



COMPARATIVE STUDY OF FUNCTIONAL OUTCOME AND OPERATIVE TIME BETWEEN PALMARIS LONGUS 4 TAIL AND FDS TENDON TRANSFER IN POST HANSEN'S ULNAR CLAW HAND.

General Surgery

Dr Amit Kumar Roy

Associate Professor, Dept. Of General Surgery, Midnapore MC&H. Paschim Medinipur

Dr Suman Das

Assistant Professor, Dept. Of General Surgery, R.G.Kar MC&H .Kolkata

Dr Rupnarayan Bhattacharya

Professor, Dept. Of Plastic and Reconstructive Surgery, R.G.Kar MC&H .Kolkata

Dr Shubhrojyoti Roy*

Senior Resident Surgeon, Department of General Surgery, R.G.Kar MC&H Kolkata
*Corresponding Author

ABSTRACT

Introduction: Leprosy is a leading cause of permanent disability. Claw hand deformity caused by involvement of Median and ulnar nerve, compromises the vocational activities. Surgeries aim in stabilization of the metacarpo-phalangeal joint in flexion, to prevent it from hyperextension. This study compared the outcomes & operative time after Palmaris Longus 4 tail & FDS tendon transfer in ulnar claw hand.

Material and methods: A total of 40 Patients meeting inclusion criteria were selected into 2 groups I.e. Patients undergoing Palmaris Longus 4 tail tendon transfer (PL4T) and FDS tendon Transfer.

Results: Functional improvement in PL4T is more than in FDS. Though operative time in FDS group is shorter than PL4T group but statistical analysis does not show any significance.

Conclusion: Measurement aspect of both groups in this study failed to reveal any difference of statistical significance.

KEYWORDS

Leprosy, Palmaris Longus 4 tail, FDS tendon transfer, Ulnar Claw Hand

INTRODUCTION

Leprosy, causes considerable physical disabilities in a portion of the population. Claw hand deformity caused by involvement of Median nerve and Ulnar nerve, compromises the cosmetic outlook, activities of daily living^{1,2} and vocational activities.

Clawing of the fingers in ulnar nerve palsy is due to the combined paralysis of the interosseous muscles of all the fingers and the lumbricals of the ring and little fingers. These intrinsic muscles flex the MP and extend the PIP and DIP joints of the fingers, and loss of their resting tone results in the "intrinsic-minus" posture of hyperextension at the MP joints and flexion of IP joints. Clawing due to isolated ulnar nerve disease is most marked in the ring and little fingers, whose interosseous and lumbrical muscles are all paralyzed, but it occurs in all four fingers in 63% of cases due to Hansen's disease, even though the index and middle finger lumbricals are innervated by the median nerve.

Procedures for correction of claw deformity of fingers, involve tendon transfers with or without tendon grafting.³ The aim of these surgeries is stabilization of the metacarpo-phalangeal joint in flexion, to prevent it from going into hyperextension. The ultimate result of a combined surgical and rehabilitation program depend on duration of paralysis, age of patient, skill and experience of surgeon, motivation and perseverance of patient.

All of the following have been described as the donor muscle-tendon unit in tendon transfers to correct in clawing in ulnar nerve palsy:

- i. Flexor digitorum superficialis
- ii. Extensor carpi radialis brevis
- iii. Extensor indicis proprius and extensor digiti minimi
- iv. Flexor carpi radialis
- v. Extensor carpi radialis longus
- vi. Palmaris longus

Palmaris longus is the most superficial tendon of flexor surface of wrist. Though PL may be absent in 10% patient but it is chosen as it is supplied by median nerve & remains unaffected in ulnar neuropathy. Palmaris Longus Four-Tail Transfer is most commonly used to correct in ulnar claw hand in patients suffering from ulnar claw hand. It is indicated for the flexible long fingers with mobile joints, so characteristic of Indian and Oriental hypermobile hands. The power of the tendon is just enough to lead to flexion at the metacarpo-phalangeal joint. But the tendon is absent in about 10% of the individuals.

