

Lateral Condylar Fractures of the Humerus in Children

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ABSTRACT

Retrospective review of 35 lateral condylar fractures of the humerus in children treated in a regional hospital from December 1993 to June 1997 was carried out to determine the fracture characteristics, degree of displacement, treatment and outcome. Case notes and radiographs were reviewed. Current status was assessed via patient recalls and telephone interviews. The fractures sustained were all closed fractures, with 2 of them classified as Milch Type I and 33 Milch Type II. Of the 35 patients, 16 were treated conservatively while 16 underwent surgery within 4 days. Another 3 patients underwent surgery after failed conservative management. Failed conservative management correlated with degree of displacement ($p < 0.05$). Complications included Kirschner-wire tract infection with osteomyelitis (1) and pressure ulcer caused by fibre glass cast (1). Twenty patients were available for outcome assessment, of which 19 achieved full range of elbow movement. Two patients had mild residual pain. All achieved normal function of the elbow.

INTRODUCTION

Fractures involving the lateral condyle of the humerus in the child (Figure 1) constitute up to one-fifth of fractures of the distal humerus in the immature skeleton. Unlike supracondylar fractures of the humerus, lateral condylar fractures involves the articular surface and the risk of complications is much higher. We reviewed our experience with the treatment of this fracture.

PATIENTS AND METHODS

There were 44 cases referred by or admitted by the Accident and Emergency Department of Toa Payoh Hospital and later Changi General Hospital over a 3 and a 1/2 year period from December 1993 to June 1997. Nine cases were excluded as the clinical follow-up period was less than 6 weeks or the patients did not subsequently undergo treatment or follow-up at the hospital; leaving 35 cases for critical analysis. Case notes and radiographs were reviewed. Information was obtained regarding patient characteristics, fracture characteristics and classification, treatment and outcome. All patients were seen at weekly intervals with radiographs. Conservative management implied application

of a long backslab with the elbow at 90 degrees flexion followed by a fibreglass cast when seen at 1 week in the clinic. The casts were removed when radiographs showed fracture callus formation and stability that was usually at 6 weeks post injury. The elbows were then actively mobilised. For those patients who required open reduction and internal fixation, the standard lateral approach described by Boyd was used. The fracture was reduced and fixed with 2 or 3 smooth Kirschner wires (Figure 2). Perfect anatomical reduction was the aim and the pins were either kept buried beneath the skin or left with one end out of the skin for easy removal once fractures were healed. The pins were mainly kept for about 6 weeks before removal (Figure 3). Current status with regards to range of elbow movement, deformity, pain and function was assessed through case notes, recalls to clinic and through telephone interviews if they are unable to come. Most patients defaulted follow-up after the initial 6 weeks to 2 months of treatment as their parents felt that their child were well and did not bother to keep to the given appointment for review. In all, 20 patients were available for outcome assessments. They were queried about satisfaction of outcome, activities, appearance, motion, pain, and neurological problems. YC So's functional scoring system for fractures of the lateral condyle as given in Table 1 is used⁷. The remaining 16 patients were uncontactable.

RESULTS

There were 35 lateral condylar fractures of the humerus in children treated in the hospital. This averaged 8 cases a year. The ages of the children ranged from 2 to 11 years, with a mean of 5.6 years. There were 20 (57.1%) Chinese, 12 (34.3%) Malays and 1 (2.9%) Indian. Another 2 children were of other races. There were more boys ($n=26$, 74.3%) than girls ($n=9$, 25.7%). Patients were followed up at the outpatient clinic for a duration range of 6 weeks to 87 weeks with a mean 20 weeks.

Fracture Characteristics

For the mechanism of injury, all but one of the fractures was caused by falls. The exception was a fracture caused by a mattress falling onto the elbow. Falls occurred indoors as well as outdoors. All the fractures sustained were closed fractures. Seventeen fractures occurred on the right, 18 fractures on the left. The fractures were classified according to Milch's classification. Two (5.7%) of them were classified as Milch Type I and 33 (94.3%) as Milch Type II. Fracture displacements were assessed by the initial radiographs. Five patients' pre-treatment radiographs were not available for assessment of initial displacement and hence excluded. The distribution of initial displacement is tabulated in Table 2.

