VALGUS DEFORMITY FOLLOWING SUPRACONDYLAR ELBOW FRACTURES IN CHILDREN

H. DE BOECK, P. DE SMET

We reviewed the cases of 10 patients with cubitus valgus deformity who had a supracondylar elbow fracture during childhood, in order to identify the causes of valgus deformity.

Cubitus valgus deformity occurred in 3 cases because of failure to recognize the deformity at the initial treatment. In 7 patients the deformity was recognized but was insufficiently treated.

In this series there was no evidence of progressive valgus deformity after healing of the fracture. Incomplete correction is the main cause of valgus deformity. It is suggested that, in order to reduce the incidence of valgus deformity following supracondylar elbow fracture, careful analysis of the fracture pattern is necessary and the initial angulation should be reduced anatomically and fixed in a correct manner.

Key words : cubitus valgus ; supracondylar fracture ; elbow.

Mots-clés : cubitus valgus ; fracture supra-condylienne ; coude.

INTRODUCTION

Much has been written about supracondylar elbow fractures in children and their complications. Though 2 types of angular deformities are recognized, valgus deformity has received little attention in the past. The average incidence of varus deformity as reported in the literature is 30% (6, 7, 8). Reports of valgus deformity following supracondylar elbow fractures are rare. The incidence of valgus deformity following supracondylar elbow fracture ranges from 0% to 8.6% (average 3.7%) depending on the author. In most series, patients with varus and valgus deformities have been reported together (1, 2, 3, 4, 8, 9). The present study was undertaken to identify the causes of valgus deformity and to suggest a method of preventing this complication.

PATIENTS AND METHODS

During a retrospective clinical and radiographic review of all 196 cases of supracondylar elbow fractures treated in our institution between 1980 and 1992, we found 10 cases of valgus deformity. Besides, 3 children with a valgus deformity secondary to a supracondylar elbow fracture were referred to us for a second opinion after they had been treated elsewhere. Complete radiographic and clinical data were available for 7 patients treated in our hospital and for the 3 patients treated elsewhere. There were 7 boys and 3 girls in the study. The left side was involved in 8 patients and the right side in 2 patients. The average age at initial injury was 6.7 years ranging from 4.2 years to 9.8 years. All fractures were closed and there were no associated injuries. Three fractures were treated by plaster cast immobilization without reduction. One fracture was treated by closed reduction and plaster cast immobilization for 4 weeks. In 6 patients the fractures were fixed with Kirschner wires after closed reduction. The time between initial trauma and follow-up ranged from 16 months to 11 years, the average being 58 months. The age of the patients at follow-up ranged from 7 years to 17 years (average 11.2 years). At follow-up, the carrying angle of both elbows was measured

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Table I. — Classification of supracondylar elbow fractures

Type I	Undisplaced or minimally displaced requiring no reduction
Type II	Extension type with posterior cortex intact
Type III	Extension type with posterior cortex intact and angulation in the frontal plane
III a	Medial impaction
III b	Lateral impaction
Type IV	Extension type. No cortical contact
IV a	Posteromedial displacement
IV b	Posterolateral displacement
Type V	Flexion type
V a	Anteromedial displacement
V b	Anterolateral displacement

clinically with a goniometer. The goniometer was placed with its axis in the centre of the antecubital fossa. The angle between the long axis of the humerus and a line from the centre of the antecubital fossa to the centre of the wrist was measured with the elbow fully extended and supinated. A difference of more than 5 degrees between the control and the injured elbow was considered as significant. The fractures were classified according to our classification system shown in table I.

RESULTS

The data related to the patients are summarized in table II. The average increase in the carrying angle as compared with the uninjured side was 11.9 degrees (ranging from 6 to 18 degrees).

