CASE REPORT

Paraplegia and transtibial amputation: successful ambulation after dual disability: a retrospective case report

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INTRODUCTION: This is a single-subject case report. The objective is to describe the unique rehabilitation outcome of an individual with motor complete T12 paraplegia and a right transtibial amputation. This study was conducted at the Department of Physical Medicine and Rehabilitation of Christian Medical College in India.

CASE PRESENTATION: A 42-year-old policeman presented to our rehabilitation centre with motor complete T12 paraplegia and right transtibial amputation, 3 months following a road traffic accident. As the patient's goal was to walk, he was given a trial of independent ambulation with a customized prosthesis on the right side and a regular knee ankle foot orthosis (KAFO) on the left side.

DISCUSSION: At the end of 12 weeks of rehabilitation, the patient was able to walk independently with the prosthesis/orthosis and bilateral elbow crutches. His Walking Index for Spinal Cord Injury (WISCI) score improved from 0/20 to 12/20 points. The scope of functional ambulation should not get restricted for a person with low thoracic spinal cord injury even when there is concurrent transtibial amputation.

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INTRODUCTION

A combination of paraplegia and amputation following road traffic accidents causes dual disability making the rehabilitation process complex. Treatment and rehabilitation needs to address both the orthopedic and neurological impairments.

CASE PRESENTATION

We report a case of a 42-year-old policeman who presented to our rehabilitation centre with motor complete T12 paraplegia and right transtibial amputation, 3 months following a road traffic accident. He sustained a T12 vertebral fracture and a grade III C comminuted fracture of the middle one-third of his right tibia and fibula. His leg was not salvageable so he underwent a right below knee amputation on the same day. The following day he underwent spinal surgery with decompression and segmental instrumentation. He also suffered a fracture of the right scapular neck, left inferior pubic ramus, right ileum and left fourth rib. These were all managed conservatively.

Neurological examination revealed paralysis below T12 level with no sensory or motor preservation. He had an AIS A injury (AIS: American Spinal Injury Association Impairment scale) according to the International Standards for the Neurological Classification of spinal cord injury. The residual right limb had adequate stump length and was conical shaped. The surgical scar healed well with no painful neuromas or any other complications. There were no other co-morbid conditions.

The patient's initial rehabilitation goals were to gain independence with transfers, bed mobility and wheelchair propulsion. He achieved all these goals reasonably quickly and within 4 weeks. The patient also expressed a strong desire to walk for at least short distances so he could go back to his vocation as a policeman even if he was restricted to desk duties. Therefore, he was fitted with a

customized patella tendon bearing (PTB) prosthesis with extended uprights similar to a knee ankle foot orthosis (KAFO). The prosthesis incorporated a standard polypropylene PTB socket and a soft ethaflux liner with a SACH foot (Dynamic Solid Ankle Cushion). Aluminium uprights with drop locks at the knee joint were attached to either side of the PTB prosthesis. The uprights had a thigh band posteriorly below the ischium and a supracondylar band anteriorly for knee support similar to the knee cap of a regular KAFO (see Figure 1). The left lower limb was fitted with a standard KAFO made of polypropylene. Both ankles were set in ten degrees of dorsiflexion to allow for hyperextension at the hip and hence better stability in standing.

The patient received 12 weeks of intensive gait training following our institute's protocol for gait training with bilateral KAFOs in people with low thoracic SCI (Table 1). Gait training was initiated within the parallel bars and then progressed to outside the parallel bars with a walker and then elbow crutches. The patient was taught to walk with a reciprocal gait pattern. The skin of both lower limbs was regularly checked for chaffing and excessive pressure. At the end of 12 weeks, the patient was able to walk a distance of 200 m at the speed of 5 m min⁻¹ using a left KAFO and right modified prosthesis with the aid of bilateral elbow crutches. He achieved a WISCI score of 12/20 points. In addition, he was able to perform a standing pivot transfer and was independent in all functional activities from a wheelchair. He was discharged 16 weeks after commencing rehabilitation.

The patient was reviewed via telephone 6 months post discharge. He reported being in good health and independent in all activities of daily living. He was continuing to walk with his left KAFO and right modified prosthesis without any notable

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Figure 1. Shows the prosthetic design used for the patient.

complications of the residual limb. He had returned to work as a policeman but on desk duties.

DISCUSSION

People with paraplegia and a lower limb amputation are typically provided with a wheelchair for mobility. However, in this case study we demonstrate that it is possible for these individuals to learn to walk with a prosthesis and orthosis. There are only a few studies reporting the rehabilitation of people with paraplegia and lower limb amputations.¹⁻³ The authors of these studies found that patients did not achieve the expected functional outcome given their level of spinal cord injury. Herman *et al.*¹ reported a person with T12 paraplegia and transfemoral amputation learning to walk, but only for exercise purposes. A study by Wang and

Hong³ reported the outcomes of 6 people with paraplegia and lower limb amputations. They claimed that all six people learnt to walk in a way that would be expected by their spinal cord injuries but no details or gait outcomes measures were provided. A third case study by Mustafa *et al.*⁴ reported successfully fitting a person with incomplete paraplegia with a prosthesis for ambulation. To the best of our knowledge, there are no other similar reports of people with complete paraplegia and lower limb amputation achieving independent ambulation.

