

## **Correction of Cubitus Varus by Supracondylar Lateral Closing Wedge Osteotomy**

Issa Sawaqed MD. JBGS, JB (Ortho)\*

**Objective:** The purpose of this study was to report our experience in treating cubitus varus with closing lateral wedge osteotomy.

**Method:** During the period 1996 to 2003, sixteen patients underwent supracondylar osteotomies for the correction of cubitus varus. The results of surgery were assessed in 12 patients. The indication for osteotomy was cubitus varus that was cosmetically unacceptable to either the child or the parents. All patients were treated with excision of an appropriate wedge of bone from the lateral side of the lower humerus and then closing the gap. Physical examinations for the gross carrying angle and the postoperative scar were assessed. Carrying angle and range of movement were used as criteria to categorize the results.

**Results:** Surgery results were excellent in 8, good in 3, and poor in one patient. The most important factor affecting the outcome in our series was the loss of fixation with recurrence of the deformity which occurred in one patient. The follow up ranged from 1 to 5 years, with an average of 2 years (mean 2.3 years).

**Conclusion:** Lateral closing wedge osteotomy is a safe and effective method of correcting cubitus varus deformity in the majority of patients.

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Cubitus varus is the most common long-term complication of supracondylar fracture of the humerus in children. Reported in 58% of patients, its occurrence is higher in fractures originally managed conservatively<sup>1,2</sup>. Although cubitus varus does not cause functional disability, surgery is often required for cosmetic reasons.

Many surgical techniques to correct an established cubitus varus deformity are described in literature<sup>3,4,5</sup>. These include closing wedge, opening wedge, dome pentalateral, and three-dimensional osteotomies<sup>6-13</sup>. The purpose of this study is to report our experience in treating this deformity with closing lateral wedge osteotomy.

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\* Orthopaedic Department  
King Hussein Medical Center  
Amman - Jordan

## **METHOD**

During the period 1996 to 2003, sixteen patients underwent supracondylar osteotomies for the correction of cubitus varus. The indication for osteotomy was cubitus varus that was cosmetically unacceptable to either the child or the parents. All patients were treated with excision of an appropriate wedge of bone from the lateral side of the lower humerus and then closing the gap.

Anteroposterior (AP) radiographs of both elbows were taken with the elbows in full extension and supination. The carrying angle of each elbow was measured. Pre-operative planning included a tracing of the AP radiographs of the injured and uninjured sides. The former was reversed 180° and superimposed on the latter so that the desired correction angle could be estimated precisely.

Surgery was performed via a lateral elbow approach and fixed with two small lateral K-wires.

Postoperatively, all patients had their upper limb immobilized by a long-arm splint with 90° elbow flexion for a 3-week interval, after which they began active ROM exercises. The pins were removed in the clinic at the end of the fifth week.

All the patients were asked to return to the hospital for clinical and radiographic evaluations. Physical examinations for the gross carrying angle and the postoperative scar were assessed. Subjective opinions about the gross appearance of the surgically treated elbow and the postoperative scar were recorded. Anteroposterior and lateral radiographs of the elbow were obtained and the carrying angles were measured. The charts were reviewed and the operative time, blood loss, neurologic complications, wound healing, and pin tract condition were all recorded.

Carrying angle and range of movement were used as criteria to categorize the results. A result was considered excellent when the correction of the varus deformity was within 5° of the contralateral elbow and motion was within 5° of the preoperative flexion and rotation arcs (Fig 2). A good result meant that the corrected elbow was in a valgus position and motion was within 10° of the preoperative motion arcs. A poor result was assigned to any case with a residual varus deformity and loss of more than 10° of preoperative motion arcs.

Clinical and radiographic assessments of the upper extremities of patients were performed before surgery. Complaints of cosmesis, range of motion (ROM), pain, and loss of muscle power were all assessed routinely.

## **RESULT**

Cosmetic appearance was the major concern in all patients for surgical correction. There was no history of pain, stiffness, weakness, or functional limitation of motion in any of the operated patients. The pre-operative range of movement of the involved elbow was normal in five patients. Four patients had 10°-15° hyperextension of the elbow. Three patients had flexion and/or extension lag of 10-20°.

