Corrective ulnar osteotomy for malunited anterior Monteggia lesions in children

12 patients followed for 1-12 years

Goro Inoue and Kaori Shionoya

We reviewed 12 children, mean 5 (1–12) years, after corrective osteotomy of the ulna, combined with open reduction of the radial head for malunited anterior Monteggia lesions (Bado type I). A simple corrective osteotomy was used in the first 6 patients (group A) and a posterior angular osteotomy was used in the second group of 6 patients (group B). All osteotomies healed uneventfully, but 3 patients had a persistent dislocation of the radial head. Children who had been treated with an angular osteotomy had the best clinical outcome.

Department of Orthopaedic Surgery, Division of Hand Surgery, Nagoya University School of Medicine, 65 Tsurumaicho, Showa-ku, Nagoya 466, Japan. Tel +81 52 744-2957, Fax -2260, E-mail: go-in@ma2.justnet.ne.jp
Submitted 97-04-06. Accepted 97-08-22

Treatment of chronic dislocation of the radial head due to unrecognized Monteggia lesions in children varies from watchful waiting (Stelling and Cote 1956, Salter 1970) to operation. Although some authors have recommended open reduction and reconstruction of the annular ligament (Bell Tawse 1965, Lloyd-Roberts and Bucknill 1977), others claim that osteotomy of the ulna and open reduction of the radial head is the best treatment (Kalamchi 1986, Hirayama et al. 1987, Stoll et al. 1992, Best and Orth 1994). Two types of ulnar osteotomies have been proposed: a simple correction of the malunited ulna (Fowles et al. 1983, Rodgers et al. 1996) and an angular over-correction osteotomy of the ulna (Kalamchi 1986, Hirayama et al. 1987, Stoll et al. 1992, Best and Orth 1994).

We compared the outcome of a simple corrective osteotomy of the ulna with a posterior over-corrective osteotomy of the ulna for malunited anterior Monteggia lesions in children.

Patients and methods

Since 1980, we have treated 15 children with old unrecognized Monteggia fracture-dislocations. Of these, 2 had a lateral dislocation of the radial head (Bado type II). One patient had nonunion of the ulna with a recurrent anterior dislocation following inadequate external fixation. The remaining 12 patients, having a healed, anteriorly bowed ulna with anterior dislocation of the radial head (Bado type I), form the study group. The children were between 3 and 11 years of age and 7 were boys. 8 children had been managed by cast immobilization without reduction of the fracture-dislocation. 1 patient underwent an unsuccessful attempt at open reduction of the radial head with annular ligament repair 10 months after the injury. The remaining 3 patients had primary open reduction and internal fixation of the ulna, with a recurrent anterior dislocation of the radial head.

The interval between injury and corrective osteotomy averaged 16 (2–60) months. At our preoperative examination, 11 children had decreased range of motion with –9° of extension, 112° of flexion, 70° of pronation and 69° of supination, on average. 1 child had a nearly normal range of motion of the elbow but complained of persistent discomfort and valgus instability at the elbow. 2 patients had a posterior interosseous nerve palsy (Table).

The radiohumeral joint was exposed by a posterolateral approach. Reduction was not possible in any position owing to the interposed capsule and annular ligament. After excision of the interposed mass, reduction was done with the forearm in full supination. However, dislocation occurred with the elbow in pronation, because the anterior bow of the ulna acted as a fulcrum, forcing the upper end of the radius forward. Through the same incision, the proximal third of the ulna was exposed and a transverse osteotomy performed. In the first 6 cases, the anterior bow of the ulna was corrected to the normal position (group A),

Table. Clinical and radiological data of the 12 patients

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	6	F	7w	–30/100	70/0	s	+	+	3	0/130	30/70	n	83	F
2	7	F	8m	0/135	30/70	s	+	–	2	0/135	70/30	d	78	P
3	6	M	7w	–20/90	70/60	s	+	+	6	0/130	30/85	s	86	F
4	10	M	60m	–	–	s*	+	–	5	0/140	60/60	n	89	F
5	6	M	3m	0/90	80/20	s	+	–	10	0/135	30/30	n	72	P
6	6	M	19m	0/100	90/90	s	+	+	5	0/140	30/70	n	85	F
7	3	F	3m	0/130	70/90	o	–	–	6	0/145	90/90	n	100	E
8	11	M	3m	–10/115	80/65	o	–	–	3	–5/150	70/70	n	92	G
9	3	M	5m	–20/120	80/80	o	–	–	1	0/140	90/90	n	100	E
10	8	M	42m	0/120	70/90	o	+	–	12	0/130	70/90	d	90	F
11	9	F	24m	0/130	–	o	+	+	2	0/140	60/90	n	94	G
12	9	F	16m	0/110	–60/90	o	–	–	4	0/140	30/100	n	89	F