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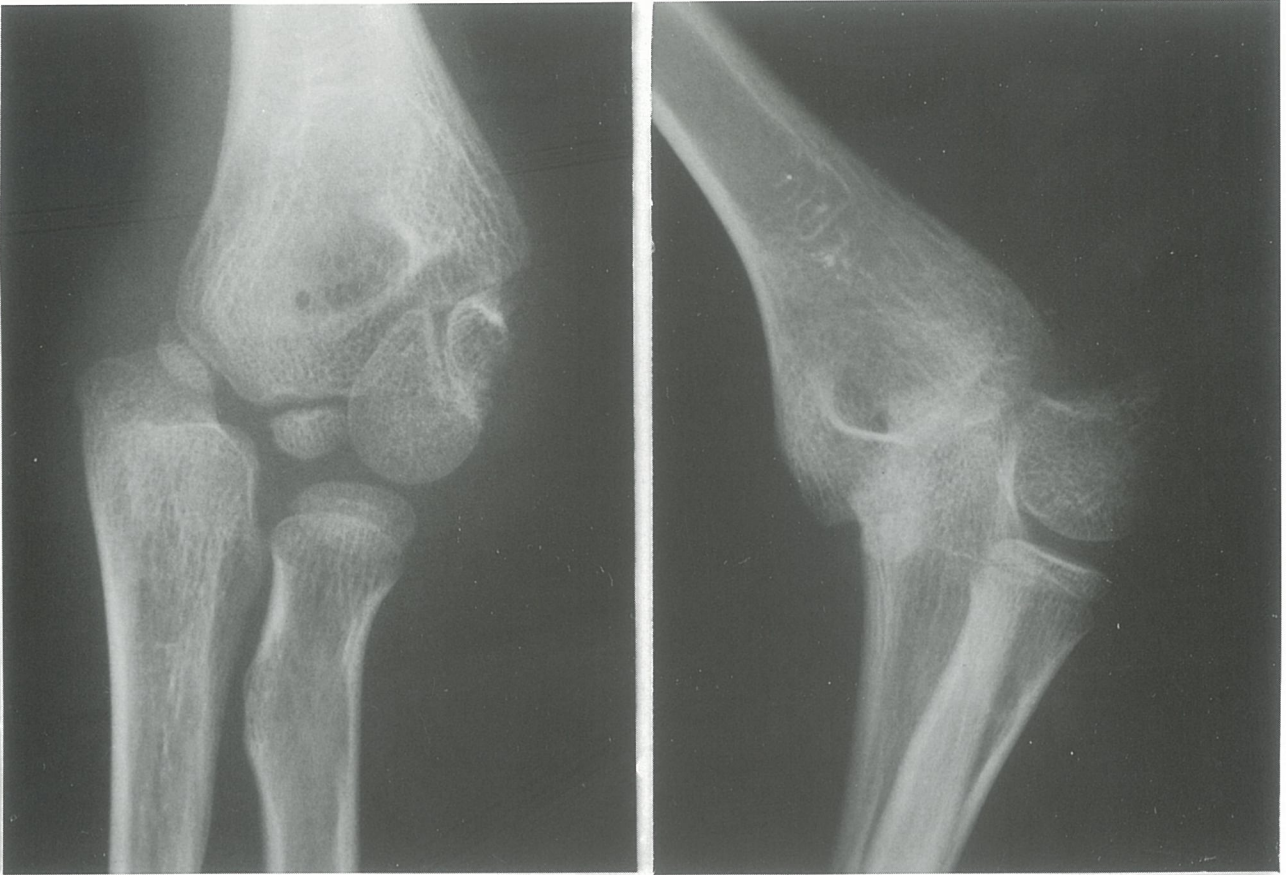