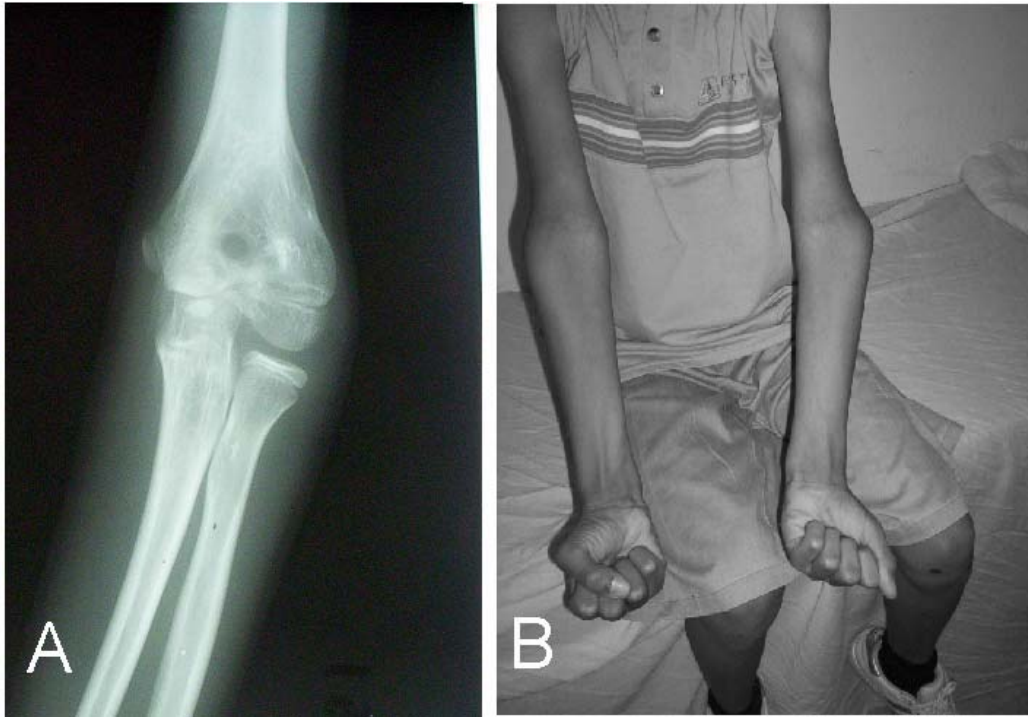
Pre-operative carrying angles of the cubitus varus deformity ranged from  $-20^{\circ}$  to  $-34^{\circ}$ , with an average of  $-27.4^{\circ}$ . All the lateral closing wedge osteotomies were done smoothly. The operative time ranged from 30 minutes to 58 minutes, with an average of 46 minutes. Intra-operative blood loss was an average of 50 mL. No postoperative nerve palsy occurred. Three patients were given oral antibiotics for superficial pin tract infection, but no pin had to be removed before union of the osteotomy. In all 12 patients, correction of the deformity was maintained well through the healing stage. No loosening of fixation or loss of obtained correction had occurred, and no revision surgery was needed. Osteotomies had healed uneventfully by the fifth postoperative week and full ROM of the elbow was achieved within 2 months after surgery.

The postoperative carrying angle measured at follow up ranged from  $-5^{\circ}$  to  $16^{\circ}$  valgus with an average of  $10.7^{\circ}$  valgus. The patients were satisfied with the cosmetic outcome except for one who complained about the operative scar with good correction of the deformity. Categorizing these results, 8 were excellent, three good, and one poor result. The most important factor affecting the outcome in our series was the loss of fixation with recurrence of the deformity, which occurred in one patient.

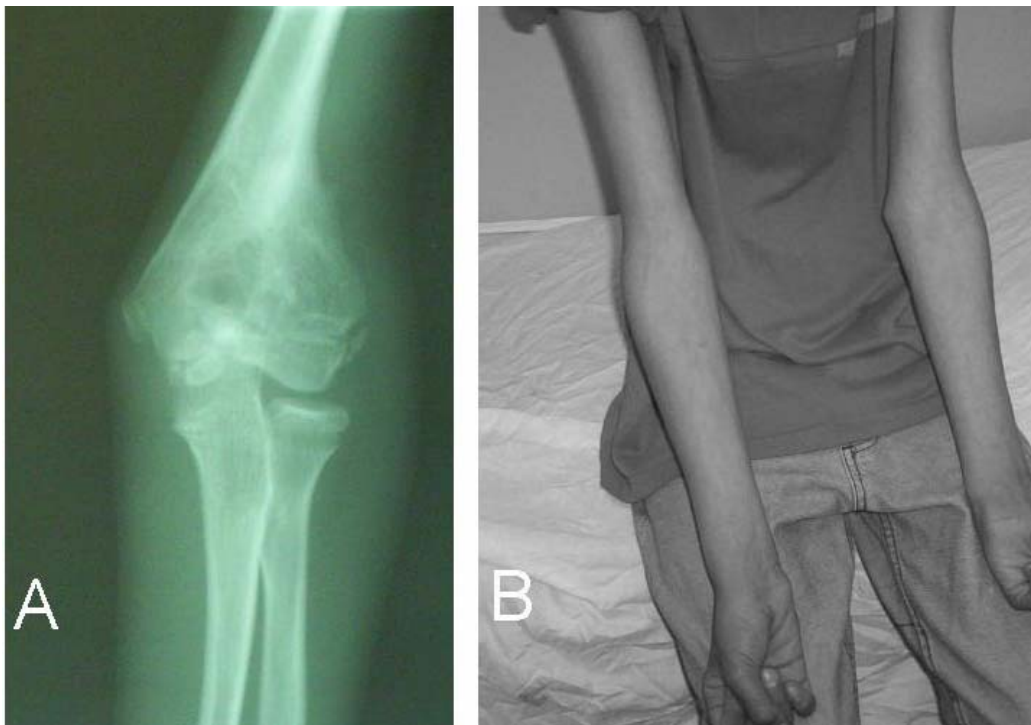
The results of surgery were assessed in 12 patients (Table1). Four patients were lost to follow-up. There were seven boys and five girls. Their ages at operation ranged from 7 to 14 years (mean, 10.4 years). The average interval between the injury and the corrective supracondylar osteotomy was 3.3 years (range, 2-8 years). Right-elbow injuries occurred in five cases, and in the remaining seven cases injury was to the left elbow. The follow-up period ranged from 1 to 5 years (mean, 2.5 years). All fractures were caused by accidental falls on the outstretched arm.

