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Functional Outcome of Tibialis Posterior Tendon Transfer to Tibialis Anterior & Peroneus Longus among Foot Drop Patients- a Prospective Study

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Abstract **Original Research Article**

Introduction: Foot drop is described as the loss of active ankle dorsiflexion due to neurologic, systemic, or traumatic causes. The purpose of this study was to assess the functional outcome of tibialis posterior tendon transfer to tibialis anterior and peroneus longus in patients with foot drop. ***Aim of the study:*** The aim of this study was to evaluate the functional outcome of tibialis posterior tendon transfer to tibialis anterior and peroneus longus in patients with foot drop. ***Methods:*** This study was a randomized clinical trial that evaluate the results of tibialis posterior tendon transfer surgeries for patients with foot drop. The patients met certain inclusion and exclusion criteria, and gave written consent before the surgeries. The patients were followed up for six months after the surgery, and evaluated using the Stanmore assessment questionnaire and other measures. ***Result:*** The study enrolled 30 patients (26 males and 4 females) with mean age being 35.40 years. We evaluate tibialis posterior tendon transfer to tibialis anterior and peroneus longus for foot drop in the patients. After 24 weeks, all patient improved in foot dorsiflexion, eversion, function, posture, and satisfaction. 26 (86.70%) patients did not need orthosis and 28 (93.30%) had balanced foot posture with no deformity. ***Conclusion:*** The results showed all patient had significant improvement after the surgery. Therefore, this study concluded that tibialis posterior tendon transfer can be used effectively and safely for the management of foot drop.

Keywords: Tibialis posterior tendon transfer, Foot drop, Peroneal nerve palsy, Foot surgery, Orthopedic surgery.

INTRODUCTION

Footdrop is described as the loss of active ankle dorsiflexion [1]. Foot drop can result from a variety of factors, including injuries, neuromuscular conditions, or anatomical variations [2]. It is a debilitating condition that is so severe that there is no positive outcome after nerve repair and grafting; 64% of sciatic nerve repair and grafting and 46-54% of common peroneal nerve palsies do not result in the restoration of functional dorsiflexion [3].

The most prevalent form of lower limb compressive neuropathy is common peroneal nerve (CPN) palsy, which is linked to the beginning of acute and gradual foot drop [4]. Compressive etiologies are the most common cause of peroneal nerve palsies [5].

Various methods have been used to alleviate foot drop in cases with irreversible peroneal nerve paralysis, including tendon transfers, arthrodesis, and nerve repair [6]. Tendon transfer restore the dorsiflexion of the foot and allows near normal functional activity in patients with foot drop [7].

The gold standard for surgically restoring functional dorsiflexion to a persistently paralyzed foot is dynamic tendon transposition [8]. If nerve repair looks unsuitable, the posterior tibial tendon transfer across the

interosseous membrane is the preferable method of tendon transposition for dynamic splinting [6].

The Bridle procedure was initially established by Richard E. McCall in 1991 [9]. It involves a tritendon double-end-weave anastomosis between the anterior, posterior, and peroneus longus tendon. In case it's required, a subcutaneous Achilis tendon lengthening is done. A total of 107 procedures were carried out on patients with cerebral palsy, with 74% excellent and good results. Adult mononeuropathies comprise 15% of cases involving injury to the peroneal nerve [10].

Hans Ulrich Steinau performed the "Bridle procedure" (stirrup-plasty) in 2010 to treat 53 patients who had foot drop [6]. The procedure involved transferring the posterior tibial tendon through the interosseous membrane and fixing it to the anterior tibial and long peroneal tendon. The mean range of motion in the ankle joint was 8 degrees dorsiflexion and 15 degrees planter flexion. The majority of patients developed gait without the use of an orthotic device and attained plantigrade foot position. The majority of patients reported significant improvements in their quality of life and were happy with the treatment results.

Peroneal nerve injury is the most prevalent mononeuropathy in the lower leg and a leading cause of trauma-induced foot drop [11]. Watkins was the first to describe the substitution of loss of foot dorsiflexion with a posterior tibial tendon transfer across the interosseous membrane in 1954 [12]. It is evident that, regardless of method, the tibialis posterior functions well as a dorsiflexor when transferred forwards. In terms of dorsiflexion, the various approaches only slightly improve dorsiflexion. The papers cited also show that tendon-to-tendon fixation works well and that it is not imperative to do tendon-to-bone fixation [11].

The aim of this study was to evaluate the functional outcome of tibialis posterior tendon transfer to tibialis anterior and peroneus longus for management of foot drop in patients with irreversible peroneal nerve palsy.

Objectives

- To evaluate the functional outcome of tibialis posterior tendon transfer to tibialis anterior and peroneus longus in patients with foot drop.

