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Evaluating Outcome of Uncomplate Osteotomy and Bone Holes Drilled of the Distal Humerus for Pediatric Cubitus Varus

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Abstract

Background: Various types of osteotomy have been proposed to treat cubitus varus. We reviewed the results of osteotomy distal humerus combined bone holes drilled.

Methods: Between 2000 and 2011, we treated 20 cases of cubitus varus with two Variants (Variation 1, n= 6): complete osteotomy; Variant 2 , = 14: incomplete osteotomy and bone holes drilled) and tried determined by a Kirschner wire. After surgery, patients were followed up for an average of 46.5 months. We compared humerus-elbow-wrist angles before and after surgery, range of motion, and lateral or medial prominence indices for all patients. Outcomes were evaluated according to the revised criteria of Oppenheim et al. The presence of delayed ulnar nerve palsy and its prolonged duration, postoperative inactivity or unsightly scarring were also noted.

Results: In Variant 2: PreOperatively, Age: 9. 7 year; Carrying Angle (°): 17.5 ± 14.00; Baumann Angle.(°): 98.95; 20.15; LCP Index: - 0.14. PostOperatively, Carrying Angle: 3.42; Baumann Angle: 78.714; LCP Index:-098; Follow Up (mo): 49.35. Result: Excellent: 10; Good: 2 ; Poor result: 2. In Variant 1: PreOperatively, Age: 9.3 year; Carrying Angle (°): 23; Baumann Angle.(°): 97.16; LCP Index: -0.14. Post Operatively, Carrying Angle: 6.166; Baumann Angle: 81.166 ; Follow Up (mo): 46.5; Result: Excellent: 2; Good 2 ; Poor: 2.

Compared result of operation: Cosmetic satisfaction: Lateral Prominance 33.33% / 14.26%; Unsightly scar 16.7% / 14.3%. Complications: Iatrogenic Ulnar palsy 33.3% / 14.3%. Compared Carrying angle (P valuate = 0.25) and Results (P valuate = 0.12730) no comparative valuate; but, Operative time with P valuate = 0. 0128 comparative valuate;

Conclusion: Incomplete osteotomy distal humeral and bone holes drilled for cubitus varus gave results with the results obtained in our study concluding that surgical technique is a safe. and effective for correcting deformities with some mild complications.

Key Words: *Cubitus varus, medial approach, osteotomy, elbow, dome, step-cut.*

Introduction

The supracondylar fracture of the humerus is the most common elbow injury in children (Sins 1939 [1]; Mitchell and Adams 1961 [2]; Griffin 1975 [3]). Nerve damage or blood vessel failure may be associated with trauma or reduction. However, cubitus varus (buttstock deformity) is the most common long-term complication according to Mitchell and Adams 1961 [2]; Amspacher and Messenbaugh 1964 [4]; Langenskiold and Kivilaakso.1967 [5].

Anterior and lateral malformations are complications of elbow fractures in children. These deformities may require surgical treatment for cosmetic reasons rather than functional limitations. Late ulnar nerve palsy can be associated with both malformations and may require treatment.

Various types of osteotomy have been proposed to treat medial and medial Cubitus varus [6, 7]. The goal of osteotomy is to correct the coronal plane deformity as well as any associated flexural and rotational contractures.

This deformity is unsightly and although function is not greatly impaired, parents often require surgery to improve the shape of the elbow according to French 1959 [8].

Many published articles are concerned with the early management of supracondylar fractures, but few have mentioned the management of medial cubitus varus. Several methods of corrective osteotomy in the distal humerus have been described. Only five authors reported more than four cases, and in all series there was a high complication rate. French, in 1959 [8], reported a procedure that "creates good contact, eliminates some of the surgical hazards, provides a method for adequate control of osteotomy, and allows for maneuvering earlier elbow movements". There are no published reports on its performance.

This article reviews the published works on cubitus varus and reports the results of bone holes drilled at the Vietnam National Children's Hospital.

Material and Methods

Between 2000 and 20011, we treated 20 children (14 boys and 6 girls) for cubitus varus with severe osteotomy and bony perforation. The mean age at surgery was 9.6 years (6.5 to 14.3). A total of 20 patients suffered a supracondylar humeral fracture. Six men and fourteen women, with malformed arm fractures, were admitted to our hospital and underwent elbow correction surgery at distal humerus. Median follow-up was 48.5 months (range 39–63 months). Reasons for switching to surgery were cosmetic rather than functional problems such as ulnar nerve palsy or elbow instability.

All members have confirmed consensus. The study was approved by the Ethics Review Committee of our Institute and was conducted in accordance with the tenets of the Declaration of Helsinki.

