



## Acquired radial club hand deformity after osteomyelitis in ten years old child treated by centralization of ulna; Early outcome report

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### Abstract

**Introduction:** Radial club hand deformity acquired post haematogenous osteomyelitis of radius bone is a very rare. Resulting in functional and cosmetic deficit. There are various options to reconstruct the deformity by bone grafting, plating, Ilizarov, monorail external fixator, callus distraction and centralization of the ulna.

**Materials and methods:** This is case report on 10 years old male patient with radial club hand treated with centralization of the ulna.

**Result:** Decrease in the angle of radial deviation (radiologically) preoperatively from 22° to 3° and volar flexion deformity was 15° to 0°. No neurovascular complication noted and full range of movement regained.

**Discussion:** Centralization of ulna is relatively simple procedure with good outcome.

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**Keywords:** Centralization; Hematogenous; Osteomyelitis; Radial club hand.

**Abbreviation:** CBC: Complete Blood Count; ESR: Erythrocyte Sedimentation Rate; OR: Operation Room/Theater; PACU: Post Anesthesia Care Unit.

### Introduction

The most common cause of radial club hand deformity in children is congenital that is radial ray deficiency which is estimated to be 1 per 100,000 live births. But acquired causes included traumatic bone loss or post osteomyelitis. Chronic osteomyelitis even though rare in the developed world it has high burden in the developing world accounting to ten percent of orthopedic admissions [1]. Radius is a rarely affected with hematogenous osteomyelitis, its incidence is only around 3% [2]. This figure might be higher in low income countries [3].

Osteomyelitis results in absorption and lysis of radius, causing a radial defect. The radial defect might occur also due to surgical removal of the dead bone resulting in shortening of the radius which in turn is the cause of ulnar angulation and dislocation of the distal radio ulnar joint, radial deviation of the wrist. If left untreated result in severe cosmetic and functional deformity. There are variety of treatment options reported by authors previously with good outcome, the options include plating and bone graft with or without ulnar shortening, bone transport with Ilizarov, centralization of the ulna, and vascularized bone graft [2,4-6].

## Case presentation

This is 10 years old boy who presented with right side forearm swelling, fever worsening over 3 months. He visited local health center and was given unspecified po medication. But, he didn't have any improvement. He had no any trauma history. No other medical illnesses.

On presentation he had low grade fever, right forearm was swollen and tender. The wrist was deformed deviated radially and palmar flexed. He looks well nourished.

He was investigated with CBC, ESR, and X ray. CBC shows mild anemia, ESR was 87 mm/hr. X ray shows long segment sequestration of the radius with remaining small epiphyseal segment. The radial deviation deformity was 22° and volar flexion deformity was 15° (Figure 1).

After informed consent taken and procedure explained to the family. Two stage procedure was planned.

**Stage 1:** He was taken to the OR and with supraclavicular block via Henry's approach debridement and removal of the sequestered bone and excision of the infected soft tissue done, leaving bone defect of 8 cm (Figure 2). Patient was transferred to PACU and then to the ward with stable V/S. He was put on empiric IV antibiotics (ceftriaxone and cloxacillin) and analgesics. The wound was being dressed every day for 1 week. IV antibiotics was continued for 3 weeks and he was discharged with the forearm splinted and po antibiotics (cotrimoxazole).

At the clinic the wound was being assessed and serial ESR was being done. At 3 months post-operatively he no longer had fever the swelling had decreased and no local signs of infection, ESR dropped to 12 mm/hr. The second stage of the procedure was planned.

**Stage 2:** A lazy 'S' dorsal midline incision was made over the ulnar styloid. Once the incision is made and fascia is divided, sensory branches of superficial sensory radial nerve was identified and preserved. The extensor tendon was identified, and a thorough dissection was done to release any tight radial structure. The extensor digitorum tendons were identified and retracted to expose wrist capsule and extensor carpi ulnaris tendon was freed. The capsule was incised transversely exposing the distal ulna. The distal radial epiphysis was exposed. The distal end ulna was freed from its surrounding, and osteotomy was done just distal to the distal ulnar physis. A K-wire (2.5 mm) the distal radial epiphysis into the third metacarpal and was pushed retrograde into the ulna medullary canal after fixing the ulna into the epiphysis. The thickness of K-wire was selected in such a manner that it fills the diameter of the metacarpal, as recommended by Goldberg and Meyn [7]. The ulnar periosteum was left untouched. At the ulnar side, the wrist was stabilized by suturing the distal capsule to the periosteum of the distal ulna. Additionally, advancing or reefing the extensor carpi ulnaris tendon. The wrist was kept immobilized in the above elbow plaster cast, with 90° of elbow flexion and mid-prone position (Figure 3).

Post-operatively, the limb was elevated and observed for any swelling, discoloration of the fingers and stretch pain. Sutures were removed on 15<sup>th</sup> day of surgery and the cast was changed. The K-wire was left in situ. Plaster cast was applied for total of 3 months. Parents were instructed how to move the wrist and fingers. The parents were advised to passively mobilize all the finger joints and elbow and promote the child to use the hand

in daily activities.

Follow-up evaluation was done monthly for 3 months. At final follow-up, the range of motion of fingers and elbow was recorded. Patient had full ROM at the elbow and wrist volar flexion of 10° and dorsal flexion of 11° and good hand function (Figure 4). Radial deviation (i.e. angle between third metacarpal and distal end of ulna) had improved to 3° volar flexion deformity was 0° (Figure 5). Finally, patient was able to return to school with good hand grip strength and no symptoms (Figure 6).



Figure 1: Sequestrum removed from the radius.



Figure 2: Intraoperative picture showing the bone defect after sequestrectomy.



Figure 3: Preoperative radiograph AP (A) and Lateral (B) views.