METHODOLOGY & MATERIALS

This randomized clinical trial was conducted at the Department of Orthopaedic Surgery, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh, from March 2012 to September 2014. The study population consisted of patients of both sexes with foot drop. The inclusion criteria were complete paralysis of the muscles supplied by the common peroneal nerve or extensor muscle or tendon injury, full range of passive dorsiflexion and an active and powerful tibialis posterior, and age of 12 years or more. The exclusion criteria were flail limb, fixed equinus, fixed varus, tibialis posterior power < 4, and partial common peroneal nerve palsy. The patients were randomly assigned by lottery. Patients underwent tibialis posterior tendon transfer to tibialis anterior and peroneus longus. The patients were informed about the aims, objectives, procedures, risks and benefits of the study and gave written consent. The surgery was performed after proper counseling and anesthesia fitness. The patients were followed up at 6 weeks, 3 months and 6 months after the surgery. The outcome measures were the Stanmore assessment questionnaire (Yeap JS *et al*., 2001) on need for orthosis, ability to wear normal shoes, functions, degree of active dorsiflexion, foot posture, and final outcome, as well as the complications. The data were analyzed using SPSS (V-20) software and Microsoft. Descriptive and inferential statistics were also used.

RESULT

The present single-centered, randomized clinical trial was conducted between the periods of March 2012 and September 2014 for a duration of two and a half years in the Department of Orthopedic Surgery, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka. All patients admitted to the Department of Orthopedic Surgery, aged 14 to 56 years, with both sexes clinically diagnosed as foot drops, were the study population. A total of 30 patients with foot drops were included in the study. In this study, the age of the patients ranges from 14-56 years. Maximum age incidence was found in the 30-39 and 40-49 year age groups, and the average age was 35.40 years. Out of 30 patients, 26 (86.70%) were male and 4 (13.30%) were female. Male are more likely to suffer from the footdrop than female (Table 1). 26 (86.70%) patients did not need orthosis. 2 (6.67%) patients need orthosis rarely, and 2 (6.67%) patients need it frequently (Table 2). Maximum of 28 (93.30%) patients could wear normal shoes, except for 2 (6.70%) patients who needed special models (Table 3). 20 (66.70%) patients had normal daily activity and limited recreation, and 10 (33.30%) patients had normal daily activity and normal recreation (Table 4) after a follow-up of 24 weeks post-operatively. 28 (93.30%) patients had a degree of active dorsiflexion in grade 4, and the rest (6.70%) had a grade 3 after a follow-up of 24 weeks post-operatively (Table 5). 26 (86.70%) patients' degree of active dorsiflexion was 0-5^{o}. 4 (13.30%) patients had a degree of active dorsiflexion greater than 6° (Table 5). 28 (93.30%) patients had balanced foot posture with no deformity; the rest 2 (6.70%) of the patients had mild deformity in foot posture after a follow-up of 24 weeks post-operatively (Table 6). There was no complication in 26 (86.70%) patients (Table 7). According to the Stanmore assessment questionnaire (Yeap JS *et al*., 2001), 8 (26.67%) patients had a very good outcome, and 22 (73.33%) patients had a good outcome (Table 8).

Table 1: Demographic variables of the patients (N = 30).

Variables		Frequency	Percentage (%)
Age	10-19	4	13.30%
	20-29	4	13.30%
	30-39	8	26.70%
	40-49	8	26.70%
	50-59	6	20.00%
	Total	30	100.00%
Gender	Male	26	86.70%
	Female	4	13.30%
	Total	30	100.00%

Table 2: Distribution of the patients by Stanmore assessment questionnaire (Yeap JS *et al.*, 2001) on need for orthosis (N=30).

Need for orthosis	Frequency	Percentage (%)
No need	26	86.67%
Rarely (once a week)	2	6.67%
Sometime (twice a week)	0	0.00%
Frequently (more than twice a week)	2	6.67%
Total	30	100.00%

Table 3: Distribution of the patients by Stanmore assessment questionnaire (Yeap JS *et al.*, 2001) on ability to wear normal shoes (N=30).

Ability to wear normal shoes	Frequency	Percentage (%)
Yes	28	93.30%
Only special models	2	6.70%
Total	30	100.00%

Table 4: Distribution of the patients by Stanmore assessment questionnaire (Yeap JS *et al.*, 2001) on functions (N=30).

Functions	Frequency	Percentage (%)
Normal daily activity and normal recreation	10	33.30%
Normal daily activity and limited recreation	20	66.70%
Limited daily activity and limited recreation	0	0.00%
Total	30	100.00%

Table 5: Distribution of the patients by Stanmore assessment questionnaire (Yeap JS *et al.*, 2001) on degree of active dorsiflexion (Grade) & (Degree) (N=30).

