



## Case report

# Tendon transfer for dysfunction of all tendons in leg excepting Achilles tendon and plantaris tendon following irreparable sciatic nerve palsy – A case report

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## ARTICLE INFO

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Foot drop  
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## ABSTRACT

**Introduction and importance:** Irreparable sciatic nerve palsy is a cause of foot drop and resulting in absent or weak most of the muscles in leg. There may be dysfunctions of all tendons in the leg excepting Achilles tendon and plantaris tendon. The treatment of this atypical neurologic injury has not been defined.

**Case presentation:** I reported a case of foot drop following irreparable sciatic nerve palsy in which there was a dysfunction of all tendons in leg excepting Achilles tendon and plantaris tendon. The medial gastrocnemius tendon and plantaris tendon were transferred into the anterior tibialis tendon, the extensor digitorum longus tendon and extensor hallucis longus tendon. The lateral gastrocnemius tendon was transferred into the peroneus brevis. Four months post-operative, he reported no pain and became capable of walking without the assistance of an orthosis or a crutch and without steppage gait.

**Clinical discussion:** Anterior transfer of the tibialis posterior tendon was the preferred procedure. If no posterior tibial tendon function was presented, then in order of preference, the extensor hallucis longus, extensor digitorum longus, peroneal, flexor hallucis longus tendon, medial gastrocnemius, lateral gastrocnemius and plantaris tendon would be used.

**Conclusion:** The atypical dysfunction of all tendons in the leg excepting Achilles tendon and plantaris tendon following irreparable sciatic nerve palsy was presented. Tendon transfer using medial gastrocnemius tendon, lateral gastrocnemius tendon and plantaris tendon seemed to be a good choice for treatment of this injury. It allowed reconstruction of a stable, painless, plantigrade foot.

**Level of evidence:** Case report.

## 1. Introduction and importance

Drop foot deformity is a common problem with severe restrictions in quality of life and impairment of daily activities. Common peroneal nerve palsy is a common cause of foot drop. Common peroneal nerve injury results in absent or weak anterior and lateral compartment muscle function. The posterior tibial tendon transfer is a preferred procedure if nerve repair seems inappropriate. Sciatic nerve palsy results in absent or weak most muscles of the leg. There may be a dysfunction of all tendons in the leg excepting Achilles tendon and plantaris tendon. To my knowledge the treatment of this atypical neurologic injury has not been defined. I reported the use of an unusual tendon transfers for treatment of this injury. My case was treated by using gastrocnemius tendon and plantaris tendon to transfer into anterior tibial tendon, extensor

digitorum tendon, extensor hallucis longus tendon and peroneus brevis tendon.

## 2. Case presentation

This case followed 2020 SCARE guidelines for reporting of cases in surgery [1]. A 31-year-old man was transferred from a local hospital to my hospital with a diagnosis of a foot drop of right leg. He was in a good state overall. He walked with a mild steppage gait. Manual testing of his right leg revealed 0/5 strength in the extensor digitorum, extensor hallucis longus, tibialis anterior, tibialis posterior and peroneal tendons; 1/5 strength in the flexor hallucis longus and flexor digitorum longus muscles; 5/5 strength in the Achilles tendon. Sensation was intact to light touch on the plantar aspect and dorsum aspect of his right foot. The

