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Original Article

Supracondylar extension type III fracture of the humerus in children: Percutaneous cross-pinning

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Abstract
Objective: Supracondylar extension type III fractures in children are difficult to treat especially in maintaining reduction after closed manipulation, thereby increasing chances of complications.
Materials and methods: Forty consecutive patients with supracondylar extension type III fracture of the humerus attending Kathmandu Medical College Teaching Hospital (KMCTH) between July 2004 to December 2005, treated by closed manipulative reduction and percutaneous cross-pinning under general anaesthesia, were the subject of this prospective study.
Results: There were 16 females and 24 males. The mean age of the patients was 6.5 years (2 to 12 years). Left side was injured in 27 patients and right side in 13. Patients were followed for a period of one year on average (6 to 18 months). Under general anaesthesia and C-arm image intensifier, closed manipulative reduction was performed. Two K-wires of size 1.6 to 2.0 mm were introduced from lateral and medial side in crossed fashion. Ulnar nerve was protected by pushing it posteriorly during medial pinning. Long arm plaster slab was applied post-operatively. Patients were discharged the next day of operation. Callus was visible in all patients on X-rays after 3 weeks. The long arm slab and K-wires were removed and active mobilization of the elbow joint was started. Fracture union was seen in all, 6 weeks post-operatively. At follow-up, range of motion of the elbow joint was 25 to 135 degrees after 6 weeks and 0 to 140 degrees after 3 months, which was similar to that of normal side. After 3 months of operation carrying angle was 8 – 10 degrees in all except in two cases (0 degree). There were no neuro-vascular complications or cubitus varus deformity in any of the patients.
Conclusion: Percutaneous crossed K-wire pinning after closed manipulation in supracondylar extension type III fracture of the humerus is a reliable and safe method of treatment and is recommended in all.

Supracondylar fracture of the humerus is one of the commonest fractures in children[1]. Gartlands'[2] extension type III fractures with complete displacement possess problems in their management especially in terms of stability and maintaining reduction after closed manipulation thereby increasing the chances of complications like neuro-vascular deficits, malunion and deformities[1,3]. Thus, we undertook this prospective study in Kathmandu Medical College Teaching Hospital (KMCTH) for the treatment of supracondylar extension type III fractures of humerus by closed manipulative reduction and percutaneous crossed K-wire pinning from July 2004 to December 2005. They were evaluated in terms of their stability after closed manipulative reduction and cross K-wire pinning, callus formation and fracture union on radiographs. Range of motion of elbow, carrying angle and presence or absence of deformities and neuro-vascular deficits were noted at follow-up.

Our study concludes that closed manipulative reduction and crossed K-wire pinning under general anaesthesia and C-arm image intensifier is a safe and reliable method of treatment for supracondylar extension type III fracture of humerus in children thereby reducing the chances of complications.

Materials and methods

Every patient attending KMCTH either the general casualty or out-patient of orthopaedic surgery from July 2004 to Dec 2005 with Gartland extension type III supracondylar fracture of the humerus were subjected to this prospective study of closed manipulative reduction and crossed K-wire pining. The exclusion criteria in this study were open fractures, other associated long bone fractures, pre-operative neurovascular deficits and pathological fractures.

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There were 40 elbows from 40 patients. The left side was injured in 27 and the right in 13 patients. Male is to female ratio was 3: 2. The mean age of the patient was 6.5 years (range 2 – 12 yrs.) They were followed for a period of minimum 6 months up to one and a half years (average one year). They were evaluated in terms of radiological callus, range of motion and carrying angle at 3 weeks, 6 weeks and 3 months post-operatively. Presence or absence of complications like neurovascular deficits and deformities were noted at follow-up.

