

Treatment of Paediatric Supra Condylar Fracture Humerus

Haque MM¹, Ahmed M², Haque ME³, Faisal MA⁴, Islam MS⁵, Sen SK⁶

DOI: <https://doi.org/10.3329/jafmc.v15i2.50827>

Abstract

Introduction: One of the most frequent elbow fractures in childhood, is supracondylar fracture which requires rapid diagnosis and treatment. It is usually associated with neurovascular, functional problems and deformity.

Objectives: To assess demographic, clinical features and treatment outcomes of the patients who underwent closed reduction and splinting, stabilization by percutaneous pinning or Open Reduction and Internal Fixation (ORIF).

Materials and Methods: This retrospective study was conducted in the department of orthopedic surgery, CMH, Bogura from June 2017 to December 2018. The inclusion criteria was Gartland type I, II, III fracture who attended in emergency and casualty, between 2 to 13 years of age. Total 40 patients with the mean age 7.5 years were included in the study group.

Results: All were closed fractures, 2 flexion and 38 extension type. Two (5%) Gartland type I, 24(60%) and 14(35%) had type II and III fracture respectively. 2(5%) were treated by cast immobilization, 8(20%) of type II by closed reduction & splinting, 22(55%) and 8(20%) of type II & III by crossed k-wire or by ORIF respectively. According to Flynn's criteria our study shows 33(82.5%) excellent, 4(10%) good, 2(5%) fair and 1(2.5%) poor outcome. 4(10%) had ulnar nerve neuropraxia, 1(2.5%) elbow stiffness, 1(2.5%) cubitus varus, 2(5%) experienced superficial pin tract infection.

Conclusion: Management of supracondylar fracture should be decided according to patient's age, fracture pattern and deformity status. Closed reduction and stabilization by percutaneous wiring provides an effective and safe treatment, when failed, open fractures or associated neurovascular complications ORIF should be preferred.

Keywords: Supracondylar fracture, Closed reduction, K-wire fixation.

Introduction

Most common fracture in children around the elbow is supracondylar fracture, it occurs due to fall on outstretched hand. This fracture had been reported to constitute nearly 60% of elbow fracture and 13% of all fracture in pediatric ages. Most of this occur within 5 to 7 years of age and are more frequent in boys. Supracondylar fracture is subdivided into extension or flexion injuries; extension type is most common accounting for 97% to 99%¹. In extension type injury mostly displacement is posteromedial.



Figure-1: Types of supracondylar fracture according to Gartland's classification

Gartland² classification is simple and widely used. In which type I fracture is non-displaced, type II fractures are displaced with a variable amount of angulations, but the posterior cortex is intact. Type III fractures are completely displaced with no cortical contact. In extension type injury may cause compression of the radial nerve, median nerve and brachial artery between the fracture fragments³. Prevalence of vascular involvement in elbow injuries has reported as 12%-20%¹. Supracondylar fracture associated with forearm fracture increases the risk of compartment syndrome. Flynn JC et al⁴ reported the incidence of cubitus varus was 5% following treatment, whereas Arino VL et al⁵ shows that it was about 21%. Various types of treatment methods are available such as closed reduction and splinting, Dunlop traction, olecranon traction but these have some complications. The preferred method involves closed reduction and Kirschner wire fixation, with variable number of pins and configuration, either medial and lateral or only lateral wires, which can be either parallel or crossed. Open reduction is generally reserved for irreducible fractures, vascular compromise and open injuries⁶. The aim of our study is to evaluate demographic and clinical features and treatment outcome of the patients having supra condylar fracture who underwent closed reduction and splinting, closed reduction and percutaneous wiring or ORIF with k wire.

Materials and Methods

This retrospective study was carried out in CMH Bogura from June 2017 to December 2018. After taking departmental approval of the study protocol, ethical clearance was taken from the ethical review committee. Before enrolling any patient for the study, informed written consent was taken. Forty patients between 2 to 13 years of age with the mean age of 7.5 years who came to the hospital and diagnosed as supracondylar fracture were included into the study group. Pediatric patient with supracondylar fracture above the age of 13 years were excluded from the study group. Notes and radiographs were reviewed for demographics. Detailed history was collected from the records. Site, mechanism of injury and time since injury was worked out. From the notes the deformity, swelling around elbow, tenderness, movements of elbow, any associated head injury or fracture of other bones, vascular status of the limb, capillary refilling, radial and ulnar artery pulsation were assessed. AP and lateral radiographs were taken in the emergency department. The fracture seen in the x-ray was classified according to Gartland's classification. Clinical and radiological features, complication and outcome were assessed. Management was given according to type of fracture. Two patients of type I fracture were treated by applying long arm posterior cast with elbow at 90-degree flexion and forearm in neutral rotation, a collar and cuff sling applied then plaster instruction was given to the patients attendant and advised to review

