

### A COMPARATIVE STUDY OF OUTCOMES FOR CORRECTION OF CUBITUS VARUS DEFORMITY BY DOME OSTEOTOMY VERSUS MODIFIED FRENCH OSTEOTOMY

Hiranmay Deb<sup>1</sup>, Kanchan Kumar Sabui<sup>2</sup>, Sanjoy Hait<sup>3</sup>, Michael Hira<sup>4</sup>

<sup>1</sup>Associate Professor, Department of Orthopaedics, Medical College, Kolkata, West Bengal, India.

<sup>2</sup>Associate Professor, Department of Orthopaedics, Medical College, Kolkata, West Bengal, India.

<sup>3</sup>Medical Officer, Department of Orthopaedics, Darjeeling District Hospital, West-Bengal, India

<sup>4</sup>Professor, Department of Orthopaedics, Medical College, Kolkata, West Bengal, India.

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Corresponding Author:  
**Dr. Hiranmay Deb,**  
 Email: hiranmaydebdep@gmail.com  
 ORCID: 0000-0003-0851-4623

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#### Abstract

**Background:** Cubitus varus is the most common angular deformity that results from supracondylar fracture of Humerus in children. The normal carrying angle increases from childhood to adulthood, an increase in valgus is not cosmetically noticeable as complete reversal to a varus position. The indication of surgery in most children with cubitus varus is presence of unsightly deformity. The function of the elbow joint is generally not impaired. **Materials and Methods:** A Pilot Study Was conducted and Sample size determined after obtaining Ethical clearance from the Institute. In our study we have included 30 Adolescent children of Post-Traumatic Supracondylar fractures with Cubitus Varus deformity of more than six month old with complain of cosmetic deformity of the upper limb. The thirty children deformity was corrected by surgically by Supracondylar Osteotomy. Among the thirty cases, Half of the children undergone Dome Osteotomy and another fifteen children undergone Modified French Osteotomy. Cases are Randomly Allocated. **Result:** Results are analyzed by Bellmore et al and Oppenheim et el criteria on the basis of Range of Motion(ROM), Carrying Angle correction, Lateral condyle prominence index (LCPI), Humerus elbow wrist angle correction basis. **Conclusion:** Results by Bellmore criterion 12 patients (80%) Excellent results and 3 patient (20%) have good results by Modified French osteotomy and 11patients (78%) have Excellent result, 4 patients (22%) have good results by Dome Osteotomy.

#### INTRODUCTION

Cubitus varus is the most common angular deformity that results from Supracondylar fracture in children. Supracondylar fractures of the distal humerus accounts for 3% of the fractures in children and may be associated with various acute and long term problems.<sup>[1,2]</sup> The indication of surgery in most children with cubitus varus is the presence of unsightly deformity. Several causes of cubitus varus have been suggested.<sup>[3]</sup> Medial displacement and rotation of the distal fragment have been cited most often as the cause, but experimental studies have shown that varus tilting of the distal fragment is the most important cause of change in carrying angle.<sup>[4,5]</sup> Osteonecrosis and delayed growth of the trochlea, with relative overgrowth of lateral side of the distal humeral epiphysis is cause of progressive cubitus varus deformity after supracondylar fracture.<sup>[6]</sup> This progressive growth abnormality cannot be prevented by stabilisation of distal fragment, because it probably is related to injury to the blood supply of

trochlea at the time of fracture.<sup>[7]</sup> Rotational malalignment of the distal humerus is compensated to a large degree by motion of the shoulder joint.<sup>[8]</sup> Occasionally a hyper extension deformity requires the addition of a flexion component. Three basic types of osteotomies have been described for cubitus varus deformity; a medial wedge osteotomy with a bone graft and dome osteotomy with de-rotation and a lateral closed wedge Osteotomy. In this study an attempt was made to compare the two operative procedures, Dome Osteotomy and Modified French Osteotomy for correction of cubitus varus deformity.<sup>[9,10]</sup>

The carrying angle shows a progressive increase with age, followed by a slight fall after the age of 15 years. The P values the sex differences. The P values indicate that sex differences gradually set in with age with a minimum around puberty.