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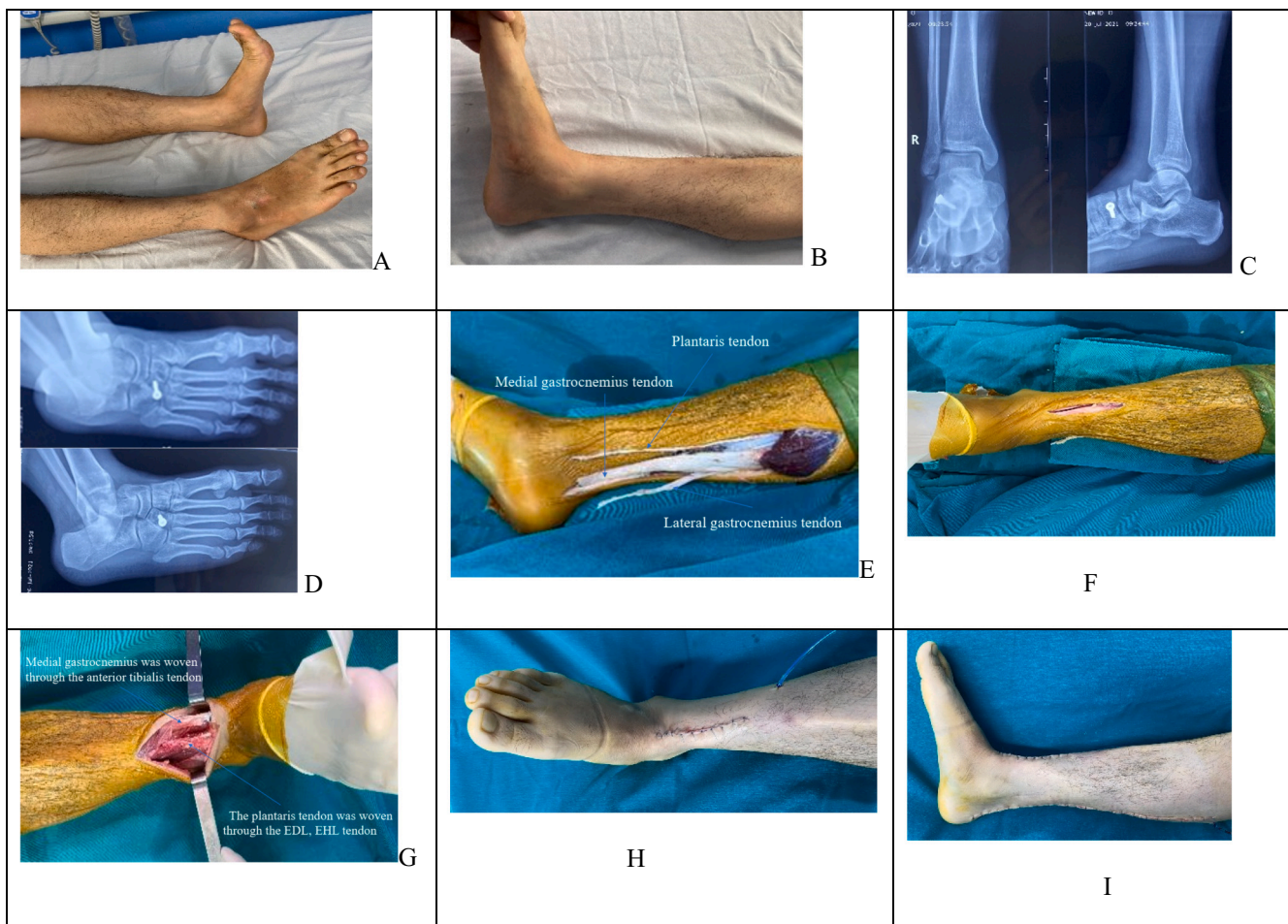
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passive ankle dorsiflexion and plantar flexion were normal. There was no compromising of blood flow. X-rays showed a normal ankle joint excepting a screw at the middle cuneiform (Fig. 1). She reported a history of right sciatic nerve injury due to a knife stab wound at right thigh seven years ago. He was treated by repairing right sciatic nerve in a local hospital. The sciatic nerve palsy had not been recovery after repairing sciatic nerve two years. He was under an intervention of posterior tibial tendon transfer for treatment of drop foot. Unfortunately, he had a wound infection and the posterior tibial tendon became necrotic requiring excisional debridement post-operatively. After that, he had not been under any treatment. The patient had no family history for any relevant genetic information, and psychosocial history and relevant pre-existing illnesses. He did not smoke and he drank alcohol socially.

Based on his history, physical and X-rays findings, it was determined that he had the dysfunction of all tendons in right leg excepting Achilles tendon following irreparable sciatic nerve palsy seven years ago. After discussion of the risks and benefits of surgery, the patient decided to undergo the recommended surgical procedure: Medial gastrocnemius tendon was transferred into the tibialis anterior tendon, extensor digitorum longus tendon and extensor hallucis longus tendon through the subcutaneous tunnel; lateral gastrocnemius tendon was transferred into the peroneus brevis tendon, to restore balance of ankle. Surgery was performed by the author (L.N.V.). Patient underwent surgery in the supine position with spinal anesthesia. He was received a single dose of prophylactic antibiotics before thigh tourniquet inflation. An examination was performed to evaluate the medial border of gastrocnemius muscle. The operative leg was prepared and draped in a routine surgical

sterile fashion above the knee. The first 20 cm longitudinal incision was done at just the medial border of the gastrocnemius and at the medial border of Achilles tendon. The fascia was opened and the gastrocnemius was exposed. As the subcutaneous tissue was entered the lesser saphenous vein was encountered and preserved by retracting it laterally. Deeper, the sural nerve was encountered and also spared. Blunt dissection between the gastrocnemius and the soleus and between the fascia and the gastrocnemius allowed identification of the gastrocnemius muscle. The midline raphe was identified, careful dissection was carried out between the medial and lateral gastrocnemius muscle bellies and the lateral gastrocnemius and medial gastrocnemius was released from each other proximal to distal. The Achilles tendon was split equally in the horizontal plan to separate between gastrocnemius tendon and soleus tendon. The medial gastrocnemius tendon and lateral gastrocnemius tendon were then split in the axial plane and were transected distally at the calcaneal insertion. The plantaris tendon was found to be in good condition for tendon transfer so this tendon was transected at the level of Achilles tendon insertion (Fig. 1).

