

Results of Treatment of Displaced Supracondylar Fractures of Humerus in Children by Closed Reduction Using Percutaneous K-Wires- A Case Series

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Abstract:

Introduction: Closed reduction and percutaneous K-wire fixation is the standard modality of treatment in displaced supracondylar fractures of distal humerus in children. We report the result of a prospective study of two hundred fifty seven patients, who were treated by closed reduction and simple percutaneous K-wire fixation using two lateral pins or medial - lateral pins.

Methodology: In a prospective controlled study, 257 cases of Gartland type III supracondylar humerus fractures in children were treated with closed reduction and percutaneous fixation by simple K-wires. The age group of the patients was 3 to 12 years. The fracture was immobilized for duration of three weeks. Cases were followed up for an average of eight months post operatively.

Results: Assessed as per Flynn's criteria for functional results at the end of 6-8 months of follow up. Excellent anatomical result was seen in around 76.03 % patients and good results seen in 23.97 % patients.

Conclusion: Closed reduction and percutaneous K-wire fixation is the standard method for the management of displaced supracondylar fractures in children. It not only obviates the need of open reduction and internal fixation and/or POP cast but also gives better functional results.

Keywords: functional outcome, percutaneous fixation, supracondylar fractures

I. Introduction:

Supracondylar fractures of the humerus are the most common fractures around the elbow in children [1,2]. It is a fracture that occurs at the supracondylar area or the metaphysis of the distal humerus and accounts for 65.4% of upper extremity fractures in children[3]. Immobilisation in a posterior above elbow slab is generally accepted as the standard treatment for non-displaced fractures. For displaced supracondylar humerus fractures, closed reduction and percutaneous K-wire fixation is widely accepted as the standard treatment unless the fracture is complicated by vascular or nerve injury that requires exploration[1]. Percutaneous pinning of supracondylar humerus fractures in children is an effective way to maintain an anatomic reduction after closed reduction of a displaced fracture and was first described by Casiano[4] in 1960. The goals of surgical management include correction and maintenance of alignment, avoid deformity, and early functional range of elbow movement. The aim of our study was to evaluate the functional results of closed reduction and percutaneous pinning in the treatment of displaced supracondylar fractures of the humerus in children done by relatively inexperienced orthopaedic surgeons under supervision of a senior surgeon. The reason for doing such a study was that in our centre, which is a tertiary hospital in northeast admitting approximately 1500 paediatric orthopaedic emergencies each year, two thirds of the surgeons on call have less than four years experience after graduation. Following protocol was chosen, after extensive review of literature; Closed manipulation and reduction which was confirmed by image intensifier and followed by percutaneous K-wire pinning. K-wires were placed either in parallel or divergent configuration in lateral fixation technique and for the medial and lateral fixation technique cross wires were placed engaging the opposite cortex.

II. Materials and methods:

A prospective study was carried out for a total of 257 cases of displaced supracondylar fractures of humerus aged between 3-12 yrs attending the OPD and Emergency department of Orthopaedics, Gauhati Medical College & Hospital who met the inclusion and exclusion criteria outlined below. All the cases were followed up for a minimum period of six months. In our study patients whose parents/guardians gave consent, children aged between 3 to 12 yrs, closed Gartland type III supracondylar humeral fracture, with no associated fractures in same limb and intact neurological and vascular status of the affected limb, ipsilateral shoulder, wrist

and fingers functionally good enough, so as not to exert an adverse effect on the rehabilitation process and who met the medical standards for surgery were included.

The patients excluded were those whose parents/guardians did not give consent, patients aged <3yrs and >12yrs, patients unable to take part in post-operative rehabilitation, not fit for surgery/anaesthesia, open fractures, fractures with history of trauma > 4 days and fractures requiring open reduction or neurovascular exploration.

After appropriate radiological and pre-operative investigations the individual was posted for surgery. Patients were discharged usually after 2nd or 3rd post-operative day when reduction of pain, oedema and return of good active finger movements occurred. Patients were followed up at 3 weeks after which K-wires were removed. Clinical evaluation was done for passive range of motion, measurement of carrying angle, neurovascular status, superficial and deep infection and necessity to re-operate. Clinical evaluation was done according to Flynn criteria[5].

