

# Management of Upper Limb in Cerebral Palsy - Role of Surgery.

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## Abstract

Forty six patients with cerebral palsy ( hemiplegic and diplegic ) aged from five to twenty one years had surgical procedures for the upper limb to increase functional status of hand. All the patients underwent various surgical procedures depending upon the necessity . The mean age is of thirteen years .( five to twenty one years ) IQ of all the patients were more than seventy .Forty one out of forty six patients felt there was an improvement in function . Range of movement in the fore arm and wrist were also increased in most of the patients . Thumb in palm deformity was completely corrected . Resting position towards neutral and stability of hand were also some of the achievements of surgery. There was improvement in different functional grasps. The management of upper limb in cerebral palsy is a challenge. But in properly selected patients there is some improvement in functional status.

**Key Words :** Upper limb - Cerebral palsy - Role of surgery.

## Introduction

Neonatal intensive care units are saving more children of lower gestational age and lower birth weight than previously , and these children are more likely to have birth injuries or prenatal defects than are other children , there by increasing the cerebral palsied population. <sup>1</sup>

A majority of those with involvement of the upper limb are adequately handled by occupational therapists by developmental therapy and bracing. Probably fewer than 4 % of patients with hands disabled by cerebral palsy can be benefitted by surgery. But, because of the general feeling that the results of surgery in cerebral palsy is poor , many patients have not been considered for surgery . If we recognize that some improvement of hand function may aid the patients to a marked degree in ADL , then the correct place of surgery will be established.

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Typical pattern of spasticity in upper limb includes elbow flexion , pronation of the fore arm , ulnar deviation and flexion of the wrist with thumb in palm deformity . Each individual case must be carefully evaluated and when indicated surgery can be extremely beneficial . It has been seen that ideal candidate for surgery is a spastic hemiplegic , who is co operative , IQ more than seventy and has a pattern of grasp and release are so functional that the hand is useful to some extent. Hoffer et. al <sup>10</sup> believed that adequate cognition was important and suggested that patients with IQ less than seventy must be carefully selected. Thometz and Tachjian <sup>11</sup> showed that in patients with IQ less than seventy , improvement in functional capacity was less. The hand should be sensitive. Because upto 50 % children with cerebral palsy have significant deficit in sensibility. <sup>2</sup> It has also been reported that 30- 97 % of patients have defective stereognosis . Stereognosis also affects the outcome of surgery .

The technique of surgical reconstruction of the upper extremity in cerebral palsy are well established. <sup>3,4,6,7,8,9</sup>

We report the results of surgery in forty six patients who had reconstructive surgery of upper limb in spastic cerebral palsy.

## Material and Methods

Forty six patients with cerebral palsy ( hemiplegic and diplegic ) under went various types of surgical procedures for upper extremity from 1995 to 2001. There were twenty six males and twenty females . There were forty hemiplegics and six diplegics. Out of forty hemiplegics right side was involved in thirty three cases and left side in seven cases. A total number of fifty two hands were operated and two hundred and five operations were done. ( Table I ) Our youngest patient was five years and eldest was twenty one.

**TABLE- I : OPERATIVE PROCEDURES**

NAME OF OPERATION	NUMBER
1. Fractional lengthening of biceps tendon	17
2. Flexor aponeurotic release	32
3. Rerouting of pronator teres	29
4. Fractional lengthening of flexors of fore arm	5
5. FCU > ECRL/ ECRB	21
6. FCU > ED	13
7. Release of adductor pollicis	33
8. PL > EPB	15
9. PL > APL	7
10. BR > APL	6
11. Release of first dorsal interosseous	25
12. Excision of head of radius	2
Total	205

The patients were selected after evaluation of IQ ( 70 or more ) . Cases with moderate degree of spasticity were selected for surgery. Athetoids were not included in our study . All patients had some type of physical therapy before surgery . No medicines were used pre operatively to reduce

spasticity . Different grips and grasps were assessed pre operatively and were compared with that of post operative cases. ( Table II ) Various movements like that of elbow extension , supination of fore arm, wrist dorsi flexion and thumb in palm deformity were compared post operatively. ( Table III ) Different ADL were assessed post operatively to confirm the post operative functional improvement.