All surgical indications are cosmetic deformities. The goal of surgery is to adjust the elbow so that it resembles the normal opposite side anatomically and functionally. Before planning an osteotomy, full radiographs of both upper extremities were taken with the elbow fully extended and the forearm fully supine. The method described by Oppenheim et al [9] was used to determine the arm-elbow-wrist (HEW) angle in both arms (Figure 1).

Figure 1: Measured Humerus – Elbow – Wris.

Humerus – Elbow – Wris

The HEW angle is measured by drawing two lines, one along the anatomical axis of the humerus and the other connecting the midpoints of two transverse lines (one proximal and one distal) across the forearm connecting the medial cortex of the humerus. ulna and lateral radius shell.

Preoperative examination

The humeral-elbow-wrist angle (Figure 1) measured on anteroposterior radiographs accurately reflects the contours of the upper extremities [9]. Radiographs are performed with the patient sitting in a chair with the hand and forearm supine and the elbow fully extended on the x-ray table. To measure the arm-elbow-wrist angle, we first draw two horizontal lines (one proximal and one distal) across the humeral bone connecting the medial and lateral cortex and two lines (one proximal and one distal). one distal) across the forearm connected to the medial. the shell of the ulna and the side shell of the radius. Then we draw a line connecting the midpoints of the two diagonals of the humerus and another connecting the midpoints of the two transverse forearms. These lines are stretched until they intersect and the angle of intersection is measured with a potentiometer. The angle of medial cubitus varus in patients with cubitus vaurus ranged from 17° to 35° (mean 23.25 ± 4.961).

The Valgus angulation was described as positive (+) and varus angulation as negative (-). The amount of correction required was determined by adding the valgus angulation of the normal side to the varus angulation of the deformed side.

The degree of rotational distortion is estimated by physical examination. Examination is performed by having the patient lean slightly forward and place the forearm behind the patient's back with the elbow flexed at 90° and the shoulder maximally extended. The examiner holds the patient's elbow for support and places the humerus maximally inward by lifting the arm from behind.

While the arm of a person with a normal upper limb cannot be raised from the back, the hand of a patient with an internal rotation defect can be raised, forming an angle between the transverse plane of the midline of the forearm and the plane of the forearm. rim of the arm. behind. This angle is considered to be the angle of internal rotation of the humerus. One of our patients had significant internal rotation deformity >10°.

The humeroulnar Angle

The ulnohumeral angle (HUA) or bearing angle on radiographs, which is the angle formed, in AP view, the diaphragmatic axis of the humerus and the axis of the proximal third of the ulna (Fig. 2).

Figure 2: HumeroUlnar Angle defined as the angle formed between **(A)** the longitudinal axis of the humerus. and **(B)** the axis of the proximal third ulna (normal range 5°–15°) [10].

Baumann's angle

Baumann's amgle (also known as Humerocapitellar angle) serves as a necessary indicator of alignment and development of the elbow joint. It is an important help for Precise reduction of supracondylar brachial fractures young. It also provides valuable insights into development of the distal humerus and can help identify different and unusual condition.

We calculated the "Baumann angle" (BA) from the postoperative radiographs (Figure 3). This angle is formed by the perpendicularity of the longitudinal axis of the humerus to the axis of the physical line (normal range: 9–26°) [11]. For AP X-ray films, we should assess the direction of displacement, the presence of internal or internal tortuous alignment, and the extent of the crack. However, the Baumann angle has many normal values and varies greatly with radiographic humeral position (that is, rotation).

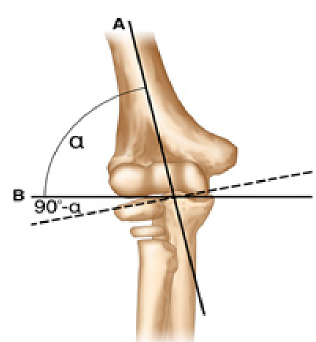


Figure 3: Baumann's angle is a radiographic angle created by the intersection of a line drawn down the humeral axis **(A)** and a line drawn along the physis, **(B)** of the lateral condyle of the elbow on the AP view of the elbow (normal range, 9°–26°).

Lateral Condylar Prominence Index (LCPI)

We calculated the lateral condylar prominence index (LCPI) to objectively assess the preoperative and postoperative luminal striation. The calculated LCPI on the affected side is the difference between the measured median and lateral width of the bone relative to the median longitudinal axis and is expressed as a percentage of the total width of the distal humerus to minimize errors due to magnification and variation of the size of individual humeri (AB - BC/AC x 100) (Figure 4).

Figure 4: The lateral condylar prominence index was calculated using the following formula: (AB - BC)/AC x 100, where B is the cross-link between a line connecting the lateral prominence; A, the medial prominence; C, and the longitudinal midhumeral axis.

