



OPEN REDUCTION AND K-WIRE FIXATION FOR THE TREATMENT OF GARTLAND TYPE III SUPRACONDYLAR HUMERAL FRACTURES IN CHILDREN- A PROSPECTIVE STUDY.

**Barun kumar
Golwara**

Senior Resident, Department of Orthopaedics, Jawaharlal Nehru Medical College and Hospital, Bhagalpur.

Maseeh Azam*

Assistant Professor, Department of Orthopaedics, Jawaharlal Nehru Medical College and Hospital, Bhagalpur. *Corresponding Author

ABSTRACT In this study, we aim to evaluate the clinical and radiological results of children with displaced supracondylar humerus fractures who were treated with open reduction and internal fixation with posterior surgical approach. Clinical outcomes were evaluated for 50 patients with Gartland type 3 extension supracondylar fractures. Functional and cosmetic results of the patients were determined according to the Flynn criteria. Mean age of the patients was 7.33 (between 2 and 14) among which 24 of them were girls and 26 were boys. Mean follow-up was 12.36 months. While 45 of the patients had satisfying results (excellent, good, or fair), five of them had unsatisfactory (poor) results. The results of this study suggest that clinical results with surgical treatment of Gartland type 3 extension fractures were satisfactory. However, the delay in the surgical treatment may cause a number of complications.

KEYWORDS : Children, Humerus, Supracondylar fractures.

Introduction-

Supracondylar humerus fractures are the second common type of pediatric fractures. It accounts for 65.4% of upper extremity fractures in 5-10 year age group in children, fall on outstretched hand being the commonest cause [1]. Surgical procedures are the treatment of choice in displaced supracondylar humerus fractures [2]. It is a fracture near the distal end of bone, at transformation zone, where shape changes from tubular to flat, and fracture line crosses just proximal to the articular surface. This anatomy makes it difficult to achieve satisfactory reduction and more so to maintain it. Humerus fractures are a significant part of pediatric fractures due to high incidence, high morbidity, and serious complications [3, 4]. The fracture is associated with devastating complications, including arterial occlusion- leading to VIC, nerve injury - median nerve most common, deformity, permanent disability, myositis ossificans, compartment syndrome and amputation. It should be considered as a surgical urgency. Various treatment modalities available are close reduction and POP cast, traction, open reduction and internal fixation and close reduction and percutaneous pinning. Each method has its own advantages and disadvantages. In this study, we aim to evaluate the clinical and radiological results of children with displaced supracondylar humerus fractures who were treated with open reduction and internal fixation with posterior surgical approach.

Material and Methods-

Study was conducted in the Department of Orthopaedics, JLNMC Bhagalpur from October 2016 to April 2017. Present study consisted of 50 cases of Gartland's type III supracondylar fracture in children admitted to our department in above mentioned duration. Patient age ranged from 2 to 14 years with average age of 7.33 years. Twenty one patients attended emergency same day, 21 patients came on second and third day and rest 8 came in 3-7 days after injury.

Initial medical history and neurovascular physical examination were recorded in the emergency room for all patients. Anterior-posterior and lateral radiographs of the elbow were obtained. All the results were recorded. All of the patients were hospitalized, and long arm splints were applied. Then, the patients were operated as soon as possible. Parents of all patients included in this study were informed about the study and their consent was taken.

Indications for Open reduction-internal fixation (ORIF) were fractures with high risk of neurovascular injury, engagement of the distal aspect of the proximal fragment in brachial muscles and unsatisfactory closed reductions. In this study, our groups comprise only the patients who need open reduction after failed closed reduction attempts. Fractures treated with closed reduction and percutaneous fixation was excluded from the study.

The patients underwent surgical intervention under general anesthesia, often using pneumatic tourniquet. Skin incision was made midline to

olecranon starting about 5 cm proximal to the olecranon, giving a slight curve to the distal for 1-2 cm. Ulnar nerve was located to prevent an injury. Fixation was made by at least two cross or lateral K-wires. A long-arm cast was applied in the elbow 90° flexion and neutral forearm rotation. The sutures were removed after 10 days. Postoperative radiological controls were performed regularly. We removed the wires at 4th week. Active exercises were started according to the fracture healing in radiographs. Patients were under regular follow-up for at least 1 year.

Modified criteria developed by Flynn [3] were used for evaluation (Table1).