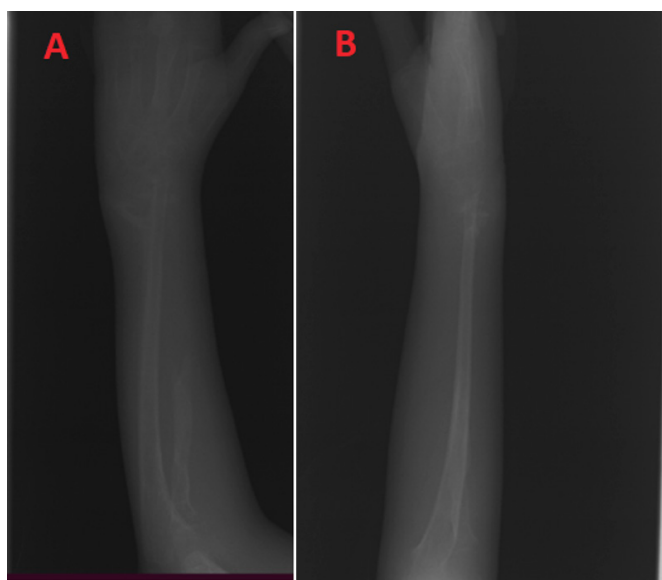


Figure 4: At 3 months AP (A) and lateral (B) views.

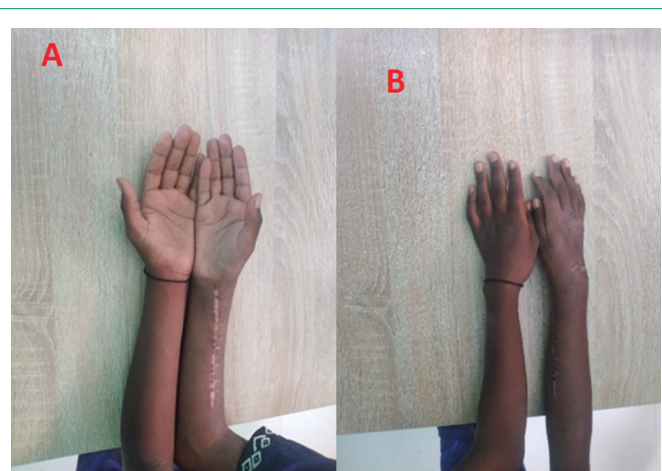


Figure 5: Clinical pictures at 3 months.



Figure 6: Patient was back to school at 4 months with good hand function.

## Discussion

Radial club hand deformity acquired after haematogenous osteomyelitis is not common as congenital club hand surgical correction remains a challenge. Various surgical procedures are described for treatment of acquired club hand like; plating with cancellous bone graft, centralization of the ulna, and bone transport.

Honsy mentioned the distraction of the radius with the Ilizarov technique in three patients with a non-union of radius. In two patients, he found it to be a safe technique to correct traumatic radial club hand [8]. Zhang et al reported on 12 patients treated with distraction lengthening with good outcome [9].

Ulnar centralization is one of the treatment modalities described in literature, Malki and colleagues performed centralization of the ulna on 11 years old boy with infected nonunion [10].

One bone formation is the other treatment option for acquired radial club hand. Rasool performed one bone formation by radioulnar synostosis in six children by using intramedullary pins [11].

Vascularized and non-vascularized bone grafts to fill the radial deficiency by keeping the ulna intact have also been mentioned as a treatment modality. Netrawichien described good functional and cosmetic results at follow-up at one year in two patients with acquired club hand deformity, which had been treated by cancellous bone graft and plating combined with ulnar shortening [4]. Cortico-cancellous bone grafting of the radial defect after complicating acute hematogenous osteomyelitis in an infant is also reported [12]. The vascularized fibular graft was used by Jupiter et al. for segmental radial deficiency [13].

There are no clear guidelines to manage this problem, except Khan et al. tried to come up with algorithm. Management depends on either there is a short radius or the segment of radius is absent. For short radius, distraction lengthening of the radius with or without ulnar shortening should be performed. Treatment of segmental loss of radius is further dependent on whether the distal part of the radius is present or absent. If the distal part of the radius is absent, then one should either go for centralization of the ulna or a vascularized fibular graft. In segmental loss of radius, if the distal part of the radius is present, then the management depends upon whether the distal radioulnar joint is preservable or not. If the joint is not preservable, then one bone formation with radioulnar synostosis is a better treatment option. If it is possible to preserve the joint, then management depends upon whether the defect is up to 6 cm or more. If the defect is up to 6 cm, a non-vascularized graft either cortical or cortico-cancellous can be used to fill the radial gap. If the radial defect is more than 6 cm, then a free vascularized fibular graft should be used as a treatment modality [6].

In our case, the distal end of radius that is metaphysis and epiphysis were absorbed in disease process, only cartilaginous flange remained, thereby we adopted centralization of ulna and creation of one-bone forearm for our case. The patient had good cosmetic and functional outcome.

## Conclusion

Acquired radial club hand is a distinct entity from congenital radial club hand. Acquired radial club hand can be secondary to trauma, infection, tumor, etc. Due to the presence of these causes, the management plan, treatment options, and guidelines also vary from that of congenital radial club hand. First priority is to achieve soft and supple tissue coverage to achieve tissue equilibrium. Then, the defect is treated as required. Using centralization of carpus over the ulna has showed good result in correcting the deformity and producing wrist stability. In patients with radial defect and lost or small epiphysis, and setups where it is difficult to do other procedures like vascularized graft or Ilizarov, it is good alternative.

There was no detrimental effect on the growth of the distal ulnar epiphysis. The finding of the study needs further follow-up, as a short follow-up period for evaluating such rare cases is not appropriate.

## Declarations

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