

Surgical Reconstruction of Painless Foot Drop Using Tendon Transfer: A Two-Case Experience

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Abstract

Background: Foot drop is a disabling neurological characterized by diminished dorsiflexion of the foot, often due to neurological, musculoskeletal or traumatic etiologies. Different surgical techniques/surgeries such as tendon transfer are taken into consideration when conservative therapies fail to restore functional mobility and quality of life.

Case Presentation and Management: We report two cases of painless foot drop with different underlying causes, managed at Swat Medical Complex and Teaching Hospital, Saidu Sharif, Swat, KPK, Pakistan, following unsuccessful conservative treatment approach. One of the Patients had a sciatic nerve injury (traumatic) while the other developed peripheral neuropathy following radiation therapy for relapsing and remitting acute lymphoblastic leukemia (ALL). Both patients underwent tibialis posterior tendon transfer using a two-sling technique, resulting in improved dorsiflexion, gait and quality of life.

Conclusion: Tibialis posterior tendon transfer is a dependable and effective surgical option for restoring function in patients with painless foot drop resulting from neurological, musculoskeletal, or traumatic causes.

Keywords: Case Series, Gait improvement, Painless foot drop, Sciatic nerve, Tendon transfer Technique, Tibialis posterior.

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INTRODUCTION:

Foot drop is an increasingly recognized disabling musculoskeletal and neurological condition characterized by complete loss or weakness of active ankle dorsiflexion, resulting in inadequate clearance of foot during the swing phase of gait.¹ This medical condition commonly manifests as a steppage gait pattern, gait instability, compensatory knee and hip flexion, and difficulty with ambulation finally leading to substantial functional impairment in affected individuals.¹ In addition to causing significant gait abnormalities, foot drop adversely affects balance, mobility, independence in activities of daily living, and overall quality of life (QOL), while also predisposing patients to recurrent falls and thus fall-related injuries.¹ The estimated incidence of foot drop is approximately 1.8 per 1,000 individuals globally, making it a relatively common clinical entity encountered in routine orthopedic, neurological and rehabilitation practice.²

The root causes of foot drop are multifactorial and encompasses a broad spectrum of central, peripheral, systemic and traumatic etiologies. Peripheral nerve injuries remain among the most common causes, particularly involving the sciatic nerve and common peroneal nerve due to their anatomical course and susceptibility to trauma or compression.^{1,3} Additional causes include lumbosacral plexopathies, lumbar radiculopathy, central nervous system disorders such as cerebrovascular accidents and multiple sclerosis, motor neuron diseases, traumatic nerve injuries, and systemic conditions associated with peripheral neuropathy, including leprosy, diabetes mellitus, malignancy-related neuropathies, and neurotoxic effects of antineoplastic therapy.^{1,3,4} The resulting neuronal damage and muscular imbalance compromise the coordinated biomechanics of gait, impair function of lower limb, and substantially reduce patient independence and functional capacity during routine daily activities.

Foot drop management depends upon the underlying etiology, duration of illness, severity of neurological deficit, and the extent of neuronal involvement. Initial treatment approaches are generally conservative and nonsurgical including physiotherapy, pain management (pharmacological), strengthening exercises (neuromuscular), rehabilitation of gait, electrical stimulation, and the use of ankle-foot orthoses (AFOs) to improve

mechanics of gait and provide functional stabilization of the ankle joint.^{1,2} These primary conservative approaches aim to prevent secondary musculoskeletal deformities, enhance ambulation, reduce the risk of falls and thus trauma, and improve overall patients' quality of life. However, in patients with nonreversible and significant neuronal injury, failure of prolonged conservative management or persistent neurological deficits satisfactory restoration of active ankle dorsiflexion may not be achieved through non-operative measures alone and thus requires surgical management.⁴

Consequently, several surgical techniques have been introduced and developed over the decades with advancements to restore dynamic dorsiflexion and improve functional outcomes of gait and quality of life in patients having chronic foot drop. Among these techniques, tendon transfer procedures represent one of the most widely performed and well-established reconstructive techniques across the globe.^{5,6} These procedures involve rerouting normal functioning tendons from unaffected muscle groups to compensate for paralyzed or weakened dorsiflexor muscles, thereby restoring active ankle dorsiflexion and thus improving gait mechanics and quality of life. Of the available tendon transfer procedures, Tibialis posterior tendon transfer has emerged as one of the most reliable and commonly utilized surgical procedures across the globe due to its favorable biomechanical properties, reproducibility, and satisfactory neurological and functional outcomes reported in the literature.^{7,8} Multiple studies have demonstrated significant postoperative improvement in the stability of gait, ambulatory function, and patient-reported quality of life following tibialis posterior tendon in appropriately selected patients with irreversible foot drop.^{7,8}

Case Description: This case series describes two patients presenting with painless foot drop at the of Swat Medical Complex and teaching hospital, Neurosurgery Department who underwent surgical management following failure of long-term initial standard conservative treatment modalities. Both patients had significantly impaired dorsiflexion at ankle joint, resulting in abnormal gait mechanics, compromised ambulation and reduced functional capacity and quality of life.

The first case was a female aged 19 years, who had a history of traumatic injury of the gluteal region about

three months prior to her presentation. She progressively developed unilateral foot drops that was associated with difficulty during the gait (swing phase) and impaired clearance of foot few days later following her injury. Clinical examinations suggested sciatic nerve involvement secondary compression injury following the trauma. The resultant neuropathy led to gait disturbance, weakness of the ankle dorsiflexors, and substantial limitation in routine functional activities and quality of life.

