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The Effectiveness and Comparison of the Outcome of Tibialis Posterior Tendon Transfer to Tibialis Anterior & Peroneus Longus Versus Extensor Hallucis Longus & Extensor Digitorum Longus for Management of Footdrop

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Abstract

Background: Common Peroneal Nerve (CPN) palsy resulting footdrop has been reported as the most frequent lower extremity palsy. Footdrop is a disabling condition and the result of nerve repair and grafting is not promising. The aim of the study purpose of this present study was to find out the effectiveness and compairsion of the outcome of Tibialis Posterior tendon transfer to Tibialis Anterior & Peroneus Longus Versus Extensor Hallucis Longus & Extensor Digitorum longus for management of Footdrop. **Material & Methods:** This randomized clinical trial was conducted in the department of Orthopaedic Surgery, BSMMU, Dhaka for duration of two and half years. Thirty patients of footdrop were selected. Purposive type of non probability sampling technique was used as per inclusion and exclusion criteria. Total number of patients were divided into two groups, Group-I who treated with Tibialis Posterior tendon transfer to Tibialis Anterior & Peroneus Longus, Group-II who were treated with Tibialis Posterior tendon transfer to Extensor Hallucis Longus & Extensor Digitorum Longus. **Results:** A total number of 30 patients (male- 26 and female-4) were recruited in this study. Mean age was 35.4. Right foot was affected more. 80.0% cases had common peroneal nerve injuries. In Group I and II 12 (80.0%) patients had lateral aspect of knee injury, 1 (6.7%) had popliteal fossa, infront of ankle and anterior leg in Group I and 3 (20.0%) had anterior leg in Group II ($p = 0.392^{ns}$). **Conclusions:** Outcome of both the procedures is almost same.

Keywords:- Drop foot, Foot surgery, Podiatry, Foot deformities, Orthopedic surgery.

INTRODUCTION

Common Peroneal Nerve (CPN) palsy has been reported as the most frequent lower extremity palsy.[1,2] It can be the result of several causative mechanisms such as: Ischemia, Mechanical irritation, Traction injuries, Crushing injuries, or Laceration.[3] Paralysis of the common peroneal nerve is characterized by a supinated equinovarus foot deformity resulting from the unopposed pull of the tibialis posterior muscle.[4] Footdrop is a disabling condition and the result of nerve repair and grafting is not promising; 64% of repair and grafting of sciatic nerve and 46–54% of common peroneal nerve,[5] palsies fail to

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restore functional dorsiflexion. An ankle-foot orthosis (AFO) or brace to prevent the footdrop sometimes may be poorly tolerated,[6] especially in patients who have some degree of equinovarus contracture or in young patients who need to wear orthoses for the rest of their lives.[7] In irreparable peroneal nerve paralysis, several procedures have been employed to treat footdrop, which includes: Nerve repair, Arthrodesis and Tendon transfers.[8] Dynamic tendon transposition represents the gold standard for surgical restoration of functional dorsiflexion of a permanently paralyzed foot.[9] Among the tendon transpositions, the posterior tibial tendon transfer through the interosseous membrane is preferred for dynamic splinting if nerve repair seems inappropriate.[8] As reported by Watkins, Codivilla in 1899 and Putti in 1914 are considered the pioneers of the anterior transposition of the posterior tibialis tendon to the dorsum of the foot through the interosseous membrane.[3] This technique has been widely used,[10] becoming the most accepted reconstructive method to correct footdrop.[11,12] In 1991 Richard E. McCall,[13] introduced the Bridle procedure which is a tritendon double-end-weave anastomosis between the tendon of posterior tibialis, peroneus longus and anterior tibialis. In 2010 Hans Ulrich Steinau,[8] treated 53 patient of foot drop by transferring posterior tibial tendon through interosseous membrane and fixation to anterior tibial and long peroneal tendon "Bridle procedure" (stirrup-plasty) and result was such- mean range of motion in the ankle joint was 8 degree dorsiflexion and 15 degree planter flexion.[14,15] Most patients achieved plantigrade foot position and the majority developed gait without orthotic device. Most patients were satisfied with the operative results and reported a significant increase in quality of life.[16,17] It is clear that the tibialis posterior works well as a dorsiflexor when transposed forwards, irrespective of the method used. The benefits from the different techniques are only marginal so far as dorsiflexion is concerned. The papers cited also show that tendon-to-tendon fixation works well and that it is not imperative to do tendon-to-bone fixation.[18] In our study we compared the result of Tibialis Posterior tendon transfer to Tibialis Anterior & Peroneus Longus Versus Extensor Hallucis Longus & Extensor Digitorum Longus for management of Footdrop.