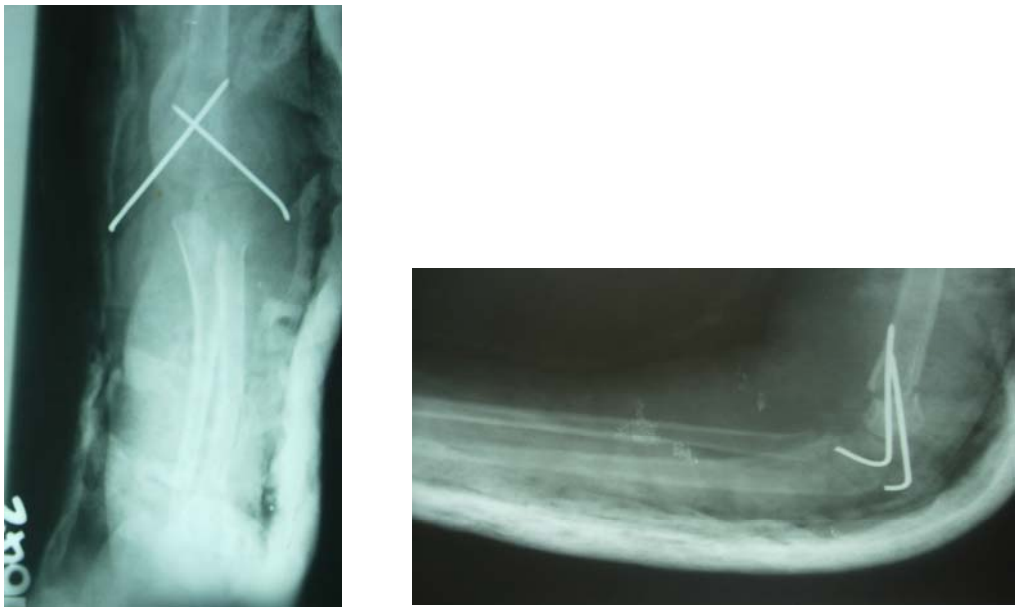
Closed manipulative reduction and percutaneous K-wire pinning was performed in 40 consecutive patients attending KMCTH with supracondylar extension type III fracture of the humerus (Fig. 1). All the patients were prepared for general anaesthesia and were shifted to the operation theatre irrespective of the time of the injury. With all antiseptic preparation and aseptic precautions, the limb was draped for closed manipulative reduction and percutaneous cross-pinning. Manipulative reduction was performed by the surgeon with counter traction by the assistant, in the following stepwise manner; disimpaction by traction, correction of angulatory and rotatory deformities by thumb and fingers manipulation and finally, correction of posterior displacement by thumb pressure over the displaced fragment and simultaneously flexing of the elbow. Reduction was confirmed in antero-posterior and lateral plane with the help of C-arm image intensifier. Two K-wires from 1.6 to 2 mm of size were introduced, the first from the lateral side, and the second from the medial side (Fig. 2). Ulnar nerve was protected by pushing it posteriorly away from the medial pin introduction site. Placements of the pins were confirmed under image intensifier so that the pin pierced the opposite cortex. The K-wires were bent and cut outside the skin so that pin removal could be facilitated after 3 weeks. Long arm posterior plaster splint was applied after protecting the pin sites by sterile dressing pads. Post-operatively, elbow was kept elevated for at least 24 hours. Patients were discharged after inspecting the pin sites. They were called for first follow-up after a week to check any pin migration or infection or any other complications.

Splint and K-wires were removed after 3 weeks post-operatively. Radiographs were taken and the range of motion exercises was started. Patients were encouraged to perform active flexion and extension exercises as taught by a physiotherapist. They were discouraged to do passive stretching or massage or to carry weight on the affected limb for at least until the desired range of motion was achieved.

Fig. 1: Radiographs showing three and a half year old female child with supracondylar fracture extension type III. a) AP view and b) Lat. view

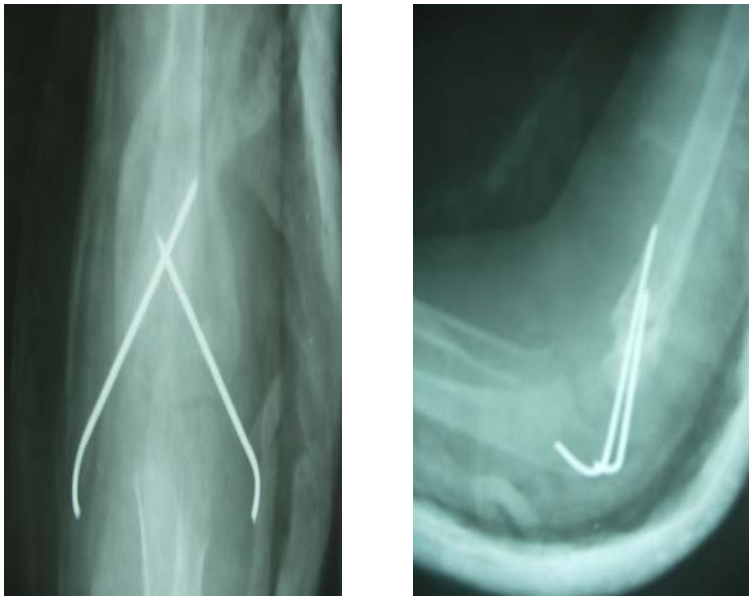
(a) (b)