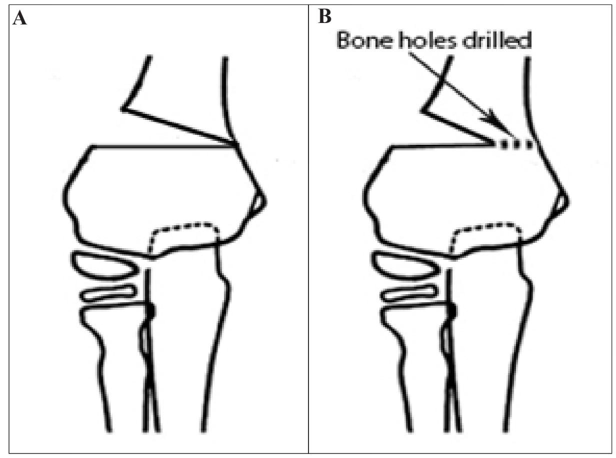
Preoperative Plan for Osteotomy

We determined the correction angle for patients with scoliosis by comparing the arm-elbow-wrist angles of normal and deformed elbows. Care should be taken to ensure that the elbow is fully extended and the forearm is supine on the x-ray. After drawing the contour of the affected elbow from the X-ray film on the paper, we cut it out with scissors. Next, we make the first bone cut, about 0.5 to 1 cm above the fossa of the elbow and perpendicular to the axis of the humerus. With all components held in the same coronal plane, the distal piece is then rotated laterally and shifted medially, so that the angle formed by the initial osteotomy and the lateral edge of the distal humerus The hand can then be traced on the nearest humeral bone. piece, forming the area where the three corners are excised. Then we cut out this triangular overlapping area from the paper. Protrusion of the medial and lateral condyles was reduced by distal or lateral rotation of the piece and by transverse displacement following the anatomical shape of the normal elbow.

Method of Osteotomy

The operation was performed with the patient supine to check the bearing angle of both elbows. Shoulders are flexed to 90° and internally rotated to 90°, and elbows are flexed to 90°. Through the posterior approach, a longitudinal skin incision of approximately 8 to 10 cm is made longitudinally on the posterior portion of the humerus. The soft tissues are then dissected, and the ulnar nerve is exposed. The triceps tendon was cut in a V shape, and the posterior aspect of the capsule was incised longitudinally to better expose the medial and lateral condyle.

First line osteotomy is performed 0.5 to 1 cm above the fovea of the elbow, perpendicular to the axis of the humerus, with an electric saw and a 6 or 9 mm wide saw blade (depending on the size of the humerus) of the cut bone). This osteotomy can be divided into two methods: Option 1, the first transverse humeral line is distal to the entire humerus (Figure 5A) and Option 2, the second line is on the incomplate humerus (Figure 5B), the oblique bone cut only 4/5 of the distal humeral transverse line (keep the same 1/5 of the line to drill the bone). Using a 3mm drill to make 3-4 holes (Figure 5B) , and did not break the medial cortex (The second line is on the lateral surface of the humerus, the distance according to the cut line on the preoperative apex and the oblique opening compared to the first hole).

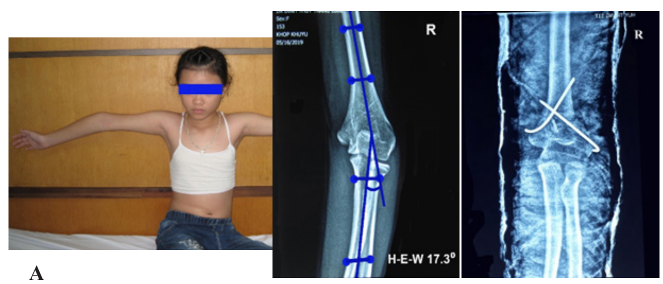


Figures 5: A-B: **A**. Variant 1; **B**. Variant 2

When flexor contracture or rotational deformity occurs, it should be corrected in the same surgery, immediately after coronary ostomy. Rotation is corrected only when the rotation angle is >10° different from the normal rotation. We corrected the rotation by rotating the distal part of the humerus outward, by the amount determined during the preoperative physical examination. After the initial adjustment in the coronal plane, there is still some room to rotate the distant piece. To correct rotation, it is necessary to excise portions of the humerus distal to the proximal portion of the humerus and to create a smooth surface for the humeral incision.

After correction of the malformation, temporary Kirschner wire immobilization was carefully performed to prevent damage to the ulnar nerve. We fix crossed pin with 2 mm Kirschner wire

(Figure 6C). After fixation, the remaining protrusions of the medial and lateral condyles were cut with an electric saw.