The second case was a 28-year-old male who had previous history of relapsing and remitting acute lymphoblastic leukemia (ALL) and developed foot drop after undergoing multiple cycles of chemotherapy and radiotherapy. The patient gradually developed progressive weakness of ankle dorsiflexion over years due to post oncological treatment related peripheral neuropathy. Chronic neurotoxic effects of the undergoing antineoplastic therapy, aggravated by the underlying hematological malignancy, resulted in dysfunction of the peripheral nerves supplying the lower limb musculature, ultimately leading to foot drop and gait impairment.

Radiological investigations:

Diagnostic Radiological investigations were performed for both the cases after detailed physical examination to evaluate the underlying root causes and assess the extent of foot drop.

Case 1: 19-year-old female Patient with foot drop due to traumatic injury to the gluteal region:

Radiological investigations included plain X-rays and magnetic resonance imaging (MRI) of the lumbar spine and pelvis. X-rays were performed to rule out any associated bony abnormalities, Pathologies, malalignments, or fractures that could contribute to the foot drop. MRI of the lumbar spine and pelvis was performed to identify any impingement or compression of the nerve in the affected region and to assess the integrity of the sciatic nerve. The MRI scans helped to localize the location of nerve injury along its path and to determine the extent of nerve involvement.

Case 2: 28-year-old male Patient with foot drop following radiotherapy and chemotherapy for relapsing and remitting acute lymphoblastic leukemia:

In this case, radiological investigations included plain X-rays of the pelvis and lower limbs, including anteroposterior (AP) and lateral views. The primary

purpose of X-rays was to look for any skeletal anomalies, fractures, or deformities that might be the cause of patient's foot drop. Electrodiagnostic studies including both Electromyography (EMG) and Nerve conduction studies (NCS) were performed to assess the integrity and functional status of the peripheral nerves. These investigations along with examination provided significant information regarding the extent of nerve damage and the degree of involvement of lower limb nerves.

Case Management Approach:

A surgical intervention involving tibialis posterior tendon transfer was considered after conservative measures failed to produce satisfactory clinical improvement in both patients. In individuals with foot drop, tendon transfer surgeries have been shown to be successful in improving gait patterns, restoring foot function and improving quality of life(QOL).^{7,12} The tibialis posterior tendon transfer is one of the most widely used tendon transfer methods because of its excellent reliable outcomes and favorable biomechanics.^{4,5,6,7}

Surgical Approach and Technique:

The tibialis posterior tendon is surgically separated from its normal insertion site and guided to a new insertion site using a two-sling technique. The paralyzed or weakened muscles involved in dorsiflexion of foot and toes are replaced by the newly transplanted tibialis posterior tendon. This method restores a more natural gait pattern by giving the foot a mechanical advantage and enhancing its ability to clear the ground during the swing phase of walking.

DISCUSSION:

Foot drop is a disabling medical condition defined by the inability to actively dorsiflex toes and foot, resulting in marked mobility limitation and a negative impact on quality of life(QOL). It is most often associated with underlying musculoskeletal or neurological pathology, particularly central neurological disorders or peripheral nerve injuries, which lead to weakness or paralysis of the dorsiflexor muscle group. Initial management strategies typically involve conservative and nonoperative measures such as the use of orthotic devices and physiotherapy; however, these approaches may not provide adequate functional recovery in all patients.¹ In such cases, surgical intervention becomes a viable

option, with tendon transfer techniques being among the most widely utilized.⁴

The global incidence of foot drop is estimated to range from 1.5 to 2 cases per 1,000 individuals.¹ This medical condition carries a considerable functional burden, limiting a patient's ability to walk on uneven surfaces, affecting gait stability and performance of routine daily activities independently. Foot drop may arise from a variety of etiologies (neurological, muscular or anatomical), including brain and spinal cord disorders, stroke, traumatic injuries, compressive neuropathies, nerve entrapment, and systemic disorders such as muscular dystrophy, peripheral neuropathies, multiple sclerosis and amyotrophic lateral sclerosis (ALS).^{1,3,4}

Management and treatment strategies for foot drop include both conservative and surgical modalities depending upon the onset, duration and severity of condition. Conservative options generally includes targeted physiotherapy aimed at improving gait mechanics and strengthening preserved muscle groups, along with ankle-foot orthoses (AFOs) that assist in maintaining dorsiflexion during the swing phase of gait.^{2,3} Despite these measures, persistent deficits may necessitate surgical correction. Surgical management approaches mainly target on restoring active dorsiflexion and improving overall foot function. Among the surgically available options, tendon transfer technique has emerged as an effective option for reestablishing dynamic control during

swing phase of gait.^{4,6} This procedure involves redirecting a functioning tendon from its normal site to a weakened or paralyzed muscle site to compensate for the effected muscle group, thereby acting as a dynamic substitute during movement.^{1,9} Different tendons may be considered for transfer, including the tibialis posterior, tibialis anterior and peroneus longus.^{10–14} The type of tendon selection depends on patients anatomical and functional considerations. Among these, the tibialis posterior tendon transfer technique is particularly favored due to its excursion, strength and consistent clinical outcomes.^{5,13} Its biomechanical properties make it well suited to restore dorsiflexion in the cases of foot drop. Additional techniques such as the two-sling (Fowler-type) construct have shown promising results in improving foot clearance and gait efficiency.^{7,8,15}

CONCLUSION:

This case series of two cases demonstrates that tibialis posterior tendon transfer technique is an effective and reproducible option for the management of painless foot drop of differing etiologies unresponsive to conservative therapies and non-operative measures. The observed improvement in functional mobility and gait underscores its role as a valuable surgical option when conservative measures fail. Further studies with larger sample sizes are warranted to validate these findings.

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