1. **Maj Md Maksudul Haque**, MBBS, MS(Ortho), Orthopaedic Surgeon, Jaber Al Ahmed Armed Forces Hospital, Kuwait (E-mail: maksudulhaque2005@gmail.com) 2. **Col Masud Ahmed**, MBBS, FCPS, Classified Anaesthesiologist, CMH, Dhaka, 3. **Dr Md Enamul Haque**, MBBS, D Ortho, Assistant Professor of Orthopaedic Surgery, RMCH, Rajshahi, 4. **Dr Md Ali Faisal**, MBBS, MS(Ortho), Associate Professor of Orthopaedic Surgery, BSMMU, Dhaka, 5. **Lt Col Mohammad Saiful Islam**, MBBS, MS(Ortho), Classified Orthopaedic Surgeon, CMH, Dhaka, 6. **L t Col Sumon Kumar Sen** MBBS, MS(Ortho), Classified Orthopaedic Surgeon, Adhoc CMH, Sylhet.

after two days if any tightening or loosening and then after four weeks for removal of cast.

X-ray was repeated to assess healing and active range of motion exercise started. Twenty four had type II fracture. After admission patient was kept nothing per orally. Under general anesthesia closed reduction was done by applying longitudinal traction to the forearm by the surgeon and counter traction was given by the assistant to the proximal arm, by applying valgus or varus force at fracture site medial and lateral displacement was corrected, then distal fragment was pushed anteriorly and the elbow was kept above 90 degree flexion. Reduction was checked by using c-arm fluoroscopy. Vascular status was assessed and posterior cast was applied with elbow in 120 degree flexion and forearm with full pronation. Eight patients were treated by this method and 14 required percutaneous cross k wire fixation. When satisfactory reduction was achieved Kirschner's wire of 1.5 to 2.5 mm were inserted and checked in c-arm fluoroscopy. Proper care was taken to avoid ulnar nerve injury. Pins were cut percutaneously.



Figure-2: (a) X ray showing supracondylar fracture treated by two percutaneous K wire (b) X-ray showing supracondylar fracture treated by ORIF with two cross K wire

After pin introduction elbow is extended and carrying angle was measured and compared with that of the normal. 2 patient of type II fracture required ORIF by two cross k wire and was observed for 24 to 72 hours then discharged. 14 had type III fracture, 8 of them required closed reduction with percutaneous k wire fixation and 6 of them required ORIF by two cross k wire due to failure of closed attempt. In open surgical approach under general anesthesia and tourniquet control, patient lie on prone position and the elbow supported with sand bag, posterior Campbell approach was used, skin, subcutaneous tissue was dissected, then ulnar nerve was identified and seen, triceps muscle was elevated from either end. The fracture margin cleaned, reduced, fixed with 2 crossed k wires. Ends of the wires were on outside the skin that will be helpful during removal. Posterior cast was applied with the elbow in 90 degree flexion and forearm in neutral position.



Figure-3: a) Clinical photograph showing preoperative hugely swollen elbow, b) supracondylar fracture treated by two percutaneous K wire, c) supracondylar humerus fracture treated by ORIF with two cross K wire

Drains removed after 48 hours, stitch off done on 2nd week, k wire and splint were removed after 4 weeks. Check x-ray was taken at 1st postoperative day then at 4 weeks, 3rd and 6th months. Follow up of every case was done for 12 to 18 months. Patients were evaluated finally at 06 months. At that time radiograph of both the elbows were taken and assessed both clinically and radiologically for carrying

angle and range of motion of elbow. Clinical outcome was assessed by using Flynn's criteria⁶ and compared with the normal elbow.

