

## A Retrospective Study of Corrective Osteotomy for Cubitus Varus Deformity

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### ABSTRACT

**INTRODUCTION:** Cubitus varus deformity is the commonest complication of supracondylar fracture of humerus in children. Even though it does not cause any significant functional limitation, it is of cosmetic concern to the parents and children alike.

**METHODS:** We carried out corrective osteotomies in 22 patients in 8 years from January 2005 to December 2013. The average age of the patients was 9 years, ranging from 6-14 years. 14 were boys and 8 were girls. The average follow-up period was 34.6 months (range 29-73 months). Preoperative as well as postoperative clinical and radiological evaluation was done in all cases.

**RESULTS:** 12 patients had cubitus varus deformity on the left elbow and 10 patients on the right side. The mean preoperative varus deformity was  $21.8^\circ$  (range  $15^\circ$ - $30^\circ$ ) as compared to the mean carrying angle of the normal side which was  $11.8^\circ$  (range  $8^\circ$ - $14^\circ$ ). The mean postoperative carrying angle was  $9.6^\circ$  (range  $7^\circ$ - $14^\circ$ ). The mean preoperative elbow range of motion was  $126^\circ$  (range  $110^\circ$ - $130^\circ$ ) and the mean postoperative elbow range of motion was  $128^\circ$  (range  $112^\circ$ - $132^\circ$ ). One patient had postoperative superficial infection that was managed conservatively. One patient had lateral condylar prominence. A lateral closing wedge osteotomy (modified French osteotomy) was performed on all patients.

**CONCLUSION:** Lateral closing wedge osteotomy is an effective surgery for correction of cubitus varus deformity in children.

**KEY WORDS:** Cubitus varus, supracondylar fracture, lateral closing wedge osteotomy, humerus – ulna – wrist angle

### INTRODUCTION

Supracondylar fracture is the commonest fracture in childhood<sup>1</sup> and cubitus varus is the commonest late complication of this fracture.<sup>2</sup> Cubitus varus may arise from distal humerus fractures in childhood as a result of malunion, nonunion, or overgrowth.<sup>3</sup> Corrective osteotomy for cubitus varus is the surgical restoration of the bent elbow to a more presentable appearance.

Many types of corrective osteotomies have been

proposed for the treatment of cubitus varus. But they all have limitations such as poor internal fixation, residual protrusion of the lateral condyle or medial condyle, technical difficulty, the need for long-term immobilization, a risk of neurovascular injury and patient discomfort.<sup>4</sup> More complex osteotomies have been described to correct the associated hyperextension and internal rotation deformities and to prevent a prominent lateral condyle. Lateral closing wedge osteotomy is a commonly described procedure

for correcting cosmetically unacceptable post-traumatic cubitus varus deformity in children. Bellemore et.al. showed that the lateral closed wedge osteotomy according to the French method was safe and had a satisfactory outcome.<sup>5</sup>

The aim of this study was to determine the efficacy of the surgical correction of cubitus varus deformity by the modified French osteotomy method .

## METHODS

This is a retrospective study of the outcome of corrective osteotomy performed for cubitus varus deformity at Shree Birendra Hospital in 22 children over a period of 8 years from January 2005 to December 2013. Clinical assessment was done before the procedure by measuring the carrying angle at elbow joint. Radiographic assessment of deformity was done by antero-posterior (AP) radiographs of the elbow by measuring the humerus-ulna-wrist angle (HUW-A) of the affected as well as the normal side. Lateral closing wedge osteotomy (modification of French osteotomy) was done in all patients.

**Procedure:** The patient was positioned supine with the arm alongside the patient. After giving general anesthesia, tourniquet was applied. A small (two inches) lateral skin incision was made along the lateral surface of lower arm. The humerus was approached subperiosteally and the osteotomy site was marked with the help of a template, which predetermines the width of the laterally based wedge. Two K-wires were inserted parallel to the proposed osteotomy site, one proximally and one distally. Two cortical screws were inserted parallel to the K-wires, one proximally and the other distally, through the lateral cortex only. If any rotational deformity correction was required, the screws were placed in slightly different positions (proximal screw posteriorly and the distal screw anteriorly) from the lateral cortex medially. After removing the measured wedge, which would fall just short of the medial cortex, the fragments were aligned by manipulating the forearm and arm, which would