FDS (sublimis) is superficial flexor group of muscle of volar surface of

forearm originate from medial epicondyle of humerus & anterior oblique line of radius. This muscle supplied by median nerve.

FDS tendons after passing through carpal tunnel reached to proximal phalanx under A2 pulley. Then it split into two slips giving way FDP tendon between slips. FDS slips then reunite & again splits and inserted to base of middle phalanx.

The FDS tendon is divided into four longitudinal slips. These are passed through the intermetacarpal spaces and lumbrical canals to their attachments on the radial lateral bands of the 2nd, 3rd, 4th & 5th finger

In the present study, we intend to compare the outcomes & operative time after Palmaris longus 4 tail & FDS (Sublimis) tendon transfer in ulnar claw hand.

MATERIALS AND METHODS

It was an institution based, observational study conducted in Department of Plastic and Reconstructive Surgery of R G Kar Medical College, Kolkata.

As per previous year statistics, it is estimated that about 40 such cases of ulnar claw hand as per inclusion and exclusion criteria will comprise the total

sample size.

Group 1: 20 patient from PL4T & Group 2: 20 patients from FDS.

Inclusion criteria:

1. Clinically low ulnar nerve palsy
2. Patients more than 12 years of age
3. Hansen disease.

Exclusion criteria:

1. Patients with fixed contracture of finger/ fingers prior to surgery.
2. Clinically high ulnar nerve palsy- patients less than 12 years of age.
3. Clinically combined high ulnar and median nerve palsy
4. Clinically cut FCR / & FCU
5. Traumatic low ulnar nerve palsy

Study design

It is a cross-sectional observational study and 40 consecutive patients undergoing Tendon Transfer Surgery i.e. PL4T and FDS were

recruited for study using following inclusion and exclusion criteria. Written informed consent was taken from all cases. Approval was taken from institutional ethical committee.

Study tools:-

Goniometer, reverse goniometer, shirt with button, cylindrical tumbler and predesigned Proforma.

Study Technique:-

Pre-operative Claw Hand appearance and function were recorded. Results of the surgeries were assessed comparing the preoperative and postoperative position and function parameters.

For the assessment of improvement in appearance the following parameters were studied (comparing preoperative and postoperative measurement)

- i. Unassisted angle of the PIP extension in attempted lumbrical position, of Ring and Little fingers measured in degree.
 - ii. Assisted angle of the PIP extension in attempted position, of ring and Little fingers measured in degree.
2. For the assessment of the function of hand, the following parameters were studied
 - i. Assessment of function of fingers by buttoning, unbuttoning of Shirt and cylindrical grasp.

The principal investigator collected data by use of questionnaires and direct observation of patient in the pre, peri-operative and postoperative periods All data were recorded and statistical study was done between two groups.

Statistical Analysis

Statistical Analysis was performed with help of Epi Info (TM) 7.2.2.2. EPI INFO is a trademark of the Centers for Disease Control and Prevention (CDC).

Of the study of 40 patients divided in 20 in each group are done by using Shapiro wilk test to asses distribution pattern when observation value found to follow normal distribution ie. When P value>0.5. Student's T test or paired t test are applied to asses difference between normal distribution. Man Whitney's U test or Wilcoxon signed rank test were applied to compare observation following skewed distribution.

RESULTS

Unassisted Angle

Ring Finger

Table 1:-middle finger unassisted angle in PL4T group Ring finger unassisted angle in PL4T preoperative was 87.7 degree in average which became 19.5 degree postoperatively. Minimum range in 0-30 degree & maximum in 90-120degree range.

PL4T				
RANGE	PREOP	%	POST OP	%
0-30	1	5	16	80
31-60	2	10	2	10
61-90	5	25	2	10
91-120	12	60	0	0
MEAN			19.5	

Table 2:- ring finger unassisted angle in FDS group In FDS pts. Ring finger mean angle changes from 85.6 degree to 14.7 degree postop. here maximum improvement in 61-90 degree range.