Objective of the study

Purpose of this present study was to find out the effectiveness and comparison of the outcome of Tibialis Posterior tendon transfer to Tibialis Anterior & Peroneus Longus Versus Extensor Hallucis Longus & Extensor Digitorum longus for management of Footdrop.

MATERIAL AND METHODS

The present single centered, Randomized Clinical Trial was conducted between the periods of March 2012 to September 2014 for duration of two and half years in the Department of Orthopaedic Surgery, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh. All patients admitted in the Department of Orthopaedic Surgery, aged 14 to 56 years with both sexes clinically diagnosed as foot drop were the study population. Total 30 patients with foot drop were included in the study.

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Total number of patients was divided into two groups randomly by lottery, Group-I treated with tibialis posterior tendon transfer to Tibialis Anterior & Peroneus Longus, Group-II treated with tibialis posterior tendon transfer to Extensor Hallueis Longus & Extensor Digitorium Longus. Purposive type of non-probability sampling technique is used as per inclusion and exclusion criteria.

Inclusion criteria of cases: Complete paralysis of the muscles supplied by the common peroneal nerve, Extensor muscle or tendon injury, Full range of passive dorsiflexion, Active and powerful Tibialis Posterior, Age twelve years or more.

Exclusion criteria of cases: Flail Limb, Fixed equinus, Fixed varus, Tibialis Posterior power < 4, Partial Common peroneal Nerve palsy. Aim, objectives, procedures, risks and benefits of the study were explained to the patient selected. All this information was collected through specially designed proforma. After proper councelling and anaesthesia fitness, patients were operated. Post-operative followup was given at 6 weeks, 3 months and 6 months interval. The demographic profile (i.e age, sex) and clinical variables (side, limp & deformity) were noted. The outcome categorization was done through stanmore assessment questionnaire.[19]

Ethical Implication: Ethical clearance given by the Bangabandhu Sheikh Mujib Medical University (BSMMU) authority. Every patient was asked for informed consent. They were informed about the procedure and study goal and also about the purpose of research. Informed consent was obtained from the patients in order to collect clinical information. They were also informed that they are free to refuse participate. Complete data collection form was kept by the principal investigator to which no one would have any access.

Data Analysis: Data was analyzed with the help of SPSS software program and express as mean ± SD. P value < 0.05 was considered significant.

RESULTS

[Table 1] shows the age distribution of our study patients between Group I and Group II. Group I treated with Tibialis Posterior tendon transfer to Tibialis Anterior & Peroneus Longus. Group II treated with Tibialis Posterior tendon transfer to Extensor Hallucis Longus & Extensor Digitorum Longus. Between 10-19 years Group I patients were 2 (13.3%) compared to Group II 2 (13.3%), then 20-29 years were 2 (13.3%) vs 4 (26.7%), 30-39 were 4 (26.7%) vs 4 (26.7%), 40-49 were 4 (26.7%) vs 4 (26.7%) and 50-59 years were 3 (20.0%) vs 1 (6.7%) respectively (p = 0.797ns). And mean age were 35.40 ± 12.33 years.

[Table 2] shows the gender distribution of our study patients. In Group I 13 (86.7%) patients were male against 13 (86.7%) in Group II, then 2 (13.3%) patients were female in both group respectively (p = 1.000ns).

[Table 3] shows the distribution of our study patients by occupation. In Group I majority 4 (26.7%) patients were in service and farmer, then 2 (13.3%) were in business and garment worker. In Group II majority 6 (40.0%) were service holder and 4 (26.7%) were business respectively (p = 0.654^{ns}).

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[Table 4] shows the distribution of our study patients by side involvement. In Group I 10 (66.7%) were right and 5 (33.3%) were left. Also 10 (66.7%) were right and 5 (33.3%) were left in Group II respectively ($p = 1.000^{ns}$).

[Table 5] we found the distribution of our study patients by causes of injury. In Group I 13 (86.7%) were common peroneal nerve injury and 2 (13.3%) were extensor muscle injury against 12 (80.0%) were common peroneal nerve injury and 3 (20.0%) were extensor muscle injury in Group II ($p = 0.624^{ns}$).

[Table 6] shows the distribution of our study patients by site of injury. In Group I and II 12 (80.0%) patients had lateral aspect of knee injury, 1 (6.7%) had poplitel fossa injury, infront of ankle injury and anterior leg injury in Group I and 3 (20.0%) had anterior leg injury in Group II ($p = 0.392^{ns}$).