**TABLE II : ASSESSMENT OF GRIP/ GRASP PRE-OPERATIVELY AND 6 MONTHS POST OPERATIVELY**

	Pre operatively Present	Post operative ( 6 month ) improvement
1. Chuck grip	8	32
2. Five finger pinch	13	26
3. Power grasp	17	32

**TABLE III : IMPROVEMENT OF RANGE OF MOTION**

Type of motion	No of Cases	Unchan- ged	Improved	In degrees
1. Elbow extension	17	1	16	10-30
2. Supination	29	5	24	10-80
3. Wrist extension	37	8	29	5-60

## Results

There was significant improvement in active elbow extension , active supination and grasp at six months post operatively in forty one patients. Five showed no improvement. Chuck grip was improved in twenty four patients, five finger pinch in thirteen cases and power grasp in fifteen cases. ( Table II ) There was improvement in ROM in elbow , forearm and wrist joint. ( Table III ) Thumb in palm deformity was completely corrected in thirty one out of thirty three cases. Thirty five patients out of forty six patients were able to hold glass, do buttons and handle objects confidently. None was made worse. Twenty five patients out of forty six were able to eat independently with some difficulty who were being fed by parents. Ten out of forty six were able to write in the

operated hand . Style of letters of hand writing improved dramatically with more follow up. The operated hands were not compared with the normal hand. They were compared with the improvement of function of same hand.

**Fig. 1 Pre-operative**



**Fig. 2 Post operative**



Almost all felt that there was some improvement in function, cosmeses, or overall improvement . Hands having severe flexion deformity of wrist and hand were unable to clean the palm which improved post operatively, Only unsatisfied are those who were having greater expectations.

## Discussion

Reconstructive surgery of the spastic upper extremity in cerebral palsy can be a most challenging one. Techniques and principles for the various procedures are established.<sup>3,5,6,7</sup> In our series most patients were of hemiplegic type. Most patients showed improvement of hand function which were maintained upto six months to four years. Thumb in palm deformity was completely corrected in most of the patients. The reconstruction included division of origin of adductor pollicis and partial release of first dorsal interosseous. Position of thumb was reinforced by transfer of brachioradialis and palmaris longus to abductor pollicis longus tendon. The results were compared with that of L.B Dahlin et. al<sup>8</sup> and results were found to be comparable.

Flexion and pronation deformity is not only a functional disability but also cosmetically displeasing. We have done lengthening of biceps, rerouting of pronator teres, flexion aponeurotic release and transfer of flexor carpi ulnaris to ECRL/ ECRB which improves elbow extension , active supination and dorsiflexion deformity. Rerouting of pronator teres was also used to improve supination. Supination gain was compared with that of Sakellarides et. al<sup>7</sup> . ROM of wrist was compared with that of L.B Dahlin et al.<sup>8</sup> and T.M Wolf et al.<sup>9</sup> . Correction of pronation increased two handed activities, because forearm pronation interferes with the ability to get the palms together. One of our patient was having bilateral superior radio ulnar dislocation probably due to long standing pronation contracture . We excised both the head of radius and then tendon transfer performed.

The level of intelligence may affect a patients co operation, training and motivation. Patients with IQ seventy or more were selected for surgery by Hoffer et. al<sup>10</sup> . After his study he concluded that adequate cognition was important

and IQ less than seventy must be carefully selected. So we have not tried the procedures in cases having less than seventy. It is also very difficult to get the co operation of parents due to lack of education and low financial status. Frequent visit or long duration stay in hospital is necessary. So, family counselling and mental status of child should be assessed thoroughly in our country before under taking the procedures.

Though any appropriate age is not selected for surgery , still it is reasonable to wait until the child can actively participate in post operative therapy. Green and Banks <sup>3</sup> recommended that surgery should not be done below the age of seven. But , it is patient dependent. Our youngest patient was of five years old. But it is reasonable to wait until the child actively participate in post operative therapy. It is seen that good results are obtained in patients who are hemiplegic , IQ more than seventy and the patients were able to perform some of the activities in the same upper limb.

Motivation of the patient and family is a very important consideration . Longer duration of hospitalization and therapy is mandatory in these cases. Patients should not be given high hope. Parents should be explained in detail about the procedure and about expectation of the results.

Patients were asked to demonstrate different ADL post operatively . The hemiplegic extremity could be used as a support in these activities in most of the patients . Surgery also improves the pattern of eating , propelling wheel chair etc. in diplegics.

Appropriately selected patients for surgery in upper extremity show some improvement in functional status. In our series most of the patients felt that there was a definite improvement in some sort of function.

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