

**Original Article**  
**Orthopaedics**

# OUTCOME OF ZANCOLLI'S LASSO PROCEDURE FOR PARALYTIC CLAW HAND DUE TO LEPROSY IN IMPROVEMENT OF DEFORMITY, GRIP STRENGTH AND RANGE OF MOTIONS

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**Abstract:**

**Background:** Many procedures for the correction of clawing due to ulnar nerve palsy in Leprosy like extensor bypass surgery, Palmaris longus tail graft, Extensor carpi radialis graft etc. gives good results with increasing power and motion functions of hand. But these procedures needs meticulous surgery, extensive institutional post operative re-education, training and otherwise results in stiff fingers. Current study is done in view of simple procedure and easy post operative physiotherapy with good results.

**Materials And Methods:** Fifteen patients with ulnar claw hand secondary to leprosy were selected between the period of January 2013 to January 2014 in our hospital. Patients with simple claw hand and mobile fingers with positive Bouvier phenomenon were included. Disease had been controlled by anti leprosy treatment with MDT for minimum of six months. Flexor digitorum superficialis tendon Lasso transfer was done with post operative physiotherapy. Method of assessment included pre operative and post operative measurement of range of motions, deformity, grip strength using hand dynamometer. Also angle measurement of unassisted extension of PIP joint with MCP joint held at 90° flexion was done with goniometer .

**Results:** The mean post operative grip strength was improved by 30% in three months and 46% by six months. Mean rate of improvement of active extension lag was 35% overall. 60% of patients had good deformity

correction, 27% fair and 13% showed poor results. One patient had superficial skin complication and one patient developed paresthesia of medial aspect of ring finger which recovered subsequently.

**Conclusion:** Zancolli Lasso procedure for ulnar claw hand is simple and can be performed even in peripheral centers of India with good results with requirement little re education and simple physiotherapy. This procedure was more successful in restoring grip strength. Early surgery and less extensor lag gives excellent results.

**Key words:** Claw hand, Flexor digitorum superficialis, Zancolli's Lasso transfer, Physiotherapy.

## Introduction:

Leprosy, commonly seen in India affects the Ulnar nerve causing claw hand. The mixed nerve trunk most often damaged by Leprosy in the upper extremity is the Ulnar nerve. Less often the Median nerve is involved, usually in combination with the Ulnar nerve<sup>15</sup>. The Radial nerve is rarely involved. With paralysis of the intrinsic muscles, the hand adopts the typical posture of clawing, initially maybe only the ring and little fingers, eventually often all fingers<sup>15,16</sup>. Many dynamic surgical procedures for the correction of clawing like extensor bypass surgery, Palmaris longus tail graft, Extensor carpi radialis graft etc. gives good results with increasing power and motion functions of hand but needs meticulous surgery, extensive institutional post operative re-education, training and otherwise results in stiff fingers<sup>9</sup>. Intrinsic replacement operations utilizing Flexor digitorum superficialis are the most commonly done procedure<sup>9</sup>. This tendon was first used by Stiles in 1922 where the FDS was split, passed dorsally and one half of each sutured to EDC<sup>1</sup>. Bunnell modified this procedure where the split FDS was passed to the transverse fibers of intrinsic apparatus of each finger<sup>2</sup>. Current study with Zancolli's Lasso procedure is done in view of simple procedure and easy post operative physiotherapy with good results which can be done in peripheral centers of India.

## Materials And Methods

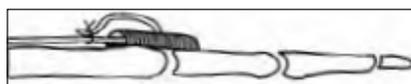
Fifteen patients with Ulnar claw hand secondary to leprosy were selected between the period of January 2013 to January 2014 in our hospital. Patients with simple claw hand and mobile fingers with positive Bouvier

phenomenon were included. In all patients selected, disease had been controlled by anti leprosy treatment with MDT for minimum of six months. Patients with joint contractures were excluded from the study.

## Surgical technique:

Procedure was done under general anaesthesia or brachial block. Curved, transverse incision is made in the palm from the radial border to the ulnar border, about one cm proximal to the MCP flexion crease. The flexor tendon sheaths are dissected free and the proximal border of the A1 pulley identified. The synovial sheaths are opened just proximal to the A1 pulley border with scalpel or pointed scissors, care taken not to injure the flexor digitorum superficialis<sup>3</sup>.

The flexor digitorum superficialis of the ring finger is transected distally. It is easily withdrawn through the long transverse incision. The tendon was split into four slips, one slip for each finger. The slips were passed through the flexor sheath with the help of tendon tunneller. The slips were then passed under the proximal pulley (A1) of the corresponding finger and through the opening distal to the pulley, the tendon was taken out and brought palmar and proximal to the pulley. The slip was sutured to the same slip forming a loop under proper tension with metacarpophalangeal joint in 30-90 degree flexion where flexion increases from index to little finger to make resting position of hand<sup>3</sup>.



