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VARUS AND VALGUS DEFORMITY OF THE ELBOW FOLLOWING SUPRACONDYLAR FRACTURE OF THE HUMERUS

By

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Supracondylar fracture of the humerus is a common injury in children, and in Scandinavian medical literature much attention has been paid to it (*Avellan* 1933, *Sandegård* 1943, *Holmberg* 1945). However, little has been written about the treatment of the unsightly deformities of the elbow which sometimes follow this type of fracture. The functional end-result is uniformly adequate with practically all methods of treatment of the supracondylar fractures of the humerus, but the incidence of carrying—angle change is unnecessarily high (*Smith* 1960).

The most common deformity following supracondylar fracture is cubitus varus, the incidence of which according to the literature varies between 9 and 57 per cent (*Høyer* 1952). Cubitus valgus is less common but more harmful because it carries the risk of progressive palsy of the ulnar nerve (*Gay* and *Love* 1947).

MATERIAL

Between 1958 and 1966 fourteen patients were treated in the Orthopaedic Hospital of the Invalid Foundation for deformity including a change of the carrying angle of the elbow after supracondylar fracture of the humerus. Seven of the patients were boys and seven were girls. They had all been primarily treated elsewhere from the fracture and came to the hospital for correction of the established deformity.

History. The age of the patients at the time of fracture varied between two and eight years. In one case the cause of the fracture was a bicycle accident, in the other cases it was a fall from a height of from a half to two meters.

One patient had been primarily treated by open reduction and six had been conservatively treated in hospital. Four children had been treated in plaster as out-patients, one by a bone-setter and two had had no primary treatment at all.

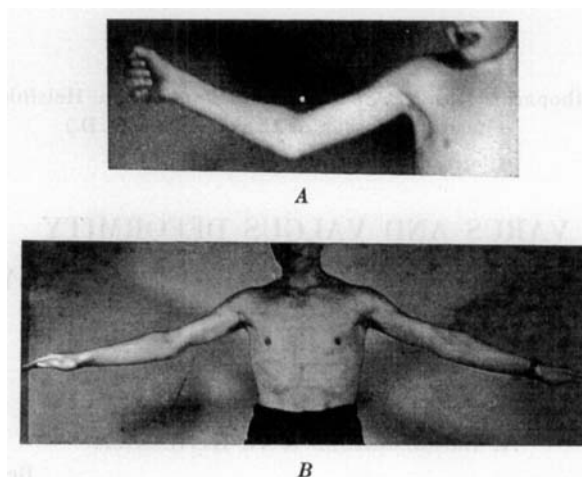


Figure 1 A. Photograph of a boy aged ten years. A supracondylar fracture had been treated nine years previously by open reduction. Valgus 35 degrees and 40 degrees limitation of extension.

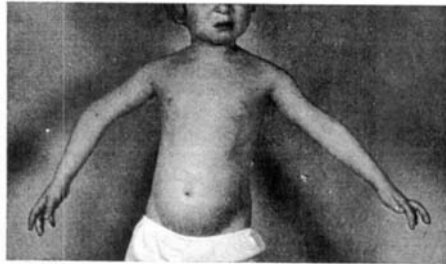
B. The same boy five years after operative correction of deformity. Normal valgus, 20 degrees limitation of extension.

The time which had elapsed between the injury and admission to the hospital for correction of deformity varied from two months to fifteen years. According to the parents, the deformities had mostly been apparent when the mobility of the elbow returned after immobilisation. In no case had gradual progression or gradual correction by growth been observed with certainty.

Condition before correction. The age of the patients on admission to the hospital varied between four and a half and eighteen years. Cubitus valgus (Figure 1) was present in three cases and varied between twenty-five and thirty-five degrees. All these patients had a limitation of extension of twenty to fifty degrees, the rotation movements being slightly impaired. One patient, who had a valgus deformity of twenty-five degrees, had a palsy of the ulnar nerve. This began to appear five years after the injury and had gradually progressed for four years. In all three cases, the valgus deformity was somewhat impairing the function of the limb.

Cubitus varus (Figure 2) was seen in eleven patients, with a deformity of twenty-five to forty degrees. Almost all patients had some limitation of extension and flexion of the elbow and some of them had slight limitation of rotation. Neither the patients nor their parents complained about impaired function of the limb but it was the unsightliness of the deformity that caused the desire for its correction.

