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A study of early post-operative active mobilization in Tibialis posterior tendon transfer for foot drop correction in leprosy patients-a surgical anatomy prospective

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Abstract
Background: Immobilization or late post-operative mobilization after tibialis posterior tendon transfer for foot drop correction has been the conventional post operative management.
Purpose: To determine whether early active mobilization after tibialis posterior transfer for foot drop have a higher rate of tendon insertion pullout or not or is there any reduce rehabilitation time for Active Dorsiflexion, Plantar Flexion, Active Total Ankle Dorsiflexion.
Methods: This study was conducted at Leprosy Home and Hospital, Cuttack, Odisha which is a leprosy reconstructive surgery center, from October 2015 to September 2017. We performed a tendon transfer for foot drop correction in 49 Patients with Hansen's disease with irreversible common peroneal nerve paralysis of more than one-year duration. The cases were followed up for at least one year.
Result: There is no incident of insertion pullout of the transferred tendon in any of the patients and having good outcome.
Conclusion: In Hansen disease early, active tendon transfer is feasible and safe method with no added risk of tendon pull out. There is earlier restoration of independent walking with early mobilization with reduction of total cost and loss of work for patients.

Keywords: hansen's disease, dorsiflexion, plantar flexion, foot drop, tibialis posterior

Introduction
Leprosy also known as Hansen's disease since long. The causative organism is an acid-fast bacillus known as Mycobacterium Leprae that has affinity to involve, infect and destroy peripheral nerves, those of limbs. In the initial stage nerves are thickened, tender and painful, but have no loss of function. In the final stage there is damage and loss of sweating and sensibility, muscle weakness or complete paralysis. Leprosy involves dermal nerves, cutaneous nerves [3] and major nerve trunk in the peripheral nerve and ulnar, median and occasionally radial nerve of upper extremity and common peroneal and posterior tibial nerve involvement in the lower extremity.

Different nerve involvement gives different disability:
- Ulnar nerve damage: Claw finger deformity
- Median nerve damage: Claw finger and claw thumb deformity
- Radial nerve damage: Wrist drop
- Common peroneal paralysis: Foot drop
- Posterior tibial nerve: Claw toe

WHO classified disability due to nerve involvement into three grades [1]
- **Grade 0:** The nerves are thickened/ tender but have no motor or sensory deficit.
- **Grade 1:** Loss of sweating and sensibility but no visible deformity
- **Grade 2:** Visible deformity of hand feet and face

Definition
Early active mobilization is defined as starting post-operative therapy for reduction of transfer in the first week of surgery.

Principle of Early Post-Operative Active Mobilization
Tendon repairs were traditionally immobilized postoperatively for 3 to 4 weeks to allow for sound healing of repair side. Such immobilization was associated with slower return of strength, adhesion formation and poor tendon glide. This lead to development of early mobilization program that allows healing but decrease adhesion formation [2]. Studies demonstrated that tendon repairs followed by early mobilization program heals faster, gained tensile strength

quicker and had better excursion because of less adhesion formation than the unstressed repair [4].

Aim of Study

Whether early active mobilization after tibialis posterior transfer for foot drop

1. Have a higher rate of tendon insertion pullout or not
2. Is there any Reduce rehabilitation time for active Dorsiflexion, Plantar flexion, active total ankle Dorsiflexion.