The main challenges in teaching our patient to walk were related to his anaesthetic amputated limb. He was highly vulnerable to pressure ulcers because of his lack of sensation and the pressure associated with the total contact socket and the self suspension system (moulding over the patellar tendon and tibial condyles). Ohry *et al.*⁵ states that fitting an insensate limb

Table 1. Shows the 12 weeks rehabilitation course of the patient

Rehabilitation protocol
<p>Phase I (Week 0–6)</p> <p>Goals</p> <ul style="list-style-type: none"> Muscle strengthening of the entire upper limb with special emphasis on crutch muscles Achieve independent standing balance using sway back posture Improve standing endurance Improve physical and cardiovascular endurance Retrain walking using compensatory leg clearance technique (hip hitching) Achieve ambulation with reciprocal walker Transfer skills using walker <p>Week 1 and 2</p> <ul style="list-style-type: none"> Strengthening program of key muscles of upper extremity (Biceps, triceps, latissimus dorsi, pectoralis, wrist extension) Functional abilities training in plinth Taught donning and doffing of Knee Ankle Foot Orthoses (KAFO) Standing inside parallel bar using right BK prosthesis with extended uprights and left KAFO Standing balance training using sway back position aided by 10° of dorsiflexion at ankle (anti-jack knifing) Foot clearance trained by depressing shoulder to approximate pelvis (hitching) Ambulation inside parallel bar using reciprocal four-point gait <p>Week 3 and 4</p> <ul style="list-style-type: none"> Ambulation—continued Direct transfers using walker and appliances Functional abilities training in plinth—continued Upper limb strengthening—continued <p>Week 5 and 6</p> <ul style="list-style-type: none"> After 100 m of walking endurance in bar, ambulation progressed using a reciprocal walker Upper limb strengthening—continued Balance training with elbow crutches Initiation of ambulation using bilateral elbow crutches <p>Phase II (Week 7–12)</p> <p>Goals</p> <ul style="list-style-type: none"> Improve standing endurance with crutches Progress ambulation with elbow crutches using reciprocal gait pattern Negotiation of curbs and rough terrain Work on walking speed and endurance Improve physical and cardiovascular endurance <p>Week 7 and 8</p> <ul style="list-style-type: none"> Upper limb strengthening—continued Progression of ambulation with elbow crutches Progressed to independent walking Direct and pivot transfers using elbow crutches <p>Week 9 and 10</p> <ul style="list-style-type: none"> Walking endurance with elbow crutches Upper limb strengthening—continued Gait training—swing to pattern <p>Week 11 and 12</p> <ul style="list-style-type: none"> Walking endurance in different walking surfaces Gait achieved with the speed of 5 m min⁻¹ and 200 m of endurance

with a prosthesis is contra-indicated. However, Shin *et al.*² says that the possibility of fitting a prosthesis to an insensate limb should not be dismissed, and that a trial of prosthetic fitting for the insensate limb and training is appropriate if the patient has the potential for ambulation. We avoided pressure ulcers by including a soft lining within the socket, and closely monitoring the patient's skin for deterioration.

Prosthetic fitting in a transtibial (below knee) amputee with paraplegia is more challenging than a transfemoral amputee because of the need for uprights to lock the knee joint while walking. This requires customization of the prosthesis. Therefore, even though a transtibial amputation has less structural loss, the prosthetic challenge is more than for a transfemoral prosthesis which already has a knee component that can be locked. The knee uprights require drop-locks to ease the process of donning and doffing the KAFO independently and also to allow flexion of the knees while sitting.

In low- and middle-income countries like India where wheelchair accessibility in the community is a major hurdle,

we have found that walking with orthoses gives individuals a better chance of community reintegration.^{6–8} The ability to walk increases a person's chances of employment because there are fewer architectural barriers. This was evident in our case study. The patient was able to return to work as a policeman (albeit on desk duties) because he was able to walk. It is for this reason that walking with orthoses and aids is a common goal for people with low thoracic paraplegia in low- and middle-income countries.

The patient reported in this case study had a good outcome because he was highly motivated and keen to move on with his life. Sometimes people with SCI lose motivation because they struggle to come to terms with their altered body image.⁹ This can be particularly problematic for a person with spinal cord injury and lower limb amputation.^{10,11} Typically, people go through a phase of difficulty in acceptance and reconciliation with their condition. This can interfere with their ability to achieve even basic rehabilitation goals.

In conclusion, the scope of functional ambulation should not get restricted for a person with low thoracic spinal cord injury even when there is concurrent transtibial amputation.

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COMPETING INTERESTS

The authors declare no conflict of interest.

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