create a crack of the medial cortex, leaving the medial periosteum intact thereby aligning the two screws in a straight line, thus producing external rotation of the distal component. The fixation was secured with the help of a figure of eight tension band wiring loop around the screw heads after achievement of reduction of osteotomy and comparing it clinically with the other elbow in full extension. The osteotomy site was further reinforced with a diagonal K-wire placed across the fracture from the lateral condyle to the proximal fragment medially. The wound was closed and an above elbow POP slab was applied for four to six weeks, for the osteotomy site to heal after which range of motion of the elbow was begun. Stitches/staples were removed after 12 to 14 days of operation, and K-wire if inserted was removed after 3 weeks. All patients were followed up at two weeks, six weeks, 12 weeks, six months, one year and, thereafter yearly, for a maximum of 2 years after the surgery. At each visit they were examined for elbow range of motion, any deviation from the corrected humerus–elbow–wrist angle, lateral prominence index, hypertrophied scar, nerve examination or any other complications.

## RESULTS

Out of the 22 patients, in whom we performed corrective osteotomies in the last 8 years, 8 were girls and 14 were boys. (Table - 1)12 patients had the deformity on left elbow whereas 10 patients had it on the right side. Their average age was 9 years (range 5-14 years). The average follow-up period was 34.6 months (range 29-73 months).

The mean preoperative cubitus varus deformity was 21.8° (range 15°-30°) while the mean carrying angle of the normal side was 11.8° (range 8°-14°). Postoperatively, then mean carrying angle was 9.6° (range 7°-14°). The mean preoperative elbow range of motion was 126° (range 110°-130°) and the mean postoperative elbow range of motion was 128° (range 112°-132°).



Fig. 1: Pre operative picture and radiograph of the patient



Fig. 2: Postoperative radiograph and pictures with corrected deformity

One patient had a superficial postoperative infection that was controlled after local wound care and antibiotics. One patient had lateral condylar prominence, which was left alone, as the patient was not keen on another surgery. Moreover, it was not causing any discomfort in the patient's daily activities. In all patients, good alignment, complete union of the bone and desired range of motion were achieved.

Eighteen patients (81.8%) showed excellent results, four (18.18%) had good results while none showed poor results in the follow-up as per the criteria of Bellemore et. al<sup>5</sup>. Statistical analysis was not done due to the small study group. None of our patients had any neurovascular deficit postoperatively. Cosmetically all were satisfied with the outcome. Objective assessment included measurement of preoperative and postoperative carrying angle and range of elbow motion.

Case	Sex	Side	Age -in years	HEW- angle		Range of motion in Degrees		Results
				Preop	Postop	Preop	Postop	
1	M	L	7	-23	10	125	126	Ex
2	M	L	11	-27	9	128	130	Good
3	F	R	7	-15	9	126	128	Ex
4	M	R	12	-19	10	128	130	Ex
5	M	R	9	-23	10	126	128	Ex
6	F	L	10	-26	11	128	130	Ex
7	M	L	6	-21	8	130	132	Ex
8	F	R	12	-19	9	124	126	Ex
9	M	L	11	-21	12	128	130	Ex
10	F	L	9	-24	8	126	128	Ex
11	F	L	9	-21	11	126	128	Ex
12	M	R	9	-27	9	124	126	Ex
13	M	L	7	-17	9	126	128	Good
14	F	L	8	-21	8	126	128	Ex
15	M	R	10	-18	9	128	130	Ex
16	M	R	11	-24	9	125	128	Good
17	M	L	14	-22	10	124	126	Ex
18	F	L	12	-26	11	130	132	Ex
19	M	R	11	-17	7	128	130	EX
20	F	L	8	-13	9	128	130	Ex
21	M	R	9	-30	14	110	112	Good
22	M	R	6	-20	10	128	130	Ex

**Table 1:** Clinical data of 22 children with cubitus varus deformity who underwent osteotomy

Mean preoperative elbow range of motion: 126° (range 110°-130°)

Mean postoperative elbow range of motion was 128° (range 112°-132°)

M-Male, F- Female, HEW- Humerus Elbow Wrist, Ex- Excellent

## DISCUSSION

Supracondylar fracture of the distal humerus is a common occurrence in children. Internal rotation, coronal tilting and posterior displacement of the distal fragment give rise to the cubitus varus. The deformity is unsightly and although function is not greatly impaired, the child's parents often request an operation to improve the appearance of the elbow.<sup>6</sup> The goal ultimately is to achieve a cosmetically acceptable elbow.