A

B C

Figures 6: **A-C: A.** PreOperative Clinical; **B.** PreOperative Radiography; **C.**Postoperative Osteotomy and bone holes drilled.

Postoperative Care

The surgically treated arm is secured in a long removable splint, or cast with the elbow in 90° flexion and the forearm in neutral rotation. Active mobility exercises are started two to three weeks after surgery.

When there is flexion of the elbow, assisted passive range-of-motion exercise is performed 5 to 6 weeks after surgery.

Result evaluation.

Outcomes were evaluated on a clinical and radiological basis using Oppenheim et al's criteria [9] (Table 1). The clinical endpoints were postoperative range of motion of the elbow and the presence of complications. The radiographic criteria were corrected degree of medial deformity (postoperative arm-elbow-wrist angle) and presence of a lateral prominence (X-Y distance on postoperative radiographs).

Result	Difference from normal side		Loss of range of movement (°)	Complication
	Carrying angle (°)	Lateral translation (mm)		
Exellent	< 5	< 5	<5	No
Good	< 10	<10	<10	No
Poor	>10	>10	>10	Yes

Table 1: Assessment of the results according to a modified Oppenheim et al [9] syntem

Statistical analysis

Statistical analysis was performed using the SPSS statistical package program (SPSS version 19.0; SPSS Inc., Chicago, Illinois, USA). The t-test was performed to compare injured and uninjured elbows. The null hypothesis was that the mean extension and angle of inclination in the injured elbow after fixation would be the same as in the uninjured elbow (control). We used a P value of less than 0.05 to determine the statistical significance of the respective variables.

Results

Twenty cases were reviewed clinically by of the authors (MCB). Follow-up after osteotomy was from 39 months to 63 months with a mean period of 48.5 ± 7.1 months.

Radiographs taken shortly after osteotomy were available for all patients, and films were taken of the affected elbow in the 20 patients reviewed later. A lateral film and an anteroposterior film taken with the elbow extended and the forearm supinated were available, clinical assessment.

The Patients was Operated according to separated two Variants, 6 patients was operated Variant 1 (Table 2) and 14 patients remaining was operated Variant 4 (Table 4).

PostOperative result of Variant 1 in table 3 and Variant 2 in table 5.

As regards appearance there was an unsightly scar in four cases and a bulge on the lateral side of the arm at the level of the osteotomy in four (Table 2&4) .

Compared result of Pots-Operation: Varient 1 / Varient 2

Patient No	Sex	Age Intra. Op(Year)	Side	Climical - Radiographic					
				Carrying Angle (°)	Varus Angle (°)	Angle of Hyperextension	Baumann Ang.(°)	HU Ang.(°)	LCP Index (°)
1	M	13.1	L	-20	35	16	92	-32	-0.12
2	M	6.5	L	-26	26	18	95	-2O	-0.12
3	F	7.4	L	-33	27	17	106	-22	-0.20
4	M	9.6	L	-18	17	26	88	-18	-0.16
5	M	7.5	R	-10	30	25	90	-16	-0.16
6	M	8.2	L	-15	24	28	104	-18	-0.12
7	M	7.8	L	-18	22	17	94	-20	-0.16
8	F	10.8	R	-26	21	25	98	-22	-0.12
9	F	9.6	L	-28	20	27	108	-20	-0.20
10	M	10.2	L	-6	18	16	95	-18	-0.13
11	M	11.4	L	-22	23	13	102	-22	-0.11
12	M	14.3	L	24	30	17	94	-18	-0.18
13	M	12.5	R	-28	22	16	98	-16	-0.15
14	F	7.8	R	-19	21	32	92	-20	-0.19
Mean	F: 4	115,926	L:10	-17.5	24.0	20.928	98.957	20.153	-0.14
STD	M:10	28.615	R: 4	14.009	5.0687	5.9145	6.099	4.118	4.85

HU angle, humero–ulnar angle; LCP, lateral condylar prominence. Varus = negative; valgus = positive.

Female: 4, Male: 10; Age Intra-Operation: 9. 7 year (6.5-14.3 years); Side: Left: 10, Right: 4; Carrying Angle (°): 17.5 ± 14.00; Varus Angle (°): 24.0 ± 5.068; Angle of Hyperextension: 20.928 ±5.91; Baumann Angle.(°): 98.95 ± 6.09; HU Angle.(°): 20.15 ± 4.11; LCP Index: - 0.14 ± 4.85.

Table 2: PreOpertive Patients in Variant 2.

