



Correction of Cubitus Varus in Young Adult Using Lateral Closing Wedge Osteotomy and Posterior Y Plating

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Abstract

Background: posttraumatic cubitus varus is a common complication after elbow fractures. There are different types of osteotomy and fixation methods used in correction of cubitus varus. Each has its advantages and disadvantages.

Patients and method: Ten cases of cubitus varus in young adult treated with lateral closing wedge osteotomy and fixation with posterior Y plate. Preoperative X-ray was taken for each patient with both elbows in full extension and forearm in full supination. Carrying angle at the affected and normal side are measured and angle to be corrected and the base of lateral closing wedge osteotomy was calculated preoperatively.

Results: No patient had functional problem resulting from the deformity as ulnar nerve palsy or posterolateral instability. Mean operative time was 96.5 min. Preoperative carrying angle was 23.9deg decreased to 4.6deg valgus postoperatively. Lateral condylar prominence was 6.07% and decreased to -8.89% postoperatively. Time of complete healing of osteotomy site was a range from 10week to 14week with a mean of 12.2 week. Mean follow up period was 12.8month with a range from 12months to 14months. Full range of motion returned in 8 cases after 12week.

Conclusion: Lateral closing wedge osteotomy and fixation with posterior Y plate is effective and safe technique in treatment of cubitus varus deformity in young adult. Adequate correction of the deformity can be achieved with preservation of the patient preoperative range of motion together with good patient satisfaction and minimal complication rate.

Keywords: cubitus varus, lateral, closing wedge, y plate, fixation.

INTRODUCTION

Cubitus varus deformity is a common complication of conservatively treated supracondylar fractures in children. Medial tilt and medial rotation are the most important contributing factors in development of varus deformity. Most patients come for correction due to cosmetic reason with no functional impairment or range problem [1, 2]. There are different types of osteotomy and fixation methods used in correction of cubitus varus. Each has its advantages and disadvantages [3]. The problems encountered during correction of varus deformity in young adult are big bone size, instability at the osteotomy site, risks of delayed union and nonunion, stiffness and neurovascular complications [4]. Lateral closing wedge osteotomy (LCWO) is commonly used technique in the literatures dealing with correction of cubitus varus as it is simple, easily performed, and allow adequate correction of this multiplanar deformity [5,6].

Stable fixation of the osteotomy site is mandatory in dealing with cubitus varus correction in young adult to allow early range of motion with less risk of stiffness and nonunion of the osteotomy site which are two of common complications after elbow surgery in adults. The most commonly used types of plate fixation are contoured lateral plate, double posterior reconstruction plate and posterior Y plates either through triceps retracting or triceps splitting approach [7].

We hypothesize that young adult with cubitus varus can be effectively and safely treated with lateral closing wedge osteotomy as it is simple and easily performed with fixation of the osteotomy using Y posterior plate through triceps splitting approach as it provide rigid fixation and allow early range of motion.

PATIENTS AND METHOD

Ten cases of cubitus varus in young adult treated in our institute from 2012 June to 2014 August with lateral closing wedge osteotomy and fixation with posterior Y plate. Patients with small bone size were excluded from the series. Preoperative X-ray was taken for each patient with both elbows in full extension and forearm in full supination. Preoperative carrying angle was measured as angle between the bisecting line of arm and forearm in both normal and affected side. Lateral prominence index was measured in both preoperative film and last follow up (12month) film [9]. Carrying angle at the affected and normal side are measured and angle to be corrected and the base of lateral closing wedge osteotomy was calculated preoperatively (Fig 1: A &B).



Fig1. (A) the method used for measuring the varus angle (B) The lateral prominence index (%) was measured on the preoperative and postoperative radiographs using the formula, $(CB - AB)/AC \times 100$. It is usually negative in normal elbows.