Table 1 Modified Flynn Criteria

Outcome	Rating	Cosmetic factor (carrying angle loss in degrees)	Functional factor (movements loss in degree)
Satisfactory	Excellent	0-5	0-5
	Good	6-10	6-10
	Fair	11-15	11-15
Unsatisfactory	Poor	>15	>15

Results-

In total, 26 patients (52 %) were male and 24 (48 %) were female. The mean age was 7.33 years. The patients were distributed between the ages of two and 14. The fractures were at the right elbow in 54 % of the cases and left elbow in 46 % of the cases. Falls (in-house, out of house, and falls from height) were the most common injuries (96 %). Only five children were immediately taken for open reduction based on presentation nerve injury, vascular injury. Five patients had accompanying injuries with two having ipsilateral fractures of the distal radius, and the others had a first metacarpal fracture, a contralateral both bone forearm fracture, and a tibial spiral fracture. Mean operation time was 45 (35-85) min. Average Length of Hospital Stay was 2.9 (1-7) days. Average duration of splints was 3.5 (2-6) weeks, while the average removal period of the wires was 4 (3-6) weeks. Mean consolidation time was 4.6 weeks (3-8). Mean follow-up was 12.36 months. We have made radiological assessment including an AP and lateral X-ray of elbow for all of our patients at postoperative consolidation time and at the final follow-up. The Baumann angle was measured on AP radiographic view. Diaphysis-condylar angle was measured on lateral view. The mean Baumann angle value was 71.9° (64°-82°) at the average consolidation time and 74.6° (64°-88°) at the last follow-up. The mean diaphysis-condylar angle was 42.3° at the average consolidation time and 44.4° at the last follow-up. In clinical findings for the average loss of mobility, loss of flexion was 1.6° and loss of extension was 0.8°. Flynn's Criteria for functional and cosmetic results was used in our study. Flynn criteria are obtained measuring with goniometers the range of elbow movement and the carrying angle (Table1). In our study, functional and cosmetic results of 50 patients' were performed. While 45 of the patients had satisfying results (excellent, good, or fair), five of them had unsatisfactory (poor) results.

Preoperative and postoperative complications were observed in seven patients. Three patients had peripheral nerve lesions in the first physical examinations at admission and four patients had superficial pin tract infections at follow-up. At the last follow up five patients had cubitus varus deformity. Figs 1, 2, and 3 shows preop., postop., and follow-up X-rays (including anteroposterior and lateral view).



Fig 1. Preoperative X-ray

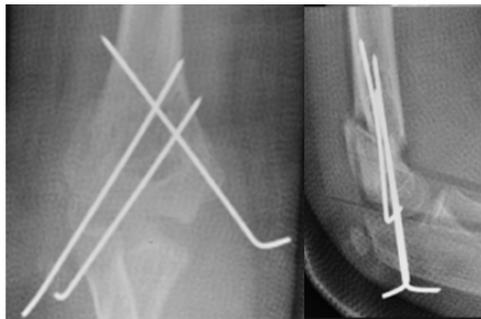


Fig 2. Postoperative X-ray



Fig 3. Follow-up X-ray

Discussion-

Goals in the treatment of pediatric supracondylar humerus fractures are full recovery of elbow movements, achieving normal cosmetic view of elbow, protecting the patient from neurovascular complications that may occur. Supracondylar fractures of the humerus in children are more common under the age of 10 [4–6]. In our series, the age distribution is from 2 to 14 yrs and the average age is 7.33. Supracondylar humerus fractures of childhood are more common in boys [4,5,7]. In this study, 52 % were boys and 48 % were girls. Left elbow fractures were more common in previous studies [4,7,8]. Left arm handles a protective duty during a fall. In our study, right arm (54 %) was more commonly injured. Mesherle et al. [8] reported the length of hospital stay as 1.6 days in their series of 36 patients. Mulhall et al. [9] reported LSH 2.5 days in their ORIF series. We had a mean LSH of 2.9 days. Supracondylar humerus fractures in children are frequently associated with various complications such as neurovascular deficit and compartment syndrome. In total, 7–16.1% neurological injuries are reported in the literature [3,10]. Anterior interosseous nerve injuries are the most common type of nerve injuries in extension fractures, and iatrogenic ulnar nerve injury is the most common type of nerve injury in flexion-type injuries [11]. These are commonly neuropraxia-type injuries in children and generally have a good prognosis. Nerve recovery is expected in 6 week to 3 months [5, 11].