Further follow ups were done on six weeks, three months and six months after the operative procedure. Patients were assessed for full function, minor limitation of function and major loss of function. Any patient with immediate postoperative iatrogenic ulnar nerve injury was explored again and the pin was placed in another location. Check X-rays were taken immediately post-operative, at one week, three weeks, six weeks, three months and six months.

III. Results:

The patients were personally reviewed with clinical and radiological evaluation with an average follow-up of 8.2 months (range six – sixteen months).

There were 257 patients with a mean age of 8.4 years and youngest patient was 3 years and the oldest patient was 12 years. The most common mechanism of injury was fall on ground while playing (64.51%). Males (72.6%) were more commonly involved than females (27.4%). Left side (77.40%) was more commonly injured than right side (22.60%). Most patients were operated within the first two days. The most common fracture displacement in our series was posteromedial type (80.65%) compared to posterolateral type (19.35%). Complications included 15 cases of pin tract infection. There were 4 cases of iatrogenic ulnar nerve injury. There was mild loss of reduction in 12 cases. Average loss of range of motion and carrying angle was 8.78° and 3.96° respectively.

The functional results were found to be excellent according to Flynn's criteria[5] in 76.03% and good in 23.97%. There were no poor results.

IV. Discussion:

Supracondylar fractures (extension type) are the most common fractures around the elbow in children and adolescents[1,2]. Gartland type-I fractures are commonly treated by an above-elbow posterior pop slab without reduction. The treatment of more severely displaced (Gartland type II and type III) fractures remains controversial. The aim of our study was to develop a simple algorithm of treatment to provide the best functional and cosmetic result even when undertaken by less experienced surgeons and the simplest follow-up regime. The conservative management of displaced supracondylar humerus fractures is known to lead to unacceptable reduction with displacement and malunion leading to varus deformity as mentioned by Flynn et al[5] and Arino et al[6]. In our study, the union rate was 100% (257/257).

Pin tract infection with pin loosening occurred in 15 cases which is comparable to Mostafavi study[7]. Pin tract infection necessitated earlier removal of K-wires (at 2 weeks). Infection was treated with antibiotics and regular dressing. However, the loss of both the range of motion and the carrying angle were greater in these 15 patients, compared to those without infection.

Pin tract infection

SERIES	PIN TRACT INFECTION
Mostafavi[7]	5
Ramsay RH et al[8]	6.5
Present study	5.8

There were 4 cases of iatrogenic ulnar injury following medial pinning. Complete neurological recovery occurred in all patients by the end of 6 months. This is comparable to series by Solak et al[9] and Skaggs et al[10]

Iatrogenic nerve injury

SERIES	IATROGENIC ULNAR NERVE INJURY
Solak et al	5%
Skaggs et al	8%
Present study	1.5%

In our series, the average loss of range of movement was 8.78⁰ which compared favourably with series by Nacht et al[11] (7.8 degrees). We did not find any significant improvement in range of motion after six months post surgery.

There was mild loss of reduction in 22 cases, though radiological and clinical union occurred in similar period without any residual deformity.

The average change in carrying angle was 3.96⁰ (range 2-9 degrees) in our series. In the series by Aronson and Prager[12] this was 2.2 degrees (range 0-8 degrees).

At the end of three months we evaluated our results for each patient according to Flynn et al criteria[5]. Overall we obtained “excellent” results in 76.03%; and “good” in 23.97% cases. There were no poor results. The findings in our study were consistent with series of Mostafavi[7].

V. Conclusion:

From our study we concluded that closed reduction and percutaneous K-wire fixation is the treatment of choice in displaced supracondylar fractures in children. This method can be done even by relatively inexperienced young orthopaedic surgeons with satisfactory functional outcome. Both the methods of pinning medial- lateral and lateral offer consistently comparable satisfactory functional results.



Radiograph showing satisfactory crossed medial - lateral entry K-wire fixation



Radiograph showing two lateral entry parallel K wire fixation

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