Acquired radial club hand with humero-ulnar dislocation: a rare sequel to infantile compartment syndrome following venous cannulation: a case report

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ABSTRACT

Acquired radial club hand caused by infection has been reported occasionally. We report a rare case of acquired radial club hand with an associated septic dislocation of the elbow, primarily caused by compartment syndrome following venous cannulation. The deformity and instability were treated with distraction using an external fixator followed by a centralisation procedure. At the 2-year follow-up the appearance and functions of the left forearm had improved considerably and the wrist was stable. There was no deterioration in ulnar growth.

Key words: catheterization, peripheral; compartment syndromes; hand deformities, acquired; osteogenesis, distraction; veins

INTRODUCTION

A massive loss of radial bone will cause wrist deformity as radial deviation and volar subluxation, particularly if the damage is inflicted during early childhood.1 The deformity and loss of function can be corrected by a centralisation procedure, but this may damage the ulnar physis and complicate further treatment, resulting in recurrence of the deformity. This complication can be avoided by adequate preoperative distraction so that reduction of the carpus over the ulna can be achieved with minimal pressure over the distal ulna.

We report a case of an acquired radial club hand and humero-ulnar dislocation resulting from infantile compartment syndrome of the forearm caused by venous cannulation.

CASE REPORT

In April 1995, a 7-month-old, unconscious, female infant was admitted to a paediatric intensive care unit with meningitis. An intravenous cannula was inserted in the left forearm and within hours of its insertion her parents noticed swelling of the left forearm. After 36 hours, the patient was referred to...
the orthopaedic department with gross swelling of the left forearm and hand. The limb was pale and pulseless. As the patient was unconscious, neither the motor power nor sensation in the left forearm and hand muscles could be evaluated. An emergency fasciotomy was performed after measuring the intracompartmental pressure. Intra-operatively, gross necrosis of the left forearm muscles was noticed and the surgical wound was left open for debridement and dressings. Dressings were performed daily for 3 months while waiting for healthy granulation tissue to develop. The whole radius was exposed and later sequestered (except the small distal epiphysyal analage) during dressings. The infection spread from the proximal radius to the proximal ulna and elbow joint manifesting as humero-ulnar dislocation and underdevelopment of the distal humerus and proximal ulna (Fig. 1). Coverage was provided with local flaps in 3 separate settings after healthy granulation tissue developed. The patient was discharged after 6 months of hospitalisation.

Seven years later, the patient presented with a grossly deformed and unstable left wrist (Fig. 2). Her left hand deviated radially from the forearm. The hand-forearm angle (the angle between the long axes of the third metacarpal and the distal ulna) was 130° in an anteroposterior view and 60° in a lateral view. There was rotational hypermobility at the ulnocarpal articulation and the hand could be rotated 360° around the forearm. The humero-ulnar joint was dislocated with an active painless range of flexion from 30° to 130°. On radiographic examination, the distal humerus and proximal ulna were underdeveloped. The radius was absent except for a small distal radial epiphysyal analage. The ulna was 76% shorter and the hand was smaller than normal. Protective sensation was present. Active abduction and opposition of the thumb was possible, but active flexion of the fingers was decreased. The motor power in the intrinsic muscles was decreased and the patient was unable to hold and lift heavy objects.

A staged fractional distraction of soft tissues was performed, followed by centralisation of the carpus over the ulna. The treatment goal was to correct the wrist deformity, maintain the corrected
position, preserve functional wrist mobility, preserve longitudinal growth of the ulna, achieve better utilisation of the finger flexors (grip function), and achieve acceptable cosmetic and functional results. Under general anaesthesia, 2 Kirschner wires were inserted through the proximal ulna in parallel from the medial to the lateral side, then another 2 Kirschner wires (1 mm) in the second and third metacarpals from the radial aspect and another 2 Kirschner wires in the fourth and fifth metacarpals from the ulnar aspect were inserted and a frame was assembled. Linear distractors were applied on both radial and ulnar aspects on the ventral side and connecting rods on the dorsal side (Fig. 3). Distraction was started 72 hours later when swelling subsided at a differential rate of 1 mm/day for the radial side and 0.5 mm/day for the ulnar side. The frame was readjusted weekly on an outpatient basis.

After 4 weeks, the external fixator was replaced by an above-elbow slab and oral antibiotics for one week. A centralisation procedure was then performed under general anaesthesia. A 5-cm long curvilinear incision was made on the ulnar aspect of the wrist. The extensor carpi ulnaris tendon and extensor digitorum communis tendons were retracted radially exposing the wrist capsule. The capsule was incised transversely to expose the distal ulna. The carpal bones were defined and a square segment of its midportion (lunate and capitate, measuring 1.25x1.25 cm) was excised to accommodate the ulna. The distal ulnar cartilage was shaved slightly to flatten the surface. Care was taken not to expose the epiphysis. The distal ulna was placed in the carpal defect and stabilised with a single 1.5-mm Kirschner wire. Another incision was made on the radial aspect of the wrist and the non-growing distal radial epiphyseal analage was excised. The wrist was further stabilised by imbricating the capsule and suturing the distal capsule to the periosteum of the ulnar shaft. The skin was closed and the wrist was immobilised with an above-elbow slab, which was later replaced by an above-elbow cast for 12 weeks. After cast removal, physiotherapy was started in order to develop wrist movement. The patient was instructed to wear a splint until skeletal maturity to prevent recurrence of the deformity.

At the 2-year follow-up, the hand-forearm angle was 4° on an anteroposterior view and 0° on a lateral view (Fig. 4). The total range of wrist movement was 30° (20° of active palmar flexion and 10° of passive dorsiflexion). There was no deterioration in the growth of the ulna. The olecranon-middle finger length had improved to 76% of normal (from 58%). The function and length of the hand and forearm had improved and ulnar growth continued. The patient

Figure 3 An external fixator is applied for soft tissue distraction.

Figure 4 The hand-forearm angle is 4° on an anteroposterior view and 0° on a lateral view at 2-year follow-up.
DISCUSSION

Acquired radial club hand caused by infection has been reported occasionally, for example osteomyelitis of the radius, premature diaphyseotomy in haematogenous osteomyelitis, osteomyelitis of the proximal radius following cannulation of the median cubital vein, and osteomyelitis of the distal radius after cannulation of the cephalic vein.

The present case is unusual because of the late presentation, almost complete loss of the radius, and the cause of compartment syndrome. The treatment goal was to correct the undesirable hypermobility and deformity of the left wrist without damaging the distal ulnar physis, which is essential for prevention of a recurrence of the deformity and for providing an adequate forearm. No surgery was performed to correct the left humero-ulnar dislocation because the elbow function was good.

External fixators have been used for distraction of congenital radial club hands. This is a simple and cost-effective means of achieving soft tissue distraction. We achieved the desired correction of both the angulation and translation of the hand over the distal ulna within a short period of 4 weeks, while preventing ulnar shortening, pressure over the distal ulnar physis and maintaining neurovascular function.

Centralisation of the radius has been widely accepted as the treatment of choice for congenital and acquired radial club hand with deformity and instability. Staged fractional distraction followed by centralisation can achieve a stable, cosmetically acceptable and mobile wrist. However, injury to the distal ulnar epiphysis at the time of centralisation can disturb the ulnar length growth. In our patient, the ulnar length discrepancy persisted even after 2 years, despite an 18% increase in the hand-forearm length (from 76% to 58% of normal), similar to a case of a congenital radial club hand having an ulnar length discrepancy of 60% of normal.

REFERENCES