

Original Paper

Physical Therapy for an Infant with Congenital Paraplegia: A Case Study

Susumu WATANABE

Department of Restorative Science, Physical Therapy Course

Faculty of Medical Professions

Kawasaki University of Medical Welfare

Kurashiki, 701-01, Japan

(Accepted May 22, 1996)

Key words: paraplegia, infant, physical therapy, ambulation exercise

Abstract

This study describes and discusses the physical therapy used on an infant patient with paraplegia caused by a thoracic spinal cord injury. Many factors, such as the extent of the injury, the strength of the upper extremities, balance while standing, the range of motion of the lower extremities and especially motivation, influenced the level of ambulation achieved by the patient. In addition, it was concluded that the patient's determination and the careful guidance of the physical therapist were very important, and that ambulation benefited the patient enormously.

Introduction

According to Hoffer et al.¹⁾, ambulation in patients with a spinal cord injury can be classified into four functional levels: namely, community ambulators, household ambulators, non-functional ambulators and non-ambulators. Most paraplegic patients with a thoracic spinal cord injury do not achieve a functional ambulation level, because their ambulation balance is very poor and the energy required for ambulation is too great. These patients generally tend to use wheelchairs for locomotion, even after they have received ambulation exercise training. Hoffer et al.¹⁾ reported that only 4 of 10 patients with a thoracic level myelomeningocele achieved non-functional ambulation. However, there

have been no reports that correlate severity of the injury to the thoracic spinal cord with the level of ambulation that can be achieved. The author provided physical therapy for six years to an infant patient with a congenital sixth thoracic spinal cord injury. The patient was finally able to achieve non-functional ambulation. The purpose of this case report is to discuss the levels of ambulation that can be realized by thoracic paraplegics depending on the type of the injury, the benefits of ambulation exercise and the factors that contribute to the achievement of ambulation. The basis of the discussion is the course of physical therapy prescribed for the infant patient with a thoracic spinal cord injury.

Case

Patient: female infant

Diagnosis: congenital paraplegia with thoracic spinal cord injury

Chief complaint: gait disturbance

Family history: nothing in particular

Past history: She suffered from pneumonia three times before she was four years old.

Social background: She was a primary student in a regular school, who commonly used a wheelchair for locomotion. Her mother and her friends helped her when she had problems at school. Her family consisted of her parents, an elder brother and a grandmother. Her mother was the main support.

History of the present illness: In November 1984, the patient was born prematurely by a breech delivery. She weighted 2,500g at birth and was nurtured in an incubator for nine months. Paraplegia and a bone deformity of the frontal thorax were found. At the age of one year and seven months, the patient was admitted to Okayama University Medical School Hospital to undergo a thorough examination. Cerebral palsy and a spinal cord injury were suspected, but a definite diagnosis could not be made. When she was three years old, scoliosis appeared and progressed gradually. At the age of four, she was able to use a wheelchair by herself. At the age of six, she was brought by her mother to our hospital with the hope of receiving outpatient treatment in the form of physical therapy, such as standing and ambulation exercises, in addition to regular medical examinations.

Program and course of physical therapy

Her initial evaluation revealed the following.

She was 102cm tall and weighted 17.8kg. A sensory and manual muscle test (MMT) showed complete sixth thoracic level para-

plegia. The strength of both upper extremities was normal, while that of the abdominal area and both lower extremities was zero. The muscle tonus of the paralyzed part of her body was flaccid but stimulation of the soles of the feet revealed hypertonus of the triceps surae muscle and ankle clonus. The range of motion test (ROM-T) revealed an extension of -10 degrees for both knees while the ankles showed zero dorsiflexion. An X-ray disclosed S-curve scoliosis of the thoracic and lumbar spine and deformity of her left frontal thorax. There were no problems with her cranial nerves, intelligence or emotional status. The patient, with the support of her mother, was motivated to achieve ambulation, even non-functional ambulation with the aide of braces and crutches. She was able to independently operate a wheelchair for locomotion and the activities of daily living. The goal of physical therapy was for the patient to attain non-functional ambulation.

Her program of physical therapy included the following:

1. muscle strengthening exercises for the upper extremities
2. range of motion exercises for the lower extremities
3. exercises to correct her scoliosis
4. standing balance exercises
5. ambulation exercises

