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Original Research Article

Prospective study of cubitus varus deformity, its etiopathology, clinical study and treatment

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ABSTRACT

Background: Loss of carrying angle at elbow (Cubitus varus) remains one of the commonest complications of supracondylar fractures. Despite the numerous ways are described of treating supracondylar fractures, cubitus varus remains a significant problem. It can only be prevented by achieving and maintaining accurate reduction. Cubitus varus deformity is not a functional problem, but it may become so disfiguring that correction is indicated.
Methods: A total of 10 cases of cubitus varus deformity were treated with modified French osteotomy outcome was measured with by the method of Oppenheim WL, Clader et al.
Results: In this study 10 cases treated with modified French osteotomy. In the present study 70% cases were female. All the patients were in the age group of 6-13 years. The average correction of carrying angle was 5.7 0 of valgus. All the patients were having nearly normal range of motion of the affected elbow. Only one patient suffered radial nerve injury. There was no infection or hypertrophic scar or non-union. The study showed result in the form of excellent - 70%, Good - 20% and poor - 10%.
Conclusions: Modified French method proved safe and satisfactory as it has improved anatomy and cosmetic results. Loss of correction of cubitus varus deformity does not occur. A proper cases selection and proper planning of osteotomy, attention to the technical details is crucial to the success of supracondylar osteotomy of the humerus for correction of cubitus varus.

Keywords: Cubitus varus deformity, Osteotomy, Preventable

INTRODUCTION

Cubitus varus or gunstock deformity as it is commonly known, is the most common complication of displaced supracondylar fractures in children, with an incidence ranging from 3%- 57%.[1] The deformity involves not only loss of coronal alignment to make the distal forearm and hand deviate to midline of the body, but also has a recurvatum deformation in the saggital plane and internal rotation deformity in the axial plane. Recurvatum deformity is in the plane of the motion of the joint and remodels well. The internal rotation deformity is compensated by shoulder movements and is tolerated well. Both these deformity may not require corrections and most of the times correction is focused on coronal plane deformity.

The malalignment rarely limits the function but the appearance of the extremity frequently, is unacceptable to both the child and parents. Cosmetically, however, the deformity can be severe, especially for girls and the parents often ask for correction. There has been considerable disagreement regarding the etiopathogenesis of cubitus varus. Medial displacement of the distal fragment, growth disturbances, medial tilt and unreduced inward rotation have been implicated as a cause of

cubitus varus deformity.[2,3] Various types of osteotomies have been described, each claiming improvements in the cosmeses as well as lesser complication rate with their technique.

The study was carried out to identify the most possible cause for the cubitus varus, to define the best method of recognizing the deformity and its prevention and to evaluate the indication for and result of surgical treatment of the established deformity.

METHODS

The study was carried out the Department of Orthopaedics of Indira Gandhi medical college and MAYO hospital, Nagpur, Maharashtra, India. Total 10 cases were considered for final follow up and analysis. The assessment of cubitus varus deformity was done by using goniometer/protractor and it was graded as per the criteria.[4] Table 1 for grading of Cubitus varus as given below.

Table 1: Grading of Cubitus varus.

Grade I	**Physiological Cubitus valgus was lost.**
Grade II	Cubitus Varus upto 5°
Grade III	Cubitus Varus of more than 5°

Assessment of rotational (internal) deformity by ISAO[5]

A method of accurately measuring the internal rotation of the shoulder in a position with the elbow at 900 flexion on the back and the shoulder held at the maximum extension.

When a patient with cubitus varus attempts to rotate his shoulder internally, there is an apparent increase in the degree of internal rotation at the shoulder of fracture side. The angle formed between the back (horizontal plane) and the forearm indicates the degree of internal rotation.

Radiological evaluation was done by Beals method by which carrying and Bowmens angle were measured.[6,7] Indication for surgery – even when cubitus varus of Grade II is clearly apparent, both patients and family usually tolerate the condition and rarely request surgery.