FDS				
RANGE	PREOP	%	POST OP	%
0-30	0	0	17	85
31-60	0	0	1	5
61-90	12	60	2	10
91-120	8	40	0	0
MEAN			14.7	

LITTLE FINGER

Table 3:- Little finger unassisted angle in PL4T group IN case of unassisted angle of little finger in PL4T series improvement comes to 15.3 degree postop. From 79.8 degree preop. minimum range is 0-30degree & maximum at 61-90 degree range.

PL4T				
RANGE	PREOP	%	POST OP	%
0-30	1	5	15	75
31-60	3	15	5	25

61-90	10	50	0	0
91-120	6	30	0	0
MEAN			15.3	

Table 4:- little finger unassisted angle in FDS group FDS procedure showed an improvement from 78.6 degree to 15.6 degree postoperatively. Again minimum range is 0-30 degree & maximum is in 61-90 degree range.

FDS				
RANGE	PREOP	%	POST OP	%
0-30	0	0	16	80
31-60	4	20	2	10
61-90	9	45	2	10
91-120	7	35	0	0
MEAN			15.6	

ASSISTED ANGLE

RING FINGER

Table 5:- Ring finger assisted angle in PL4T group Ring finger assisted angle in PL4T improves from 10.9 degree preop. to 6.7 degree postoperative. Maximum in 0-5 degree & minimum in 16-20 degree consecutively.

PL4T				
RANGE	PREOP	%	POST OP	%
0-5	15	75	15	75
6-10	1	5	0	0
11-15	0	0	2	10
16-20	0	0	0	0
>20	4	20	3	15
MEAN			6.7	

Table 6:- ring finger assisted angle in FDS group FDS cases showed change of angle from 6.5degree preop. to 7.1 degree postop. Again maximum & minimum in 0-5 & 16-20 degree respectively.

FDS				
RANGE	PREOP	%	POST OP	%
0-5	17	85	14	70
6-10	0	0	2	10
11-15	0	0	1	5
16-20	0	0	2	10
>20	3	15	1	5
MEAN			7.1	

LITTLE FINGER

Table 7:- Little finger assisted angle in PL4T group Little finger assisted angle in PL4T series showed a change from 12.4degree preop to 6.1 degree postop. Minimum change in 16-20 degree & maximum in 0-5 degree.

PL4T				
RANGE	PREOP	%	POST OP	%
0-5	15	75	15	75
6-10	1	5	1	5
11-15	1	5	1	5
16-20	0	0	1	5
>20	3	15	2	10
MEAN			6.1	

Table 8:- Little finger assisted angle in FDS group

FDS				
RANGE	PREOP	%	POST OP	%
0-5	15	75	15	75
6-10	0	0	2	10
11-15	2	10	3	15
16-20	0	0	0	0
>20	3	15	0	0
MEAN			12.1	

In FDS patients angle changes from 7.95 degree to 12.1 degree post operatively. again maximum & minimum range is in 0-5 & 16=20 degree respectively.

Cylindrical grasp:



Figure 1

RING FINGER

Table 9:- Ring finger cylindrical grasp in PL4T group

PL4T				
NO. OF CONTACTS	PREOP	%	POST OP	%
0	11	55	0	0
1	4	20	2	10
2	3	15	5	25
3	2	10	13	65
MEAN	0.8		2.55	

Ring finger PL4T cylindrical grasp showed a change from 0.8 phalanx to 2.55 phalanx contact with 65% bears by distal phalanx.

Table 10:- Ring finger cylindrical grasp in PL4T group FDS cases cylindrical grasp showed a change from 1.5 phalanx to 2.65 phalanx contact post operatively. with 75% contact by distal phalanx.

FDS				
NO. OF CONTACTS	PREOP	%	POST OP	%
0	5	25	0	0
1	5	25	2	10
2	2	20	3	15
3	8	40	15	75
MEAN	1.5		2.65	

LITTLE FINGER

Table 11:- Little finger cylindrical grasp in PL4T group

PL4T				
NO. OF CONTACTS	PREOP	%	POST OP	%
0	17	85	1	5
1	2	10	2	10
2	1	5	12	60
3	0	0	5	25
MEAN	0.2		2.05	

In PL4T group cylindrical grasp improves from 0.2 phalanx contact to 2.05 phalanx contact. with middle phalanx contact maximum.