Fig. 1 Displaced lateral condylar fracture

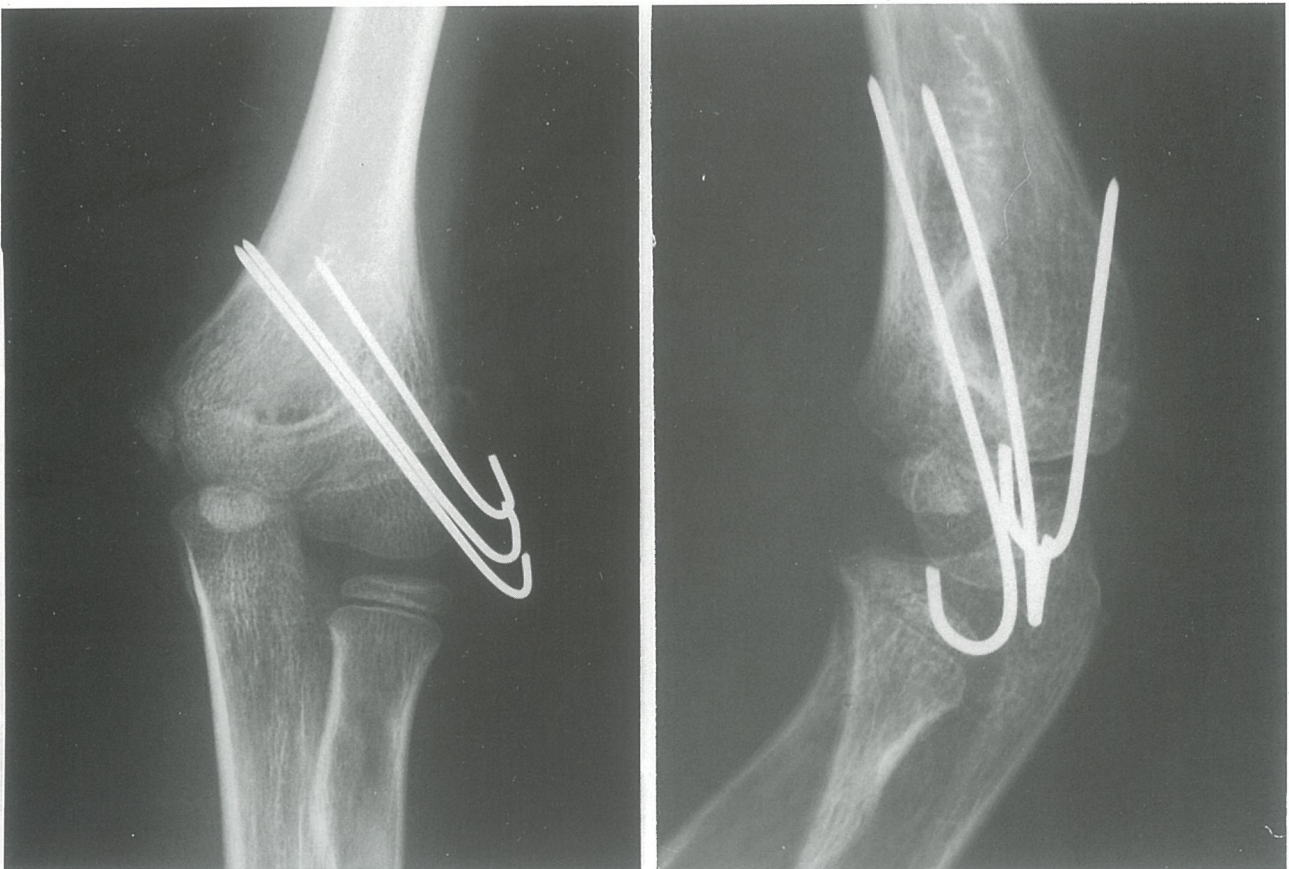


Fig. 2 Open reduction and internal fixation with Kirschner-wires

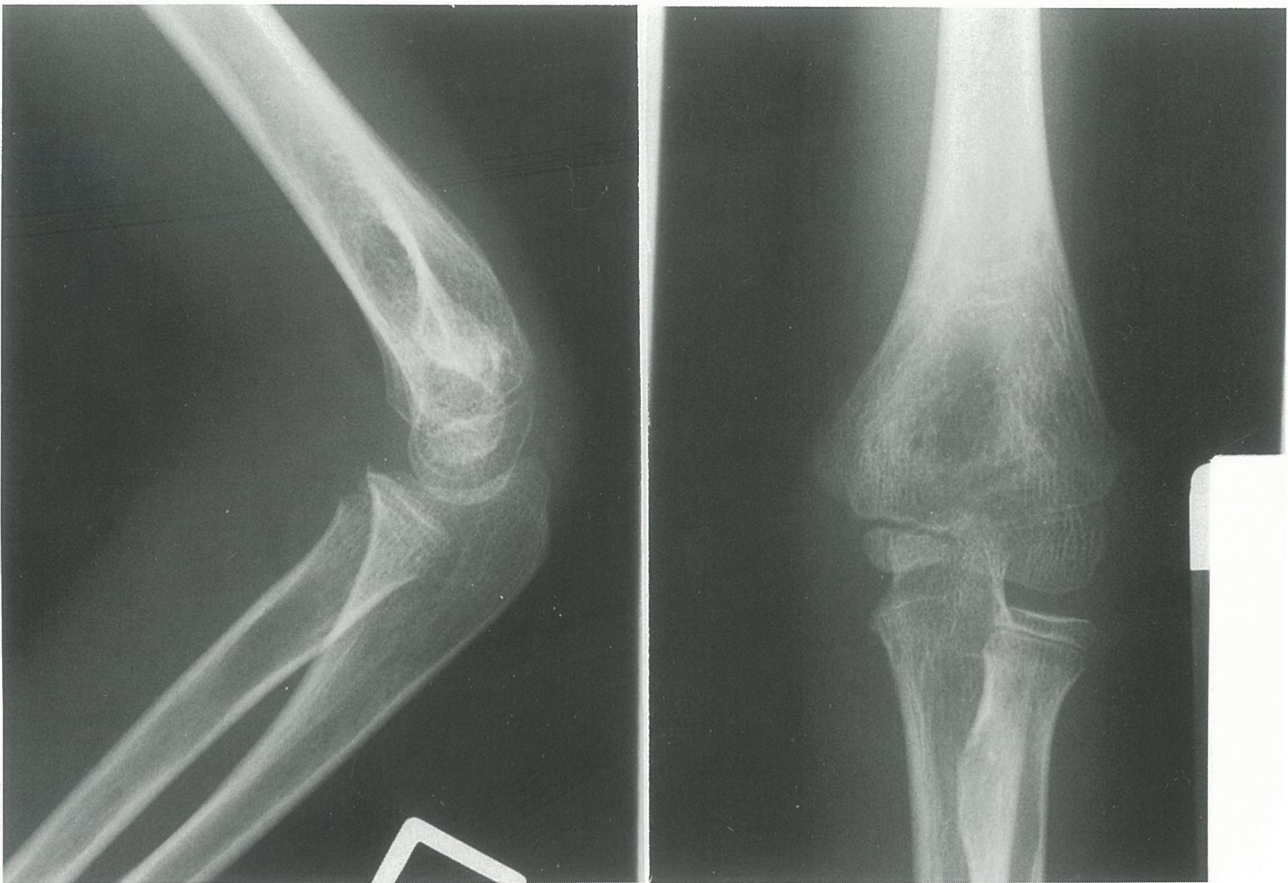


Fig. 3 United lateral condylar fracture (after removal of wires)

Treatment

Nineteen of the fractures were initially treated conservatively while 16 underwent surgery at the first instance. All undisplaced fractures ($n=5$) were treated conservatively successfully. There were 9 cases with fracture of more than 3mm displacement or those that were rotationally displaced. Eight underwent surgical treatment. The remaining patient who had initial fracture displacement of 6mm was advised strongly to undergo surgery but was included into the conservative treatment arm as the parents refused surgery. This patient was treated conservatively in a cast after manipulation and reduction. He was casted for a total of 8 weeks and the fracture eventually malunited after 4 months but the patient had an excellent clinical score. Of the 19 fractures treated conservatively, 3 of the fractures were considered to have failed conservative treatment. Failure of conservative treatment is defined as initial conservative management abandoned for a surgical solution halfway through cast treatment due to further fracture displacement. These included 3 patients who had fracture displacement while on plaster treatment. The 3 subsequently underwent surgery. The initial fracture displacement in these 3 patients were 1mm, 2mm and 3mm respectively. The