Patient No	Clinical - Radiographic						Follow-up (Mo)	Operation Time (min)
	Carrying Angle(°)	Baumann Angle (°)	Controlateral Flexion Angle	Flexion Angle	HU Angle	LCP Index		
1	1	100	40	32	1	-0.01	42	110
2	1	80	45	44	0	-0.16	39	95
3	12	80	45	38	- 12	-0.07	51	110
4	5	68	44	34	6	-0.11	48	95
5	0	78	40	38	0	-0.25	55	90
6	6	85	42	34	5	-0.02	46	100
7	5	74	43	42	15	-0.06	54	95
8	0	78	45	28	0	-0.1	44	96
9	6	74	42	37	8	-0.2	63	115
10	4	71	45	28	0	-0.04	46	100
11	1	80	40	32	15	-0.11	42	105
12	6	85	41	34	4	-0.11	56	110
13	2	71	42	37	3	-0.16	44	115
14	1	78	43	36	5	-0.25	61	105
Mean	3.428	78.714	42.642	35.285	3.571	-0.98	49.357	102.928
STD	3.523	7.926	1.945	4.598	6.744	8.207	7.438	8.185

HU angle, humero–ulnar angle; LCP, lateral condylar prominence. Varus = negative; valgus = positive.

Carrying Angle: 3.42 ±3.52; Baumann Angle: 78.714 ±7.926; Controlateral Flexion Angle: 42.542 ± 1.945; Flexin Angle: 35.285 ± 4.598; HU Angle:3.57 ± 6744; LCP Index:-098±8.207; Follow Up (mo): 49.35 ±7.43; Operation time (min): 103. 92 ± 8.185.

Table 3: PostOpertive Patients in Variant 2.

Patient No	Sex	Age Intra. Op (Year)	Side	Clinical - Radiographic					
				Carrying Angle (°)	Varus Angle (°)	Angle of Hyperextension	Baumann Ang.(°)	HU Ang. (°)	LCP Index (°)
1	M	6.9	L	-32	17	26	95	-15	-0.12
2	M	7.4	L	-24	26	18	104	-19	-0.15
3	F	8.8	L	-16	18	26	96	-20	-0.16
4	M	10.6	R	-26	22	25	104	-32	-0.12
5	F	12.5	L	-22	28	16	86	-18	-0.14
6	M	11,3	R	-18	18	18	98	-22	-0.19
Mean	F:2	111.6	L: 4	-23	21.5	21.5	97.166	-21	-0.14
STD	M: 4	25.652	R: 2	5.761	4.636	4.6368	6.705	5.865	2.658

HU angle, humero–ulnar angle; LCP, lateral condylar prominence. Varus = negative; valgus = positive

There are. Female: 2, Male: 4; Age Intra-Operation: 9.3 years (6.9-12.5 years); Side: Left: 4, Right: 2; Carrying Angle (°): 23 ± 5.761; Varus Angle (°): 21.5 ± 4.63; Angle of Hyperextension: 21.5 ± 4.63; Baumann Angle.(°): 9716 ± 6.70; HU Angle.(°): - 215 ± 5.865; LCP Index: -0.14 ± 2.658.

Table 4: Pre Opertive Patients in Variant 1.

Patient No	Carying Angle(⁰)	Baumann Angle (⁰)	Controlateral Flexion Angle	Flexion Angle	HU Angle	LCP Index	Follow Up (Mo)	Oprtation Time (min)
	Clinical - Radiographic							
1	5	88	44	42	5	-0.1	40	80
2	8	74	49	38	12	-0.25	48	80
3	7	80	42	34	0	-0.06	58	78
4	6	85	43	37	8	-0.20	47	76
5	5	74	42	42	3	-0.04	40	80
6	6	86	41	38	4	-0.25	46	88
Mean	6.166	81.1666	43.5	36.5	5.333	-0,13	46.5	80.333
STD	1.169	6.145	2.880	3.082	4.179	11.040	6.625	4.082

HU angle, humero–ulnar angle; lateral condylar prominence. Varus = negative; valgus = positive

Carrying Angle: 6.166±1.169; Baumann Angle: 81.166 ±6.145; Controlateral Flexion Angle: 43.5 ± 2.880; Flexin Angle: 36.5 ± 3.082; HU Angle:5.332 ± 4.179; LCP Index: -0,13±11040; Follow Up (mo): 46.5 ±6.625; Operation time (min): 80.333 ± 4.082;

Table 5: Post Opertive Patients in Variant 1.