Table 12:- Little finger cylindrical grasp in FDS group Cylindrical grasp in PL4T case revealed a change from 0.2 phalanx to 2.05 phalanx(55%) .IN FDS phalangeal contact changes from 0.55 to 1.9 phalanx. Maximum area covered by middle phalanx.

FDS				
NO. OF CONTACTS	PREOP	%	POST OP	%
0	12	60	1	5
1	6	30	4	20
2	1	5	11	55
3	1	5	4	20
MEAN	0.55		1.9	

BUTTONING AND UNBUTTONING OF BUTTONS



Figure 2

Table 13:- Buttoning large button in PL4T In PL4T cases large buttoning changes from 1.5 buttons/30sec to 2.45 buttons/30 sec .In FDS pts. Buttoning of large button gone to 3.3 /30 sec from 2.05 /30 sec.

PL4T BUTTONING				
RANGE	PREOP	%	POST OP	%
0-2	15	75	13	65
3-5	4	20	5	25
6-8	1	5	2	10
>8	0	0	0	0
MEAN	1.5		2.45	

Table :14

FDS BUTTONING				
RANGE	PREOP	%	POST OP	%
0-2	12	60	5	25
3-5	6	30	14	70
6-8	2	10	1	5
>8	0	0	0	0
MEAN	2.05		3.3	

Table :15

PL4T UNBUTTONING				
RANGE	PREOP	%	POST OP	%
0-2	13	65	12	60
3-5	6	30	6	30
6-8	1	5	2	10
>8	0	0	0	0
MEAN	1.95		2.95	

Table 16:- unbuttoning in PL4T & FDS group PL4T unbuttoning changed from 1.95/30sec to 2.95buttons/30 sec whereas FDS cases showed a change from 2.75 /30sec to 2.45/30sec.

FDS UNBUTTONING				
RANGE	PREOP	%	POST OP	%
0-2	10	50	0	0
3-5	7	35	16	80
6-8	3	15	4	20
>8	0	0	0	0
MEAN	2.75		2.45	



Figure 3: PL4T tendon transfer

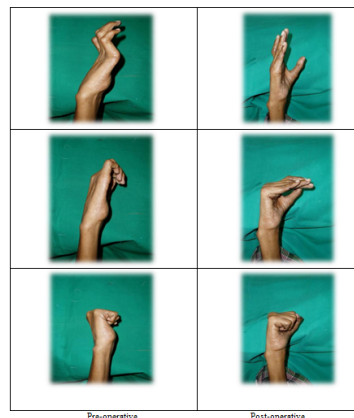


Figure 4: FDS Tendon Transfer

DISCUSSION

Leprosy is a chronic infectious disease caused by *Mycobacterium leprae*, a unique bacillus, not conforming to Koch's postulates. It has a wide range of clinical manifestations but usually affects peripheral nerves and skin. According to Job et al⁴, entry of *Mycobacterium leprae* into Schwann cells initiates a cascade of destruction with intense intra neuronal edema, and destruction of Schwann cells and axons by aCD4+T cell mediated granulomatous process, which can lead to a progressive loss of nerve function (neuropathy) mostly in the eyelids, cornea, hands and feet. Claw hand develops due to the paralysis of lumbricals (innervated by ulnar and median nerve), manifested by hyperextension of Metacarpal phalangeal joint and flexion of inter phalangeal joints. Fritschi(1971)⁵ states that ulnar nerve is the most frequently paralysed nerve in leprosy, followed by median nerve, common peroneal nerve, facial nerve and radial nerve in that order. Agarwal et al (2005)⁶, state that the clawing position is a cosmetic impairment (deformity) initially, and the inability to close the finger joints sequentially is a functional impairment (disability) ultimately⁶

