

CUBITUS VARUS DEFORMITY OF HUMERUS CORRECTION WITH MODIFIED LATERAL CLOSED WEDGE OSTEOTOMY

MUHAMMAD AYAZ KHAN, NAEEM UR RAZAQ, AWAL HAKEEM, ZAHID ASKAR, ZAFFAR DURRANI, IMRAN KHAN, IDRESS RAZA HASSAN, NASEER HASSAN, KHALID, FAIZ, WAQAR ALAM, NAJIULLAH, DILBAGH, ROOHULLAH

Department of Orthopaedics and Trauma, Khyber Medical College and Teaching Hospital, Peshawar

ABSTRACT

Objective: To evaluate the outcome of modified lateral closed wedge osteotomy for cubitus varus deformity.

Study Design: Quasi-experimental study.

Setting & Duration: Orthopaedic Department of Ayub Medical College and Teaching Hospital Complex, Abbotabad and Khyber Teaching Hospital Peshawar from January 2006 to June 2008.

Methodology: Thirty patients with cubitus varus deformity secondary to malunited supracondylar fracture of the humerus between the ages of seven to fourteen years. Clinical and radiological assessment of the upper extremity was done in all the cases. Modified lateral closing wedge osteotomy with two screws and tension bend wire between them and 2-K wires from the lateral side to engage the medial cortex of the proximal fragment were done to correct the deformities. All the patients were followed for six months. Postoperatively the patients were examined for range of motion (ROM), scar and postoperative complications. Carrying angle and lateral condylar prominence index were calculated on antero-posterior and lateral radiograph of the elbow.

Results: Thirty patients with twenty two males and eight females were studied. The average age at the time of osteotomy was 8.5yrs (range 7-12 years). The average preoperative carrying angle was 25.2 degree varus (range 18-30) and the postoperative angle was 7 degree valgus (6-13). There were no significant difference between the pre and postop range of motion. The average preoperative lateral condylar prominence index (LCPI) was 175 degrees (range 128-232) and postoperative LCPI was 156 degrees (range 100-240). Twenty six patients were excellent, two good and two poor results.

Conclusion: The additional fixation by K-wires controls rotational forces effectively besides angulation and translational forces and maintain the correction achieved.

KEY WORDS: Cubitus Varus Deformity, Malunited, Supracondylar, Humerus, Lateral Wedge, Osteotomy, K-wires

INTRODUCTION

Supracondylar fractures are the most common elbow fractures in children between 50-70% incidences.¹ The fracture usually occurs due to a fall on to the outstretched hands. The relatively high potential for neurovascular compromise and residual deformity makes these fractures a serious injury.² Displaced fractures always require anatomical reduction to decrease the risk of

cosmetic deformity (cubitus varus or valgus) and poor functional outcome. The cubitus varus is the most common delayed complication. Immediate and delayed causes of this deformity are medial angulation, posteromedial rotation, medial cortical comminution, overgrowth of the capitulum and osteonecrosis or delayed growth of the medial condyle. The medial angulation is the major determinant for deformity while medial rotation contributes to it.^{3,4,5} This usually occurs in patients who receive initial treatment by traditional bonesetters or inexperienced orthopedists. Open reduction in such circumstances may not be easy and effective. Correction of malunited supracondylar fracture after inappropriate treatment is sometimes difficult to manage. The lateral closing edge osteotomy is a commonly accepted method for correction of the cubitus varus deformity.⁶ The osteotomy needs fixation to prevent loss of correction achieved. Fixation by two screws with a figure of eight tension

Correspondence:

Dr. Muhammad Ayaz Khan

Assistant Professor Orthopaedic & Trauma,
Khyber Teaching College & Hospital, Peshawar.

Phones: 0300-5933101.

E-mail: ayazsabi71@gmail.com

band wire is not stable enough to maintain the correction achieved during surgery. We supplemented thirds fixation configuration with two k-wires from the lateral side to engage the medial cortex of the proximal fragment for stable fixation and calculated the results.

