Retrospective Study Of Neurovascular Complications In Supracondylar Humerus Fractures In Children

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Citation

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Abstract

A retrospective study of 85 children with displaced Gartland Type II and Type III supracondylar fractures of humerus admitted between February 1998 to September 2003 was carried out in Rustaq Hospital, Oman to review and analyze the neurovascular complications. The 83 patients were treated by closed reduction and crossed percutaneous pinning. In two cases where closed reduction was unsatisfactory open reduction was done. Signs of vascular compromise were noted in three cases of which two cases recovered and one patient had Volkmans Ischaemia. In suspected cases with vascular compromise short period of closed observation with involvement of vascular surgeon is advisable. Transient neurologic complications were noted in 20% cases with iatrogenic nerve injury in 1.1% cases. Good functional outcome in operated cases was noted in 90 percent cases.

INTRODUCTION

Supracondylar fracture of humerus is the common injury in children accounting for 3-7% of all fractures and the commonest upper extremity fracture in children associated with complications([1]) .

The commonest fracture is the extension type but in 2% cases it is flexion type fracture([2]). The overall incidence of vascular complications reported is 8-12% ([3,4]). The primary nerve injury rate reported in displaced supracondylar fractures is 20%([1,6,7]) and the rate of iatrogenic nerve injury reported is 2 to 3%([8,9]) .

Primary injury to brachial artery and the median and radial nerve occurs from stretching, entrapping or disruption of neurovascular structures on the sharp proximal humeral fragment. Extension Type fractures with posterolateral displacements have predilection for injury to median nerve and brachial artery and posteromedial displacement fractures are more likely to injury the Radial nerve. Ulnar nerve injuries are seen more in flexion type fractures([15]) or iatrogenic during Pinning.

PATIENTS AND METHODS

Between February 1998 to September 2003 85 children with displaced supracondylar fractures of humerus who attended the Accident and Emergency department of Rustaq General Hospital, located in South Batinah Region of Oman were included in Study. We excluded undisplaced fractures or those involving epiphysis or avulsion fractures of epicondyles. Upper age limit taken was upto 15 years.

Gartland classification was used for classifying extension type supracondylar humerus fractures.

Type I Undisplaced
Type II Minimal to moderately displaced with partially intact posterior cortex
Type III Severely displaced, no cortical contact

In all patients age, sex, mechanism of injury, duration from time of injury and neurovascular status were recorded. 82 patients with Type II and III fractures were treated by closed reduction and crossed percutaneous Kirschner wire fixation. In two cases with type III fractures which were not reduced by closed reduction primary open reduction through posterior approach was done with crossed Kirschner wire fixation. In cases with suspected vascular compromise (weak or absent radial pulse, decreased or absent capillary refilling, cold extremity, pain on passive stretching of wrist or fingers, failure to record oxygen saturation) a vascular surgeon consultation was obtained.

Surgery was performed as soon as possible. The fracture was reduced under general anaesthesia. Traction was applied to the forearm and shortening, lateral or medial displacement was corrected,elbow flexed to more than 90 degrees and the reduction was confirmed with image intensifier in both anterio-posterior and lateral views. Two crossed Kirschner

wire 1.2 to 2.0 mm in diameter were drilled percutaneously through medial and lateral epicondyle. Pins were bent to prevent migration and cut off outside skin. Post operatively the limb was immobilized in posterior back slab with elbow in less than 90 degrees flexion for period of 4 weeks after which the K-wires were removed in the outpatient clinic. The patients were followed at weekly interval during the first month in outpatient clinic.

The final outcome was reviewed by noting the distal neurovascular status along with elbow range of motion and carrying angle at the last visit in outpatient clinic. These parameters were compared with the contralateral side.

RESULTS

In our series of 85 cases with supracondylar fractures 55 patients were males (64.7 percent) and 30 patient were females (35.2 percent) with mean age of 8.1 years (3-15 years). 50 children (58.8 percent) had Gartland Type II fracture and 35 children (41.1%) had Gartland Type III fracture. Mean follow up time was 6.2 months with the range of 9 – 12 months.

Signs of vascular compromise was found complicating the fracture in three cases with Gartland Type III fractures. Two of cases with absent pulses with delayed capillary refill were observed and pulses returned after fracture stabilization with K-wires. One case who presented with compound Type III supracondylar fracture was stabilized promptly within 2 hours of admission with 2 crossed K-wires but later went into Volkmans Ischemia.