Variables		Frequency	Percentage (%)
Degree of active dorsiflexion (Grade)	Grade 4	28	93.30%
	Grade 3	2	6.70%
	Total	30	100.00%
Degree of active dorsiflexion (Degree)	More than 6°	4	13.30%
	0 - 5°	26	86.70%
	–5° / –1°	0	0.00%
	Total	30	100.00%

Table 6: Distribution of the patients by Stanmore assessment questionnaire (Yeap JS *et al.*, 2001) on foot posture (N=30).

Foot posture	Frequency	Percentage (%)
Plantigrade, balanced, no deformity	28	93.30%
Plantigrade, mild deformity	2	6.70%
Total	30	100.00%

Table 7: Distribution of the patients by complications (N=30).

Complications	Frequency	Percentage (%)

Infection	4	13.30%
Nil	26	86.70%
Total	30	100.00%

Table 8: Distribution of the patients by Stanmore assessment questionnaire (Yeap JS *et al.*, 2001) on Final outcome (N=30).

Final outcome	Frequency	Percentage (%)
Very good	8	26.67%
Good	22	73.33%
Total	30	100.00%

DISCUSSION

The randomied clinical trial was carried out at Bangabandhu Sheikh Mujib Medical University's Department of Orthopedic Surgery from March 2012 to September 2014. The present study assessed the functional outcome of tibialis posterior tendon transfer to tibialis anterior and peroneus longus in patients with foot drop.

The patients in the study were between the ages of 14 and 56. The mean age was 35.40 years. In the study conducted by Steinau *et al*., the mean age at the time of the operation was 37 years (range 14-81 years) [6]. Out of 30 patients, 26 (86.70%) were male and 4 (13.30%) were female. Male are more likely to suffer from the foot drop than females. 67% of the patients in the Steinau *et al*., (2011) research was male, while 33% of the patients were female [6].

In this study, 26 (86.67%) patients did not need orthosis. Tibialis Posterior tendon transfer enables the patients to walk without the aid of orthosis [14]. In the study of Vigasio *et al*., (2008) 87.50% patients needed no orthosis [8].

Maximum 28 (93.30%) patients could wear normal shoes except 2 (6.70%) patients who needed special models. In the study of Vigasio *et al*., (2008) 75% patients could wear normal shoes [8].

20 (66.70%) patients had normal daily activity and limited recreation. 10 (33.30%) patients had normal daily activity and normal recreation after a follow up of 24 weeks post-operatively. In the study of Vigasio *et al*., (2008) 43% patients had normal daily activity and normal recreation, 38% patients had normal daily activity and limited recreation [8].

28 (93.30%) had degree of active dorsiflexion was grade 4 after a follow up of 24 weeks post-operatively. In the study of Vigasio *et al*., (2008) 50% patients dorsiflexion strength was grade 4 or 4+ [8] 26 (86.70%) patients' degree of active dorsiflexion was 0-5º. 4 (13.30%) patients' degree of active dorsiflexion was more than 6°. The mean foot dorsiflexion was 5˚ (range -5˚to10˚) seen in 66.70% of patients in the study of Kilic *et al*., (2008) [10]. In the study of Vigasio *et al*., (2008) 62% patients' degree of active dorsiflexion was 0-5º [8].

28 (93.30%) had balanced foot posture with no deformity, rest had mild deformity in foot posture after a follow up of 24 weeks post-operatively. In the study of Vigasio *et al*., (2008) 81% patients had balanced foot with no deformity [8].

There was no complication in 26 (86.70%) patients. Apart from complaints of bulging in the 4 (30.80%) patients in the dorsum of the foot due to tendon and suture material, no complications were seen during the early postoperative period in the study of Kilic *et al*., (2008) [13].

According to Stanmore assessment questionnaire, 8 (26.67.%) patients had very good and 22 (73.33%) patients had good outcome [14]. It was seen in the study of Kilic *et al*., (2008) that the results were very good in 46.70% and good in 20% patients [14]. In the study of Steinau *et al*., (2011) success rate was 83-100% [6].

This study evaluated the Functional outcome of Tibialis Posterior tendon transfer to Tibialis Anterior & Peroneus Longus among foot drop patients. The findings of this study were consistent with other studies that used similar methods and measurements.

Limitations of the Study

This study had some limitations that should be acknowledged. First, the sample size was small due to the unavailability of the patients, which may limit the generalizability and statistical power of the results. Second, the study and follow-up period were short compared to other international studies, which may prevent the evaluation of the long-term outcome and complications of the surgery.

CONCLUSION

This study evaluated the functional outcome of tibialis posterior tendon transfer in patients with foot drop: tibialis posterior tendon transfer to tibialis anterior and peroneus longus. The results showed significant improvement in foot dorsiflexion, eversion, function, posture, and satisfaction after the surgery. Therefore, this study concluded that tibialis posterior tendon transfer can be used effectively for the management of foot drop.

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