METHODOLOGY

Thirty cases of cubitus varus deformity following mal-united supracondylar fracture of the humerus had been corrected by modified lateral close wedge osteotomy between January 2006 to June 2008 in the Orthopaedic Department of Ayub Medical College and Teaching Hospital and Khyber Teaching Hospital Peshawar. There were 22 males and 8 females, between the ages of 7 to 14 years (average 10.4 years). Patients with ligamentous laxity and neurological problems were excluded. The patients were assessed both clinically and radiologically for full range of motion, carrying angle and lateral condylar prominence index (LCPI) pre-operatively as well as post-operatively.

Clinically carrying angle was measured by angle between long axis of arm and forearm. The effected elbow was exposed and compared with the normal one. Standard anteroposterior and lateral radiographs of the effected as well as of the normal elbow in identical position were used to asses the deformity. Radiologically the humeroulnar shaft angle was taken into account. Varus angle of > 10 degree measured on radiograph and cosmetic complaints were considered as an indication for surgery. The osteotomies were fixed with two screws and figure of eight tension band wire around them and supplemented with two k-wires passed from the lateral condyle up to the proximal medial cortex. The average age at the time of corrective osteotomy was 10.4 years (range 7-14 years).

Patients were seen in out-patient department for clinical and radiological evaluation at 1, 3, 6 months interval. Clinically they were assessed for scars, carrying angle and range of motion. Carrying angle was measured on anteroposterior and lateral radiograph and lateral condylar prominence index and range of motion were used as strict criteria to assess the results (Table-I).

RESULTS

The results of the surgery were assessed in thirty patients. There were 22 males and 8 females. The age at operation ranged from 7 to 14 years (average age 10.4 years). The average interval between the injury and the corrective supracondylar osteotomy was 3.3 years (range 2-8 years). Right elbow was involved in 19 patients and left in 11 patients. Cosmetic appearance was the major concern in all the patients for surgical correction. No patient had complained of any pain, stiffness, weakness or functional limitation of motion in the post-operative period. The average time interval between the fracture and the osteotomy was 11 months (range 5-36 months). The average pre-operative carrying angle was 25.2 degree varus, with the range of 18-30 degree. The osteotomy was performed to bring the carrying angle to 11.2 degrees. The mean final angle attained was 8.73 degrees valgus (range 6-13 degrees). The difference in the carrying angle between the normal and the involved side was 2.6 degrees. The difference being significant (Table-II).

The patients were satisfied with cosmetics deformity except for one who complained about the operative scar with good correction of the deformity. There was no significant difference in the pre and post operative range of motion of the elbow except in one child who had slight limitation in elbow flexion of about 6 degrees. the average range of motion of elbow was from 2.6 degrees extension (range 0-5 degrees) to 122 degrees flexion (range 105-135 degrees) pre-operatively and from 1.3 degree extension (range 0-3 degree) to 123 degrees flexion (range 90-135 degrees) post-operatively (Table II).

The difference between the pre-operative and post-operative lateral condylar prominence was significant (mean pre-operative index 50.5 degrees, mean post-operative index 156 degrees) (Table II). No complications such as ulnar neuropathies, non-union, loosening of fixation or recurrence of deformity was observed. calculated our final result according to Oppenheim⁷. Which showed 26 excellent (86.6%) 2 good (7%) and 2 poor (7%) Table III.

