

Dome osteotomy for cubitus varus in children

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In 11 children, varus deformity of the elbow after supracondylar or transcondylar fractures was corrected with a dome osteotomy. The indication was usually cosmetic. The patients were followed for 5 years. The correction was satisfactory in all the cases, and there was no serious complication.

Cubitus varus deformity is not a functional problem, but it may become so disfiguring that correction is indicated (Carlson et al. 1982, King and Sector 1951, French 1959, Amspacher and Messenbaugh 1964, Langenskiöld and Kivilaakso 1967).

The wedge osteotomy with some modifications (Carlson 1982, Labelle 1982, Yamamoto et al. 1985, So et al. 1985, Oppenheim et al. 1984) has been commonly used, but the cosmetic result has not always been satisfactory. The dome osteotomy was initially mentioned by Tachdjian (1972) without giving details, followed by Higaki and Ikuta (1982) who reported in Japanese. We have performed this osteotomy using a new fixation and guiding device for better alignment and improved cosmetic result.

Patients and methods

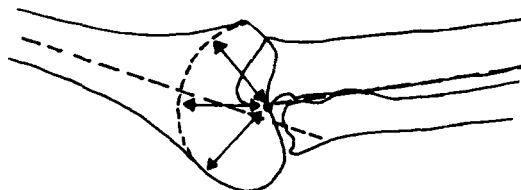
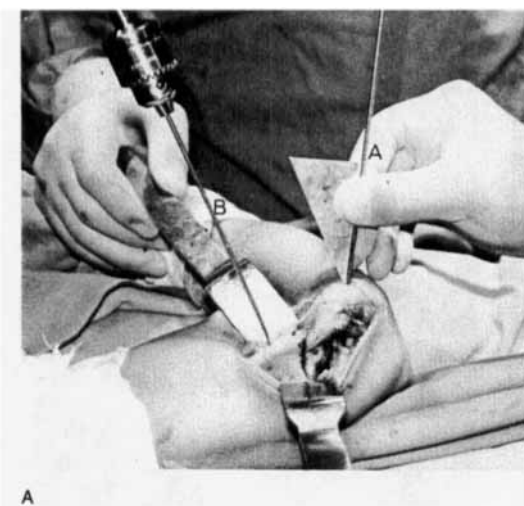
Nine boys and 2 girls with a cubitus varus deformity after supracondylar or transcondylar fracture of the humerus were operated on by dome osteotomy 4 (0.5-6) years after the injury. Their ages ranged from 5-14 years at the time of operation,

and they were followed for 5 (3-9) years. The loss of carrying angle, i.e., the angle between the long axis of the humerus and the midline of the forearm was measured in full extension and supination with a goniometer. Radiographically, the humeral-elbow-wrist angle was measured according to Oppenheim et al. (1984). The varus deformity was 31° (18-45°; Table 1). The carrying angle on the normal side was 2-10° of valgus.

At operation a 10-cm S-shaped incision was made on the posterolateral aspect of the elbow. The ulnar nerve was first exposed on the medial side and protected with a rubber band. Thereafter, an incision between the triceps and brachioradialis muscles was made, and the triceps tendon was elevated subperiosteally from the tip of the olecranon exposing the lateral border and the posterior surface of the humerus. The humeral condyle was then dissected subperiosteally from all sides. A Kirschner wire was inserted perpendicular to the midline between two condyles and perpendicular to the humeral shaft (Figure 1). A center point was determined on the olecranon 3-5 mm from the tip. From this point the osteotomy line was decided. The osteotomy was performed using an osteotome or an oscillating saw. To hold the distal fragment, Ikuta's fixation device was used (Figure 2). Then, the distally inserted Kirschner wire was rotated medially to correct the varus angle and, if necessary, internally to correct the lateral tilt. After proper correction, both guide wires became parallel to each other. For fixation, two or three crossing Kirschner wires

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B

Figure 1. Operative technique of dome osteotomy.

A. Kirschner wire insertion after measuring the angle of osteotomy by aluminum model.

B. The center of the osteotomy line is about 3–5 mm from the tip of the olecranon, and from that point about 20–30-mm distance is measured for determining the line of osteotomy.

were inserted over the osteotomy (Figure 3). Finally, the guide wires were removed and the wound closed. The elbow was kept at 90° of flexion and immobilized with a plaster cast for 3–4 weeks.