**Figure 1 Looping of FDS tendon over A1 pulley**



**FIG 2. A. Incision 1 cm proximal to MCP flexion crease. B. isolation of FDS tendon of ring finger. C. Splitting of FDS tendon into slips D. Suturing of FDS tendon slip looping around A1 pulley.**

## Post operative physiotherapy:

POP cast immobilization is given with wrist in its functional position and MCP joints flexed by 55°. By fourth week, POP is removed at the time of exercises and flexion exercises

of all joints started, with MCP joint not extending beyond 55° of flexion. Slab immobilization was done in remaining period. By sixth week, active physiotherapy was started with flexion at all joints using a soft compressible ball.

The angles of metacarpophalangeal and interphalangeal joints were measured in open hand position using Goniometer. Good, fair and poor results were categorized as per the assessment given in table.

Result	MCP joint in degrees	Interphalangeal joint in degrees
Good	+30 to 0	0 to 20
Fair	0 to -20	20 to 40
Poor	>-20	>40

## Methods of assessment

### 1. Assessment of deformity correction in open hand position

	Open hand	Closed fist	Mechanism of closing
Excellent	No residual contracture at PIP joint	Full tight fist	Complete MP flexion before IP joints begin to flex
Good	Unassisted extension at PIP joint, no flexion at DIP joint	Fingers closes tightly but not enough to hold a needle	IP joints begin to flex just before MP joint completes flexion
Fair	Unassisted extension at PIP joint, slight flexion at DIP joint	Visible gap between base and tip of finger	MP and IP joints flexion simultaneously
Poor	Any hand that does not score fair	Any hand that does not score fair	MP flexion delayed beyond IP flexion

### 2. Assessment of range of motions by modified Brand's criteria<sup>7</sup>.

Range of motions in MCP joint and interphalangeal joints were measured in open hand and closed fist assessment.

### 3. Grip strength:

Grip strength was measured using hand Dynamometer before surgery and post operatively and results were reported as percentage improvement in grip strength of the preoperative value.

### Results:

#### Deformity correction:

The correction of deformity was good in 10 (60%) cases, fair in 3(27%) cases and poor in 2(13%) cases. The average angle improvement was maximum in little finger followed by

ring, index & middle finger in that order. Minus (-) sign shows extension and Plus (+) sign shows flexion. The preoperative and postoperative angles of MCP and PIP joints are given in Table .

	Open hand position	Preoperative angle			Post operative angle			Average angle improvement
		Min	Max	Average	Min	Max	Average	
Index finger	MCP	-45	0	-15	-25	10	0	15
	PIP	0	90	30.5	0	60	10	20.5
Middle finger	MCP	-50	5	-20.5	-30	25	5	15.5
	PIP	5	90	25	0	50	5	20
Ring finger	MCP	-60	0	30	-25	15	5	25
	PIP	5	80	40	0	35	10	30
Little finger	MCP	-70	-20	-30	-30	10	0	30
	PIP	25	90	50	-5	40	10	40

**Range of motion measurements:**

Result	Open hand assesment	Closed fist analysis	Flexion at MP and IP joint sequence comparison	Average
Excellent	5(33%)	6(40%)	4(27%)	33.33%
Good	7(47%)	7(47%)	8(53%)	49%
Fair	3(20%)	2(13%)	3(20%)	17.66%
Poor	-	-	-	-

Out of 15, 33.33% of patients had excellent results, 49% had good and 17.66% had poor results in the range of motion assessment by the criteria modified from Brand's<sup>6</sup>.

**Grip strength:**

The grip strength was decreased in immediate postoperative period (4-6 weeks). But the mean post operative grip was improved by 30% of mean pre operative strength in 3 months and by 46% of pre operative strength in 6 months.

Pre operative (in kg)			Follow up	Post operative (in kg)			Mean improvement
Min	Max	Average		Min	Max	average	
1	14	7	3 months	3	20	9.1	30%
			6 months	4	23	10.22	46%



**Fig 3. A and B: Preoperative ulnar claw hand deformity  
C and D: Postoperative clinical photographs showing correction**

**Complications :**

One patient had superficial skin complication with infection which later healed with secondary intention. One patient developed paresthesia of medial aspect of ring finger probably due to traction injury to digital nerve during surgery. The paresthesia recovered subsequently in six weeks.

**Discussion:**

The principle of management of claw hand in leprosy is correction of primary deformity and prevention of appearance of secondary deformities like soft tissue contractures<sup>9</sup>.

The tendency for occurrence of clawing is greater in the small than in ring finger; tension was set slightly greater on the small finger. Although the index and long fingers generally do not exhibit the clawing posture, both objective testing and comments from the patients strongly suggest that dysfunction of these digits is also present. So, transfer is made to all four fingers regardless of clawing limited to the ring and little finger.

