으로 독립적으로 가능한 것은 거의 없었고, 기능적으로도 모든 도움이 필요한 상태였으나 재활치료결과 독립적으로 가능한 기능수행 능력은 돌아눕기, 일어나 앉기, 침상에서 의자차로 이동하기, 의자차 굴리기였고 제한적이기는 하지만 독립적으로 가능한 일상생활동작은 식사, 상의 입기, 의자차와 같은 높이의 이동 등이 가능하여 MBI 점수가 47점을 나타내었다.

이 환자의 초기의 장기치료목표는 전동 의자차를 이용하여 보호자의 도움을 줄이는 것이었다. 그러나 환자가 익숙하게 의지를 사용하였으며 일반 의자차 사용을 위해 필요한 만큼의 근력증가가 있었고, 의자차에 앉은 상태의 균형감각이 증가하여 목표를 수정하여 일반 의자차를 사용하도록 하였다. 환자 본인이 가지고 있는 재활 잠재력을 최대한 이끌어낼 수 있도록 유도한 결과 부분적으로 제한이 있었지만 실내에서는 의자차를 이용하여 독립적인 생활이 가능하였다.

**핵심단어:** 기능적 회복; 복합손상; 척수손상.

## Introduction

The incidence rate of traumatic spinal cord injury is increasing since other traumatic injuries such as motor vehicle accident, industrial accident, and sports related injury are increasing with social modernization and development. More than 10,000 cases of spinal cord injury are occurring in the United States annually. Eighty-two percent of cases are men and eighty percent of cases are occurring for individual between 16 and 45 (White et al, 1992). Thirty nine percent of spinal cord injuries were caused by a motor vehicle accident in Korea (Doh et al, 1979). Twenty seven point five percent of spinal cord injuries were caused by a motor vehicle accident in Korea (Lee, 1980). Thirty eight percent of spinal cord injuries were caused by a motor vehicle accident and twenty one percent were by a fall in the United States (Young and Northu, 1982).

Traumatic spinal cord injury can be associated with traumatic brain injury or complicated injuries such as an amputation or a burn. Karamehmetoglu and associates (1997) indicated that the most common form of associated injury with a spinal cord injury was a brain injury. Oller and associates (1992) documented that 5,021 patients among 13,834 spinal cord injury patients had associated injuries and the most frequent form of associated injury occurred was a brain injury followed by a facial injury, a clavicle injury in order. Saboe and associates (1991) studied 240 (47%) patients with associated injuries of 508 spinal cord injury patients and showed that the brain injury was the most frequent form of associated injury followed by a thoracic injury (24%), a ilium injury (23%). Ten percent of 508 spinal cord

injury patients had associated injuries affecting three body parts.

Associated injuries can limit the performance level of activities of daily living (ADL) more than paraplegia or quadriplegia caused by spinal cord injury does. The injury level, age, gender, home situation, and family support can determine the functional performance level of ADL with the complete spinal cord injury patients. Water and Adkins (1997) suggested that injury level and associated injury are the contributing factors for functional recovery after the rehabilitation program.

A twenty six-year-old male patient who had T<sub>4</sub> complete spinal cord injury with left below elbow amputation and incomplete right median nerve palsy was evaluated and treated for this case study. Without such associated injuries, the patient could have been independent with the use of the wheelchair. The functional level of the patient was expected to be low secondary to associated injuries. The purpose of this case study was to introduce the process of physical therapy with the use of prosthesis for bed mobility, transfer, and wheelchair propulsion for spinal cord injury patient with associated injuries.

## Subject

A twenty six-year-old male patient who was injured when he fell from 4 m height sustained a T<sub>4</sub> and T<sub>5</sub> compression fracture resulting in a T<sub>4</sub> complete spinal cord injury and associated injuries such as burn to left hand and right forearm on May 20, 1992. Left forearm was amputated 5 cm below elbow joint secondary to electrical burn and Benedict hand resulted from median nerve injury secondary to burn. The patient used

a mechanical ventilator when he was hospitalized for right pulmonary hematoma. Bedside physical therapy was initiated in the Department of Orthopedics on June 10, 1992 and aggressive physical therapy was initiated on July 26, 1992 when patient was transferred to the Department of Rehabilitation.