A six cm longitudinal anterior skin incision was made at the distal third of leg, it was about two cm lateral tibia crest. The fascia was opened and the anterior tibialis tendons, extensor digitorum longus tendon, extensor hallucis longus tendon were exposed. The medial gastrocnemius tendon and plantaris tendon were pulled down anteriorly though the wound and routed posterior medial to the tibia and through a subcutaneous window. The medial gastrocnemius tendon was woven through the anterior tibialis tendon proximal to the ankle extensor retinaculum using Pulvertaft technique and sutured with a No.1 fiber



**Fig. 1.** Pre-operative and post-operative clinical condition and X-rays. A, B, Pre-operative clinical condition. C, D, pre-operative X-rays of ankle and foot. E, F, G, During operation. H, I, One day post-operative clinical condition.

wire. The plantaris tendon was woven through the extensor digitorum longus tendon and extensor hallucis longus tendon above the ankle extensor retinaculum using Pulvertaft technique and sutured with a No.1 fiber wire. The peroneus brevis tendon was dissected through the posterior wound. The lateral gastrocnemius tendon was then woven through the peroneus brevis using Pulvertaft technique and sutured with a No.1 fiber wire (Fig. 1). The ankle was held in 10° dorsiflexion with the knee in extension to create a controlled tendon tear with separation of the tendon ends. The incisions were sutured. Finally, a dressing was applied, and a below-knee brace at 5° dorsiflexion was applied and being held in place.

A short leg splint and non-weight bearing ambulation with crutches were maintained for two weeks. Two weeks postoperatively, sutures were removed and a short leg walking cast was used for two weeks. Patient was permitted partial weight-bearing activities until 4 weeks after operation, followed by physical therapy including muscle re-education, muscle strengthening, Achilles stretching and gait training

(Fig. 2). He was recommended for using a night splint for 3 months and avoiding running, jumping exercises for 6 months. Monthly follow-ups were conducted by me. Any complications were encountered during operation and post-operative.

Four months post-operatively, he was noted to have -5° of active ankle dorsiflexion, +5° of passive ankle dorsiflexion, 25° of active ankle plantarflexion and no active inversion or eversion of the hindfoot. He reported no pain and became capable of walking without the assistance of an orthosis or a crutch and without steppage gait (Fig. 2). He is now checked regularly monthly by the author. The patient reports being very satisfied with his operation.

### 3. Discussion

Peroneal nerve injury was known to be the most common cause of trauma-induced foot drop as it courses around the fibular neck, resulting in absent or weak anterior and lateral compartment muscle function. For



Fig. 2. Post-operative clinical condition. A, B, C, 4 weeks post-operative clinical condition. D, E, F, G, H, I, 4 months post-operative clinical outcomes.

patients with foot drop that had lasted for more than 1 year with little chance of motor function improvement, a tendon transfer could be considered to re-create a balanced foot that is plantigrade and functional. Several tendon transfer procedures had been employed to treat foot drop due to irreparable peroneal nerve palsy. Anterior transfer of the tibialis posterior tendon transfer was preferred by many authors and several modifications and improvements had been made to the original technique [2–7]. Split tendon transfer of the tibialis posterior tendon for treatment of patients with extensive disruption of the tibialis anterior tendon was recommended [8,9]. Jeng [10] proposed the principles of tendon transfer. The goal of tendon transfer should be an achievement of stable plantigrade foot without requiring a brace. This was possible if there was adequate preoperative tendon strength, adherence to the basic principles of tendon transfer during surgery, and intensive retraining of the muscle in the recovery phase. According to Jeng [10], if no posterior tibial tendon function was presented, then in order of preference, the common digital extensors (extensor hallucis longus, extensor digitorum longus), the peroneal tendons, or even the flexor hallucis longus tendon would be used. The optimal method of tendon fixation remained unclear.

The sciatic nerve is comprised of two main divisions, the peroneal and tibial, which divide in the popliteal fossa of the knee. The sciatic nerve may be injured during traumatic hip dislocation, hip arthroplasty, acetabular fracture or the wound at the posterior thigh. The sciatic palsy causes of foot drop and resulting in absent or weak most of the muscles at the anterior, lateral or posterior compartment muscle. Hepper [11] reported a case with anterior and posterior tibialis dysfunction following hip dislocation. The peroneus longus tendon was transferred into the tibialis anterior insertion to restore ankle dorsiflexion, the flexor digitorum longus tendon was transferred to the navicular tuberosity to restore hindfoot inversion and reconstruct the tibialis posterior.