## MATERIALS AND METHODS

### Aims

The aim of the study is to find out the outcomes of correction of cubitus varus deformity by dome osteotomy and modified French osteotomy in children.

### Objectives

- To detail the clinical parameters and to review the results of Dome Osteotomy and Modified French Osteotomy for cubitus varus deformity in children.
- To compare the merits and demerits of Dome Osteotomy and Modified French Osteotomy in treating cubitus varus deformity in children.

To compare our results with other studies done till date the present series will comprise comparative randomized study comparing the outcomes for correction of cubitus varus deformity by Dome Osteotomy and Modified French Osteotomy.

### Study Design

Institutional Based Prospective Comparative Study

### Inclusion Criteria

Children of age between (5-15) years with malunited Supracondylar fracture of humerus with Injury and surgery interval more than 6 months.

### Exclusion Criteria

- Previous operation done for recurrence of cubitus varus deformity other than post traumatic cases including physal injury.
- Elbow stiffness.

### Study Variables

- Post operative range of motion.
- Post operative correction of carrying angle.
- Post operative residual deformity.
- Time taken for union after osteotomy.
- Post operative infection & Nerve injury

This prospective study was conducted in Medical College and Hospitals, Kolkata on 30 patients including 15 patients treated with Dome Osteotomy and 15 patients treated with Modified French Osteotomy, fulfilling the study criteria with Cubitus Varus deformity, after taking clearance from the institutional ethics committee and informed consent from the patients and will be analyzed using standard statistical software. The patients were assessed using the "Oppenheim Criteria" and "Bellmore criteria".

**Table 1: Mean carrying angle and standard deviation by age and sex and P value for difference between them**

Age group (years)	Carrying Mean Angle (°) ± SD		P value
	Boys	Girls	
5-6	8.6±4.2	10.0±3.0	0.136
8-9	10.4±2.9	11.8±3.9	0.121
11-12	11.6±3.2	13.6±3.4	0.023
14-15	12.4±2.5	15.4±2.6	0.000
17-18	10.8±3.6	13.6±3.5	0.004
Overall	10.75	12.88	0.000

**Table 2: Oppenheim et al criteria**

Criteria	Excellent	Good	Poor
Humerus- Elbow-Wrist Angle Correction	Within 5 deg of normal	Within 10 deg of normal	Residual Deformity>10
Loss of rom at elbow	Upto 5 deg	6 to 10 deg	>10
Complications	Nil	Scarring/lazy- S deformity	Any complication

**Table 3: Bellmore Criteria**

Outcome	ROM (Range of Motion)	Carrying Angle	LCPI (Lateral Condylar Prominence Index)	Complication
Excellent	Difference< 10 °	(5-6) °	No Increase	None
Good	Difference<(10-20) °	(6-10) °	Increase <25%	Minor
Poor	Difference> 20°	>10 °	Increase >25%	With residual defect or review surgery

## RESULTS

Total 30 patients are included in the study attended at the Medical college hospital OPD following deformity of the elbow at different time of injury. The average duration from injury and appearance for the deformity 8 months to 12 months. There is predominance of non-dominant injury with male preponderance. The patients are randomly allocated for surgical procedure of different type of osteotomy. Patient reviewed 1 month, 6 weeks, 3 month, 6 month and 9 month of interval.

More than 50% of the children average 9-11 yrs old with male dominance with left sided involvement. The Average union of osteotomy both the Dome Osteotomy and Modified French osteotomy around 8wks. After bony union confirmed radiologically, K-wires used for fixation of osteotomy are removed and gradual mobilization of the elbow started. The ROM (0°-130°) in Dome osteotomy cases regained 6 patient (40%) and in Modified French Osteotomy cases 7 patient (46.66%), P-value 0.457089, it is not significant. Regarding Distribution of residual angular deformity in Dome osteotomy cases was absent in 15 cases (100%) and Modified French

Osteotomy cases Absent in 14 patients (93.99%), p value is 0.308987 is in-significant.

Distribution of functional outcome by "BELLMORE" criteria in Dome Osteotomy Excellent 12 (80%) and Good in 3 cases (20%), In Modified French Osteotomy cases Excellent 11 cases (73.33%) and Good 4 cases (26.67%).