### Physical Examination

The initial evaluation revealed that patient lost sensory and motor function below T<sub>4</sub> level completely. The circumference of the left forearm stump was 23 cm and length was 5 cm from the elbow joint. Patient complained of phantom pain at the stump. The range of motion of the left elbow flexion was 0~65 degrees. Left elbow flexion and extension strength within the available range was graded as Good and right-hand intrinsic muscle strength was graded as Poor. Sensation assessment showed the hyperesthesia at the palmar aspect of the right hand. The Modified Ashworth Scale graded spasticity in bilateral lower extremities as Grade 2. Patient was totally dependent functionally since he was not able to roll in supine position. Lung capacity was 1,400 cc when measured by the spirometer.

### Physical Therapy

To increase functional range of motion at left elbow, hot pack, ultrasound, and therapeutic exercise program were applied. Aggressive range of motion exercise program was necessary to increase the left elbow range of motion more than 90 degrees to have the prosthesis donned for the functional purposes. Since the stump was too short to be stretched, 100 degrees of elbow flexion was determined for the goal. TENS was applied to left elbow stump for the phantom pain and desensitization techniques were used for the hyperesthesia.

Patient was elevated by a tilt-table to prevent an orthostatic hypotension. To protect thoracic artery from spinal instability, patient used a body jacket. Therapeutic exercise program was initiated for bed mobility and strengthening on a mat. Physical therapy program emphasized the maintenance and increment of range of motion and muscle strength of the left elbow, elimination of phantom pain, desensitization, independent bed mobility, and lung capacity increment. The short-term goals consisted of independent prosthetic donning/doffing, maintenance of functional sitting balance, independent

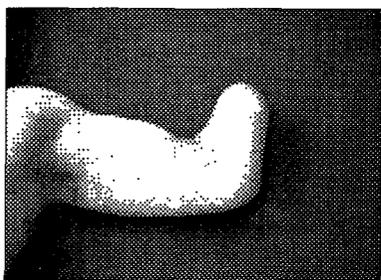


Fig. 1. Left below elbow amputation

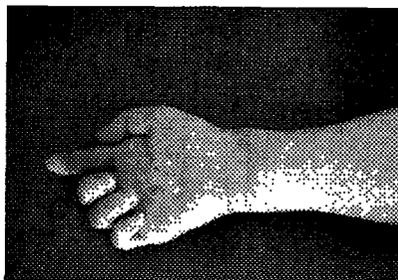


Fig. 2. Median nerve palsy in right hand

transfer from bed to electric wheelchair/  
electric wheelchair to bed, wheelchair man-  
agement/propulsion. The long-term goals  
consisted of independent performance of  
activities of daily living with the electric  
wheelchair, arrangement of home situation  
to minimize assistance level by the family  
member.

Standard hook-type forearm prosthesis  
was donned for the physical therapy session.  
Push-up and lifting activities were practiced

to improve balance and muscle strengthening  
for bed mobility and transfer activities.  
Standard wheelchair was recommended in-  
stead of electric wheelchair since patient  
continued to improve left elbow range of  
motion to 95 degrees and muscle strength  
to Good. The elastic rubber was applied to  
the wheelchair metal wheel rim and handle  
for wheelchair management and propulsion.  
Patient was able to manage and propel  
wheelchair indoors and outdoors.

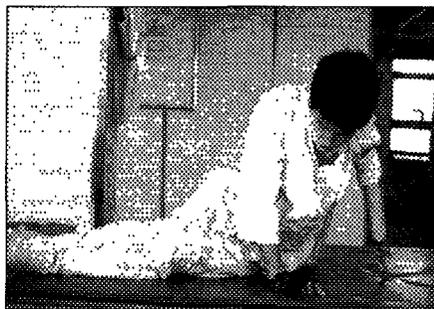


Fig. 3. Supine to sitting up



Fig. 4. Transfer wheelchair to mat



Fig. 5. Wheel chair propulsion

## Conclusion

This spinal cord injury patient with associated injuries such as left below elbow amputation and median nerve palsy in right hand was evaluated and treated. Modified Barthel Index (MBI) graded patient's functional status as twenty-two on initial evaluation. The patient was totally dependent for functional activities on initial evaluation. MBI graded the patient's functional status as 47 after the completion of physical therapy program. Patient was able to roll, sit, transfer from bed to wheelchair and propel wheelchair independently and eat, dress with some limitation.

Initially electrical wheelchair was introduced since the patient had associated injuries. Since the patient adapted to the prosthesis and improved the range of motion, strength, and dynamic sitting balance, this patient used standard wheelchair. The patient was able to return home and live with standard wheelchair with some limitation after the completion of physical therapy program,

which utilized patient's maximal potential. This case study was intended to introduce physical therapy program for spinal cord injury patient with associated injuries so that similar cases of spinal cord injury patients with associated injuries can be evaluated and treated efficiently and appropriately by physical therapists.

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