# Nerve injury supracondylar humerus fracture health and social care essay

Backgraund: Supracondylar humerus fractures are very common types of elbow fractures in children between the ages of three and ten years. Totally displaced supracondylar humerus fractures may be related to neurovascular injuries, and treatment may be complicated by iatrogenic neurovascular injury, compartment syndrome, malunion, and elbow stiffnessAim: The aim of this study was to describe the clinical outcome of nerve injuries associated with supracondylar humerus fractures in children observed over a period of seven years. Materials and Methods: Children with displaced supracondylar humerus fracture who were treated with closed reduction and percutaneous cross K-wire fixation were reviewed retrospectively at the Medical School Hospital of Yuzuncu Yil University from May 2004 to October 2012. Results: There were 91 patients available for follow-up. Nerve injury was observed in 11 (12. 1%) of 91 patients with supracondylar humerus fractures. In 10 (90. 1%) of these 11 cases, nerve functions recovered completely (excellent outcome) and in one (9. 9%) case partial recovery was seen (good outcome). Conclusions: Iatrogenic or fracture-related nerve injury in a supracondylar humerus fracture is a benign condition which may be resolved spontaneously and observation appears to be a good and valuable method for treatment of this complication. Key words: Nerve injury, supracondylar humerus fracture, treatment, iatrogenic, observation.

# Introduction

Supracondylar humerus fractures (SHF) are very common types of elbow fractures in children between the ages of three and ten years1, 2. Totally displaced SHF may be related to neurovascular injuries, and treatment may be complicated by iatrogenic neurovascular injury, compartment syndrome,

malunion, and elbow stiffness2, 3. While iatrogenic nerve injury most frequently affects the ulnar nerve4, the radial and median nerves are frequently damaged by the fracture site5-7 (Figure 1). Iatrogenic injury of the ulnar nerve has been observed in up to 20% of the cases treated with crossed K-wire8. In addition, radial pinning for SHF may cause injury in the radial and median nerve9-11. We analyzed the result and compared the rates of injuries of the ulnar, radial, and median nerves in a series of displaced SHF in children. The aim of this study was to describe the clinical outcome of nerve injuries associated with SHF in children seen over a period of seven years.

## Materials and Methods

We received approval of the Institutional Ethics Board for the study. Children with displaced SHF (Garthland type III) who were treated with closed reduction and percutaneous cross K-wire fixation were reviewed retrospectively at Medical School Hospital of Yuzuncu Yil University from May 2004 to October 2012. Gartland classification12 is shown in Table 1. Name, age, gender, time of injury, date of presentation, cause of injury (simple fall or fall from height), and any history of previous surgery were recorded for all patients in the study. The inclusion criteria of the study were children with SHF of 2-12 years age and displaced SHF (Gartland type III). The exclusion criteria were undisplaced SHF and open fracture. After closed reduction maneuver was applied, crossed K-wires were inserted percutaneously. The K-wires were bent outside the skin or cut under the level of the skin. Exploration of the injured nerve was not performed. A long arm cast was applied after operation. Implant removal was performed together with cast removal

when callus formation was seen in fracture sites where K-wires had been bent outside the skin. In children who had the K-wires cut below the level of the skin, implants were removed on a day-surgery basis 3 months later. Surgical techniqueUnder general anesthesia in a supine position on the operating table, the closed reduction maneuver was implemented under fluoroscopic guide. With the elbow in hyperflexion position, a K-wire was inserted from the lateral condyle of distal humerus across the lateral cortex engaging the medial cortex. After the ulnar nerve was palpated the elbow was extended to a position of less than 90 degrees. The medial K-wire was then located to the beginning of the medial epicondyle to engage the lateral cortex again in a hyperflexed elbow position. Neurologic EvaluationPreoperative and postoperative neurologic examinations of all patients were performed and recorded for ulnar, median and radial nerves. The operation findings and details of the surgical process were recorded. Follow-upPost-operative follow-up was performed at four weeks, two months, three months and subsequently every month until full recovery. In addition, electromyography (EMG) evaluation of motor unit was applied 3 and 6 months after the surgery. The clinical results at the last follow-up were assessed according to the criteria of Birch, Bonney and Wynn Parry13 and graded as excellent, good, fair or poor (Table 2).