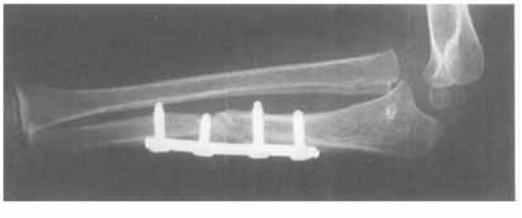
A Age (yr)
B Sex
C Interval between injury and surgery
w week
m month
D, E Preoperative ROM (degree)
D Extension/flexion of the elbow
E Pronation/supination of the forearm
F Ulnar osteotomy
s simple osteotomy
* combined with radius osteotomy
o over-correction osteotomy
G Transcapitellar fixation of the radial head
+ yes, – no
H Annular ligament reconstruction
+ yes, – no
I Period of follow-up (yr)
J, K Postoperative ROM (degree)
J Extension/flexion of the elbow
K Pronation/supination of the forearm
L Postop. position of the radial head
n normal, s subluxation, d dislocation
M Rating points (Letts 1985)
N Clinical results

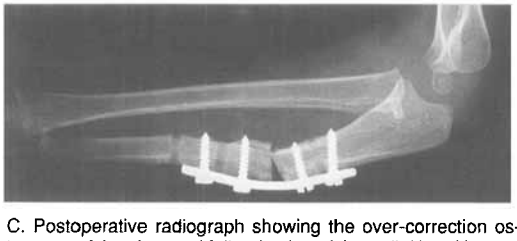
but in the latter 6 cases, the osteotomy was angulated to produce a bow posterior to the ulna (group B). The osteotomy was stabilized, using a plate, K-wires or both. The annular ligament was reconstructed, using triceps fascia in 4 patients. Temporary transcapitellar K-wire fixation of the radial head in the reduced position was performed in 8 patients. The arm was immobilized in a long arm cast, with the elbow in 90° of flexion and the forearm fully supinated for 4 weeks. In 4 patients in group B, the elbow was immobilized, with the forearm in neutral position (Figure 1).

Results

The average follow-up after surgery was 5 (1–12) years. At re-examination, Letts et al.'s (1985) rating system which is a modification of Bruce et al.'s (1974) rating system was used. This involves categories of range of motion (60 points), pain (30 points) and deformity (10 points). In this system, a perfect score is 100 points. A score of 96 to 100 was considered excellent, 91 to 95 good, 81 to 90 fair and less than 80 poor. All osteotomies healed.

Figure 1. Case 7.



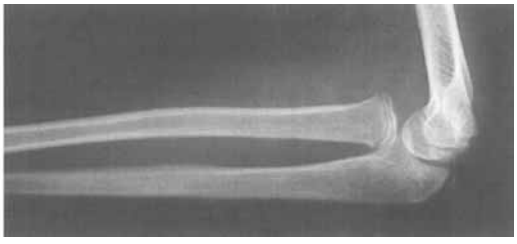


C. Postoperative radiograph showing the over-correction osteotomy of the ulna, and full reduction of the radial head in neutral rotation without pin fixation.

D. 6 years postoperatively, remodeling of the ulna is evident, and the radial head is in normal position.

Figure 2. Case 3.

Postoperative incomplete correction of the osteotomy with a residual anterior bow of the ulna. The radial head is fixed in the reduced position by a transcapitellar K-wire.



6 years after the operation with residual subluxation of the radial head.

Ulna corrected to normal position

There were 4 fair and 2 poor results. The average total flexion-extension arc of motion measured 136°, almost the same as that of the uninvolved elbow. The average arc of rotation of the forearm measured 113°, two thirds of that of the other side. Postoperative radiographs revealed recurrent dislocation or subluxation of the radial head in 2 patients, who were rated poor and fair, respectively. 1 of these had an unstable valgus deformity of the elbow. Enlargement of the radial head was found in 1 patient. Case 5 had arthrosis of the radio-humeral joint. This patient had only 60° of rotation of the forearm, despite a concentric reduction and a radial head of nearly normal size.