Dynamic procedures such as tendon transfers may be done with or without grafts. The aim of surgery is to stabilize the metacarpal phalangeal joint and prevent its hyper extension. Any deficiencies in the expected improvement of parameters, such as assisted and unassisted angles of proximal inter phalangeal joint extension (on lumbrical position), muscle power of metacarpal phalangeal joint flexors were studied. Deficiencies in the activities of daily living like buttoning and unbuttoning, holding a cylindrical object were assessed. In the operation known as the modified Stiles-Bunnell procedure, only one or two FDS tendons were removed, split, rerouted along the lumbrical canal and sutured to the transverse fibres, of the radial lateral band. Burkhalter(1973,74)^{7,8} inserted the superficialis slips onto the proximal phalanx in patients with traumatic ulnar nerve palsy to avoid the risk of proximal inter-phalangeal joint hyperextension.

In 1984, Shah⁹ modified the superficialis transfer and addressed only clawing of the ring and little fingers. Antia(1969)¹⁰ reported use of Palmaris longus extended by a graft and divided into four slips, inserted into the lateral bands of the dorsal digital expansion. He reported good results, especially in the hypermobile Indian hand as it is a less powerful muscle, so the risk of over correction is less.

According to Sundararaj et al¹¹ the contracture angles at the proximal interphalangeal joint can be graded as: 0-9° as minimal, 10-20° as mild, 21-40° as moderate and over 40° as severe.

In our Study we found Ring finger unassisted angle: Pre-operatively in PL4T is 87.7 degree where it becomes 19.5 degree post operatively. So the improvement is 22.3%. In FDS tendon transfer pre-operative angle was 85.6 degree where it comes to 14.7 degree post operatively. So the improvement 17.7%. For little finger pre-operative unassisted angle was 79.8 degree and post operatively it becomes 15.3 degree. Improvement is 19.1%.

In FDS the angle of little finger was 78.6 degree pre-operatively and become 15.6 degree post operatively. Improvement is 19.5%

Assisted angle: - Improvement is 21.92% For PL4T tendon transfer pre-operative angle in ring finger was 10.9 degree where it becomes 6.70 post operatively. Improvement is 61.46%. For FDS tendon transfer pre-operative angle was 7.1 degree where it becomes 6.5 degree post operatively Improvement is minimum.

In little finger pre-operative angle in PL4T was 12.4 degree and post operative angle was 6.1 degree. Improvement is 51.19% For FDS tendon transfer pre-operative angle was 12.1 degree and post operative it becomes 7.95 degree. Improvement is 34.3%

Functional assessment : Buttoning and unbuttoning of button: In PL4T it was 1.5 button/30 sec pre-operative which becomes 2.45 button/30 sec in post operative. Improvement is 1.633 times. For FDS it was 2.05 button/30 sec pre-operative which becomes 3.5 button /30 sec post operatively. Improvement is 1.32 times. Unbuttoning of button in PL4T it was 1.5 button/30 sec pre-operative and 2.95 button /30 sec post operatively. Improvement is 1.97 times. For FDS unbuttoning it was 2.75/30 sec pre-operative where there it becomes 2.45/30 sec post operative. Improvement is 1.12 times.

Cylindrical grasp which is evaluated as phalanges in contact with

object. For ring finger in PL4T average contact was 2.55 which comes to 3.19 postop. So improvement is times. In FDS for ring finger preop contact was 1.6 which became 2.65 postoperatively. With an improvement of 1.65 times In little finger for PL4T phalangeal contact was 0.2 preop & it comes to 2.05 postop. Improvement is 10.25 times. In case of FDS of little finger phalangeal contact was 0.55 preop & 1.9 phalangeal contact post op. So it improves by 3.45 times.

To compare operative time between PL4T & FDS tendon transfer, mean time taken in PL4T 95 minutes whereas FDS had taken a mean time of 85 minutes.

CONCLUSION

Measurement aspect of both groups in this study failed to reveal any difference of statistical significance

Source of Support: Nil;

Conflict of Interest: None

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