Materials and Methods

This study was conducted at Leprosy Home and Hospital, Cuttack, Odisha which is a leprosy reconstructive surgery centre we performed a tendon transfer for foot drop correction in 49 Patients with Hansen's disease from October 2015 to September 2017 with irreversible common peroneal nerve paralysis of more than one-year duration. The diagnosis and treatment of the disease was performed at the field level by the trained medical staff of the national leprosy eradication programme. The neurological deficit was documented by the physiotherapist using manual muscle strength test grading (MMST) [5]. All patients had completed multidrug therapy for Hansen's disease. We excluded 8 patients with claw toes having additional surgery, active neuropathic plantar ulcers.4 patients expressed their inability for repeated follow up therefore excluded. These exclusions left 37 patients for study. In all the patients, a tibialis posterior tendon transfer for foot drop correction was performed by the Circum-tibial route. Patients were operated on under sedation using wide local infiltration of 1% lidocaine with 1:10000 adrenaline and with use of tourniquet. The surgical technique is like as described by Srinivasan *et al.* [3]. The tibialis posterior tendon was detached from its insertion to the navicular bone, retrieved in the lower leg and split to the musculotendinous junction into two slips. Each slip was then transferred to foot separately along the circumtibial route passing anterior to the ankle and superficial to extensor retinaculum. One slip was attached to extensor digitorum longus with maximum tension and second slip was inserted to extensor hallucis longus tendon in neutral tension. The transfer was inserted using a Pulvertaft's Weave and point of entry and exit was sutured using 3-0 prolene. Percutaneous lengthening of achills tendon was always performed before the tendon transfer because passive ankle dorsiflexion was less than 20 degrees in all patients. During the suturing of the transferred tendon slips, the limb was put in a prefabricated splint that maintained the knee in 60 degrees flexion and ankle in 20 degrees dorsiflexion to ensure standardization of tendon transfer tension and after completion of surgery the ankles were immobilized in 20 degrees dorsiflexion with a below knee posterior splint. For early active mobilization group below knee posterior splint was removed on 4th post operative day for therapy. The therapy program consisted of once a day 10 repetitions of active dorsiflexion exercise in the first week of therapy i.e. post operative week 2, 25 repetitions of active dorsiflexion and plantar flexion exercises in the second week of therapy i.e. post operative week three, partial weight bearing using of parallel bars in third week of therapy i.e. post operative week 4 and full weight bearing and gait training in the fourth week of therapy i.e. post operative week 5. The limb was supported after therapy in a posterior splint in 20 degrees dorsiflexion for 3 weeks and there after only at night for 3 months. Patients in both groups were discharged from rehabilitation when they had obtained MMST grade IV of transferred muscle and independent walking without any aids. Unrestricted activities of daily living were allowed 3 months after discharge from rehabilitation.

Clinical review was recommended once a month for three months, then every 3 months for one year.

Results

We observed that no insertion pullout of the transferred tendon in any of the patients, so we conclude that early active tendon transfer is a safe method. Rehabilitation time was 42 ± 6 days. These patients discharged from rehabilitation earlier. Dorsiflexion was MMST grade V in 29 patients, Grade IV in 7 patients, Grade III in one patient. Common functional problem of walking, climbing stairs, scraping the toes during the swing phase of gait and riding bicycle were resolved by tibialis posterior tendon transfer. Patients improved gait and cosmoses.

Discussion

There are many limitations to our study. Number of patients enrolled in the trial was relatively small. In this study we observed that no insertion pullout of the transferred tendon in any of the patients, so we conclude that early active tendon transfer is a safe method. This finding is similar to report with the study of Silfverskiold and May on early active mobilization after tendon transfer to the hand using mesh reinforced suture technique reported no insertion pull out [6]. Germann *et al.* in their study on dynamic splint- assisted mobilization of extensor indices proprius transfer for thumb extension had no incidence of transfer insertion pullout [7]. Taken together these studies indicate that tendon insertion pullout is negligible with early mobilization of these tendon transfers. The quicker discharge from rehabilitation surgery may affect the tendon transfer surgery for foot drop correction. German *et al.* reported that hand function recovers quicker in hand function recovers quicker in patient receiving extensor indices proprius transfer for thumb extension after early dynamic motion. In this case we have followed Pulvertaft weave in all cases in sizable tendons. Further investigations are required to determine if tendon transfer insertion to bone can be a solution in situations where Pulvertaft weave [8] is not possible. Tendon to bone insertion was not tried in our study.

Conclusion

We conclude that early active tendon transfer is feasible and safe method with no added risk of tendon pull out. There is earlier restoration of independent walking with early mobilization with reduction of total cost and loss of work for patients.

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Conflicts of Interests: None

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