Ulna overcorrected

There were 2 excellent, 2 good and 2 fair results. The average total flexion–extension arc of motion measured 139°, the same as that of the uninvolved elbow. The average arc of rotation of the forearm measured 153°, 85% of that on the other side. Case 10 had persistent anterior dislocation of the radial head, with mild limitation of elbow motion.

The differences in the clinical results between the two groups were significant ($p < 0.01$, Mann-Whitney U-test).

Discussion

The age of the patient at the time of surgery, time since fracture, and whether the annular ligament is reconstructed or a transfixation pin across the radiocapitellar joint is used, have been proposed as important criteria for the outcome of surgical treatment of chronic Monteggia lesions (Bell Tawse 1965, Salter 1970, Lloyd-Roberts and Bucknill 1977, Stoll et al. 1992). We believe, however, that problems in our earlier cases resulted from inadequate correction of the angulation of the ulna (Figure 2). The interosseous membrane is normally taut in supination and lax in pronation. In pronation, the borders of the radius and ulna are more closely approximated, allowing the interosseous membrane to fold between them (Wiley et al. 1974). After excision of the interposed soft tissues and incomplete correction of the ulnar osteotomy, the radial head can be reduced with anterior pressure and supination of the forearm; however, when the forearm is pronated, the residual anterior bow of the ulna acts as a fulcrum to the radius, forcing the radial head anteriorly. If the radial head is firmly stabilized in position with an annular ligament reconstruction, the deformed ulna acts as a mechanical block to pronation of the forearm. The excessive callus formation and scar tissue around the fracture site may help to cause this phenomenon even if the ulna is corrected adequately. Therefore, we believe that a posterior angular over-correction is better than a simple correction of the anterior bowing of the ulna. The taut interosseous membrane acts as a retaining structure for the radial head even in pronation of the forearm.

The tendency of the radial head to redislocate after open reduction has prompted some surgeons to stabilize it by reconstructing the annular ligament and pinning the head to the capitellum with the forearm fully supinated (Fowles et al. 1983, Stoll et al. 1992, Rodgers et al. 1996). This may lead to a decrease in rotation, especially pronation, of the forearm. We agree with Kalamchi (1986) and Hirayama et al. (1987) that these procedures are unnecessary in most patients with the anterior type of Monteggia lesion because a posterior angulation of the osteotomy alone will secure the reduction. When a stable reduction of the radial head in all positions of the forearm is confirmed after a posterior angular osteotomy of the ulna, immobilization in a long arm cast with the forearm in neutral position is advisable to prevent decreased pronation.

References

Bell Tawse A J S. The treatment of malunited anterior Monteggia fractures in children. J Bone Joint Surg (Br) 1965; 47: 718-23.

Best T N, Orth F A. Management of old unreduced Monteggia fracture dislocations of the elbow in children. J Pediat Orthop 1994; 14: 193-9.

Bruce H E, Harvey J P, Wilson J C. Monteggia fractures. J Bone Joint Surg (Am) 1974; 56: 1563-76.

Fowles J V, Sliman N, Kassab M T. The Monteggia lesions in children: Fracture of the ulna and dislocation of the radial head. J Bone Joint Surg (Am) 1983; 65: 1276-83.

Hirayama T, Takemitsu Y, Yagihara K, Mikita A. Operation for chronic dislocation of the radial head in children. J Bone Joint Surg (Br) 1987; 69: 639-42.

Kalamchi A. Monteggia fracture-dislocation in children. J Bone Joint Surg (Am) 1986; 68: 615-9.

Letts M, Locht R, Wiens J. Monteggia fracture-dislocations in children. J Bone Joint Surg (Br) 1985; 67: 724-7.

Lloyd-Roberts G C, Bucknill T M. Anterior dislocation of the radial head in children. Aetiology, natural history and management. J Bone Joint Surg (Br) 1977; 59: 402-7.

Rodgers W B, Waters P M, Hall J E. Chronic Monteggia lesions in children. J Bone Joint Surg (Am) 1996; 78: 1322-9.

Salter R B. Textbook of disorders and injuries of the musculo-skeletal system. Williams and Wilkins, Baltimore 1970: 427-9.

Stelling F H, Cote R H. Traumatic dislocation of the head of radius in children. J Am Med Ass 1956; 160: 732-6.

Stoll T M, Willis R B, Paterson D C. Treatment of the missed Monteggia fracture in the child. J Bone Joint Surg (Br) 1992; 74: 436-40.

Wiley J J, Pegington J, Horwich J P. Traumatic dislocation of the radius at the elbow. J Bone Joint Surg (Br) 1974; 56: 501-7.