In grade III cases with >100 of varus, one think the condition should be corrected, especially in girls. One do not postpone correction until the end of growth period but delaying operation until after one year from fracture and await full restoration of elbow extension. All the cases were operated with modified French osteotomy. Result were graded by the criteria as Excellent, Good and Poor after a follow up of 1 and half years.[8]

Table 2: Evaluation of final results.

Evaluation of final results	
Excellent	Correction to within 5° of the Contralateral elbow.
	Maintenance of preoperative elbow motoion.
	No perioperative complication.
Good	Demonstrated a valgus elbow position
	Motion to within 10° of the preoperative level.
Poor	Any perioperative complication including residual varus.
	Loss of greater than 10° of elbow motion.

RESULTS

In the present study of 10 cases there were 30% male and 70% females which is a strong evidence for cosmetic concerned as parents are more conscious about the cosmesis of female children. In our series all the patients were within age group of 6 years to 13 years, which again indicates that cubitus varus deformity is commonest pediatric problem. The average age at operation was 9.7 years. In our series in 60% cases dominant upper limb i.e. right elbow was affected and in 40 % cases non dominant upper limb (left elbow) was affected. There was not a single case of bilateral cubitus varus in our series. The average correction of carrying angle was 5.7o of valgus. Table 3 showing carrying angle of both normal and varus side correction.

Table 3: Angles of both normal and varus side correction.

Preop varus (Degrees)	**( )**	**Post op valgus (Degrees)**	**Difference from normal (in Degrees)**
-14	(8)	+5	+3
-12	(12)	+10	+2
-8	(10)	+6	+4
-18	(11)	+6	+5
-12	(10)	+8	+2
-15	(12)	-5	-5
-20	(15)	+12	+3
-16	(8)	+5	+3
-14	(12)	+6	+6
-12	(10)	+4	+6

Carrying angle: - varus; + valgus; ( ) Normal

Only one patient had residual varus deformity of -5° due to inadequate wedge removal at surgery.

All the patients were having nearly the normal range of motion of the affected elbow. Table 4 shows the range of motion of varus side preoperatively and postoperatively at followup.

Table 4: Range of motion (ROM) of varus side preoperatively and postoperatively or at follow up.

Range Of motion (ROM) (Degrees)	Follow up or Postoperatively (Degrees)
0-125	0-125
0-120	0-120
0-130	0-130
0-132	0-132
0-120	0-120
0-122	0-122
0-135	0-133
0-132	0-132
0-126	0-120
0-124	0-116

Only one patient suffered a radial nerve injury which in the form of Neurotemesis. This stresses importance of careful disscection to be done at the time of surgical correction of deformity. Every attempet should be made to protect this nerve in the proximal portion on the lateral approach. This was the same patient with residual deformity of -5°.

The nerve was repaired and partial recovery was evident. There was no infection, hypertrophic scar, nonunion. The final results were calculated according to the criteria of Oppenheim WL, Clader et al.

The study shows excellent results in 70%, Good in 20% and poor in 10% as per Table 5.

Table 5: Results according to the criteria of Oppenheim WL, Clader et al.

CA (Degrees)	ROM (Degrees)	Complications	Results
+5 (8)	0-125	--	Excellent
+10 (12)	0-120	--	Excellent
+6 (10)	0-130	--	Excellent
+6 (11)	0-132	--	Excellent
+8 (10)	0-120	--	Excellent
-5 (12)	0-122	Radial nerve injury and residual varus	Poor
+12 (15)	0-133	--	Excellent
+5 (8)	0-132	--	Excellent
+6 (12)	0-120	--	Good
+4 (10)	0-116	--	Good

( ) Normal: CA – carrying Angle; ROM – Range of Motion

Case 1

Figure 1: Clinicoradiological photographs showing preoperative and post-operative conditions.

Case 2

Figure 2: Clinicoradiological photographs showing preoperative and post-operative conditions.