Operation. In cubitus varus the distal end of the humerus is exposed subperiosteally through a lateral incision. Proximal to the joint, a wedge-shaped piece of bone is removed (see Figure 3 A.). The angle of the wedge should correspond to the degree of correction from varus deformity aimed at to a normal position of slight



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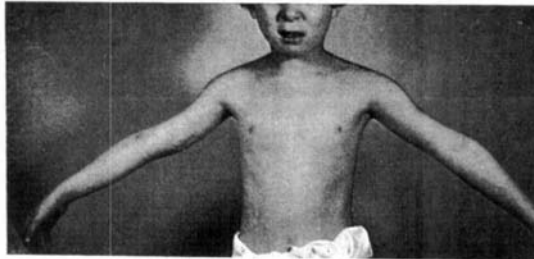


Figure 2 A. Photograph of a girl aged four and a half years. Supracondylar fracture of the humerus treated two years previously in plaster. Varus deformity 30 degrees.

B. The same girl five years later. Corrected to normal position after two operations.

valgus. The cut surfaces of the bone are approximated and a possible deformity of rotation is corrected by rotating the distal fragment outwards. The fixation of the fragments can be suitably achieved by a metal plate which is bent to correspond to the shape of the surface of the bone, and fixed by short screws perforating the lateral cortex only (Figure 3).

The fossa olecrani and the fossa coronoidea should not be penetrated by the screws, and penetration of the epiphyseal cartilage should be avoided in growing individuals. A plaster cast reaching from the fingers to the axilla is applied.

In cubitus valgus, the operation is correspondingly carried out from the medial side and when necessary the ulnar nerve is transposed to the anterior aspect of the elbow.

RESULTS

In the cases of cubitus valgus, a normal position was achieved without reoperation (Figure 4). In the patient with the ulnar palsy, the nerve was transposed anteriorly. After a year the palsy had disappeared and the function of the hand was normal.

In two cases of cubitus varus, a reosteotomy had to be carried out

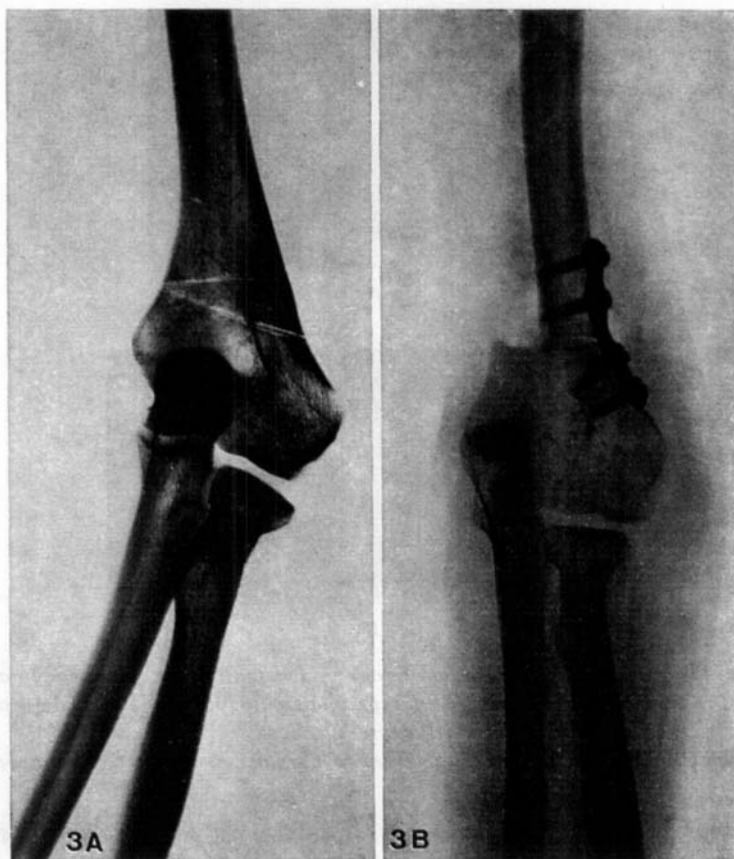


Figure 3 A. Cubitus varus in a girl aged eighteen years. Supracondylar fracture at the age of three years.

