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Spina Bifida

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CASE REPORT

OPEN

From Wheelchair to Cane

Elective Transtibial Amputations in a Patient with Spina Bifida

ABSTRACT

Mayo A, Berbrayer D: From wheelchair to cane: elective transtibial amputations in a patient with spina bifida. *Am J Phys Med Rehabil* 2015;94:e107–e110.

Spina bifida is associated with foot deformities, which may lead to foot ulcers, osteomyelitis, and limb amputation. Calcanectomy and Symes amputations have been reported successful in spina bifida. There is lack of evidence for transtibial amputations. This case describes a 27-yr-old woman with L4 level spina bifida who underwent bilateral transtibial amputations. She ambulated with bilateral ankle foot orthoses and canes until age 22. At age 22, she had bilateral foot reconstructive surgeries complicated by nonunion, ulcerations, and osteomyelitis. She was using a wheelchair by age 25. She had elective bilateral transtibial amputations at age 27 for progressive osteomyelitis. Four weeks after amputations, she was fit with bilateral prostheses. On completion of 2 mos of rehabilitation, she ambulated with a cane. This case demonstrates good functional outcomes after transtibial amputations in a young spina bifida patient. Prosthetic fitting should be considered for similar, previously high functioning spina bifida patients with transtibial amputation(s).

Key Words: Meningomyelocele, Lower Extremity, Amputation, Prosthesis

Spina bifida is a congenital spinal defect associated with lower-extremity motor and sensory loss.¹ In lumbar level spina bifida, congenital foot deformities are almost always present.^{1–3} Foot deformities may progress secondary to muscle imbalances, insensate feet, and tethered cord syndrome.^{1–3} Patients often require multiple surgical procedures to maintain a plantigrade foot for ambulation.^{2–4} Patients with significant foot deformities often have difficulty ambulating despite good lower-extremity muscle strength.^{3–5} In childhood and adolescence, gait aids and braces are typically required for ambulation.^{5,6} Because of musculoskeletal complications and obesity, the majority of adults use a wheelchair part-time or full-time for ambulation.^{3,5,6}

With foot deformities and insensate feet, spina bifida patients are at risk of foot skin breakdown, pressure ulcers, and osteomyelitis.^{2–5} Rarely, pressure ulcers progress to squamous cell carcinoma.⁷ Spina bifida patients may require limb amputation for osteomyelitis, foot ulcers, and/or squamous cell carcinoma.^{2–5} There is concern that transtibial amputations would have poor functional outcomes in spina bifida patients because of lower-extremity weakness.⁸ However, there is no available literature on transtibial amputation outcomes in this

population. More distal calcanectomy and Symes amputations have been successful in restoring ambulation in lower-level spina bifida patients.^{3,8}

The purpose of this study was to demonstrate good functional outcomes after transtibial amputations in a lower-level spina bifida patient.

PRESENTATION

A 27-yr-old woman presented with L4 level spina bifida with history of congenital bilateral clubfeet. She had a neurogenic bowel and neurogenic bladder, requiring self-catheterization. She was a smoker. On presentation, she had a body mass index of 28.9, with a weight of 65 kg and a height of 150 cm. She had a high school education with some college level courses. She was on long-term disability.

As a young child, she underwent multiple castings and surgeries to correct foot alignment. At age 10, she had tethered cord syndrome with release surgery. During adolescence, her foot deformities worsened with progressive foot supination and lateral foot weight bearing (Fig. 1). She developed severe subtalar arthritis with pain and stiffness.

The patient was a full-time community ambulator with bilateral ankle foot orthoses and two single point canes until age 22. At age 22, she had bilateral triple hindfoot arthrodesis to regain plantigrade feet, relieve pain, and maintain ambulation. Weight bearing was restricted postoperatively and ambulation ability declined. By age 25, she used a wheelchair and motorized scooter full-time. Because of constant pain and immobility, the patient stopped working as a customer service representative.

Both foot fusions were not successful, with hindfoot nonunion. The patient developed bilateral infected foot ulcers from postoperative casting and bracing. She had recurrent lower leg cellulitis (Fig. 2). Multiple emergency department visits and



FIGURE 1 Patient's foot deformity before amputation.



FIGURE 2 Patient's lower-extremity cellulitis before amputation.

hospitalizations for pain management, antibiotics, and irrigation/debridement procedures were required. The patient became narcotic dependent and was prescribed methadone.

At age 27, extensive osteomyelitis of the bilateral tibiotalar joints with talar and midfoot destruction was diagnosed on contrast computed tomography and magnetic resonance imaging scans. The patient's orthopedic surgeon offered repeat foot surgeries with poor prognosis for healing. Frustrated by her lack of mobility, chronic pain, and infections, the patient declined further limb salvage procedures. She underwent elective transtibial amputations. Transtibial levels were chosen by her orthopedic surgeon because of the extent of osteomyelitis into her tibiotalar joint, active lower leg cellulitis, and poor foot skin quality.

One week postoperatively, the patient was admitted to a specialized amputee rehabilitation inpatient unit. Her inpatient rehabilitation admission Functional Independence Measure score was 101. On the Medical Research Council scale for testing muscle strength, she had grade 5/5 hip flexion, 4/5 hip abduction, 4/5 hip extension, 4/5 knee flexion, and 5/5 knee extension bilaterally. Sensation was intact in her residual limbs.



FIGURE 3 Patient's healed residual limbs after amputation.



