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Research Article

Assessment of Functional Outcome of Cubitus Varus Deformity Treatment in Children Undergoing Modified French Osteotomy

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ABSTRACT

Background: Cubitus varus is the most common late complication following supracondylar fractures of the humerus in children, primarily resulting from improper fracture reduction and conservative management. Although largely a cosmetic concern, surgical correction is often required to restore anatomical alignment. Modified French osteotomy is among the preferred techniques for its effectiveness and safety.

Objective: To assess the functional and radiological outcomes of children with cubitus varus deformity treated using modified French osteotomy.

Materials and Methods: This prospective study included 25 pediatric patients with established cubitus varus deformity. The deformity was corrected using the French osteotomy and its modifications, such as a lateral approach without triceps splitting and preservation of the medial cortex. Preoperative evaluation included clinical and radiographic assessment of the carrying angle and range of motion. Postoperative follow-up was conducted at 10 days, 1 month, 2 months, and up to 6 months with emphasis on clinical-radiological parameters including Baumann's angle, carrying angle, and movement range.

Results: The mean age was 10.8 years, with a male predominance (76%). The left elbow was more commonly affected (64%). The average interval between injury and corrective surgery was 2.4 years. Most patients (68%) had severely restricted motion (>20° loss). Postoperative assessment revealed 76% of patients achieved a valgus carrying angle. Excellent outcomes were noted in 60% of patients, fair in 24%, and poor in 16% based on modified Bellemore criteria. The most common complication was residual deformity (16%), followed by lateral elbow bulge (12%) and minor infections (8%).

Conclusion: Modified French osteotomy is a reliable, technically feasible, and cosmetically acceptable technique for correcting cubitus varus deformity in children. It provides excellent to fair outcomes in the majority of patients, with a low incidence of complications.

Keywords: cubitus varus, pediatric patients, Modified French osteotomy, corrective surgery.

INTRODUCTION

Cubitus varus deformity is the most common late complication after supracondylar fracture of distal humerus in children, incidence varying from 4% to 58%.[1] Growth cessation is another factor for progressive cubitus varus deformity for which in addition to above factors, osteonecrosis and overgrowth of lateral condyle is also responsible. Cubitus varus is more common after conservative management (upto 58%). Presently closed reduction and percutaneous pinning under c- arm is the recommended treatment for displaced supracondylar fractures which has significantly reduced the cubitus varus deformity following these fractures. Although it rares poses a functional problem but most patients are concerned with it cosmetically. Correction of cubitus varus deformity can be done by various types of osteotomies. which use different methods of implants for fixation like k-wires, external fixator (monolateral as well as illizarov ring fixator), screws with s-s wire, plates, etc with their respective immediate and delayed complications (nerve injuries, pin infections, stiffness, delayed union and non- union, etc). Surgical treatment of cubitus varus in adults is more challenging in view of poor remodelling due to growth cessation, osteotomy union problems, infections, stiffness, neurovascular complications, etc. So keeping in view above complications. The modified French osteotomy

is the most widely accepted standard procedure for correcting a varus deformity. An effort has been made in this study to analyse the necessity and timing of operative correction as also the technique of operation and complications.

MATERIAL & METHOD

The present study comprises of randomly selected 25 cases of French Osteotomy and its modifications for correcting the cubitus varus deformity after supracondylar fractures of humerus in children. Fresh cases of already developed cubitus varus were personally examined in outdoor and interrogated for mode of injury, age at time of injury and treatment taken. Patients were thoroughly clinically examined as per proforma attached for swelling, deformity, local bony irregularity, neurovascular status and most important was the carrying angle. Carrying angle was calculated clinically as well as radiologically.

Preliminary skiagrams are taken in antero-posterior and upper half forearm bones, taken with elbow in full extension and forearm in full supination, skiagrams of normal (unaffected) elbow is also taken for comparison and calculation of degree of correction required. Size of the wedge is calculated by standard formula shown in Labelle et al.

We are correcting the deformity by French osteotomy and its modifications. Following are the modifications-

1. We are using lateral approach instead of posteriorly
2. We are not splitting triceps but retracting it posteriorly,
3. Medial cortex is osteoclased while correcting medial rotation and angulation.

Technique of French osteotomy

Patient is taken on operation table in supine position with the involved extremity on the side table under tourniquet control and under general anaesthesia. The distal end of humerus is exposed through a lateral longitudinal incision starting just above lateral epicondyle and extending further proximally about 2-2.5" deep fascia is dissected between triceps posteriorly and branchialis muscle anteriorly. Before the bone is osteotomised two cortical screws are inserted, one proximal and one distally to drill points. The placements of screws are as such that after osteotomy and tightening both screws, the rotation is corrected. Distal screw is placed anteriolaterally and proximal is postero-laterally. Medial rotation is calculated by pronation of forearms, degree of pronation is calculated. The angle of pronation (medical rotation) is kept between two screws and when screws will be tightened, the rotation will be corrected. Using a osteotome, desired size of wedge is excised. Distally the wedge osteotomy is horizontal while proximally it is oblique. Excise the wedge bone between drill points, divide the bone but leave medial cortex intact. Extend the elbow and close the wedge by fracturing the medial cortex while correcting rotation and angulation both simultaneously carefully retaining a periosteal hinge. Place the forearm in supination and assess the carrying angle if it is satisfactory, tighten the encirclage wire loop around the head of screws which when tightened will firmly oppose the cut surface. Closure done in layers inner with catgut, dressing done and bandage applied. Carefully holding the osteotomy, tourniquet released, immediately the circulation in fingers seen and radical artery pulsation seen and neurologically assessed when he is out of effect of general anaesthesia.

