OSTEOCLASIS OF THE UPPER EXTREMITY IN CHILDREN

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In 1940 I published a paper entitled, "Osteoclasis for Supination Deformities in Children, (1) and reported nine cases. Since that time, at the Milwaukee Children's Hospital, osteoclasis has supplanted open operation in the correction of resistant bony pronation and supination deformities in children. Although the technic has proved completely satisfactory in our hands, it is little known in other communities.

In the same year I read a paper before the Chicago Orthopaedic Society (2) suggesting the revival of the suprapectoral rotation osteotomy of the proximal end of the humerus of Vulpius, (3) Spitzy, (4) and others in the treatment of shoulder deformities with limited external rotation following obstetrical trauma. In these cases with brachial palsy and/or epiphyseal injury, in addition to the rotary deformity, there was usually limited active elevation, although passive motion might be free almost to the pivotal position. Active forward elevation was not increased by muscle release operations but was augmented almost degree for degree by angulation apex posteriorly of 40° or more at the site of the rotation osteotomy. I have seen no mention elsewhere of this most important angulation feature (Figure 1).

Since the appearance of the abstract, (2) this method has been used frequently in correcting deformities at both ends of the humerus involving rotation and angulation. In recent years in children, instead of an osteotomy we have performed a drilling osteoclasis which avoids the scar that is so objectionable in females.

Through a puncture wound, multiple 3 mm holes are drilled through the cortex of the bone at the desired level. About three holes can be made in the deep side of the cortex through each of three holes on the near side of it. The bone is then broken manually over a sharp wedge. This is easy at the lower end of the humerus (Fig. 6) but may be difficult at the proximal end due to the poor grip that one obtains on

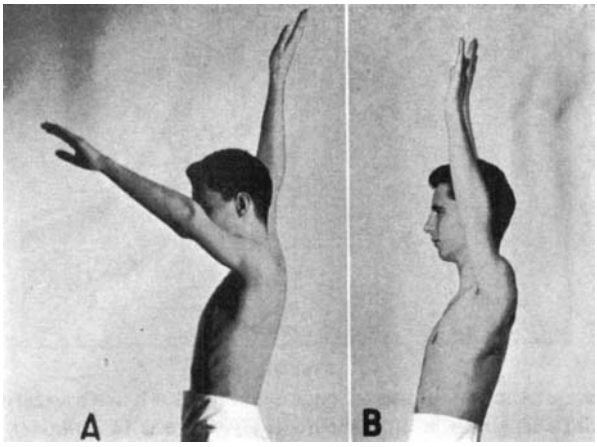

Fig. 1.

Case 1. T.G., age 15 years. (A) February 20, 1961. As the result of an obstetrical shoulder injury, the left arm was short with active forward elevation of only 110°. Backward elevation was increased 10°. Rotation outward was 30° as compared to 60° on the right. Other shoulder motions were normal. Power was good through the limited range. (B) April 7, 1962. Fourteen months after a rotation angulation osteotomy, the range of forward elevation is increased to 180°. Function is excellent. The iatrogenic angular deformity is not disfiguring.

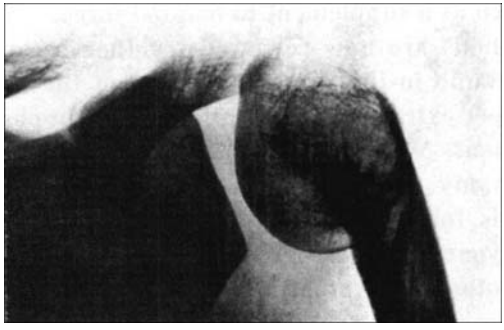

Fig. 2.

Case 1. An anteroposterior x-ray, February 20, 1961, shows a very short left humerus with characteristic deformity. The proximal humeral epiphysis was separated at birth with 120° rotary displacement of the epiphyseal fragment so that the articular surface came to lie caudad. The clear zone of the articular cartilage is seen extending up to the point of bony union on the lateral side.

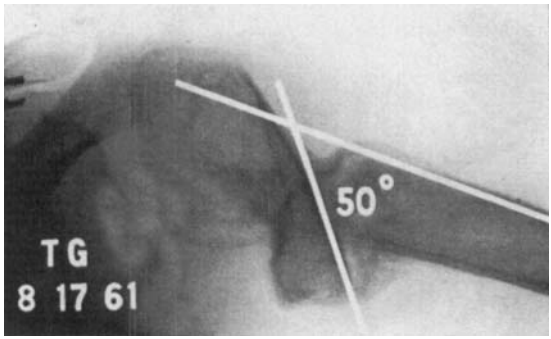

Fig. 3.