**Table 1: Patients Data**

Patient No	Age (yrs)	Sex	Time from fracture to operation (months)	Duration of follow-up(months)	Carrying angle (deg)			Range of motion (deg)				Result
					Pre-op	Follow-up	Normal	Pre-operative Extension /Flexion		Postoperative Extension/ Flexion		
1	11	M	36	48	-26	13	15	5	130	5	125	Excellent
2	9	M	24	14	-22	8	12	10	135	15	135	Excellent
3	12	F	32	24	-28	14	15	-5	130	-5	130	Excellent
4	13	M	40	36	-34	7	15	0	140	5	135	Good
5	7	M	26	16	-24	16	13	-10	125	-5	125	Excellent
6	10	F	48	36	-28	8	14	10	135	5	130	Good
7	9	M	30	48	-32	10	16	5	135	10	135	Good
8	14	F	96	22	-30	14	12	-20	125	-15	120	Excellent
9	10	M	48	60	-20	16	15	10	135	15	130	Excellent
10	11	M	28	18	-29	-5	12	15	135	15	130	Poor
11	8	F	32	20	-26	12	16	-10	135	-5	130	Excellent
12	11	F	36	32	-30	15	12	5	135	0	140	Excellent
Average	10.4		39.7	31.2	-27.4	10.7	13.9	1.2	132.9	3.3	130.4	



**FIG. 1. A:** Preoperative anteroposterior radiograph of 9-year-old boy demonstrates left-sided cubitus varus deformity of 22°. **B:** Preoperative clinical appearance.



**FIG. 2. A:** Postoperative anteroposterior radiograph of the same patient 2 years after corrective surgery **B:** Postoperative clinical appearance which was rated as an excellent result.

## DISCUSSION

Various osteotomies and fixation modalities have been described for the correction of cubitus varus deformity secondary to elbow fractures. The lateral closing wedge osteotomies and the dome osteotomies have shown good success rates, albeit with some problems<sup>14,15</sup>.

Wong et al reported a poor cosmetic appearance of the elbow in many patients because of bulging of the lateral epicondyle, which was more prominent if there was atrophy of the flexor muscles of the forearm<sup>16</sup>. More recently, Voss et al. claimed that no patient in their series was disturbed by the cosmetic appearance of the lateral step-off, although many were aware of its presence<sup>17</sup>. In our series, 11 out of twelve (92%) patients were satisfied with the cosmetic appearance of the operated-on elbow.

The tendency to form an unsightly scar is reported to be due to direct crossing of the Langer skin lines by the standard longitudinal incision<sup>14</sup>. A hypertrophic scar was observed in only one patient.

Although rotation of the humerus may be ugly, the rotational deformity without any other deformity, contrary to some reports, cannot be cubitus varus or prominence of the lateral condyle, and such a deformity would be easily compensated for by a rotation of the shoulder joints<sup>18</sup>.

Neurapraxia is one of the postoperative complications of the lateral closing wedge osteotomy<sup>8-14</sup>. The nerve palsy is caused mainly by the pins used to stabilize the osteotomy. Fortunately, there was no postoperative nerve palsy seen in our series.

Our study considered patient satisfaction as well as clinical assessment in evaluating the results of lateral closing osteotomy. Our results demonstrate that a lateral closing-wedge osteotomy can achieve a good correction of cubitus varus without unsightly scar in the majority of patients. Eleven out of twelve (92%) in our series had excellent and good results. The only poor result was due to fixation failure, which occurred in one patient.

## CONCLUSION

**Lateral closing wedge osteotomy is a safe and effective method of correcting cubitus varus deformity in the majority of patients.**

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