[Table 7] shows the pre-operative and post-operative comparison of Group-1 and Group-11 by Stanmore assessment questionnaire. All the patients are evaluated preoperatively according to Stanmore assessment questionnaire and post operatively after 6 months parameters are also calculated. There is significant improvement of all functional activity. p- Value is significant for all parameters that are compared.

[Table 8] shows the distribution of our study patients by Stanmore assessment questionnaire on pain. In Group I and Group II 2 (13.3%) patients had pain never and 13 (86.7%) had occasionally respectively ($p = 1.000^{ns}$).

Table 1: Age distribution of our study patients (N=30)

Age (yrs)	**Group-I(n=15)**		**Group-II(n=15)**		**p Value**
	n	**%**	**n**	**%**	
10-19	2	13.3	2	13.3	0.797ns
20-29	2	13.3	4	26.7	
30-39	4	26.7	4	26.7	
40-49	4	26.7	4	26.7	
50-59	3	20.0	1	6.7	
Total	15	100	15	100	

Table 2: Gender distribution of our study patients (N=30)

Gender	**Group-I(n=15)**		**Group-II(n=15)**		**p Value**
	n	**%**	**n**	**%**	
Male	13	86.7	13	86.7	1.000ns
Female	2	13.3	2	13.3	
Total	15	100	15	100	

Table 3: Distribution of our study patients by occupation (N=30)

Occupation	**Group-I(n=15)**		**Group-II(n=15)**		**p Value**
	n	**%**	**n**	**%**	
Student	1	6.7	1	6.7	0.654ns

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Manual worker	1	6.7	1	6.7	
Business	2	13.3	4	26.7	
Housewife	1	6.7	1	6.7	
Garment worker	2	13.3	1	6.7	
Service	4	26.7	6	40.0	
Farmer	4	26.7	1	6.7	
Total	15	100	15	100	

Table 4: Distribution of our study patients by side involvement (N=30)

Side involved	**Group-I(n=15)**		**Group-II(n=15)**		**p Value**
	n	**%**	**n**	**%**	
Right	10	66.7	10	66.7	1.000ns
Left	5	33.3	5	33.3	
Total	15	100	15	100	

Table 5: Distribution of our study patients by causes of injury (N=30)

Causes of injury	**Group-I(n=15)**		**Group-II(n=15)**		**p Value**
	n	**%**	**n**	**%**	
Common peroneal nerve injury	13	86.7	12	80.0	0.624ns
Sharp cut injury	10	66.7	10	66.7	
Iatrogenic injury	1	6.7	0	0.0	
Penetrating injury	1	6.7	0	0.0	
Tight Plaster	1	6.7	2	13.3	
Extensor muscle injury	2	13.3	3	20.0	
Total	15	100	15	100	

Table 6: Distribution of our study patients by site of injury (N=30)

Site of injury	**Group-I(n=15)**		**Group-II(n=15)**		**p Value**
	n	**%**	**n**	**%**	
Lateral aspect of knee	12	79.9	12	80	0.392ns
Poplitel fossa	1	6.7	0	0	
Infront of ankle	1	6.7	0	0	
Anterior Leg	1	6.7	3	20	
Total	15	100	15	100	

Table 7: Pre-operative and post-operative comparison of Group-1 and Group-11 by Stanmore assessment questionnaire (N=30)

	Group-I(n=15)		**Group-II(n=15)**		**p Value**
	Pre-operative	**After 06 months**	**Pre-operative**	**After 06 months**	
Pain	6.66 ± 2.43	10.66±1.75	6.66 ± 3.08	10.66 ± 1.75	0.001
Need for orthosis	2.67 ± 3.71	14.00 ± 2.80	3.66 ± 3.99	14.33 ± 1.75	0.001

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Ability to wear normal shoes	0.60 ± 1.24	4.86 ± 0.51	1.00 ± 1.46	4.46 ± 0.91	0.001
Function	0.80 ± 1.37	7.33 ± 1.95	1.00 ± 1.46	6.53 ± 1.40	0.001
Grade	0.00 ± 0.00	19.33 ± 2.58	0.00 ± 0.00	18.66 ± 3.51	0.001
Degree	0.00 ± 0.00	20.67 ± 1.75	0.00 ± 0.00	20.67 ± 1.75	0.001
Foot posture	1.80 ± 1.52	4.87 ± 0.51	2.20 ± 1.37	4.46 ± 0.91	0.001