FIGURE 4 Patient using her bilateral transtibial prostheses and her single point cane.

Amputation wound healing was uncomplicated and her residual limbs healed well (Fig. 3). In inpatient rehabilitation, she received 1 hr each of physiotherapy and occupational therapy daily. The patient was fit with bilateral transtibial prosthesis with a silicone gel liner and Vari-Flex feet. The silicone gel liner was prescribed for improved socket comfort and skin protection. The patient had goals of community ambulation involving uneven terrain; thus, the dynamic Vari-Flex feet were chosen.

After 4 wks of inpatient rehabilitation, she was independently ambulating with a single point cane (Fig. 4). She was discharged home to live independently in a single-floor apartment. The patient felt that her quality-of-life was better after amputations.

She attended 1 mo of outpatient physiotherapy consisting of 1-hr sessions, three times a week. Her rehabilitation course was 2 mos in total (4 wks inpatient and 4 wks outpatient).

To evaluate physical function, several validated outcome measures of clinical mobility were used. The 2-min walk test measures the distance walked in 2 mins and is predictive of the 6-min walk test.⁹ The Houghton scale evaluates prosthetic use with respect to daily wear time, gait aids, and ambulation in the community and on various terrain.¹⁰ The Houghton scale is scored out of 12, with higher scores indicating greater prosthetic performance and comfort.¹⁰ The L-test of mobility consists of two transfers and four turns and is predictive of functional household transfers and mobility.¹¹ Deathe and Miller¹¹ report that the average time for unilateral lower-extremity amputees to complete the L-test for the first time is 32.6 secs. No L-test data have been reported for bilateral transtibial amputees. The Functional Independence Measure score at discharge was compared with the patient's score before prosthetic fitting.

A timeline of the patient's functional abilities is presented in Table 1. Upon completion of rehabilitation, the patient's 2-min walk test was 98 m with a single point cane. Her inpatient discharge Functional Independence Measure score was 113, an improvement of 12 points. She had no history of falls. Her Houghton score was 10 out of 12 with no feelings of instability. She completed the L-test of functional mobility in 27 secs.

Four months after amputation, the patient had acute pain, redness, and swelling in her left distal residual limb. She was found to have heterotopic ossification on a triple-phase bone scan. She was treated with 3 mos of the bisphosphonate etidronate,

TABLE 1 Timeline of patient's changes in function before and after amputation

	Ambulating	Gait Aid	FIM Score	2MWT, m	L-Test	Houghton Scale	Employment
Adolescence	Yes	2 single point canes, AFOs	113	Unknown	Unknown	N/A	High school student
Young adulthood	Yes	2 single point canes, AFOs	113	Unknown	Unknown	N/A	College student, customer service representative
Before amputation	No	Wheelchair, scooter	101	Unable to complete	Unable to complete	N/A	Unemployed, on disability
Admission to rehab	No	Wheelchair, scooter	101	Unable to complete	Unable to complete	N/A	Unemployed, on disability
Discharge from rehab	Yes	Single point cane	113	98	27 secs	10	Unemployed, on disability
Six-month follow-up	Yes	Single point cane	113	100	Not tested	10	Hospital volunteer, tattoo apprentice

2MWT, 2-min walk test; AFO, ankle foot orthosis; FIM, Functional Independence Measure; N/A, not available.

dosed 10 mg/kg of body weight. She required a new prosthetic socket. Her pain symptoms resolved within 3 mos. She was left with a bony prominence at the lateral distal end of her left residual tibia.

In a 6-mo follow-up appointment after discharge from rehabilitation, her 2-min walk test was 100 m. She still ambulated with a single point cane. She volunteered at a local hospital as a patient advocate for persons with physical disabilities.

Within the first year of getting her prostheses, the patient returned to work after being on long-term disability for more than 5 yrs. She has gained employment in a tattoo parlor as an apprentice. She wears her prostheses full-time. She does a flight of stairs at work, without issues, several times during the day. The patient was pleased with her improvement in function.

DISCUSSION

This young, nonobese patient had an improvement in function and ambulatory ability restored with bilateral transtibial amputations. Before amputation, she had a 5-yr history of primarily using a wheelchair. Despite a prolonged period of wheelchair mobility before amputation, she was able to achieve independent ambulation after a 2-mo course of intensive rehabilitation.

Transtibial amputations should be considered for spina bifida patients with chronic foot and/or ankle osteomyelitis despite previous reports of poor outcomes. Transtibial amputations with shorter residual limb length may result in poorer prosthetic control, less energy efficient gait, and slower walking speed than calcaneotomy and Symes.^{12,13} Calcaneotomy and Symes amputations are advantageous in allowing distal weight bearing and decrease the risk of bony overgrowth.¹³ However, there are advantages of transtibial amputation including improved dynamic prosthetic foot options and no risk of heel fat pad migration.¹³

Patients with spina bifida may be at increased risk for heterotopic ossification after amputation.¹⁴ Symptoms of acute residual limb pain, swelling, redness, and/or bony deformity should be investigated for heterotopic ossification. Socket modification and prompt treatment of heterotopic ossification are advised to maintain prosthetic use and ambulation.

Not all spina bifida patients may be prosthetic candidates after transtibial amputation. Criteria for prosthetic candidacy should include a healthy body weight, good proximal lower-extremity muscle strength, and good cognitive function. Careful evaluation of the patient's goals and environment should

be done before prosthetic componentry selection. The patient should have access to intensive rehabilitation and prosthetic follow-up.

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