Table II. — Degree of valgus deformity in 10 patients following a supracondylar elbow fracture

Case	Sex/age (yr-mth)	Side	Initial diagnosis *	Treatment	Valgus deformity (degrees)
1	M 4 2	L	III b	CRPI &	14
2	F 4 5	L	I +	NRPI &&	10
3	F 5 0	R	IV b	CRPP &&&	6
4	M 6 3	L	I +	NRPI	8
5	M 6 7	L	I +	NRPI	8
6	F 7 2	L	IV b	CRPP	14
7	M 7 5	L	IV b	CRPP	15
8	M 7 8	L	IV b	CRPP	18
9	M 8 0	R	V b	CRPP	10
10	M 9 8	L	IV b	CRPP	16

* According to Table I ; + For all three cases the final diagnosis made at follow-up control was Type III b ; & CRPI : closed reduction, plaster immobilization ; && NRPI : no reduction, plaster immobilization ; &&& CRPP : closed reduction, percutaneous pinning.

Five patients with type IV b fractures were all treated by closed reduction and percutaneous pinning (3 with 2 crossed pins, 1 with 2 laterally placed pins and 1 with 3 pins, 2 laterally and 1 medially placed). They all had incomplete reduction, resulting in an average increase of the carrying angle of 13.8° (6-18 degrees). Three patients with an impaction of the lateral condyle (Type III b) were initially considered as having a minimally displaced supracondylar fracture requiring no treatment. They were simply put in a plaster cast without reduction. At follow-up an increase of the carrying angle of respectively 8, 8 and 10 degrees was measured. One patient with a type III b was treated by closed reduction and plaster cast immobilization. A secondary displacement in the cast took place and at follow-up he had an increase of the carrying angle of 14 degrees. One patient had an anterolateral flexion type fracture (Type V b). He was treated by closed reduction and pinning with 2 laterally placed pins and 1 pin placed from the medial side. At follow-up there was a cubitus valgus deformity of 10 degrees.

The average flexion lag for all 10 patients was 5 degrees, none exceeding 12 degrees and the average extension lag was 7 degrees, none exceeding 15 degrees. There was slight limitation of pronation and supination, but no important functional incapacity could be detected. There were no cases of ulnar nerve palsy. None of the patients underwent corrective osteotomy.

DISCUSSION

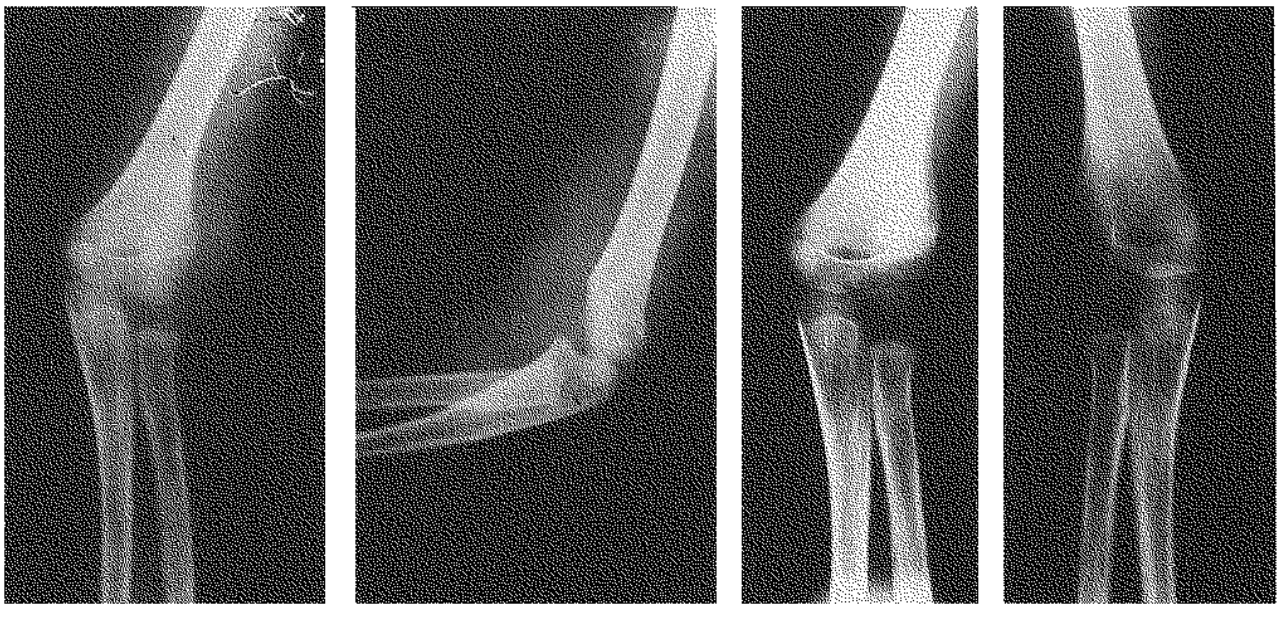
Cubitus varus is by far the most common angular deformity after supracondylar elbow fracture in children (4, 8). Reports of valgus deformity have been scarce. The etiology of angular deformities has been a subject of discussion in the past but nearly all authors now agree that angular deformity in the coronal plane is the result of an uncorrected angulation. Growth disturbance is now no longer considered as the main cause of angular deformity of the carrying angle following supracondylar elbow fractures in children. Cubitus valgus deformity is rare but by no means exceptional after supracondylar elbow fracture. In our series the incidence of cubitus valgus was 5.1%. Cubitus valgus as well as cubitus varus is the result of poor treatment.