Post Operation

While advised for strict elevation and active finger movement. During the first 48 hours, patient should be examined for any complication like neurovascular involvement, fever, pain or swelling over fingers. If asymptomatic then patient discharged and followed up after 10 days for stitch removal and clinical review like any type of superficial/deep infection followed by forearm cast application.

Again follow up after 1 month for clinic-radiological evaluation, if findings favours consolidation of osteotomy then active mobilisation started with instruction for keeping the forearm in cuff and collar sling otherwise on months plaster immobilisation continued.

At 2 months (approx.) post-operative follow up again clinic-radiological evaluation performed with emphasis on signs of union and range of movements of affected limb. Then followed up at 4-6 months post operatively through clinical and radiological evaluation done finally with stress on carrying and Baumann's angle.

Out of 17 retrospective cases, 10 cases attended Orthopaedic Outdoor and evaluated for type of operation performed with way of fixation, post-operative complication, carrying angle, Baumann's angle and range of movements and deformity, if any.

The end results were assessed according to

modified Bellemore et al (1984) criteria (6):

1. Excellent-
a. Loss of carrying angle degree or less.
b. Loss of movement of flexion- extension by 10 degree or less.
2. Fair-
a. Loss of carrying angle from 6 to 10 degree.
b. Loss of Flexion extension by 20 degree or less.
3. Poor-
a. Loss of carrying angle more than 10 degree.
b. Loss of flexion-extension by more than 20 degree.

Pre op

Post op (6 month)

Pre op

Post Op

RESULT

In our study mean age of patients is 10.8 years. There are 19 males and 6 female present in this study. 16 patients with left side involved are present and 9 with right side involved present in this study. We also find the time interval between injury and operation. Minimum interval after which corrective operation done was 2.5 months whereas maximum interval was 10 years. Majority of patients were operated after 1-2 years of injury followed by more than 2 years after injury. Average duration after which osteotomy was done is 2.4 years

In majority of cases (48%) close reduction done and forearm slab applied in hospital followed by local massage in 28% cases. In 16% cases combined type of treatment ad in 8% cases open reduction and internal fixation type of post treatment was done. We also found that in 68% cases range of movement was restricted to more than 20^0. Most of cases in this series were grade 3rd and 4th (12 cases in each) and only single case of grade 2nd while no cases in grade 1st. In our study we consider 3 technique of operation. French osteotomy is used in 17 patients and osteotomy fixed with cross kirschner wires is used in 7 patients. (Table:1).

Table.1

Post Injury Treatment	Total no. of patients	%
C.R & F.A Slab	12	48
By Local Massage	7	28
Open Reduction And Internal Fixation	2	8
Combined	4	16
Range of movement		
Restricted u pto 10^0	2	8
Restricted from 11^0-20^0	2	8
Restricted more than 20^0	17	68
Not known	4	16
Grading of Cubitus varus		
Grade-1	0	0
Grade-2	1	4
Garde-3	12	48
Grade-4	12	48
Technique of operation		
French Osteotomy	17	68
Osteotomy Fixed With Cross Kirschner Wires	7	28
Osteotomy Fixed With Cross Kirschner Wires And Cerclage Wires	1	4

Here, minimum angle of correction was 17^0 and rise of wedge was 6 mm (22 cases) while maximum angle of correction was $44^0$and side of wedge was 14 mm (3 cases). Average angle of correction was in between 26^0 to 35^0 group and size of wedge was 9-12 mm (Table:2).

Table.2

Angle of correction	**No. of cases**	**Size of wedge**	**No of cases**
16^0-25^0	9	6-8 mm	7
26^0-35^0	9	9-12 mm	11
More than 36^0	6	More than 12 mm	5
Not known	2	Not known	2

Here, most common complications was residual cubitus varus (4 cases) followed by lateral bulging of elbow (3 cases) and least complications were infection (2 cases), scar (2 cases) tourniquet palsy in one case and one case in which post operatively the circlage wires was broken in French osteotomy repeated Majority of cases post-operatively has carrying angle on valgus side (76%) followed by 16% cases had carrying angle on varus side and 8% had carrying angle on rectus side. Similarly, post-operative movements was normal on 52% cases followed by 24% cases had restricted movement up-to 11-20 degree, 20% cases had restricted movements up-to 10 degree and 4% cases had restricted movements more than 20 degree (Table:3). Majority of cases showed excellent result (15 cases) followed by fair results (6 cases). 4 cases shows poor results in improvement

Table 3. Technique of Operation

Carrying Angle	No. of patients	%
Cubitus Valgus	19	76
Cubitus Rectus	2	8
Cubitus Varus	4	16
Range of movements (Post-operatively)		
Normal	13	52
Restricted up to 10 degree	5	20
Restricted up to 11-20 degree	6	24
Restricted more than 20 degree	1	4

DISCUSSION

The management of cubitus varus remain a great challenge to the orthopaedic surgeon. Cubitus varus is one of the most common complication of supracondylar fracture of humerus in children treated with non-operative management without reduction and fixation.