In my case, the dysfunction of all tendons in the right leg excepting Achilles tendon and plantaris tendon following irreparable sciatic nerve palsy was presented seven years ago. Manual testing of his right leg revealed 0/5 strength in the extensor digitorum, extensor hallucis longus, tibialis anterior, tibialis posterior, peroneus brevis and peroneus longus muscles; 1/5 strength in the flexor hallucis longus and flexor digitorum longus muscles. To my knowledge, the treatment of this atypical neurologic injury has not been defined.

The muscle of the triceps sural comprises three heads, two of which superficial, the medial head and the lateral head, which form the gastrocnemius muscle, and a deeper muscle, the soleus muscle, and in a small percentage, the plantaris muscle. The sural arteries are collateral arteries of the popliteal artery. The sural arteries originate at the level of the popliteal fossa and nourish the twin muscles and the soleus. The medial and lateral gastrocnemius muscles each have independent vascular supplies. The medial muscle is nourished by the medial sural artery, while the lateral is supplied by the lateral sural. The nerve supply is also independent, with branches from the tibial nerve going to the medial and lateral gastrocnemius independently. This anatomy allowed isolating medial gastrocnemius muscle, lateral gastrocnemius muscle and soleus muscle. The medial gastrocnemius flap, lateral gastrocnemius flap had been used for decades to reconstruct defects of the proximal tibia and knee [12].

In my case, the soleus tendon was intact for ankle plantarflexion, the medial gastrocnemius muscle, lateral gastrocnemius muscle and soleus muscle had been isolated for tendon transfer. The medial gastrocnemius tendon and plantaris tendon were routed posterior medial to the tibia through a subcutaneous window and were transferred into the anterior tibialis tendon, extensor digitorum longus tendon and extensor hallucis longus tendon. That restored dorsiflexion of ankle and toes and inversion of the foot. The lateral gastrocnemius tendon was transferred into the peroneus brevis tendon to restore eversion of the foot. This combination of operative procedures created a plantigrade foot with improved active dorsiflexion and rebalance of foot and ankle. This was suitable to principles of tendon transfer [10]. In case of absent of plantaris tendon, I

recommended to use medial gastrocnemius tendon transfer into the tibialis anterior tendon, extensor digitorum longus tendon, extensor hallucis longus tendon; lateral gastrocnemius tendon transfer into the peroneus brevis tendon.

Rath recommended early active mobilization of tibialis posterior transfer [13]. I recommended to suture tendons 2 cm above ankle extensor retinaculum using Pulvertaft weave technique and the ankle was held in 10° dorsiflexion with the knee in extension to create a controlled tendon tear with separation of the tendon ends. Two weeks post-operatively, the patient was permitted partial weight-bearing activities with a working brace. Four weeks post-operatively, patient was permitted full weight-bearing activities without splint and followed by physical therapy (Fig. 2). He was recommended for using a night splint for 3 months. Four months post-operatively, although he was noted to have –5° of active ankle dorsiflexion, +5° of passive ankle dorsiflexion, 25° active ankle plantarflexion and no active inversion or eversion of the hindfoot, the function in daily activities and gait ability were satisfactorily significantly improved. He reported no pain and became capable of walking without the assistance of an ankle-foot orthosis or a crutch and no steppage gait.

Any complications during operation and postoperative were encountered. However, during operation, the lesser saphenous vein and sural nerve were usually encountered, so it was carefully to preserve the lesser saphenous vein and sural nerve.

#### 4. Conclusion

The atypical tendon transfer for the treatment of dysfunction of all tendons in leg excepting Achilles tendon and plantaris tendon following irreparable sciatic nerve palsy was presented. The medial gastrocnemius tendon and plantaris tendon were transferred into the anterior tibialis tendon, the extensor digitorum longus tendon and extensor hallucis longus tendon. The lateral gastrocnemius tendon was transferred into the peroneus brevis tendon. My tendon transfer procedure allowed reconstruction of a stable, painless, plantigrade foot.

#### Consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

#### Provenance and peer review

Not commissioned, externally peer-reviewed.

#### Availability of data and materials

The data used to support the findings of this study are available from the corresponding author upon request.

#### Ethical approval

All procedures were approved by the 108 Central Military Hospital's Institutional Review Board, Hanoi, Viet Nam.

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#### Guarantor

Dr. Luong Van Nguyen.

**Research registration number**

Not applicable.

**CRedit authorship contribution statement**

Dr. Luong Van Nguyen: Conceptualization, Surgery, Writing - Review & editing, Supervision.

**Declaration of competing interest**

The authors declare that they have no conflicts of interest.

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