Fig 2: Post-operative Radiographs after closed manipulative reduction and cross-pinning, showing satisfactory reduction and position of pins a) AP view and b) Lat. View



(a) (b)

Fig 3: Radiographs 3 weeks after operation showing callus. a) AP view and b) Lat. view



(a) (b)

Fig 4: Radiographs 6 weeks post-operatively showing fracture union. a) AP view and b) Lat. view

(a) (b)

Results

Radiological callus was visible in all patients at 3 weeks post-operatively before the removal of K-wires (Fig 3). The fracture united in all after 6 weeks of operation (Fig. 4). Active mobilization of the elbow joint was started after 3 weeks of immobilization. Range of motion of the elbow joint noted was 25 – 135 degrees in comparison to 0 – 140 degrees on the normal side after 6 weeks postoperatively. After three months of operation, elbow motion was equal to that of normal side (0 - 140 degrees). Carrying angle measured at follow-up, 3 months after operation, was 8-10 degrees on the affected side except in two patients where it was 0 degree. Neuro-vascular deficits were not found in any of the patients. Deformities like cubitus varus were not present in any patient at follow-up.

Discussion

Supracondylar extension type fracture of the humerus is one of the commonest fractures in children[1]. Gartland extension type III fractures[2] may present problems in their management by plaster immobilization, even after acceptable initial reduction[3]. They are inherently unstable type of fractures[4]. Maintenance of reduction is difficult in this type of fracture by plaster immobilization[5]. Chances of re-displacement in these fractures are more, thereby causing loss of reduction and increased chances of complications[1,3,5]. Repeated check X-rays are necessary to detect the secondary displacement. Maintenance of the reduction by hyperflexing the elbow[6] is not always possible in these fractures due to associated swelling without neurovascular compromise[5]. Cubitus varus is one of the commonest late deformities in these fractures[1,3,5].

Thus, with the availability of C-arm image intensifier in our hospital, we undertook this prospective study to treat all patients attending KMCTH with supracondylar extension type III fractures of the humerus by closed manipulative reduction and percutaneous crossed K wire pinning. Our results can be considered excellent[6] in terms of range of motion of the elbow joint and having no complications like neurovascular deficit or deformities. We followed the patients for a minimum of 6 months and maximum of one and a half years, and found that there were no deformities like cubitus varus or others. All except two regained their carrying angel of 8–10 degrees, similar to that of normal side. Two patients lost their carrying angle to 0 degree, due to the fact that their initial reduction was not perfect because of swelling of the elbow.

We preferred crossed K-wires due to the fact that they are more stable than lateral pinning only (7). Ulnar nerve injury[8] was not encountered in our series as we had taken special care to protect the nerve by pushing it posteriorly away from the medial pin introduction site. Hyperflexion of the elbow as in cast treatment was not necessary to maintain the reduction in crossed percutaneous pinning thereby reducing the chances of neurovascular compromise. Full elbow motion was achieved 3 months post-operatively, and that could be attributed to early range of motion exercises started after removal of pins and splint, 3 weeks post-operatively with special instructions given to the patients not to massage or carry weight on the affected limb or to do passive stretching. Our results can be considered excellent in Flynn's criteria[9].

Conclusion

Closed manipulative reduction and percutaneous crossed K-wire pinning is a safe and reliable method of treatment in supracondylar extension type III fracture of the humerus in children, thereby reducing the chances of complications like neurovascular deficits or deformities like cubitus varus and is recommended in all.

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