Many authors like Shah<sup>10</sup> (1984); Hasting and Davidson<sup>17</sup> (1988), claim that power improvement is not seen with the lasso procedure. But in our study, we had seen a definite increase in strength. Improvement in strength is also shown by studies of Ozkan T, et al<sup>9</sup>. Other procedures like Bunnell's, Brand's, Antia's result in decrease of power and pinch strength. Flexor digitorum superficialis is the prime flexor of the PIP joint and is essential for power grasp. In above-mentioned procedures flexor tendon rerouted to extensor expansion thus causing deficiency in power grasp. However in Lasso procedure, flexor tendon is not rerouted to extensor expansion thus no flexor power deficiency is there. As the deformity improves, the hand

can be put into more mechanically advantageous position to use remaining muscle tendon units, thus increasing power grasp<sup>9</sup>.

Lakhanpal et. al (1979) reported 90% good results with Paul Brand technique. Brandsma reported 78-83% good to excellent results with FDS many tail procedure, but also point out the complication like swan neck deformity (15%), DIP flexion (29%), Checkrein deformity (26%) and insufficient finger flexion (18%)<sup>5</sup>.

In all these procedures the transferred tendon is suture to extensor expansion. These procedures take longer surgical time, meticulous surgical technique and very good postoperative re-education is required. Complications like median nerve compression<sup>4</sup>, stiffness of fingers, FDS minus deformity, under correction are quite high.

Zancolli's transfer and most of the procedures including those of Bunnell's<sup>2</sup>, Riordan<sup>19</sup>, Brand's<sup>6</sup> and Antia's<sup>18</sup> has the disadvantage of producing swan neck deformity. Our study did not report any swan neck deformity in fingers.

### Conclusion:

Zancolli Lasso procedure for ulnar claw hand is a simple procedure and can be performed even in peripheral centers of India with good results with requirement of little re-education and simple physiotherapy. This procedure was more successful in restoring grip strength. Early surgery and less extensor lag gives excellent results.

### Bibliography :

1. Stiles J Forrester-Brown MD. Treatment of injuries of peripheral spinal nerves. London: Henry Frowde and Hodder and Stoughton. 1922, page 120.
2. Bunnell. S. tendon transfers in hand and forearm. Instr course lecture, 1949 ; 6: 1
3. Zancolli, E. A.: Clawhand caused by paralysis of the intrinsic muscles. A simple surgical procedure for its correction. J. Bone Joint Surg., 39A: 1076-80,, 1957.
4. Malaviya, G.N., Husain, S. and Shantaganam, P.: Correction of hypermobile claw fingers in leprosy by pulley insertion procedure. Eu. J. Plastic Surgery, 10: 148-51, 1987.
5. Brandsma J.W. and Ottenhoff D, Jonge M.W.: flexor digitorum sublimis tendon transfer for intrinsic replacement. Long results and defects in donor fingers. J. of Hand Surg. : 17B:6:625-628, 1992.
6. Brand PW. Paralytic claw hand with special reference to paralysis in leprosy and treatment by sublimis transfer of Stiles and Bunnell. J Bone Jt Surg(Br), 1958; 40:618-632
7. Ozkan T., Ozer K. , and Gulgonen A: Surgical reconstruction of irreversible ulnar nerve paralysis in Leprosy. ; Lepr Rev 74: 53-62,2003
8. Oberlin C., Zancolli's "lasso" operation in intrinsic palsy of leprosy origin. A Study of twenty-six cases: Ann Chir Main.; 4(1): 22-30, 1985. [Article in English, French]
9. Ozkan T., Ozer K. , and Gulgonen A.: Three tendon transfer methods in reconstruction of ulnar nerve palsy, Hand Surg [am]. Jan; 28 (1): 35-43, 2003
10. Shah, A.: One in four flexor digitorum superficialis lasso for correction for claw deformity. J.Hand Surg., 11B (3) Oct: 404-6, 1986
11. Brandsma J.W and Brand F.W.: Claw finger correction (Review article) J. of Hand Surg. Vol. 17B: 6:615-621, 1992.
12. Patond K.R., Betal B.D., Kumar A. Surgical correction of claw fingers in leprosy using flexor superficialis direct lasso procedure; Indian J Lepr.: jan-Mar: 69 (1): 25-32, 1997,
13. Palande, D.D: Correction of intrinsic minus hands associated with reversal of transverse metacarpal arch. J. Bone Joint Surg., 65A (4: April:) 514-21, 1983.
14. Zancolli, E.A: Structural and Dynamic Bases of Hand Surgery. 2nd Ed., J.B. Lippincott Company, Philadelphia. p1-64, 159-207, 1979.
15. Mulder JD, Landsmeer MF: The mechanism of claw finger. J Bone Joint Surg 50A:664-668, 1968.
16. Smith RJ: Intrinsic muscles of the fingers: function, dysfunction, and surgical reconstruction. In Am Ac Orthop Surg: Instructional Course Lectures. 24, St. Louis 1975, CV Mosby 200-220, 1975
17. Hastings H, Davidson S. Tendon transfers for ulnar nerve palsy: Evaluation of results and practical treatment considerations. Hand clinics, 1988;4: 167-179
18. Antia NH, Enna, CD and Daver BM: The Surgical Management of Deformities in Leprosy. Oxford University Press, Bombay, 1992
19. Riordan DC: Tendon transfers of the hand and wrist. Curr Pract Orthop Surg 5:217-220, 1980.