DISCUSSION

Many orthopaedics surgeons have avoided the corrective osteotomy because of the reported high complication rates.[9] Some surgeons believe that the complication rate reported after supracondylar osteotomy outweigh the cosmetic benefit. Despite a detailed explanation of the operative risk, many patients and their parents, nevertheless opt for surgical correction. In the light of previous reports modified French method of corrective supracondylar osteotomy for cubitus varus deformity proved safe and satisfactory.

The lateral approach for supracondylar osteotomy is rather simple and more convenient for internal fixation rather than classical posterior approach. Preoperative planning is important in that the surgeon must consider the pitfalls ahead of time preserving the medial cortex is of paramount importance in obtaining stability with use of minimal internal fixation. Fixation is also complicated by the thin nature of distal humerus. Small degrees of rotational malalignment are clinically compensated by the shoulder and much of the rotational deficit may be more apparent than real such a deficit results from an oblique

axis of the elbow displaced by the fracture from its usual transverse plane. The significance of medial rotation is debatable the minor rotation can be compensated by shoulder movement and major and recent deformity may produce an attitude of medial rotation of the limb that makes the varus deformity look worse. Therefore correct any rotation which is to be in excess of 20°. In two patients, correction of internal rotation was done due to 35° of internal rotation measured.

The present study confirms that the deformities that follow supracondylar fracture are the result of malunion rather than the growth disturbance. There were no progressive deformities. Since the deformity is not progressive and does not remodel, and since healing is more rapid, fixation is easier at a younger age, it is suggested that the deformity should be corrected early, rather than at the conclusion of growth. The fracture is metaphyseal and does not involve the growth plate so lateral overgrowth or slowing down medially should not occur. No patient reported increase of deformity during growth and hence growth disturbance is unlikely to be cause of deformity. It was not observed the extension of the fracture line through the epiphysis so that stimulation of growth can occur.

Attention to the technical details is crucial to the success of the supracondylar osteotomy for correction of cubitus varus. The stability of osteotomy is enhanced by immobilizing the elbow in extension with forearm supinated. Piggot and Mc COY supports the postoperative immobilization of arm in extension although they prefer to use postoperative traction.[10] In present study no malalignment were seen after immobilization in extension and full supination of forearm after osteotomy. Cubitus varus was found to be the secondary to the medial tilting of the distal fragment. Failure to recognize this initial or subsequent medial tilt during early treatment of the fracture was the major factor in the development of cubitus varus deformity. The cosmesis was the primary indication for the corrective surgery. Most of the operations aims at the correction of only the varus deformity and the rotational problems are left untreated.[5,11]

About 30% Failure has been recorded.[12] This is because the lateral tilt of the distal fragment can be increased by rotational deformity and the lateral condyle become too prominent causing an ugly appearance.[13] Dowd and Hopcroft reported 85% varus deformity due to medial rotation or tilt of the distal fragment.[14] Hindman et al described that the rotation of the distal fracture fragment in the supracondylar fracture is the contributing factor in the deformity.[15] Khare et.al described the full pronation of forearm prevents cubitus varus deformity.[16] Robert DD Ambrosia had also stated that the supinated position of the forearm should be avoided in the treatment of the elbow in the children.[17] Therefore careful clinical and x ray evaluation using these method could have detected and prevented most, if not all of the cubitus varus deformity.

Lateral closed wedge osteotomy is good method to correct the deformity. Apropriate stabilization preferably with plate and screw will minimize the complication. Surgeon should be aware of complication and should counsel the same.[18]

CONCLUSION

Cubitus varus is the most common complication of supracondylar fracture of the humerus it is nearly always secondary to uncorrected or recurrent medial tilting of the distal fragment of the fracture. It is a preventable complication if medial tilt is recognized early by careful clinical and radiological assessment. It is primarily a cosmetic deformity as elbow had a full range of motion with no functional deformity.

Corrective supracondylar osteotomy is indicated only for children with unacceptable cosmesis. Modified French method proved safe and satisfactory as it has improved anatomy and cosmetic results. Loss of correction of cubitus varus deformity does not occur. Cubitus varus deformities require surgical correction or may lead to various consequences like secondary fractures, lateral instability and nerve palsy.

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