TREATMENT OF DEFECTS OF THE ULNA IN CHILDREN
BY ESTABLISHING CROSS-UNION WITH THE RADIUS

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When one growing forearm bone is destroyed by disease, develops imperfectly or lacks stability because of a pseudarthrosis or dislocation at either end, the effect is not usually confined to the abnormal bone, because secondary structural changes in the other are likely to follow.

The consequences may be serious when stability is impaired, because normal function of the hand is largely dependent upon this property of the forearm. This stability is provided at the elbow by the ulna and at the wrist by the radius, stress being transmitted from radius to ulna through the interosseous membrane.

When the ulna is defective distal to the humero-ulnar joint this mechanism commonly fails in spite of stability at the elbow and a radius which is at first normal. This very normality of the radius is the factor responsible, because its growth is unimpaired and it soon outstrips its partner. Bowing is followed by dislocation of the radial head so that even this stabilising influence is lost (Figs. 1 and 8). Stress directed upward from the hand now forces the unsupported radial head still more proximally, being no longer transmitted to the ulna and thence through the elbow to the shoulder. The grip is inevitably weakened and dexterity impaired. Furthermore, as the radial head continues to migrate, shortening increases and elbow flexion and forearm rotation decrease, thus aggravating the situation.

This unfortunate sequence may be interrupted if bony union is achieved between the ulna proximally and the radius distally. The immediate effect is to restore stability and enable growth in length to continue from the epiphysis at either end of the now conjoined forearm bone. Rotation is unavoidably sacrificed, but since it is diminished already, little is lost provided the forearm is reconstructed in neutral rotation. The dislocated radial head with its epiphysis is of no further value and may be excised with impunity if it obstructs elbow flexion.

This principle is attributable to Hey Groves (1921), who employed it in the treatment of recalcitrant non-union of radius and ulna. Vitale (1952) described two patients in whom the method was applied for defects of the ulna in growing children, and Lowe (1963) presented his experience with similar patients in whom either the ulna or the radius was involved. Both authors reported satisfactory results and emphasised the dangers of neglect in such patients.

Although the need to perform this operation is becoming less frequent as treatment for fractures and osteomyelitis becomes more effective, it seems timely to report three patients in whom the operation was indicated and performed with satisfaction. In one further patient a disabling pronation deformity due to a combination of obstetric paralysis and cerebral palsy was managed similarly and the outcome was, within the limits of the underlying cause, a success.

THE OPERATION

The posterior approach is satisfactory: it provides direct access to the shaft of the ulna and may be readily extended. The radius is approached at about its centre by lifting the muscles from the interosseous membrane, and is divided at a level depending on the length of ulna available. The distal fragment is opposed to the rawed lateral surface of the ulna and secured in the position of mid-rotation either by a strong Kirschner wire or by screws. The contact area is reinforced by autogenous cancellous bone and a plaster applied. At this level
the posterior interosseous nerve presents no hazard because its important branches are already distributed and furthermore it has moved proximally in company with the neck of the radius. Should it be desirable to remove the proximal radial fragment the incision should be extended upwards into the arm and the nerve identified.

**CASE REPORTS**

**Case 1**—A child presented at the age of two with hypoplasia of the ulnar component, including the hypothenar muscles and the ring and little fingers (Fig. 1). The head of the radius was dislocated and the range of elbow movement was from 20 degrees to 40 degrees. Supination was full but there was no pronation. There was shortening by 6 centimetres.

![Fig. 1](image1.jpg)  ![Fig. 2](image2.jpg)  ![Fig. 3](image3.jpg)

Case 1. Figure 1—Hypoplasia of ulna with dislocation of radial head. Figure 2—After operation to fuse the proximal ends of the radius and ulna. The proximal radius has been excised and the wire is seen to transfix the still cartilaginous ulna and ossified radius. Figure 3—The final result. The proximal ulna is now ossified.

Although the ulna appeared to lack an olecranon process this was evidently present in cartilage for it was palpable and the elbow was stable. At operation this was confirmed and consequently radio-ulnar synostosis was performed, together with excision of the now redundant proximal radial fragment (Fig. 2).

At the age of eight the forearm was stable and the hand deviated 20 degrees ulnawards. Elbow flexion was from 20 degrees to 130 degrees and shortening was 7 centimetres. The function of the hand was virtually normal (Fig. 3).

**Case 2**—This child had diffuse haemangiomatisis of the arm with involvement of the forearm bones. At the age of two the ulna fractured spontaneously and remained ununited after bone grafting. Six months later the radius also fractured and later developed a pseudarthrosis with dislocation of the head (Fig. 4). At three, both bones were stabilised by intramedullary Kirschner wires in an attempt to maintain length and some stability. The radius united but progressive erosion of the distal ulna resulted in the loss of about half its length (Fig. 5).

At five years the head of the radius remained dislocated and the forearm was 3·5 centimetres short in spite of growth stimulation attributable to the haemangioma. Flexion was from 35 to 90 degrees and rotation was lost. Radio-ulnar synostosis was performed, followed later by excision of the radial head (Fig. 6).
Case 2. Figure 4—The ulna and the radius are fractured and the head of the radius is dislocated. Figure 5—After intramedullary wire fixation the radius has united but the distal ulna has resorbed.

Case 2. Figure 6—Early union between radius and ulna. Figure 7—The final result. Note that the radial head has been excised.
Case 3.—Figure 8—The ulna has been extensively destroyed by neurofibromatosis. The radius is bowed and dislocated proximally. Figure 9—Union of radio-ulnar synostosis. Figure 10—The final result. The ulna and radius are solidly united. The proximal radius has also united with the distal part of the radius.

At nine years the forearm was stable with 5 centimetres of shortening and the elbow range was from 15 degrees to full flexion. Function of the hand was good (Fig. 7).

Case 3.—Neurofibromatosis had eroded the distal ulna when this girl was first seen at ten years of age (Fig. 8). She complained of aching of the wrist and weakness of the hand. The forearm lacked one-third of the normal length and flexion was limited to 90 degrees from full extension of which about half was at the elbow joint and half in the forearm. In spite of the dislocation of the radial head, forearm rotation was full. Radio-ulnar synostosis was performed (Fig. 9).

At the age of sixteen true elbow flexion was from 0 degrees to 120 degrees. Shortening had not increased relative to the other arm. The forearm was stable and the hand had developed normal power without pain (Fig. 10).

SUMMARY

1. Attention is drawn to the progressive disability caused by irreparable defects of the ulna in growing children.
2. Cross-union between the radius and the ulna resolves some of these problems and contributes greater stability and power to the hand.

REFERENCES