It is now widely accepted that cubitus varus after supracondylar fracture is not the result of growth disturbance but of malunion, with medial angulation of the distal fragment.

As per Kumar et al, the dome osteotomy is technically more difficult than the French osteotomy and has a higher incidence of complications. They suggested that the French osteotomy be used for the correction of cubitus varus after supracondylar fractures of the elbow in children.<sup>7</sup>

Takagi et. al. in their study concluded that in the surgical treatment of posttraumatic cubitus varus deformity, correction of internal rotation malalignment may not be needed as it is difficult to maintain the corrected carrying angle because of the small area of osseous contact.<sup>8</sup>

Ever since French<sup>9</sup> did his pioneering work for the correction of cubitus varus, lots of modifications have been done on his initial operation. Borate and Sancheti showed that the modified French technique was simple, safe and

accurate method of correcting cubitus varus deformity in children.<sup>10</sup> We also carry out this procedure in our institute routinely.

Wong et al described prominence of lateral condyle post operatively after correction of cubitus varus in their research.<sup>11</sup> This prominence was less obvious in patients who had their osteotomy at a young age, but worse after operations near or after skeletal maturity. This difference appeared to be due to remodeling. Since then various authors have described different ways to counter the possibility of this prominence, albeit with a set of complications. In our series one patient had a lateral condylar prominence, which was left alone.

According to North D et al, though the deformity does not result in any functional impairment, it is cosmetically unacceptable in children and that the results of the French osteotomy are comparable with the more technically demanding dome, step-cut translation, and multiplanar osteotomies, with a lower complication rate.<sup>12</sup>

Takeyasu Y et al carried out a three dimensional study and compared it to traditional radiographs of cubitus varus deformity and concluded that HEW-A and MEF (mean elbow flexion) showed reasonable accuracy as measures for the degree of deformity, whereas TA (tilting angle) and IRA (internal rotation angle) were found to be inaccurate.<sup>13</sup> We never did any three-dimensional study and stuck to conventional radiographs and our series showed appreciable results.

Bali K et al in their series showed that a modified step-cut osteotomy is a safe and simple procedure which might be beneficial over the conventional lateral closing wedge osteotomy in certain aspects like the lateral humeral condyle prominence, scar acceptability and cosmesis. However, they also mentioned that it needs to be further evaluated and confirmed on the basis of a larger trial.<sup>14</sup> We continue to perform a lateral closed wedge osteotomy for the correction

of cubitus varus in our institute. McCoy and Piggot reported in their research stated that French osteotomy was an acceptable treatment for correction of cubitus varus.<sup>15</sup>

Mahaisarvariya and Laupattarakasem stabilized the osteotomy with two k-wires and a tension – band wire loop, leaving the medial periosteal hinge intact, with a satisfactory outcome.<sup>16</sup> Song et.al. (1997), Handelsman et al (2006) and Piskin et al (2008) have shown good results with external fixators for the correction of cubitus varus.<sup>17,18,19</sup> We don't use external fixation for supracondylar fractures in our institute. Srivastava et al. have shown that after the lateral wedge was removed and fixation was carried out with figure of eight tensioning across the two screws holding the fracture site, two k-wires are also inserted across the fracture to strengthen the final outcome.<sup>20</sup> We also placed one K-wire across the osteotomy in our series, if we thought the fixation was not adequately stable.

Our results were comparable to the other published results of the classical lateral closing wedge osteotomy in terms of elbow motion and correction of deformity.

## CONCLUSION

All patients had a good to excellent outcomes of the surgically corrected elbows. Cosmetically all were satisfied with the outcome as evident from improvements in humerus-wrist-angles. We believe that modified French osteotomy is an effective procedure in correction of cubitus varus deformities in children.

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