likelihood of failed conservative treatment correlated with the degree of displacement (Table 3) (Pearson's chi-squared test, $p=0.04$). It is interesting to note that 4 patients consulted traditional Chinese bonesetters before presenting to the hospital. However, there was no incidence of myositis ossificans. Surgery was eventually performed

Table 1. Functional scoring system

Pain and Weakness	Points	Range of Motion	Points
No pain, full elbow strength	3	Full	3
Occasional Mild pain or mild (Grade IV) weakness	2	Loss of up to 20°	2
Troubling pain, severe weakness	1	Loss of exceeding 20°	1

A total score of 6 was excellent; 5 satisfactory and 2 - 3 poor

Table 2. Distribution of fracture displacements ($n=35$)

Displacement (mm)	Frequency (%)
0	5 (14.3)
1	11 (31.4)
2	4 (11.4)
3	1 (2.9)
4	2 (5.7)
6	2 (5.7)
Totally displaced	5 (14.3)
Missing X-rays	5 (14.3)
Total Cases	35 (100)

Table 3. Initial displacement vs success of conservative therapy (n=19)

Displacement (mm)	Conservative treatment only	Immobilisation followed by surgery (failed conservative treatment)
0 (n=5)	5	0
1 (n=10)	9	1
2 (n=2)	1	1
3 (n=1)	0	1
6 (n=1)	1 (refused surgery)	0
Total (n=19)	16	3

for 19 patients (16 at diagnosis and 3 after failed conservative treatment). Surgery was delayed (more than 4 days) after injury in 4 patients (Table 4). They were operated on at intervals of 11 days to 52 days. Reasons for delay included displacement following conservative surgery in 3 patients and dermatitis caused by the initial backslab in 1.