Results

All the osteotomies healed normally and there was no ulnar nerve palsy. The postoperative carrying angle was normal in all the patients except 1 (Table 1), and there was no recurrence of the deformity during the observation time. The radial prominence of the lateral condyle was also markedly reduced, giving better appearance of the arm. In Case 11, about 5 mm of semilunar

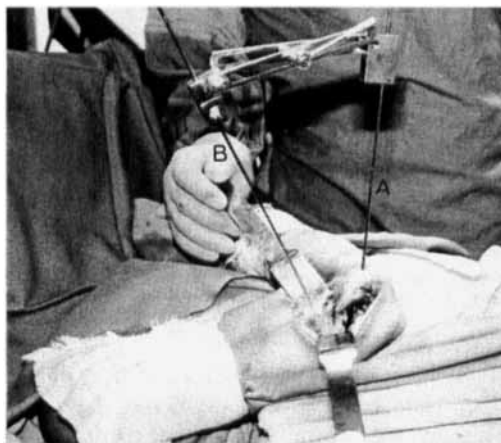


Figure 2. Ikuta fixation device holding the bony fragments after the osteotomy.

Table 1. Dome osteotomy for traumatic cubitus varus. Clinical data

Case	Age	Sex	Side	Duration of injury	Carrying angle		Range of motion		Duration of postop. follow-up (yr)
					Preop. varus	Postop. valgus	Preop	Postop	
1	7	M	L	0.5	18	5	-5-120	10-120	8
2	11	M	R	5	20	5	-15-120	-2-135	9
3	5	M	L	2	43	5	0-110	0-130	6
4	8	M	R	6.5	30	3	0-110	-20-135	10
5	14	M	L	6	25	10	-45-105	-33-122	4
6	11	M	L	6	25	0	-10-135	-5-110	4
7	9	M	L	2.5	22	10	-25-125	-12-130	3
8	11	M	R	5	36	5	0-135	-5-110	3
9	9	F	R	6	25	5	-25-150	-8-140	3
10	8	F	L	1	30	5	-5-105	-7-135	3
11	5	M	R	4	45	8	0-120	-15-135	4



Figure 3. Case 10. An 8-year-old girl with 30° varus angle.

A. Preoperatively.

B. Postoperatively. The varus angle is reduced with good alignment of the arm and forearm.

C. After 3 years. The carrying angle is about 5°. Bony union with reduction of the lateral condylar prominence.

osteotomy was performed for shortening of the lateral condyle because of the severe degree of deformity, which facilitated another 10° of correction. The Ikuta's fixation device proved to be useful during the correction of the deformity and for holding the distal fragment.

Discussion

Medial displacement of the distal fragment (Siris 1939), growth disturbance (Brewster 1964, Palmer 1978), medial tilt (Aitken 1943, D'Ambrosia 1972, King and Sector 1951, Lund-Kristensen and Vibild 1976, Smith 1960), and unreduced inward rotation (French 1959, Madsen 1955) have been implicated as a cause of cubitus varus deformity. Medial tilt is most common, and it is sometimes difficult to prevent (Carlson 1982).

Different procedures for correction of cubitus varus deformity have been advocated. French

(1959) used a lateral closing wedge through a posterior approach, placing a screw in each fragment joined by a wire. This is technically difficult and the fixation is inadequate. King and Sector (1951) advocated a medial approach and an opening wedge osteotomy with a bone graft; and Langenskiöld and Kivlaakso (1967) advocated a lateral closing wedge, but with plate and screw fixation – a difficult technique because of the thin supracondylar ridge. Carlson (1982) used staple fixation after fracturing the medial cortex and predrilling the lateral ridge. Oppenheim et al. (1984) performed wedge osteotomy and fixed the fragments with threaded Steinmann pins, plate and screws; and they had a 24 percent complication rate.

All of these operations aim at correction of only the varus deformity, and the rotational problems are left untreated (Blender 1979, Yamamoto et al. 1985); about 30 percent failure has been recorded (Sweeney 1975). This is because the lateral

tilt of the distal bone fragments can be increased by the rotational deformity (Watson Jones 1982) and the lateral condyle becomes too prominent causing an ugly appearance. Dowd and Hopcroft (1979) reported 85 percent varus deformity due

to medial rotation or tilt of the distal fragment. Therefore, the operative procedure must permit reduction of the internal rotation or of the prominence of the lateral condyle, which has been difficult by other procedures.

