MODIFIED FRENCH OSTEOTOMY FOR CUBITUS VARUS DEFORMITY

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ABSTRACT
Objective: *To evaluate the outcome of Modified French Osteotomy for correction of cubitus varus deformity.*
Design & Duration: *Descriptive quasi-experimental study from Feb. 2000 to Oct. 2003.*
Setting: *Dept. of Orthopaedics and Trauma, Post-Graduate Medical Institute, Hayatabad Medical Complex, Peshawar.*
Patients: *All children, aged 3-12 years, with cubitus varus deformity were included in the study.*
Methodology: *Pre-operative clinical as well as radiological assessment of upper extremities were done in all cases. Modified French osteotomy was done to correct the deformity. All patients were followed for seven months. Physical examination for the range of motion, scar and post-operative complications were assessed. Antero-posterior and lateral radiographs of the elbow were obtained, and the carrying angles and lateral condylar prominence index were measured and recorded.*
Results: *Out of the total 30 patients, 26 were male and four female. Left side was involved in 24 cases and the right side in six. The average age at the time of osteotomy was seven years (range 3½-12 years). The average pre-operative carrying angle was 25.2^{o} (range 18-30^{o}) and the post-operative angle 8.7^{o} (range 5-13^{o} valgus). The average pre-operative range of motion was 122.6^{o} (range 105-135^{o}) and the post-operative range 123.86^{o} (range 90-135^{o}). The average pre-operative lateral condylar prominence index (LCPI) was 175.56 (range 128-232) and the post-operative lateral condylar prominence 156 (range 100-240). Based on Bellmore criteria, 25 patients showed excellent, three good and two a poor result.*
Conclusions: *Modified French technique of supracondylar osteotomy has excellent results in the management of cubitus varus in terms of cosmesis, radiological findings and fewer complications.*

KEY WORDS: *Deformity, Trauma, Cubitus Varus, French Modified Osteotomy*

INTRODUCTION

Cubitus varus is a common long term complication of supracondylar fracture malunion resulting in medial displacement, internal rotation and extension of distal fragment; this then permits the distal fragment to tilt into varus[1-5]. Cubitus varus produces a cosmetic deformity, besides a defect in the function of elbow[3,6,7]. Varus deformity has been considered by many authors to be only a cosmetic deformity[8-10], though recent studies have suggested that there may be associated morbidity also[4,8]. An increased incidence of lateral condylar fractures in the elbow in varus[4,11,12] is associated with dislocation of both the medial portion of the triceps and the ulnar nerve[8, 13]. In addition to the snapping it may cause medial elbow pain[14-16]. Cubitus varus shifts the line of pull of the triceps more medially, which can cause anteromedial displacement of the medial portion of triceps during elbow flexion. The ulnar nerve is concomitantly pushed or pulled anteromedially by the triceps, thus resulting in ulnar neuropathy from friction neuritis or dynamic compression by the triceps against the epicondyle[13]. Cubitus varus can also be associated with posterior instability of the shoulder[17].

Cubitus varus may be associated with recurrent posterior dislocation of the head of the radius[14,18]. The varus deformity changes the biomechanics of the elbow, which

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may lead to posterolateral rotatory instability of the elbow[12,14].

Understanding the biomechanical forces of this combination of deformities will guide treatment rationale in the future. Cubitus varus deformity secondary to distal humeral malunion is not necessarily a benign condition, and may have significant long term implications relating to elbow instability, medial elbow pain from subluxation of the medial head of the triceps over the epicondyle, and ulnar neuritis or neuropathy. Preventive corrective osteotomy is an intervention that may merit consideration[19-23].

This study was designed to evaluate the outcome of French modified osteotomy for cubitus varus deformity. The study carries great significance as it evaluates the outcome of a commonly performed procedure for a common deformity.

PATIENTS & METHODS

Supracondylar humeral osteotomy by Modified French technique was performed on 30 children, aged 3 to 12 years, for post-traumatic cubitus varus deformity, between February 2002 and October 2003 at the Department of Orthopaedics, Hayatabad Medical Complex, Peshawar. Patients with ligamentous instability, paralysis and deformity resulting from firearm injuries were excluded. All the children were assessed clinically and radiologically and their carrying angles, range of motion (ROM) and the lateral condylar prominence index (LCPI) were recorded.

Technique of operation
All osteotomies were performed under general anaesthesia and tourniquet control, by the Modified French method. The humerus was approached through a small lateral incision directly over the supracondylar ridge, which was exposed susperiosteally. Pre-operatively the size of the wedge was determined from radiographs and then two cortical screws were inserted through one cortex only, above and below the proposed wedge. In some cases where additional rotational deformity was identified, then correction was attempted by placing the screws in different positions in the sagittal plane. The wedge was cut with an oscillating saw, leaving the medial cortex intact to be cracked as a hinge, thereby approximating the screws. The screws were then wired together in a figure of eight fashion and the wound closed. Post-operatively, the elbow was placed in 90^o flexion with the forearm in neutral position in a long arm back slab for three weeks, after which mobilization was started.

Follow-up Assessments
All the patients were asked to return to the hospital for clinical and radiological evaluations for a period of seven months. Physical examination included assessment of the scar, carrying angle and ROM. X-rays of elbow in anteroposterior and lateral views were taken and the carrying angle measured. Carrying angle, lateral condylar prominence index and range of motion were used as strict criteria to categorize the results (Table I).