Distribution of functional Outcome by "Oppenheims" criteria in Dome Osteotomy, Excellent 11 cases (73.33%) and Good 4 cases (26.67%), In Modified French Osteotomy cases, according to "OPPENHEIM CRITERIA" Excellent 12 cases(80%) and Good 4 cases (20%).



**Figure 1: Pre-Operative Clinical**



**Figure 2: Preoperative X-Ray**



**Figure 3: Post-Operative Clinical**



**Figure 4: Post-Operative X-Ray**

## DISCUSSION

In India the treatment of closed skeletal injuries in rural areas is still quite commonly carried out by traditional bone setters. In most of the cases we got the history of injury at elbow and attended by village quacks, traditional bone setters, Immobilization done for few weeks and after removal of support as the elbow extension gradually, parent notices the inward bending of forearm in-relation to arm (Cubitus Varus). In most of the cases parents brought their children to our OPD for this unsightly deformity, no loss of power at the elbow and they afraid of increase of the deformity. Among the various Osteotomy we studied outcome of lateral closing wedge osteotomy (Modified French Osteotomy) and Dome rotational osteotomy. Levine M J, et al,<sup>[1]</sup> witnessed minimum and maximum age of patients in their study was 9 years and 16 years. Mean age of patients was 10.6 years. In our study minimum and maximum age of the patient was 5 and 15 years and mean age was 9 years. Oppenheim. WL, et al,<sup>[2]</sup> founded 30% patients were males and 70% patients were females in their study. However, in our study 60% patients were males and 40% patients were females. Song HR, et

al,<sup>[3]</sup> founded in their study that 70% patients had left sided deformity and 30% patients had right sided deformity. In our study 60% patients had left sided deformity and 40% patients had right sided deformity. Dunlop et al,<sup>[4]</sup> stated that average union in Dome Osteotomy average time taken for union was 6.8 weeks. Yamamoto I, et al.<sup>[5]</sup> founded average time taken for union was 7 weeks. In our study average time taken for union in patients undergoing dome osteotomy was 7.4 weeks with range from 4 - 12 weeks. King D & Secor C et al,<sup>[6]</sup> witnessed average time taken for union in Modified French Osteotomy as 7.2 weeks. Masood Habib et al,<sup>[7]</sup> founded average time taken for union in Modified French osteotomy was 5.5 weeks. However, in our study average time taken for union in patients undergoing modified French osteotomy was 7 weeks with range 4-12 weeks. 80 % patients had excellent result, 20 % patients had good result according to "BELLMORE" criteria who underwent Dome osteotomy. 73.33 % patients had excellent result 26.67 % patients had good result according to "OPPENHEIM" criteria in patients who underwent Dome osteotomy. 73.33 % patients had excellent result, 26.67 % patients had good result according to "BELLMORE" criteria who underwent modified French osteotomy. 80 % patients had excellent result, 20 % patients had good result according to "OPPENHEIM" criteria who underwent modified French osteotomy.

## CONCLUSION

The present study was conducted on a series of 30 cases of mal united supracondylar fractures treated by corrective osteotomy-15 cases by Dome Osteotomy and 15 cases by Modified French Osteotomy. The mean age of patients was 8.8 years, median age 9 years and range being (5-15) years. 60% male patients and 40% female patients. Mean time taken for union was less in Modified French osteotomy comparative to Dome osteotomy but this difference of proportion did not differ in a statistically significant way. Functional outcome of patients according to Bellmore criteria was better in case of Dome osteotomy than Modified French osteotomy, though did not differ in a statistically significant way. Functional outcome of patients according to Oppenheim Criteria was better in case of Modified

French Osteotomy than Dome Osteotomy, though did not differ in a statistically significant way. Post operative complications of both the groups were comparable and none had advantage over other regarding complications statistically.

So, the present study shows that, there were no significant differences in radiological union and final functional outcome between Dome osteotomy and Modified French Osteotomy. The complications which arise from the procedures were within acceptable limits. Modified French Osteotomy is a safe and easy procedure, but in Dome osteotomy lateral prominence was less seen. Statistically there were no differences in any outcomes and the outcomes in both the groups were acceptable.

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