Clinical: Carying Angle : 6.16 / 3.42 (P valuate : 0.25) ; Angle of Hyperextension: 8.6 / 8.07; Baumann Angle(⁰):81. 16 / 78. 71; Controlateral Flexion Angle: 43.5 / 42.6; Flexion Angle: 35.5 / 35.3; HU angle: 5.3 / 3.57; LCP Index: - 0.13 / - 0.98; Follow-up (Mo): 46.5 / 49.3; Operation time (min): 80.33 / 102.92 (P valuate : 0.012845). Result: Satisfactory 4 (66.7%) / Satisfactory 12 (85.7%) (P valuate : 0.1273) (Table 3 & 5). Cosmetic satìsfaction: Lateral Prominance 33.33% / 14.26%; Unsightly scar 16.7% / 14.3%.Complications: Iatrogenic Ulnar palsy 33.3% / 14.3%.

The range of movement in flexion and extension at the treated elbow was reduced by more than 20°. Significant loss of rotation or alteration of its arc at the shoulder was not seen.

The carrying angle and the range of elbow movement, compared with the normal side, were combined to grade the results of the methods of treatment in this series. An excellent result was one with loss of carrying angle of 5°or less, and loss of the range of flexion and extension by 10° or less. A good result was one in which the loss of carrying angle was from 6° to 10° and the loss of flexion and extension was 20°or less. A poor result was one in which the difference in carrying angle was over 100 or the range of flexion and extension was limited by more than 20°.

Radiographic assessment. No radiographic evidence was seen that growth disturbance had been a cause of cubitus varus deformity. Neither was there evidence of recurrence of varus deformity after osteotomy, in that the correction on early postoperative radiographs was Unchanged on late review. Radiographs at review were not very helpful in assessing correction of varus since no control films were taken of the normal side. Loss of correction due to inadequate fixation was, however, evident on films taken soon after operation.

	Infection	Lateral Prominance	Unsightly scar	Nerve Palsy	Loss of Motion	Vascular Complication
Variant 1 (n=6)	0	2	1	2	0	0
Variant 2 (n=14)	0	2	2	2	0	0

Table 6: Complications.

	Excellent	Good	Poor
Variant 1 (n=6)	2 (33.3%)	2 (33.3%)	2 (33.3%)
	Satisfactory 4 (66.7%)		Unsatisfactory 2 (33.3%)
Variant 2 (n=14)	10 (71.4%)	2 (14.3%)	2 (14.3%)
	Satisfactory 12 (85.7%)		Unsatisfactory 2 (14.3%)

Table 7: Operative result.

Overall Results

Table 6&7 shows the number of patients classified as excellent, good, and poor. Using Oppenheim [9] criteria, in Variant I, 2 (33.3%) were classified as excellent, 2 (33.3%) were classified as good, and 2 (33.3%) was classified as poor. In Variant 2, 10 (71.4%) patients were classified as excellent, 2 (14.3%) were classified as good, and 2 (14.2%) were classified as poor. Compared Result V1/V2 with (P valuate = 0.12730) no comparative valuate.

Discussion

Etiology of Cubitus varus

The etiology of cubitus varus deformity remains unclear. Several theories have been considered. Most authors believe that misalignment, rotation or inward tilt of the distal fragment, or both, is the main cause of this deformity. Others have reported that the growth disturbance of the cartilaginous complex at the distal humerus caused by the fracture itself can cause the medial deformity. Kim et al.[12] reported their long-term follow-up of children who developed ligamentous malformations following distal brachial fractures, with radiographic and magnetic resonance imaging findings. Cuboid malformation develops in all patients with this ligament malformation, and although no progression is observed after 3–4 years, it persists into adulthood.

Weiland et al. [13] reported 25% of the tumor's medial deformity in their study series that included patients treated surgically with open reduction with a lateral approach. They concluded that inadequate correction to the medial angle was associated with residual cubitus varus and that the factors contributing to poor reduction were related to surgical technique, in which only the lateral cortex was affected. direct visualization. Several results of different surgical approaches to cubitus varus have been reported in the literature. Smith[14] reported an internal curvature in up to 57% of cases surgically operated with an open-to-intermediate corrector. Lal and Bhan [15] reported this strain rate of 35% on rear approach.

None of our patients lost their reduction during treatment and follow-up. Although anatomical reduction was achieved in all patients with open medial manipulation, class III-A fractures with posterior medial angulation resulted in a statistically significant loss of gill angle ($P < 0.05$). Devnani [16] reported results for 28 children with late presentation of supracondylar humeral fractures. Seven patients with type III-A supracondylar fractures had a curvilinear mass deformity in their series. However, none of their patients had posterior displacement of this deformed side.

Surgical Osteotomy

In our series, all of our patients with medial mass deformity had lateral foreskin fractures secondary to repetitive trauma. The timing of corrective osteotomy remains controversial. Some authors recommend delaying surgery until late puberty to reduce the recurrence rate of malformations. However, Tien et al [17] reported that if the distal humerus muscle is not affected and the distal humerus is uniformly developed, the deformity can be permanently corrected. However, they recommend that when a direct injury occurs, clinicians should always consider the possibility of late recurrence of the deformity after corrective osteotomy. Recently, some authors have recommended correcting the deformity earlier than waiting until the bone is mature, because the deformity does not progress and does not improve with remodeling. In our series, we found better long-term outcomes in the pre-pubertal group than in the post-pubertal group.