B. The same elbow radiographed on the operating table immediately after correction of varus and rotation deformity and fixation by a bent metal plate.

because too much varus was left uncorrected at the first operation. In seven cases the final result of operation was a normal carrying angle, in two cases normal valgus was lacking (Figure 5) and in two cases there was slight varus. In both these, the varus position was less than ten degrees and reoperation was not considered necessary.

After operative correction of the carrying angle, the mobility of the elbow joint remained unchanged or increased. In no case was there decreased range of motion at follow-up examination, not even in the patients who underwent two operations.

In one case, the follow-up time was six months, in two cases one-

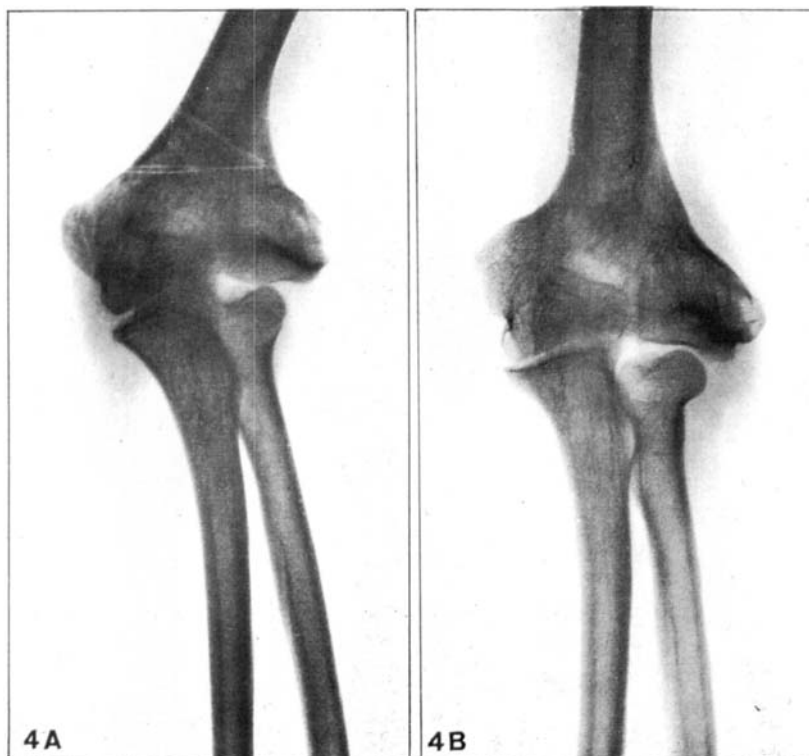


Figure 4 A. Cubitus valgus in a boy aged fourteen years. Valgus 30 degrees, limitation of extension 35 degrees, limitation of supination.
B. The same elbow three years after operative correction of deformity. Normal valgus, limitation of extension decreased to 20 degrees, supination still limited.

and-a-half years, and in the other cases over two years. The average follow-up time was three-and-a-half years.

DISCUSSION

The pathogenesis of the change of the carrying angle of the elbow causing deformity after supracondylar fractures of the humerus has been the subject of discussion. *Madsen* (1956) was of the opinion that the most common cause of cubitus varus is unreduced inward rotation of the distal fragment after fracture. Growth disturbance is frequently blamed as a cause of change in the carrying angle. *Brewster & Karp* (1940) examined eight cases of cubitus varus deformity and found that clinical measurements of the lengths of the outside of the arm exceeded those of the inside by one-quarter of an inch in six cases. They con-