The effect of cubitus varus and of cubitus valgus are primarily cosmetic (4). The angulation may be mild, moderate or severe. Cubitus varus produces the greatest degree of cosmetic deformity while cubitus valgus seldom produces an obvious unsatisfactory-appearing elbow (4). None of our patients asked for surgical correction. Tardy ulnar nerve palsy has been reported with cubitus valgus (9). In our series none of patients had ulnar nerve palsy. Langenskiöld and Kivilaakso reported loss of extension with cubitus valgus (9). Although not incapacitating, extension and flexion lag and slight limitation of pronation and supination was noted in our patients. Cubitus valgus seems more prone to giving a functional loss, while the cosmetic effect is much less significant than with cubitus varus (10). The type of the fractures and the method of treatment are the most important factors which determine the final result.

Pure horizontal rotation of the distal fragment will not produce any cosmetic deformity or functional disability. Only horizontal rotation with coronal tilt of the distal fragment produces the typical varus or valgus angulation (4, 8, 10).

In 5 cases the correct diagnosis of a supracondylar fracture with posterolateral displacement (Type IV b) was made but imperfect reduction resulted into valgus angulation.

In a previous study, we had noted cubitus varus angulation following supracondylar elbow frac-



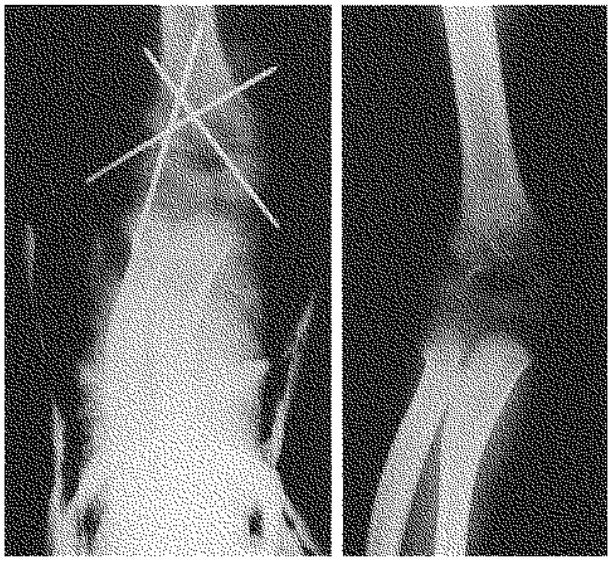
a b c d

Fig. 1a-d. – Radiographs of a 4.5-year-old girl (case 2) with a left supracondylar elbow fracture Type III b (a) (b). Note collapse of the lateral column. Two months later the girl was seen in our hospital. There was a valgus angulation of 10 degrees as compared with the normal right side (c) (d).

tures with impaction of the medial column (5); a similar observation was made here concerning cubitus valgus deformity following collapse of the lateral column (Type III b). This type of fracture is easily underestimated or misdiagnosed as a simple supracondylar fracture requiring no reduction. The angulation becomes visible once the fracture is healed and when the elbow is fully mobile. This type of fracture is a real trap for the unattentive surgeon.