Various techniques for corrective osteotomy for cubitus varus have been described, including medial wedge-type osteotomy, palatal osteotomy, stepped osteotomy, and resection. lateral wedge bone. We perform Osteotomy and drill bony holes at the distal humerus without breaking the outer shell of the bone, thus limiting bony protrusion in the humerus. This technique is simple and safe. Hower, comparison of Cerying angle (P valuation = 0.25) and Result (P valuation P = 0.12730) is not comparable; but, Time Operation (P vatuation =0.012845) compare value.

Comparison of functional outcome of previous osteotomy techniques (Table 8)

Table 8 shows the post-operative results of the authors for cubitus varus with different techniques, so it is difficult to compare the results.

No	Osteotomy Technique	Author	Total cases	Results (Oppenheim)			Complication
				Exellent	Good	Poor	
1	Modified French	Bellemor [18]	13	10	3	0	2
2	Step cut	Derosa and Graziano [19]	13	10	3	2	2
3	Pentalateral	Laupattarakesam [20]	58	22	31	5	5
4	Modified step cut	Kim [21]	31	21	7	3	2
5	Dome	Tien [22]	15	10	4	1	2
6	Reverse skep cut	Yun [23]	22	20	2	0	2
7	Dome	Pankai [24]	12	7	5	0	2
8	Modified reserve step cut	PGI [25]	15	9	5	1	0
9	Incomplate Osteotomy and bone holes drilled	Hung (this study)	14	10	2	0	2
10	French's Osteotomy	Hung (this study)	6	2	2	0	2

Table 8: Comparison of functional outcome of previous osteotomy techniques.

The latter technique is the most widely used because it is relatively simple and can simultaneously correct the rotational strain; however, some authors have reported poor outcomes or significant complication rates with use. Its complications include recurrent deformity, lateral capsule protrusion, cosmetically unacceptable scarring, and nerve palsy. Although this technique is capable of restoring the gill angle and preserving elbow motion, some authors have reported that the protrusion of the capsule may lead to poor esthetic results because of the hinge on the case. brain while closing the bony opening effectively shifts the distal segment to the side. In this study, with V1/V2 postoperative results Aesthetic satisfaction: Side protrusion 33.33%/14.26%; scars are not beautiful 16.7%/14.3%. Complications: Muscle paralysis due to treatment 33.3%/14.3%.

Fixation in Osteotomy

Various methods of fixation in osteotomy have been described, including Kirschner wire, Kirschner wire with figure 8 loop, pins, screws, screws with figure 8 ring, plate and fixator external determination [18,19]. We used fixation with a figure 8 wire around the screw head in 10 patients and if necessary, fixation with an added Kirschner wire for stability. We fixed only the Kirschner cross wire for 1 patient. There were no fixed failures in all patients; however, 1 patient in the postpubertal group had a spontaneous recurrent deformity despite adequate correction. The center of rotation of the distal humerus is located in the medial cortex during lateral closed wedge osteotomy. Tension of the internal soft tissue after osteotomy tends to produce a strong internal scoliosis movement that can lead to recurrent deformity or failure of fixation if the osteotomy site is not firmly fixed[36]. Therefore, we believe that complete osteotomy without intact cortical cingulate and with firmer fixation is warranted in near-skeletal or elderly patients. Lateral closed wedge osteotomy of the humerus is a relatively simple and effective procedure to correct prepubertal clavicle deformity, as the lateral condylar protrusion can be corrected. back to create a beautiful appearance.

Our technique of K-wire fixation was modified to increase stability. Both cross-pins were inserted from the lateral side reducing the chance of iatrogenic injury to the ulnar nerve. This configuration provided resistance to both varus and valgus forces at the site of the osteotomy. We believe that additional wiring of the K-wires enhanced the stability of the construct.

Complications Prominence

Additional reports include an unsightly prominence in the lateral capsule, which can be troublesome for patients and their families despite the well-restored gill angle. The protrusion of the outer sleeve is a consequence of not correctly calculating the center of the angular strain. To prevent protrusion of the foreskin, the distal segment can be shifted inward. This translation requires cortical destabilization, thereby increasing the likelihood of destabilization and reduction. Therefore, to fully correct cosmetic deformities, surgery becomes technically more difficult. Dissatisfaction can also stem from an unsightly scar. An unacceptable scar is often associated with a lateral approach. No such correlation was noted in this study. Asking questions directly can result in a higher rate of scar dissatisfaction.