Case 1. An x-ray of the left humerus on August 17, 1961, with external rotation to show the angular correction of 50° by osteotomy. He was in a plaster spika (Fig. 4) for eight weeks. Healing was rapid. Improved function in rotation and forward elevation was dramatic. See figure 1B.

the proximal fragment. It is important at the shoulder to make an adequate number of drill holes to weaken the bone.

It has not been necessary to drill the radius for a forearm osteoclasis but it might be a desirable preliminary in an adolescent with very strong bone. The leverage is so good at mid-forearm that osteoclasis is easy when the bones are atrophic. In case seven of the original publication, (1) drilling could have been used to obviate the need for a Thomas wrench as a supplement to manual force.

The two methods are now reviewed together because they have a common background in that closed fractures of the shafts of the long bones of the upper extremities heal satisfactorily in children even with gross displacement. With non-operative treatment a non-union has not occurred in my experience. *Open reduction* of fractures of the distal forearm is followed by non-union in a significant number of cases, even in young children. We have encountered delayed union with open osteotomy of forearm bones, whereas healing has been prompt in all closed osteoclases of the forearm and humerus.

After twenty-two years of further experience with these methods I have no retractions to make. I urge that in children all such procedures be performed closed with drilling if necessary. The only detail of technic that requires discussion is the position of immobilization after osteoclasis.

In treating the characteristic internal rotation deformity of the arm with failure of elevation, the distal fragment must be rotated to a

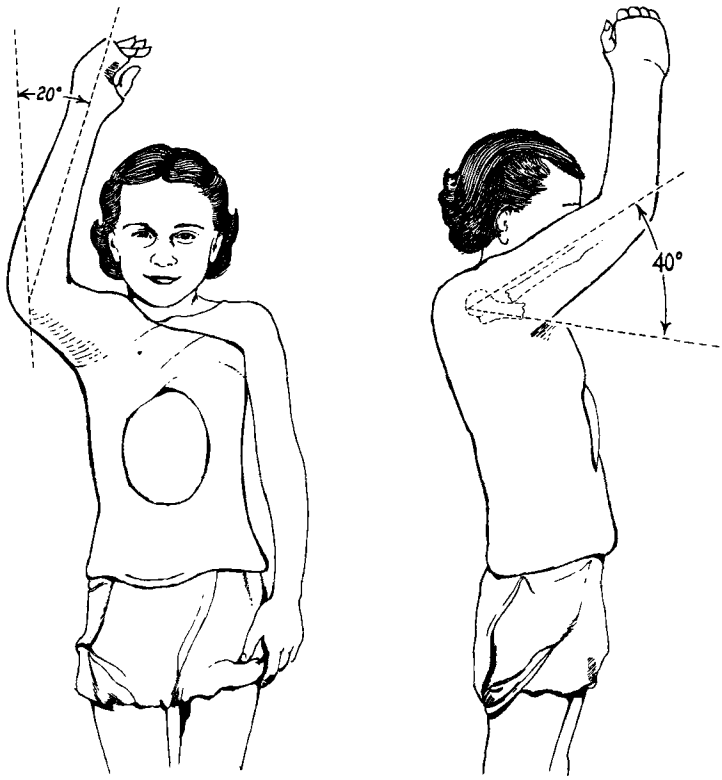

Fig. 4.

The proper position of the arm in a post-operative plaster spika maintains correction of the internal rotation, forward elevation deformity following a drilling osteoclasis of the proximal third of the humerus. With the elbow elevated to the level of the chin, neutral rotation is not at zero but at 20° or more of internal rotation. Increased forward elevation is obtained by angulating the fragments.

functionally neutral position and angulated upward until the elbow is as high as the chin in a young child. One can angulate apex posterior 50° without obvious deformity. The fragments may be boldly displaced with complete disregard for anatomy. Every degree of angulation is an added degree of forward elevation.

In the forward elevated position, one must rotate the distal fragment externally only to the salute position of O°–20° (Fig. 4). The proximal fragment will revert toward its previous position of internal rotation. If more than O°-20° of external rotation is obtained, the arm will likely be grotesquely externally rotated when it is brought down to the side.

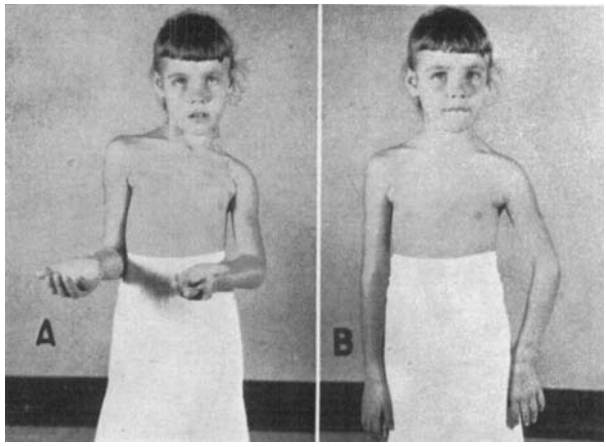

Fig. 5.