SURGICAL TECHNIQUE

Patients were operated under general anesthesia in the lateral position with tourniquet inflated. Mid line posterior arm and elbow incision was made. Ulnar nerve was exposed, released from the cubital tunnel and protected. Triceps tendon was split in the midline with exposure of posterior, medial, and lateral aspect of distal humerus with preservation of the medial periosteal hinge. Lateral wedge was resected from the distal humerus with its base calculated according to the desired degree of correction. The osteotomy was closed and provisionally fixed with k wire. The Y plate was applied on the posterior surface of humerus with fixation of at least 3 screws on the proximal humerus and 4 screws on the distal fragment. The distal limbs of the plate can be contoured slightly posterior to be well fitted on the distal fragment in case in whom correction of the associated internal rotation is needed. The triceps aponeurosis was repaired and wound was closed with suction drain. Posterior slab was applied for 2 weeks then patients used arm sling for another 4 weeks (Fig 2, 3). Patients

are instructed to start passive range of motion as pain tolerated from 2 to 4 week then active movement from 4 to 6 weeks. Follow up visits were made 2, 4, 6, 8, and 12 weeks after surgery, then 6month and 12 month postoperatively. In 12 month follow up visit patients were examined for complete healing of osteotomy, return of full range of motion, carrying angle, and lateral condylar prominence.



Fig2. (A) preoperative photo of 16 years old young man with left side cubitus varus (B) 2 week postoperative with suture removal (C & D) ROM after 4 week postoperative (E & F) 12 week postoperative with full range of elbow.

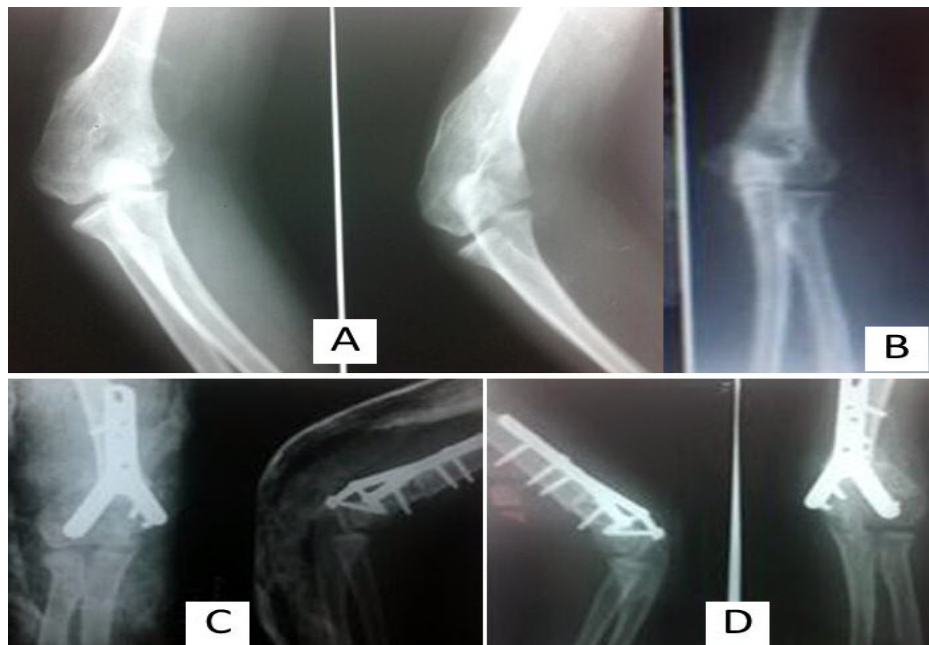


Fig3. (A) preoperative A-P x ray; (B) A-P image of the normal side; (C) immediate postoperative A-P and lateral images with posterior slab applied (D) 4 month postoperative A-P and lateral images with healing of osteotomy.

RESULTS

Mean patient age was 17.4years with a range from 15 to 22 year. Sex distribution was 6 females and 4 males. All cases were due to malunion of conservatively treated supracondylar fracture of distal humerus in their childhood.No patient had functional problem resulting from the deformity as ulnar nerve palsy or posterolateral instability. Mean operative time was 96.5 min.

Preoperative carrying angle was 23.9deg decreased to 4.6deg valgus postoperatively. Lateral condylar prominence was 6.07% and decreased to -8.89% postoperatively. Time of complete healing of osteotomy site was a range from 10week to 14week with a mean of 12.2week. Mean follow up period was 12.8month with a range from 12months to 14months. Full range of motion returned in 8 cases after 12week. One case lost 10degrees of extension and 15deg of flexion and one case lost 5deg of extension (Table1). No cases with deep wound infection, vascular or nerve injury, loss of fixation or nonunion were present in our study.