There were 17 nerve injuries in 15 patients radial nerve injury was found in total of 5 patients median nerve injury in 8 patients and Ulnar nerve injury in 4 patients. All nerve injuries were detected pre operatively except in one case where patient had Radial and median nerve injury accompanying vascular compromise. In another patient who had initial median nerve injury pre operatively developed post-operative iatrogenic ulnar nerve injury after Kirschner-wire stabilization of fracture which recovered in 4 weeks period. All nerve injuries recovered in 4 months time.

Five cases developed Pin tract infection which resolved in due course of time after removal of Kirschner-wire with oral antibiotics.

Functional Outcome in group B: In 62 patients there was no functional impairment (72.9%) at last visit to our outpatient clinic. In 18 patients (21.1%) had mild impairment in form of loss of terminal flexion or extension. In 5 patients (5.8%) of total cases with loss of motion the deficit in extension was seen together with cubitus varus deformity of < 10°. (Table I) None of the cases had cubitus valgus deformity. Their deformity remained constant over follow up period of up to 9 months. One patient who had vascular compromise later had severe disability from contracture of forearm. All fractures united in 4-5 weeks time.

Figure 1

Table 1: Functional Results in Operated Patients

	Impairment	Explanation	Number	Percentage
1.	No	Full ROM, no malalignment	62	72.9
2.	Mild	Loss of flexion or Extension >10° but < 20°	18	21.2
3.	Severe	Cubitus Varus < 10°	5	5.9

DISCUSSION

Supracondylar fractures in children can be associated with neurovascular complications of varying degree. Reviewing the Literature it is agreed that Gartlands Type II and III supracondylar fractures are best treated by closed / open reduction and percutaneous pinning. Treatment by other modalities such as Plaster immobilization or Skeletal tractions are associated with increased cubitus varus deformity.

Neurological Complications: As reported earlier reported primary nerve injury in displaced supracondylar fractures is 20% ([1,6,7]). The rate of latrogenic nerve injury has been reported to be 2-3 percent([8,9]) .Our results of primary nerve injury rate of 20% was comparable to that documented in literature. We similarly had comparable rate of iatrogenic nerve injury of 1.1%. Literature has documented that ulnar nerve injury during closed pinning can occur due to direct penetration of nerve by pin([9]). Delayed ulnar nerve palsy can occur from contusion of nerve due to edema or stretching of nerve over a pin([10]) Late ulnar neuropathy occurs in cubitus varus deformity from stretching of nerve due to medial shifting of triceps([11]). To prevent ulnar nerve injury different methods have been reported or using mini incision over the medial epicondyle([7]) or by placing two parallel lateral pins instead of cross-pinning, but lateral pinning is associated with increased rotational instability([7]).Moreover in younger children with communution in the medial cortex. Lateral pinning does not provide good stability.

In our study we used conservative approach towards nerve Palsies. Some authors have recommended open reduction and pinning in fractures where satisfactory reduction is not obtained by closed reduction to avoid increased risk of complications.

Vascular complications: In our series impaired circulation (absent pulsation) was found in three cases. Two of the cases had vascular spasm which recovered when fracture was stabilized. One case with intimal trauma to brachial artery associated with compound fracture and not detected at early stage went in for Volkmans ischaemia. It is possible that angiography at earlier stage might have avoided this complication or if early exploration within 6-8 hours was done. Poor prognosis has been reported by other authors as Ottolenghi ($_{12}$) in cases of Volkman's ischemia where exploration is delayed beyond 24 hours after injury.

Our policy in cases with warm and pink hand with absent pulsation was to check for vascular status at frequent intervals by physical examination and Doppler Sonography before going in for more invasive procedures as exploration or arteriography($_{13}$) .However prompt exploration and stabilization in displaced supracondylar fractures associated with cold hand can avoid dreaded vascular related complications.

CONCLUSION

1. In Type II and Type III Gartland supracondylar fractures good functional results are obtained by early closed / open reduction and cross Kirschner wire fixation.

2. In cases with vascular compromise clinical examination is the most valuable tool, and in patients were there is no improvement in physical signs after short period of observation exploration with vascular surgeon involvement is recommended.

3. Transient neurological complications are common with these fractures which usually recover with time. However Iatrogenic nerve injuries can be avoided by proper precautions or adopting mini open procedure.

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