Wong et al. [16] eloquently describe the method of quantifying radiographic lateral projection using LPI, which is a calculation of the amount of bone on the axial side of the humeral axis relative to the width of the distal portion. Although it has been suggested that lateral highlights may change over time, it is not clear that this can be relied upon. There is a significant difference between the clinically observed lateral protrusion rate and the radiographic rate. In this study, standard patient satisfaction scores were not used. Given the high rate of protrusion on the X-ray, it is possible that direct questioning will reveal a higher rate of dissatisfaction. Voss et al [20] note that there is no correlation between the radiographic buoyancy and the patient's response to the question of whether they have a bump on their arm.

Before the child reaches skeletal maturity, bone remodeling will also flatten the lateral border of the humerus, reducing prominence of the lateral condyle. In our series, the difference in reductions between mean postoperative LCPI and mean LCPI at last follow-up in the prepubertal group (36%) was greater than in the postpubertal group (5.4%). All patients in the prepubertal group had excellent long-term outcomes, with the exception of 1 patient who was not adequately corrected intraoperatively. This may be explained by the fact that reconstruction of the ostomy protrusion is more likely to yield better results when the patient is young enough at the time of osteotomy for adult deformity.

Bellemore et al. [18] reported prominence of the foreskin in 6 of 27 cases in their series. Wong et al. [21] reported it in 14 of 22 cases and noted that prominence increased markedly when surgery was performed after the patient was 12 years old. They emphasize that the inward displacement of the distal fragment avoids the creation of capsular convexity in patients with near skeletal maturity. Devnani [16] and Levine et al. [19] also recommend total osteotomy to allow for inward displacement of the distal segment if necessary, thus avoiding the sheath protrusion at the elbow. Some authors have reported that palatal osteotomy or stepwise osteotomy to avoid lateral capsule protrusion has yielded satisfactory results.

However, two groups of investigators reported that a unilateral closed wedge osteotomy could well correct the medial cubitus varus without leaving a significant capsular protrusion or unsightly scarring and yielding excellent results. great results in children young enough to be remodelled. Our technique with uncomplicated osteotomy and bone drilling to allow inward displacement of the distal fragment. According to this technique, we have 14.3% patients with lateral capsule protrusion (Tables 2&4). The prominence of the outer conduit is emphasized by the post-operative disuse of muscle atrophy. As upper limb function and strength return, the increase in muscle size helps to mask the lateral condyle.

Iatrogenic nerve injury

No nerve injury occurred with the lateral, triceps-sparing approach. Our experience differs from that of Blasier [22], who noted a lower rate of nerve paralysis with posterior triceps separation. When the radial nerve twists around the back of the humerus, it lies between the lateral and medial ends of the triceps. At this point, it is vulnerable to excessive muscle separation. Further, the radial nerve penetrates the lateral intermuscular septum and runs between the brachial muscle and the rotator cuff muscle. In this position, it is vulnerable to extending the proximal part of the triceps approach to the side. Keep the contact of the humerus to a minimum, helping to avoid damage to the radial nerve. The ulnar nerve is protected by careful retraction, taking care to avoid excessive retraction. The ulnar nerve can also be visualized and protected during posterior access. Although ulnar osteotomy is a useful technique to expose the articular surface of the distal humerus, extensive soft tissue mobilization is required to achieve a level suitable for radial osteotomy. it's France. Exposure through olecranon osteotomy, which is rarely performed in this series, is associated with a high incidence of nerve palsy. Both nerves are vulnerable excessive dissection or contraction during each approach. Surgeons must be highly aware of the location and vulnerability of nerves during surgery. We included 4 patients with Iatrogenic ulnar nerve palsy in this study.

The long-term follow-up study by Ippolito et al reported that 10 out of 12 patients (83%) without traumatic physical injury had recurrent varicocele with a mean recurrence rate of 20 degrees [23]. They say many patients are also frustrated with the appearance of their elbows. The present study noted no fully corrected deformity recurrence. Instead, the present study supports the experience of Hernandez and Roach [24] that the recurrence of internal scoliosis is indeed being corrected.

Conclusion

Incomplete distal humeral osteotomy and bone holes drilled for cubitus varus gave results with the results obtained in our study concluding that surgical technique is a safe. and effective for correcting deformities with some mild complications.

Limitations

Limitations of this study included its retrospective design, small sample size, and the lack of comparative osteotomy groups. The lack of preoperative functional assessment was another limitation of this study. However, the management of distal humeral fracture in children has improved. In future studies, more cases should be assessed, and objectivity should be improved by monitoring changes in functional outcomes over time instead of performing one time assessments.

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