Regarding complications of treatment, there was one patient who had Kirschner wire pin tract infection with osteomyelitis and another patient who had a pressure ulcer caused by an improperly applied deltalite cast. None of the patients had non-union or aseptic necrosis. There were no ulnar nerve problems. Implants were removed at a mean time of 6.7 weeks (range 3-22 weeks). Kirschner wires are removed later if they are buried under the skin.

Outcome Assessment

Twenty (57%) patients were available for outcome assessment. The others were uncontactable by phone or mail. The time of outcome assessment post injury ranged from 12 months to 58 months (mean 26 months). There were 17 excellent results and 3 satisfactory results and no poor results. All the patients contacted had no difficulty with the use of their upper limbs in their activities of daily living. One patient who had pin tract infection and osteomyelitis after surgery developed loss of up to 20 degrees of elbow range of motion. He had cubital varus deformity with loss of carrying angle (0 degrees) compared to the other limb. Two other patients had occasional mild

elbow pain. Four patients developed prominence of the lateral condyle. There was only 1 case of cubital valgus deformity.

DISCUSSION

Initial fracture displacement correlated well with the likelihood of success by conservative methods¹. Foster² reviewed 53 patients with 56 fractures of the lateral humeral condyle in 1985 concluded that closed treatment resulted in satisfactory results if the initial displacement did not exceed 2 mm. In our study, all undisplaced fractures treated conservatively had solid union in good position while 1 out of 10 with 1mm displacement failed conservative treatment and 1 out of 2 with 2mm displacements failed conservative treatment and developed further displacement despite immobilisation in a molded plaster slab. All those with more than 2mm displacement or with rotational displacements failed conservative treatment.

The need for close follow-up is emphasized. It is recommended that percutaneous pinning of non displaced and minimally displaced fractures should be done if close follow-up is not possible². In our practice, patient compliance for close follow-up in the initial 6 weeks to 2 months are not a problem and hence we have not had a need to carry out prophylactic pinning of undisplaced or minimally displaced fractures. In this review, all the undisplaced fractures remained stable and united without problems. If the fragment is displaced, many authors agree that open reduction and internal fixation should be carried

Table 4. Delay in surgery

Case	1	2	3	4
Initial Displacement	2 mm	1 mm	3 mm	Rotated
Initial Management Decision	Conservative	Conservative	Conservative	Surgery (but delayed due to dermatitis)
Further Displacement to Detected on (days after injury)	4 mm	4mm	5 mm	-
Surgery performed (days after injury)	19	14	34	-
Reasons for further delay	Surgery postponed due to URTI	On next operating list	Surgery postponed due to URTI	Due to dermatitis
Outcome	Prominent lateral condyle	Cubital valgus	Prominent lateral condyle	Well

out as early as possible^{3,4}. This is because inadequate reduction is closely related to the development of fishtail deformity.

Jacob⁵ concluded that the results of open reduction more than three weeks after the fracture fare no better than those of no treatment at all. This is because delayed surgery is associated with more dissection and higher risks of damaging the blood supply to the lateral condyle, causing avascular necrosis. In our study 3 patients underwent surgery more than 3 weeks after injury. One had prominent lateral condyle deformity and 1 had cubital valgus deformity. Review of all the radiographs showed no evidence of aseptic necrosis. However, it is recommended that open reduction and internal fixation should be promptly carried out when possible. Most papers report good results in terms of function except for cases in which reduction is grossly inadequate^{5,6}. Patients in our study also have good function. Prominent lateral condyle deformity is the common deformity with lateral condyle fractures. This observation is similar to So et al⁷

from Hong Kong who documented that varus deformity is a common sequela following lateral condyle fractures in children.

CONCLUSION

Lateral condylar fractures of the humerus are not infrequent in our hospital. Undisplaced fractures can be treated conservatively with success. The likelihood of failed conservative treatment increases with increased displacement. Good clinical outcome can be expected if fracture reduction can be maintained till solid union occur. Close follow-up of patient while on conservative treatment is necessary to make an early decision to abandon conservative treatment for open reduction and internal fixation. The outcome is generally good with good function and with the occasional case of decreased range of movement and pain. Parents of patients should be educated on the need for long term follow-up to detect deformities that may present as a late sequela.

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