The course of physical therapy was as follows: From 1990 to 1995 the patient received training for about 40 minutes, once a week, as an outpatient. In August 1990, physical therapy was begun, and she was fitted with long leg braces attached to a spinal brace. In September, standing balance exercise was begun between parallel bars using the brace. At first the patient needed a great deal of assistance to stand while supporting herself with both hands. Gradually she began to maintain standing balance and in a month

could stand without any assistance. However, she was not able to push herself up enough with the parallel bars to raise her feet from the floor. In January 1991, the patient gradually began to push herself up between the parallel bars and to swing herself forward a little, but that exercise exhausted her. In March 1991, she attained the swing-to gait between the parallel bars without any assistance and her endurance increased. In September 1991, she could independently perform the swing-to gait 30 times. Other programs such as muscle strengthening for the upper extremities, range of motion for the lower extremities and a correction exercise for scoliosis were conducted simultaneously. In October 1991, she began ambulation exercise using a walker. Soon, with close supervision, she was able to do the swing-to gait for 200 m and was very pleased. In December 1991, ambulation with two Lofstrand crutches was

begun, but it was too difficult for her to maintain standing balance. About one year's standing balance and ambulation exercises were needed before she was able, under close supervision, to ambulate for 10 m using both Lofstrand crutches. Her ambulation endurance increased gradually and by September 1993, she was able to independently ambulate with crutches for 150 m on a flat floor (Fig. 1). She was able to participate in her school's autumn athletic meeting ambulating together with her friends. That event emotionally moved her friends, parents and teachers and she gained self-confidence along with a great deal of pleasure. By 1994, she was able to ambulate for 300 m at a speed of about 25 m/min. and maintained that functional level.

Discussion

Other authors have described the goals of ambulation in infants with spinal cord injury. Hoffer et al.¹⁾ divided ambulation in patients with myelomeningocele into four functional levels: community ambulators, household ambulators, non-functional ambulators and non-ambulators.

1. Community ambulators: These patients are able to walk indoors and outdoors for most of their activities and may need crutches or braces, or both. They use a wheelchair only for long trips out of the community.
2. Household ambulators: These patients are able to walk only indoors and with apparatus. They are able to get in and out of the chair and bed with little or no assistance. They may use the wheelchair for some indoor activities at home and school, but must use a wheelchair for activities in the community.
3. Non-functional ambulators: Walking for these patients is a therapy session at home, in school, or in the hospital. Afterwards,



Fig. 1 The patient was able to ambulate independently using her brace and crutches.

they use their wheelchairs to get from place to place and meet all their transportation needs.

4. Non-ambulators: These patients are wheelchair-bound but usually can transfer from chair to bed.

Hoffer reported that only four of their 10 patients achieved non-functional ambulation after a long period of exercise in the hospital. However, neither Hoffer nor other authors referred to the level of paraplegia and the conditions which divided patients into the two functional levels. Stauffer²⁾ also reported on the results of a study to determine the success of ambulation exercise in patients with thoracic paraplegia. Of 44 patients with complete thoracic injuries (from T-1 to T-11), none were functional ambulators and 11 were able to use their braces for standing only. The present report described a sixth thoracic paraplegic patient who achieved non-functional ambulation: that is a swing-to gait using long leg braces with a Knight spinal brace. This was in spite of the fact that the strength in her abdominal area and lower extremities, as measured by the manual muscle test, was zero. The strength of her upper extremities, good standing balance and great motivation enabled her to achieve this level. Ascher³⁾ reported that thoracic level paraplegics usually cannot become functional ambulators. In studying the factors affecting the ambulatory status of 28 patients, they found that age and knee-foot-ankle deformities were significant factors influencing ambulation functions in thoracic level para-

plegics. The oldest non-functional ambulator was 12 years old. The severity of knee-foot-ankle deformity also correlated significantly with age. Our patient was six years old at the beginning of her training and she attained the non-functional ambulator level after four years of exercise. I believe that the prevention of knee-foot-ankle deformity using range of motion exercises was also very important in her case.

What is the meaning of attaining non-functional ambulation for a patient who has usually used the wheelchair for daily activities? Goghlan et al.⁴⁾ indicated that the benefits of non-functional ambulation included physical exercise, feeling good about being upright, and improved bowel and bladder functions. The same benefits were found in our patient. The psychological value was especially great. She hoped to join her classmates in many kinds of school activities such as athletic meetings, literary exercises and a graduation ceremony in an upright position with her brace and crutches. Her successful experience and a sense of unity with her class gave great pleasure and a sense of accomplishment.

In conclusion, the strength of the upper extremities, a good standing balance, an almost normal range of motion of the lower extremities, age and great motivation are important factors for the achievement of non-functional ambulation by thoracic level infant paraplegics. Attaining non-functional ambulation has many beneficial effects and the psychological value is especially great.

Reference

- 1) Hoffer MM, Feiwell E, Perry R, Perry J and Bonnett C (1973) Functional ambulation in patients with myelomeningocele. *The Journal of Bone and Joint Surgery*, **55**-A(1), 137—148.
- 2) Stauffer ES, Foffer MM and Nickel VL (1972) Ambulation in thoracic paraplegia. *The Journal of Bone and Joint Surgery*, **54**-A(6), 1336-1337.

- 3) Asher M and Olson J (1983) Factors affecting the ambulatory status of patients with spina bifida cystica. *The Journal of Bone and Joint Surgery*, **65**-A(3), 350-356.
- 4) Goghlan JK, Robinson CE, Newmarch B and Jackson G (1980) Lower extremity bracing in paraplegia — a follow-up study. *Paraplegia*, **18**, 25-32.