RESULTS

Out of the total 30 children, 26 were male and the rest female. Their average age was seven years (range 3½-10 years). The left side was involved in 24 cases and the right side in six. The average time interval between the fracture and the operation was 11 months (range 5-36 months). The average time interval between the fracture and the operation was 11 months (range 5-36 months). The mean pre-operative carrying angle was 25.2^o (range 18-30^o). The mean desired carrying angle was 11.3^o. The mean final carrying angle attained was 8.73^o (range 6-13^o). The carrying angle differed between the normal and the injured sides by 2.6^o, the difference being significant (Table II).

The mean pre-operative range of motion was 122.6^o (range 105 to 135^o). The mean post-operative range of motion was 123.86^o(range 90-135^o). The difference between the pre-operative ROM and post-operative ROM was 2^o, the difference being non-significant. The

Table I. Bellmore Criteria for assesment of the Outcome[12]

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

mean pre-operative condylar prominence index was 175.56 (range 128-232) and the mean post-operative LCPI was 156 (range 100-240), the difference between the pre and post-operative values being significant as depicted in Table II.

The operative time was 25-30 minutes with tourniquet control. Intra-operative blood loss ranged from 10-15 ml. No damage to nerves or blood vessels occurred during the operation. Post-operatively hand swelling occurred in some patients but settled on elevation of the hand and loosening of dressing. Most of patients were satisfied with the cosmetic outcome and none complained about the operative scar. We had 25 excellent, three good and two poor outcomes (Table III).

Grade	Number	%
Excellent	25	83.3
Good	3	10.0
Fair	2	6.7

Table III. Overall Outcome

DISCUSSION

Cubitus varus is a common complication after supracondylar fractures of the humerus, and there are controversies about the timing of correction of this deformity and the technique of osteotomies[1,2,7,8,14,17,24-26].

The results of this study showed 25 excellent, three good and two poor outcomes, which are comparable with other studies. McCoy and Piggot[1] performed 20 osteotomies in 1988 by a modification of French method with good results in respect of physiological valgus angle, range of movement and an acceptable scar.

Ipplito et al[27] from Rome showed in 1990 loss of correction (due to change in growth), ulnar nerve palsy (due to K-wire), limitation of motion in 40% and hypertrophic scar in supracondylar osteotomy. This increased rate of complications may be due to the difference in the characteristics of the patients, fixation of osteotomy by K-wire, cubitus varus resulting from physical injury. There was no nerve palsy in our study, probably due to fixation of osteotomy by screws and closing osteotomy from the lateral side.

Walsh and Nicol[28] demonstrated in 1995 that after a medial opening wedge osteotomy and external fixation in 13 patients, there was no major pin tract infection and loss of range of motion, though transient ulnar nerve neuropraxia occured in three patients. This technique avoids lateral scar but the disadvantages are traction on the ulnar nerve, requiring an anterior transposition and a bone graft. There was no ulnar nerve neuropraxia in our study, because the lateral closing wedge osteotomy avoids ulnar nerve damage as compared to the medial opening wedge osteotomy.

Tien et al[29] reported good results of the dome corrective osteotomy in respect of scar, site of osteotomy correction and neurological complications as compared to the lateral closing wedge osteotomy. A comparative study by Kumar et al[23] on dome and French osteotomy revealed no significant difference in correcting the carrying angle by both the techniques, though correction of the internal rotation was significant with dome osteotomy. There was a higher incidence of post-operative complications in the dome osteotomy group including infection, inadequate correction, nerve palsy, loss of motion and circulatory compromise, besides it is often difficult to rotate in the coronal plane because of contractures of the soft tissue on the medial side, especially in the intermuscular septum. The dome osteotomy is therefore technically more difficult and has a higher complication rate.

Karatosun et al[30] from Turkey treated the cubitus varus deformity in 2000, using the Ilizarov technique of distraction osteogenesis. They reported excellent results on seven children in respect of scar, range of motion and correction of deformity.

Prominence of the lateral condyle has been reported as a complication of supracondylar osteotomy for cubitus

Table II. Statistical Analysis of the Outcome Measures

Parameter	Pre-operative mean ± SD	Post-operative mean ± SD	P-Value	Result
Carrying Angle	25.2^{o}±4.7	8.7^{o}±1.8	0.0200	Significant
Range of motion	12.6^{o}±6.9	123.8^{o}±7.3	0.4300	Non-Significant
LPCI	175.5±31.5	156±38.4	0.0049	Significant

varus[7,24,31-33]. Various authors recommend prevention of the medial displacement of the distal fragment of the osteotomy before skeletal maturity to allow remodeling, to avoid this complication[8,24,28,31,34]. In our study lateral condylar prominence index increased in five patients, probably due to inadequate correction or fixation of the narrow contact area.

Heterotopic ossification was the major cause of limitation of movement in one of our patients, and penetration of the screw into the joint in another, thus giving rise to poor results. In our study the mean carrying angle achieved at last follow up was 8.73° valgus as compared to 10.7° valgus reported by Tien et al[29].

CONCLUSION

Modified French osteotomy technique for correction of post-trumatic cubitus varus deformity around the elbow gives excellent results in children. There was no neurovascular complications or unsightly scars, and no loss of correction was observed despite early mobilization of the elbow. All osteotomies united within the expected time period.

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