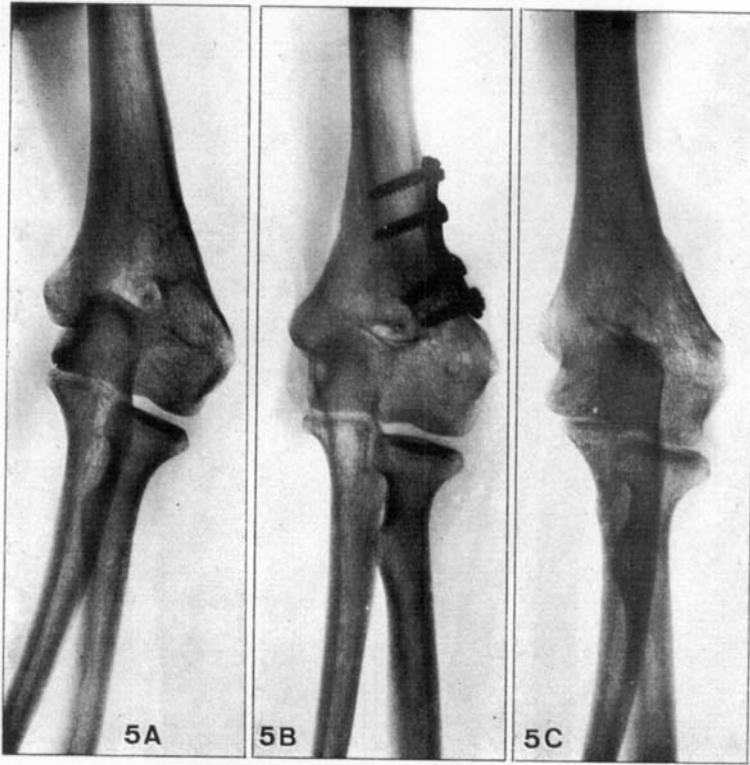


Figure 5 A. Cubitus varus in a girl aged fifteen years. Supracondylar fracture at the age of twelve years. Varus 30 degrees, limitation of flexion 20 degrees. B. The same elbow one year after osteotomy and wedge resection. No varus, but normal valgus is lacking. C. The same elbow four and a half years after correction. Plate and screws removed.

cluded that this had been caused by stimulation of the external epicondylar and capitellar epiphyses. *Smith* (1960) did not consider growth disturbance the cause but thought that change in the carrying angle of the elbow after supracondylar fractures of the humerus is caused by medial or lateral angulation of the distal fragment.

We did not see our patients when the deformity appeared because the primary treatment was given elsewhere. However, in none of these cases was there a definite history of gradual increase of deformity. When correction was achieved, gradual recurrence was not seen in any of the cases although the operation in ten of them was performed during the growth period. Thus our observations do not speak in favour of the idea that these deformities are caused by growth disturbance.

For retaining the position of the fragments after osteotomy and correction, their fixation is important. Thus the operative methods formerly proposed (*King & Secor 1951, French 1959*) imply internal fixation. *Watson-Jones (1955)* did not use internal fixation but applied a plaster cast with the elbow in an extended position. The method described by the present authors seems to ensure the position of the fragments in a plaster cast applied with the elbow flexed to a right angle. Before the plaster cast is applied the degree of correction can be checked in full extension without the risk of changes in the position. With the elbow joint in flexion the degree of correction is almost impossible to estimate. When a varus deformity is corrected, the normal valgus position of the elbow should be taken into account, a fact often easily neglected.

SUMMARY

In three cases of cubitus valgus and eleven cases of cubitus varus appearing after supracondylar fracture of the humerus, the deformity was corrected by wedge resection of the bone and fixation of the fragments by a bent metal plate (Figure 3). In the cubitus valgus cases, a normal position was achieved. Seven of the cubitus varus cases were corrected to a normal degree of valgus, in two cases the normal valgus position was lacking after operation and in two cases slight varus remained. In all cases the mobility of the elbow was found to have remained unchanged or increased at follow-up examination.

RESUME

Dans trois cas de cubitus valgus et dans onze cas de cubitus varus qui se sont produits après fracture supracondylaire de l'humérus, la déformité corrigée par résection en coin de l'os et fixation des fragments par une plaque métallique courbe (Figure 3). Dans les cas de cubitus valgus, une position normale a été obtenue. Sept cas de cubitus varus ont été corrigés à un degré normal valgus; dans deux cas, la position valgus n'a toutefois pas été obtenue et dans deux cas un faible varus a subsisté. Dans tous les cas, la mobilité du coude a été trouvée inchangée ou accrue lors d'un examen complémentaire.

ZUSAMMENFASSUNG

In drei Fällen von Cubitus valgus und elf Fällen von Cubitus varus nach suprakondylärer Fraktur des Humerus wurde die Deformität

durch Keilresektion und Fixation mit einer gebeugten Metallplatte korrigiert (Figure 3). In den Fällen von Cubitus valgus wurde eine normale Stellung erreicht. In sieben Fällen von Cubitus varus wurde eine normale Valgusstellung erlangt, in zwei Fällen fehlte die normale Valgusstellung und in zwei Fällen wurde die Varusstellung nicht ganz vollständig korrigiert. In allen Fällen war die Beweglichkeit des Ellenbogengelenks bei der Nachuntersuchung ebenso gut wie oder besser als vor der Operation.

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