Table 8: Distribution of our study patients by Stanmore assessment questionnaire on pain (N=30)

Pain	**Group-I(n=15)**		**Group-II(n=15)**		**p Value**
	n	**%**	**n**	**%**	
Never	2	13.3	2	13.3	1.000ns
Occasionally	13	86.7	13	86.7	
Total	15	100	15	100	

DISCUSSION

The present single centered, Randomized Clinical Trial was conducted between the periods of March 2012 to September 2014 for duration of two and half years in the Department of Orthopaedic Surgery, Bangabandhu Sheikh Mujib Medical University, Dhaka. The present study assessed the effectiveness and compared the outcome of Tibialis Posterior tendon transfer to Tibialis Anterior & Peroneus Longus Versus Extensor Hallucis Longus & Extensor Digitorum longus for management of Foot drop. It also assessed the range of active dorsiflexion and planter flexion of ankle, improvement of pain, function and foot posture, assessed the necessity of orthosis, ability of wearing normal shoes in both groups after tendon transfer. All patients admitted in the Department of Orthopaedic Surgery, BSMMU, Dhaka, aged 14 to 56 years with both sexes diagnosed clinically as foot drop were the study population. Total 30 patients with foot drop were included in the study.

In this study the age of the patients was ranges from 14-56 years. Maximum age incidence was found in 30-39 & 40-49 years of age group and mean age was 35.40 years. The mean age at the time of the operation was 37 years (range 14–81 years) was seen in the study of Steinau et al. [8]. Male are more sufferer for the footdrop than female. Out of 30 patients 26 (86.7%) were male and 4 (13.3%) were female. In the study of Steinau et al,[8] 67% patient were male and 33% were female. In our study Group I majority 4 (26.7%) patients were in service and farmer, then 2 (13.3%) were in business and garment worker. In Group II majority 6 (40.0%) were service holder and 4 (26.7%) were business respectively (p = 0.654ns). Among the patients 66.7% had right sided and 33.3% had left sided footdrop in both groups. In this study common peroneal nerve injury occurred in 25 (83.33%) cases, extensor muscle injury in 5 (16.7%) cases. Forty five percent peroneal nerve injury was seen in the study of Steinau et al.[8]

All the patients operated by transfer of tibialis posterior tendon to tibialis anterior and peroneus longus are evaluated preoperatively according to the stanmore assessment

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questionnaire,[19] and post operatively after 6 months parameters are also calculated. There is significant improvement of all functional activity. p- value is significant (.001) for all parameters that are compared. Success rate was 26.67% very good and 73.33% good results. In the study of Steinau et al,[8] success rate was 83-100%. On the other hand patients treated with transfer of tibialis posterior tendon to extensor hallucis longus and extensor digitorum longus were also evaluated pre and post operatively according to stanmore assessment questionnaire,[19] and p value is(.001) also significant for all parameters that are compared. Success rate was 6.7% very good and 93.3% good results. Srinivasan H et al,[20] showed that 87 % success rate with transfer of tibialis posterior tendon to extensor hallucis longus and extensor digitorum longus.

During the initial follow up almost all patients complained of slight to mild pain. But at final follow up 2 (13.3%) patients had no pain and 13 (86.7%) patients had occasional pain in each group. The difference between this two groups in pain was not statistically significant (p>0.50). After five (average) years follow up Vigasio et al,[9] found 81.0% patients had no pain.

Limitations of the study

We took a small sample size due to unavailability of the patients. The study and follow-up period was short in comparison to other international series. So, we could not evaluate late post-operative outcome and complication.

CONCLUSIONS

This was a Randomized Clinical Trail carried out at BSMMU between March 2012 to September 2014 for two and half years involving 30 patients of footdrop. The aim of this study was to compare the results of Tibialis Posterior tendon transfer to Tibialis Anterior & Peroneus Longus Versus Tibialis Posterior tendon transfer to Extensor Hallucis Longus & Extensor Digitorum Longus for management of foot drop. Statistically, overall result had shown that there was no significant difference between group-I (Tibialis Posterior tendon transfer to Tibialis Anterior & Peroneus Longus) and group-II (Tibialis Posterior tendon transfer to Extensor Hallucis Longus & Extensor Digitorum Longus). So, it is concluded that footdrop can be treated either by Tibialis Posterior tendon transfer to Tibialis Anterior & Peroneus Longus or with Tibialis Posterior tendon transfer to Extensor Hallucis Longus & Extensor Digitorum Longus. Need long term follow up, effective training programme on tendon transfer. Similar type of study should be performed over a large sample size.

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