Case 2. K.B. At age six this girl had the residuals of an obstetrical trauma to the left upper extremity. It was completely flail at birth. She was left with no external rotation at the left shoulder (A) while other shoulder motions were normal. Extension of the left elbow was reduced 25° (B) and flexion increased 10°. There was an increase in the carrying angle.

Fig. 6.

Case 2. K.B. The original x-rays were not remarkable and are not reproduced. These anteroposterior and lateral views were made six weeks after a drilling osteoclasis on November 13, 1959. The humerus was broken through completely above the condyles and the distal fragment was rotated outward 20°, extended an additional 25° and adducted to correct the excessive valgus. In this position, with forward elevation at the shoulder of only 45°, a plaster spika was applied for three weeks and a collar and cuff for two weeks.

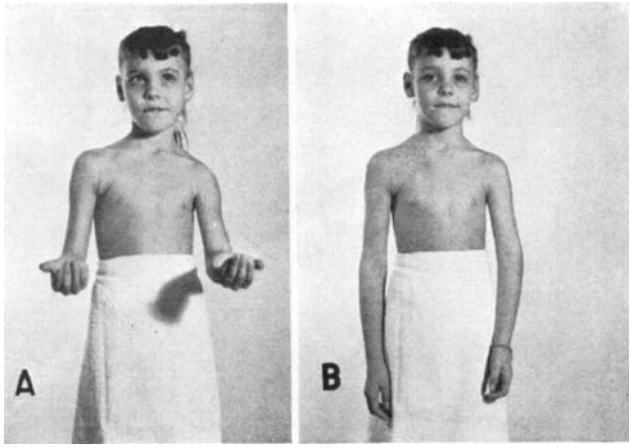

Fig. 7.

Case 2. Three months after the operation the rotation deformity was well corrected (A). The carrying angle was normal and extension at the elbow increased (B). Fifteen degrees of limitation of flexion was not objectionable. Two years later there was no obvious deformity nor disability although limitation of motion persisted.

It was necessary in one child to operate a second time to restore some internal rotation.

Maximal forward elevation is desirable, but one must not exceed prudent limits. In one boy, age 10, there was a transcient radial nerve palsy from excessive distraction. The fragments were completely displaced and held sharply angulated in a cast with fixed skeletal traction for five weeks. (5) The shoulder that had only 45° of active forward elevation prior to operation could be elevated to 100° after the osteotomy healed.

Osteoclasis of the forearm should be done with the bones in supination and the dorsum of the forearm in contact with the wedge. Angulation as much as 90° should be produced and vigorously reversed in order to break the bones through completely. Extreme pronation and supination deformities in young children have a strong tendency to recur. A repetition of the procedure has been necessary in several cases. The cast is applied with the forearm completely overcorrected. If there is apprehension about the circulation, there may be less than full correction in the first cast. A week or two later, the forearm is manipulated again under anesthesia and a cast rapplied with further rotation. The tendency is toward under correction.

The forearm is immobilized so that it looks straight. The position

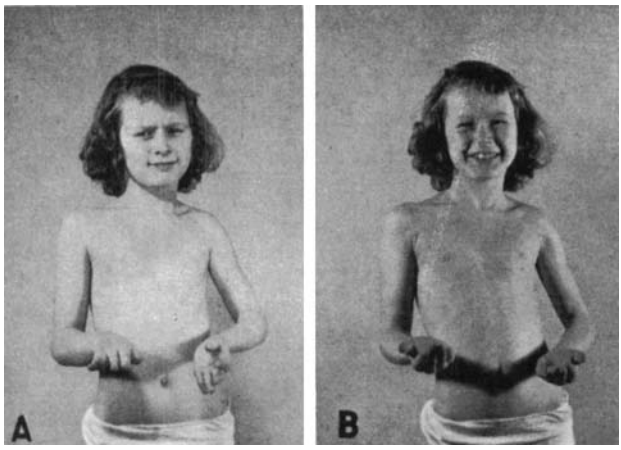

Fig. 8.

Case 3. S.L. At age nine this girl could pronate the left forearm to only 0–80° as a result of obstetrical trauma (A) Supination was normal (B). With non-operative treatment the function of the left shoulder had improved greatly. There was a right right myogenic wry neck which was corrected.