In our study mean age of patients is 10.8 years. There are 19 males and 6 female present in this study. Verka et al (A) found that Male to female ratio was 17:8 and the age group of our patients was 4 to 10 years with an average of 7.7 years. Sath et al studied total of 12 cases with 7 males and 5 females. Patients were ranging from 15 - 25 years of age with a mean age of 19.41 years. Most cases were right handed forming 8 of the 12 cases (66.66%). In our study 16 patients with left side involved are present and 9 with right side involved present in this study.

We also find the time interval between injury and operation. Minimum interval after which corrective operation done was 2.5 months whereas maximum interval was 10 years. Majority of patients were operated after 1-2 years of injury followed by more than 2 years after injury. Average duration after which osteotomy was done is 2.4 years

In our study majority of cases post-operatively has carrying angle on valgus side (76%) followed by 16% cases had carrying angle on varus side and 8% had carrying angle on rectus side. Sath et al found that Carrying angle on the normal side ranged from 5-12 degrees with a mean of 9.16 degrees while varus deformity of the affected side ranged from 12-28 degrees with mean of 17.16 degrees. They also found that post-operatively valgus ranging from 6-12 degrees with a mean of 8.66 degrees was achieved which is close to the mean of carrying angle on normal side. Range of motion preoperatively was from 130-140 degrees of flexion with a mean of 134.16 degrees while postoperatively range of motion was 125-140 degrees of flexion with a mean of 132.5 degrees. Hahn SB et al. used dome osteotomy in 16 adult patients of cubitus varus deformity with a mean age of 31.1 years with mean postoperative carrying angle of 6.1 degrees and good to excellent results in all cases. Similarly, here, post-operative movements was normal on 52% cases followed by 24% cases had restricted movement up-to 11-20 degree, 20% cases had restricted movements up-to 10 degree and 4% cases had restricted movements more than 20 degree. Majority of cases showed excellent result (15 cases) followed by fair results (6 cases). 4 cases shows poor results in improvement. Sath et al found good to excellent results in all patients. All patients were satisfied. They had no poor results. S. Pandey found excellent results in all patients except one who had lateral condylar prominence. Muhammad Ayaz Khan et al., achieved good to excellent results. They concluded this as simple, reliable, acceptable and effective method of correction.

Here, most common complications was residual cubitus varus (4 cases) followed by lateral bulging of elbow (3 cases) and least complications were infection (2 cases), scar (2 cases) tourniquet palsy in one case and one case in which post operatively the circlage wires was broken in French osteotomy repeated. Sath et al found Complications in the form of mild stiffness was present in most patients in the early follow-up period but it was restored to near normal in almost all patients with physiotherapy

In majority of cases (48%) close reduction done and forearm slab applied in hospital followed by local massage in 28% cases. In 16% cases combined type of treatment ad in 8% cases open reduction and internal fixation type of post treatment was done. Previous studies have proved the French's method to be safe and satisfactory. For example, results of a corrective osteotomy performed over a ten-year period on 32 patients at the Royal Alexandria Hospital for Children in Sydney proved the French's method to be safe. A prospective study of Cubitus Varus deformity where 10 cases were treated with French osteotomy, all patients reported having normal range of motion of the affected elbow with no infections, hypertrophic scars or non-unions reported. In this case as well, modified French method proved safe and satisfactory.

We also found that in 68% cases range of movement was restricted to more than 20^0. Most of cases in this series were grade 3rd and 4th (12 cases in each) and only single case of grade 2nd while no cases in grade 1st. In our study we consider 3 technique of operation. French osteotomy is used in 17 patients and osteotomy fixed with cross kirschner wires is used in 7 patients. (Table:1). S. Pandey et al. corrected cubitus varus in young adults in a series of 7 patients where he used lateral closed wedge osteotomy and fixed with k-wire, S-S wire and screw. Muhammad Ayaz Khan [B-25] et al., in a case series of 30 patients used modified lateral closed wedge osteotomy in

children and adolescents in the age group of 7-14 years where they fixed the osteotomy with two screws and figure of eight tension band wire supplemented with two k-wires.

Here, minimum angle of correction was 170 and rise of wedge was 6 mm (22 cases) while maximum angle of correction was 440and side of wedge was 14 mm (3 cases). Average angle of correction was in between 260 to 350 group and size of wedge was 9-12 mm (Table:2). Muhammad Ayaz Khan et al., achieved valgus correction in all patients with near normal range of motion and improved Lateral prominence index .28(93%) patients achieved good to excellent results.

CONCLUSION

The present study sugggest that Modified French osteotomies showed excellent results. The complications arising from the procedure were within acceptable limits. Modified French osteotomy is an easier and safer procedure.

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