Table I. Bellmore criteria for assessment

Outcome	ROM	Carrying Angle	LCPI	Complication
Excellent	Difference < 10 ⁰	5-6	No increase	None
Good	Difference 10-20 ⁰	6-10	Increase < 25%	Minor
Poor	Difference < 20 ⁰	> 10	Increase > 25%	With residual defect or review surgery

Parameter	Pre-operative mean + SD	Pre-operative mean + SD	P-value	Result
Carrying Angle	25.2 +/- 4.7	8.7 +/- 1.1	0.0200	Significant
Range of Motion	12.6 +/- 6.9	123.8 +/- 7.3	0.4300	Non-significant
LCPI	175.5 +/- 31.5	176 +/- 38.4	0.0049	Significant

Table II. Final Outcomes of Surgery

DISCUSSION

Cubitus varus is one of the most common late complications of supracondylar fracture of the humerus in children treated with non-operative treatment without proper reduction and fixation. Its reported incidence varies from 4% to 58%.⁹⁻¹¹ This deformity may result from inadequate reduction, inadequate fixation or from disturbance of growth at the lower end of the humerus. Most authors consider the deformity to result from inadequate reduction that leaves a residual rotatory deformity that can collapse into the medial tilt resulting therefore in a varus deformity¹³⁻¹⁶. Lateral closing wedge osteotomy is the easiest, safest and inherently stable method of correction. The type of fixation of osteotomy is a concern to achieve good results. Roach¹⁷ believed that unstable, non-rigid fixation led to slip of the fragments and loss of correction.

The various methods of fixation are the use of two screws and figure of eight tension band wire in between them, plate fixation, cross k-wires, staples and few authors used no fixation. The fixation by cross k-wires leads to loosening with recurrence of deformity, pin tract infection, skin slough. Nerve palsy etc.^{18,19,20} The modification, in which authors have used two k-wires in addition to two screws with tension band wire at the osteotomy site gives more control on the proximal and distal fragments. In addition it gives better control on translation, rotation and angulation which reduces the chances of recurrence. The biological determinants of fracture healing are as important as the mechanical and must be respected.²¹ The results of the study showed 26 excellent, 2 good and 2 poor results, which are comparable to other national and international studies.

Table III. Subjective Outcomes

Outcomes	Number	Percentage
Excellent	26	86
Good	2	7
Poor	2	7

Ahmad⁶ studied 30 patients and calculated the carrying angle, range of motion and lateral condylar prominence index and achieved 25 excellent, 3 good and 2 poor results, which are comparable to this study. Ippolito²² from Rome showed loss of correction due to change in growth, loss of motion, hypertrophic scar and ulnar nerve palsy in supracondylar osteotomy. This showed an increased rate of complications which may be due to the differences in the characteristics of the patient, fixation of the osteotomy by K-wire and cubitus varus resulting from physal injury. There was no loss of correction, ulnar nerve palsy and limitation of motion in this study, probably due to fixation of the osteotomy site by screws and tension band wire in between, supplemented by two K-wires from the lateral side which give a more stable fixation.

Walsh²³ performed medial opening wedge osteotomy and external fixation in 13 patients. Although there was no major pin tract infection and loss of range of motion but there was ulnar nerve neuropraxia because of traction on the ulnar nerve which later on needed anterior transposition. In this study there was no ulnar nerve neuropraxia because the lateral closing wedge osteotomy avoids ulnar nerve damage as compared to the medial opening wedge osteotomy. A comparative study by Kumar²⁴ on Dome and French osteotomy revealed no significant difference in correcting the carrying angle by both technique, though correction of the internal rotation was significant with the Dome osteotomy.

Lateral condylar prominence has been reported by various authors as a complication of supracondylar osteotomy for cubitus varus deformity.^{23,24} Various authors recommended prevention of the medial displacement of the distal fragment of the osteotomy before skeletal maturity to allow remodeling to avoid this complication.^{24,25} In this study lateral condylar prominence index was significant probably due to inadequate correction or fixation of the narrow contact area.

In this study the mean carrying angle achieved at the last followup was 8.73 degree valgus as compared to 10.7 degree valgus reported by Tien²⁶.

CONCLUSION

Modified method of fixation is simple, reliable, acceptable and effective, with this fixation method correction achieved per operatively lasted till the union is achieved.

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