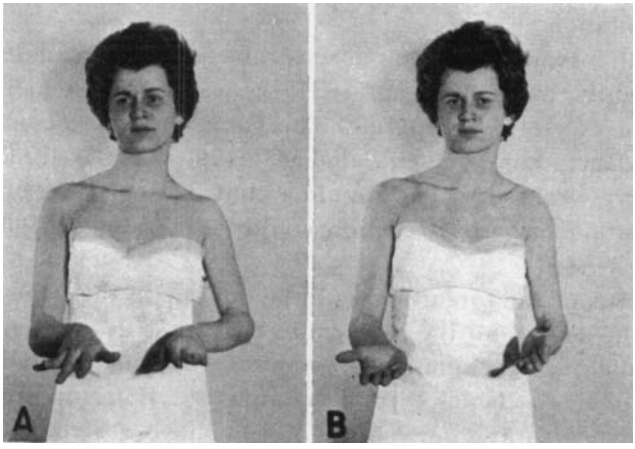

Fig. 9.

Case 3. Ten years after the osteoclasis, the patient could still pronate to 60° on the left Supination was only 30° (B) but this was of less significance. Function of the left shoulder was satisfactory. A rotation angulation osteotomy of the proximal third of the humerus had not been necessary.

of the bone ends is of no importance. Complete displacement of the bones is usually necessary to maintain the desired position.

No significant complication has been encountered. The X-ray will frighten the uninitated, but healing is prompt and molding soon takes care of the irregularities in children with a skeletal age under 11 in girls, or 13 in boys.

The range of pronation and supination is often *increased* rather than diminished after healing is complete (Fig. 9).

In this age of more and more elaborate open operations, it is a pleasure to recommend an old and tried orthopaedic method that is relatively simple with no likelihood of complication and one that may be applicable in a variety of situations. Particularly gratifying was case two (Figs. 5–7) in which the osteoclasis was done at the lower end of the humerus. It accomplished not only correction of a vicious rotation deformity but changed the arc of motion at the elbow to a more useful and cosmetically desirable one. After osteoclasis, the girl could use her elbow with good function and without obvious deformity.

I am glad to review these two procedures and recommend them again in a memorial to two great orthopaedic surgeons whose sophistication and wide experience have not alienated them from the simple procedures that are so satisfactory and safe in the correction of deformities of childhood.

SUMMARY

1. Osteoclasis is preferable to open operation in the correction of fixed rotation deformities of the forearm in children.

2. Drilling osteoclasis or osteotomy of the upper third of the humerus is used, not only to correct internal rotation deformity, but also to increase active forward elevation.

3. The tendency is to overcorrect rotation of the humerus and undercorrect that of the forearm.

4. In old obstetrical shoulder injuries, an increase of 40° or more of active forward flexion can be obtained by angulating the fragments apex posterior.

5. At the lower end of the humerus, persistent angulation into flexion and valgus or varus of the elbow may corrected simultaneously with a rotation deformity.

RESUME

1. Il faut préférer l'ostéoclasie à l'opération ouverte pour la correction de déformités fixes de rotation de l'avant-bras chez les enfants.

2. Une ostéoclasie ou ostéetomie par forage dans le tiers supérieur de l'humérus est utilisée non seulement pour corriger la déformité de rotation interne, mais aussi pour augmenter l'élévation active en avant.

3. La tendance doit être de surcorriger la rotation de l'humérus et de sous-corriger celle de l'avant-bras.

4. Dans les cas de vieille lésion obstétricale, on peut obtenir une augmentation de 40° ou plus de la flexion active en avant par le placement angulaire du fragment de l'apex postérior.

5. A l'extrémité inférieure de l'humérus, une angulation persistante en flexion, en valgus ou en varus du coude doit être corrigée simultanément avec une déformité de rotation.

ZUSAMMENFASSUNG

1. Osteoklase ist der offenen Operation zur Korrektur von fixierten Rotationsdeformiteten des Armes von Kindern vorezuziehen.

2. Die Bohrosteoklase oder Osteotomie des oberen Drittels des Humerus wird verwendet, nicht nur um die Innenrotationsdeformitet zu korrigieren, sondern auch um die Vorwährtshebung zu vermehren.

3. Die Tendenzbesteht die Rotation des Humerus überkorrigieren und die des Unterarms unterzukorrigieren.

4. In alten Geburtsverletzungen der Schulter kann eine Vermehrung von 40° und darüber hinaus erhalten werden, wenn man den Fragmenthöhepunkt nach rückwäts abwinkelt.

5. Am unteren Ende des Humerus kann bestehende Winkelung in Beuge-, Valgus-, oder Varusstellung am Ellbogen gleichzeitig mit der Rotationsdeformitet korrigiert Werden.

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