Table1. Preoperative and postoperative patients data.

Age	Sex	C A	C A Normal	C A Postop	ROM preop	ROM postop	extension	Union time	Lat c index preop	Lat c index postop
15	M	20	4valg	0	130	130	0	12 w	5.4%	7.5%-
17	M	26	6var	4valg	140	135	0	10 w	7.2%	10.8%-
20	F	28	10valg	4 var	140	125	0	14 w	7.4%	12.4%-
19	F	19	8valg	0	140	140	0	12 w	4.5%	5.8%-
15	F	20	12valg	4valg	130	135	0	14 w	5%	4.9%-
22	M	26	6var	8var	135	135	0	12 w	6.8%	12.3%-
18	F	24	13valg	10valg	130	135	0	12 w	6.6%	9.7%-
17	F	22	10valg	4valg	140	140	0	14 w	5.8%	-6.8%
15	M	30	6var	6var	130	130	0	12 w	7.2%	-10.5%
16	F	24	10val	6valg	135	135	0	10 w	4.8%	--8.2%

DISCUSSION

There are various types of corrective osteotomy and fixation methods of cubitus varus deformity.These are lateral closing wedge osteotomy, medial opening osteotomy, three dimensional osteotomy, step cut osteotomy, and dome shaped osteotomy. There are several methods of fixation to hold corrective osteotomy as k-wires, two screws with a figure of eight tension band wire, plate fixation, staples, external fixator and ilizarov [9]. Correction in adult is different and difficult due to mature skeleton, increased instability at osteotomy site, delayed union and chance of stiffness [10].

We hypothesize that fixation of the osteotomy with Y plate has several advantages more than it provides rigid fixation and allow early range of motion which has beneficial effect on healing potential of the osteotomy and prevention of postoperative stiffness. In cases of cubitus varus with significant rotational component, posterior plating for osteotomy fixation is considered ideal method of fixation as rotation of distal fragment result in loss of medial contact which may jeopardize the stability of other fixation method and healing potential of osteotomy site. On contrary, some authors believed that internal rotation is usually not required to be corrected as it is compensated by shoulder movement. Secondly, we can displace the distal fragment slightly medially with adequate fixation using Y plate so minimizing lateral condylar prominence.

The limitation of our study is that limited patient number, patients with small bone size are not suitable for this technique, need of triceps splitting to put the plate, big skin incision, no comparison with other osteotomy and

fixation method but we achieve good correction of the varus deformity and carrying angle in all the cases with preservation of the near normal preoperative range of motion ,no infection ,no neurovascular complication, no nonunion with achievement of adequate satisfaction of all patients.

There are several studies reporting the outcome of corrective osteotomy for cubitus varus in adults. Pentalateral osteotomy was used for 108 patients at the mean age of 14 years with satisfactory results, but information on patients older than 15 years was lacking [11]. Arc osteotomy [12] was used in three post pubertal patients with the mean age of 20 years, with pinning and 6 to 8 weeks of cast immobilization. In two of the three patients, total arc of motion decreased: in one patient by 40deg and in the other by 10deg [12].

In a study of dome osteotomy done by Tien et al [13], olecranon osteotomy was done for two post pubertal patients to apply the plate posteriorly, and these patients lost motion by 20 to 30 deg. Three-dimensional osteotomy was done for 23 adult patients, with one nerve palsy associated with pinning and one myositis ossificans [14]. In a step-cut osteotomy [15], the triceps muscle was divided to apply the Y-plate posteriorly. Although the triceps-splitting approach has been used safely for many elbow surgeries, peak triceps torque does not recover fully and the deficit is still 3% to 6% at 3 years and 6 months (3.5 years) after triceps division [9]. Our results were comparable or superior to those reported in the literature.

CONCLUSION

Lateral closing wedge osteotomy and fixation with posterior Y plate is effective and safe technique in treatment of cubitus varus deformity in young adult with adequate correction of the deformity with preservation of the patient preoperative range of motion together with good patient satisfaction and minimal complication rate.

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