One median nerve and two radial nerve involvement were noted in our study. Closed reduction and percutaneous pinning have been accepted as the gold standard in reaching these goals [12]. If close reduction cannot be achieved, open reduction should be preferred in displaced fractures, flexion-type fractures, nerve injury after closed reduction, open fractures requiring irrigation and debridement, posterolateral displaced fractures with a high risk of neurovascular injury [8, 13]. While 45 of the patients had functionally satisfying results, five had bad results. Similarly, while 46 patients were satisfactory cosmetically, there were four poor results. In management of these fractures, different pin configurations were also used [5, 6]. Youstri et al. [4] reported in the current systematic review article that there was no significant difference between crossed and lateral pinning in terms of loss reduction both configurations have similar stability. Mostly, we used crossed k-wires for fixation. But sometimes when it became risky for the ulnar nerve injury because of severe swelling and difficulty in pinning upon surgeon preference, two lateral pins were used. In general, K-wires can be removed 3–4 weeks after surgery in children under 10 years and at 4–5 weeks in older children [14]. Mean removal time of wires was 4 (3–6) weeks in our study. Baumann angle is an important angle in control of the reduction. Normal range is between 64° and 81° [10]. In our study group, the mean Baumann angle was 74.6°. Body-condylar angle measured after the surgery shows flexion or extension displacement of the distal fracture fragment [15]. Normal range is 40–45°. In our study, we found this angle 44.4°. The common complication of pediatric supracondylar fractures is cubitus varus (4–58%). Ippolito et al. [16] state that varus deformity is due to the defect of the distal humeral epiphysis growth plate. Surgical intervention decreases the rate of varus deformity. There were five cubitus varus cases in our study group.

Conclusion-

The results of this study suggest that clinical and radiological results of surgical treatment of Gartland type 3 extension fractures were satisfactory.

References-

- Hasler CC (2001) Supracondylar fractures of the humerus in children. *Eur J Trauma* 1:338–353
- Cheng JC, Lam WY (1995) Closed reduction and percutaneous pinning for type 3 displaced supracondylar fractures of the humerus in children. *J Orthop Trauma* 9:511–515
- Flynn JC, Matthews JG, Benoit RL (1974) Blind pinning of displaced supracondylar fractures of humerus in children. *J Bone Joint Surg* 56A:263–272
- Youstri T, Tarassoli P, Whitehouse M, Monsell F, Khan WS (2012) Systematic review of randomized controlled trials comparing efficacy of crossed versus lateral K-wire fixation in extension type Gartland type III supracondylar fractures of the humerus in children. *Ortop Traumatol Rehabil* 14(5):397–405
- Kasser JR, Beatty JH (2006). Supracondylar fractures of the distal humerus. In: Rockwood and Wilkins' fractures in children. 6th(ed.). Philadelphia, PA: Lippincott Williams & Wilkins. pp. 543–90
- Pretell-Mazzini J, Rodriguez-Martin J, Auñon-Martin I et al (2011) Controversial topics in the management of displaced supracondylar humerus fractures in children. *Strategies Trauma Limb Reconstr* 6:43–50
- Mazda K, Boggione C, Fitoussi F et al (2001) Systematic pinning of displaced extension-type supracondylar fractures of the humerus in children. A prospective study of 116 consecutive patients. *J Bone Joint Surg* 83B:888–893 *Strat Traum Limb Recon* (2014) 9:79–88 87 123
- Mesherle WL, Meehan PL (1991) Treatment of the displaced supracondylar fracture of the humerus (Type 3) with closed reduction and percutaneous cross-pin fixation. *J Pediatr Orthop* 11:705–711
- Mulhall KJ, Abuzakuk T, Curtin W et al (2000) Displaced supracondylar fractures of the humerus in children. *Int Orthop* 24:221–223
- Aronson DD, Prager BI (1987) Supracondylar fractures of the humerus in children. *Clin Orthop Relat Res* 219:174–184
- Erdil M, Imren Y, Ceylan HH et al (2012) [Multiple neural injuries in a pediatric supracondylar humerus fracture]. *J Clin Exp Invest* 3:438–442
- Ersan O, Gonen E, İlhan RD et al (2012) Comparison of anterior and lateral approaches in the treatment of extension-type supracondylar humerus fractures in children. *J Pediatr Orthop B* 21:121–126
- Millis MB, Smger JJ, Hail JE (1984) Supracondylar fractures of the humerus in children. *Clin Orthop* 188:90–97
- Kabukcuoğlu Y, Öztürk L, Bulut G et al (1993) [The treatment of supracondylar fractures in children by open reduction]. *Acta Orthop Traumatol Turc* 27:243–247
- Jones KG (1967) Percutaneous pin fixation of fractures of the lower end of the humerus. *Clin Orthop Relat Res* 50:53–69
- Ippolito E, Catenm R, Scola E (1986) Supracondylar fractures of the humerus in children. *J Bone Joint Surg* 68A:333–344