This fracture has no horizontal rotation and looks minimally displaced. Because there is no support of the lateral column, dynamic forces even on an elbow with a normal valgus angle tend to drift the distal fragment into full valgus angulation (fig. 1).

In our series there was one case of valgus deformity following a flexion injury (Type V b). This fracture was treated by closed reduction and pinning. Two pins were placed laterally and 1 pin medially. Careful analysis of this type of fixation disclosed the cause of the deformity. The pin on the medial side was not placed adequately in the medial column. This allowed the medial wall to open up producing a valgus deformity (fig. 2).



a b

Fig. 2a-b. – Radiographs of an eight-year-old boy (case 9) with a Type V b fracture. Radiograph taken after closed reduction and pinning (a) showed that the medial column was insufficiently stabilized which allowed tilting of the distal fragment (b).

Most authors advise to treat fractures with minimal posterolateral displacement by immobilization with the forearm in supination. We agree with this concept on the condition that there is no lateral column impaction, otherwise these fractures tend to angulate and they should therefore be reduced and fixed. No correction with growth is to be expected in the coronal plane.

In our department we treat most displaced suupracondylar elbow fractures in children by closed reduction and percutaneous Kirschner wire fixation with two pins inserted lateral to the olecranon. Open reduction is reserved for fractures with vascular compromise, and for irreducible fractures. Crossed Kirschner wires are used for some indications (unstable fractures, most fractures of the flexion type).

For the treatment of posterolateral displaced fractures, Wilkins proposes to use medial and lateral pins because he feels that 2 lateral pins do not provide adequate fixation (10). We agree with this concept and moreover we recommend that the same principles should be applied for fractures with lateral column impaction. To prevent valgus deformity, after reduction, the medial column should be fixed carefully with a Kirschner wire to prevent tilting and the lateral column should be fixed as well to prevent its collapse. Care should be taken to place the pins well in the center of the supracondylar columns medial and lateral to the supracondylar foramen. By adhering to the above principles, cubitus valgus can virtually be eliminated in supracondylar elbow fractures.

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SAMENVATTING

H. DE BOECK, P. DE SMET. Cubitus valgus na supracondylaire elleboogfracturen bij kinderen.

Tien gevallen van cubitus valgus als gevolg van een supracondylaire elleboogfractuur werden onderzocht om de oorzaak van deze standafwijking te achterhalen. In 3 gevallen werd de asafwijking niet gediagnosticeerd op het ogenblik van het trauma. In 7 gevallen werd de afwijking wel gediagnosticeerd maar onvoldoende gecorrigeerd op het ogenblik van de behandeling van de fractuur. Een secundaire groeistoornis was in geen van de gevallen de oorzaak van de cubitus valgus. De enige mogelijkheid om een asafwijking te voorkomen is een juiste diagnose gevolgd door een correcte behandeling.

RÉSUMÉ

H. DE BOECK, P. DE SMET. Cubitus valgus après fracture supra-condylienne du coude chez l'enfant.

Les auteurs ont recherché les causes d'une déformation en cubitus valgus observée chez 10 enfants après fracture supra-condylienne du coude.
Dans 3 cas, cette déviation n'avait pas été diagnostiquée au moment du traumatisme. Dans les 7 autres cas, elle l'avait été, mais elle fut insuffisamment corrigée lors du traitement. Dans aucun cas le cubitus valgus n'était dû à un trouble de croissance secondaire. Le seul moyen de prévenir cette déviation axiale est d'en faire le diagnostic dès le départ et d'appliquer un traitement correct.