References

- Amspacher J C, Messenbaugh J F. Supracondylar osteotomy of the humerus for correction of rotational and angular deformities of the elbow. *South Med J* 1964;57:846-50.
- Bakalim G, Wilppula E. Supracondylar humeral fractures in children. Causes of changes in the carrying angle of the elbow. *Acta Orthop Scand* 1972;43(5):366-74.
- Bender J. Cubitus varus after supracondylar fracture of the humerus in children: can this deformity be prevented? *Reconstr Surg Traumatol* 1979;17:100-6.
- Baumann E. Beiträge zur Kenntnis der Frakturen am Ellbogengelenk. Unter besonderer Berücksichtigung der Spätfolgen. I. Allgemeines und Fractura supracondylarica. *Bruns' Beitr Klin Chir* 1929;146:1-50.
- Beals R K. The normal carrying angle of the elbow. A radiographic study of 422 patients. *Clin Orthop* 1976; (119):194-6.
- Brewster A H, Karp M. Fractures in the region of the elbow. *Surg Gynecol Obstet* 1940;71:643-9.
- Carlson C S Jr, Rosman M A. Cubitus varus: a new and simple technique for correction. *J Pediatr Orthop* 1982;2(2):199-201.
- D'Ambrosia R D. Supracondylar fractures of humerus prevention of cubitus varus. *J Bone Joint Surg (Am)* 1972;54(1):60-6.
- Dowd G S, Hopcroft P W. Varus deformity in supracondylar fractures of the humerus in children. *Injury* 1979;10(4):297-303.
- French P R. Varus deformity of the elbow following supracondylar fractures of the elbow in children. *Lancet* 1959;2:439-41.
- Higaki T, Ikuta Y. The new operation method of the domed osteotomy for 4 children with varus deformity of the elbow joint. *J Jap Ortho* 1982;31:30-5.
- Hoyer A. Treatment of supracondylar fracture of the humerus by skeleton traction in an abduction splint. *J Bone Joint Surg (Am)* 1952;34:623-37.
- King D, Sector C. Bow elbow (cubitus varus). *J Bone Joint Surg (Am)* 1951;33:572-6.
- Langenskiöld A, Kivilaakso R. Varus and valgus deformity of the elbow following supracondylar fracture of the humerus. *Acta Orthop Scand* 1967;38:313-20.
- Labelle H, Bunnell W P, Duhaime M, Poitras B. Cubitus varus deformity following supracondylar fractures of the humerus in children. *J Pediatr Orthop* 1982;2(5):539-46.
- Lund-Kristensen J, Vibild O. Supracondylar fractures of the humerus in children. A follow up with particular reference to late results after severely displaced fractures. *Acta Orthop Scand* 1976;47(4):375-80.
- Mitchell W J, Adams J P. Supracondylar fractures of the humerus in children. *JAMA* 1961;175:573-7.
- Madsen E. Supracondylar fractures in children. *J Bone Joint Surg (Br)* 1955;37:241-5.
- Oppenheim W L, Clader T J, Smith C, Bayer M. Supracondylar humeral osteotomy for traumatic childhood cubitus varus deformity. *Clin Orthop* 1984;(188):34-9.
- Palmer E E, Niemann K M, Vesely D, Armstrong J H. Supracondylar fracture of the humerus in children. *J Bone Joint Surg (Am)* 1978;60(5):653-6.
- Smith L. Deformity following supracondylar fracture of humerus. *J Bone Joint Surg (Am)* 1960;42:235-52.
- Siris I E. Supracondylar fractures of the humerus - 330 cases. *Surg Gynecol Obstet* 1939;68:201.
- Sweeney J G. Osteotomy of the humerus for malunion of supracondylar fractures. *J Bone Joint Surg (Br)* 1975;57:117.
- So Y C, Fang D, Leong J C, Bong S C. Varus deformity following lateral humeral condylar fractures in children. *J Pediatr Orthop* 1985;5(5):569-72.
- Tachdjian M O. *Pediatric Orthopedics*. W.B. Saunders Co, Philadelphia 1972:1566-85.
- Watson-Jones R. *Fractures and joint injuries* (Ed. Wilson J N.). 6th ed. Churchill Livingstone, Edinburgh 1982;2:606.
- Yamamoto I, Ishii S, Usui M, Ogino T, Kaneda K. Cubitus varus deformity following supracondylar fracture of the humerus. A method for measuring rotational deformity. *Clin Orthop* 1985;(201):179-85.

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