## Results

There were 91 patients available for follow-up. Nerve injury was observed in 11 (12. 1%) of 91 patients with SHF. In patients with nerve injury, the mean recovery time was 6. 7 months (range 3-12 months). The mean age of the 11 patients (3 female, 8 male) was 7. 4 years (range 2-12). Concomitant injuries

included one ipsilateral distal radius fracture and one ipsilateral bicondylar fracture of humerus. A closed reduction maneuver was successful in all of the patients. K-wires were removed at the 4th week in three cases, the 5th week in two case and the 6th week in five cases. Final EMG studies showed complete recovery in ten cases. Iatrogenic nerve complication was seen in three patients (3. 3%), and noted as two ulnar and one radial nerve injuries. Fracture-related nerve injuries were seen in eight (8. 8%) patients (six ulnar, three radial and one median-two patients had both ulnar and radial nerves injury) (Table 3). We did not observe any deep infections after surgical treatment. Early removal of implant (in cases of irritation of the nerve) and early exploration were not applied. In 10 (90. 1%) of 11 cases, nerve functions completely recovered (excellent outcome) and in one (9. 9%) case partial recovery was seen (good outcome) according to the criteria of Birch (Table 3).

## Discussion

There have been many variations of suggested pinning techniques for treatment of SHF. Cross-pins (Figure 2), lateral pins (Figure 3) and cross-pins (Figure 4) are used in the treatment of SHF. Swenson14, Flynn et al. 15, and Nacht et al. 16 recommend using cross-two pins, which are placed through the medial and lateral epicondyles. Biomechanically, fixation provided by the two lateral K-wire is less safe in comparison to the cross-pins. Fixation of fracture fragment by two lateral K-wire may allow rotation of the fracture fragment. It has been discussed that insertion of two lateral cross-pins will provide a biomechanically stable fixation along with avoiding the risk of ulnar nerve injury9, 17. Nerve injuries after SHF may occur primarily because of

tenting or entrapment of the nerve on the sharp proximal humeral part. Iatrogenic injuries may occur either during closed manipulation or percutaneous pinning of the fracture fragments or rarely during open procedures8, 18, 19. Wilkins reported the frequency of neurologic complication after percutaneous pinning from 2 to 3%20. Flynn et al, in a series of 72 cases, had only one (1. 4%) postoperative ulnar nerve palsy which recovered spontaneously in six weeks15. Royce et al, had three (2%) cases of postoperative ulnar nerve injury occurred with a medial pin21. Our incidence of iatrojenic ulnar nerve injury after percutaneous pinning of the SHF was 3. 3% and this ratio compatible with the literature. There are several controversies about treatment options for nerve injury after percutaneous pinning. Observation, medial K-wire removal, medial K-wire reposition, exploration + medial K-wire reposition, exploration + reposition + cubital retinacular release were recommended by different authors8, 15, 18. We did not attempt any surgical intervention and only observed patients who had suffered nerve injury. In our study, full recovery at 3-12 months (mean 6. 7 months) was observed in nine cases and partial recovery was seen at five months in two cases. It appears that the recovery period varies according to the sensory or motor deficit of the nerve and the degree of nerve damage.

## Conclusion

Iatrogenic or fracture-related nerve injuries in SHF are a benign condition which may be resolved spontaneously and observation appears to be a good and valuable method for the treatment of this complication.

## Statement of Interests’

The authors declare that no financial arrangement with any product or rival product featured in the article, sources of funding, institutional affiliations, and any possible financial or personal conflicts of interest.