Results

Fourty children with unilateral supracondylar fractures were treated during the study period. All the patients had full documentation with a mean follow up of 14.5 months. The mean age at injury was 7.5 years and 32(80%) were boys and 8(20%) were girls. 25(62.5%) left and 15(37.5%) right sided fractures. 20 (50%) had injury during playing, 12(30%) fall from height, 8(20%) road traffic accident. All were closed fractures. Extension type injuries were 38(95%) and flexion type 2(5%). There were no open injury and concurrent fractures. Neurological examination was documented in all the patients with paresthesia noted in 2(5%) cases, vascular examination was documented in all patients with no evidence of impairment. A weak radial pulse was recorded in 6(33.33%) patients. Fractures were subdivided into Gartland type I (5%), type II 24(60%) and type-III 14(35%). Total 38(95%) patients underwent operative intervention for type II and III fractures. Closed reduction and plaster immobilization done in 8(20%) cases, closed reduction and crossed k-wire fixation was carried out in 22(55%) patient, open reduction and stabilization by crossed k-wire required for 8(20%) fracture. Most operations done on the day of admission 30(75%). 36(90%) patients were carefully observed for 12-72 hours and then discharged. Pre-operatively 2 cases and post operatively another 02 total 04 had ulnar nerve neuropraxia recovered within 3 months. Two (5%) patients had suffered from superficial wound infection, recovered by oral antibiotic and after removal of k wire. One (2.5%) patient had developed cubitus varus deformity who had type III fracture and was treated by closed reduction and percutaneous pinning. Elbow stiffness was found in 1(2.5%) case who had type III fracture and treated by ORIF. We called elbow stiffness when there is loss of >25 degree flexion or extension or both. Fracture united within 4 to 6 weeks post operatively. According to Flynn's criteria our result was excellent in 33(82.5%), good 4(10%) and fair 2(5%) and poor 1(2.5%).

Table-I: Methods of treatment used for supracondylar fracture (n=40)

Treatment	Type of fracture		
	I	II	III
Plaster cast immobilization	02	00	00
Closed reduction and immobilization	00	08	00
Closed reaction and crossed k-wire fixation	00	14	08
Open reduction and k-wire fixation	00	02	06

Table-II: Complications of various cases (n=40)

Complications		No of cases
Vascular injury		00
Volkmanschaemic contracture		00
Nerve injury	Radial nerve	00
	Median nerve	00
	Ulnar nerve	04(10%)
Myositis ossificans		00
Elbow stiffness		01(2.5%)
Cubitus varus		01(2.5%)
Cubitus valgus		00
Superficial pin tract infection		02(5%)

Table-III: Patients grading according to Flynn's criteria (n=40)

Grading	Cosmetic factor (Degrees)	Functional factors (degrees)	Number of patients
Excellent	0-5	0-5	34 (85%)
Good	6-10	6-10	03 (7.5%)
Fair	11-15	11-15	02 (5%)
Poor	>15	>15	01 (2.5%)

**Figure-4:** Clinical photograph showing functional and cosmetic outcome.

Discussion

Many different methods are suggested for supracondylar humeral fracture but no single technique is suitable. The aim of management of supracondylar fracture is to achieve perfect anatomical reduction, full range of motion, functionally and cosmetically acceptable extremity. Currently the preferred treatment in children is closed reduction and percutaneous pinning⁷. Although this management fails in about 15% of patients and requires manipulation of inadequate reduction or malposition of wires in 1-7% of patients⁸. Recently Hadlow AT et al⁹ have recommended manipulation and immobilization in plaster for all type of fracture, despite 31% of children required further operative treatment and development of varus deformities. In our study the mean age at injury was 7.5 years that corresponds with other reports¹⁰. Our gender ratio was 4:1, this corresponds with the Chinese study¹¹, where boys were more commonly affected. This study represents dominant arm injured more commonly, which was similar to other studies¹². In this series 2(5%) children were suffered from type I, 24 patients (60%) had type II and 14 (35%) had type III fractures that corresponds with other series^{3,11-12}. Flexion type fractures were seen in 2(5%) patients compared with 1% to 11% in the literature¹³. Dua et al¹¹ observed that closed reduction and percutaneous pinning of supracondylar fractures of the humerus in children is safe and effective method. In this series we perform successful closed reduction and crossed k-wire fixation in 22(55%) cases. 08 (20%) patient required open reduction and crossed k-wire fixation where close reduction failed. The rate of open reduction in the literature varies from 1.3% to 46%¹³⁻¹⁴ that corresponds with our study. We have done crossed k-wire as it gives better stability to fracture, iatrogenic injury to ulnar nerve can occur with this technique. Pin fixation through the lateral side can prevent this but becomes less stable, Lee SS et al¹³ reported that crossed k wire fixation provides better torsional rigidity than lateral pin fixation. Six patients (33.33%) presented with weak radial pulse with swollen elbow, under fluoroscopy emergency manipulative reduction with crossed k-wire fixation done, and limb regained perfusion. Two patients (5%) presented with preoperative ulnar nerve neuropraxia and two (5%) had iatrogenic nerve injury after 03 months they became fully recovered, which was similar to 2% to 6% reported in a literature⁶. In this study, 2(5%) patients developed pin tract infections, healed after removal of k wire and oral antibiotics. Deep infection or septic arthritis was not found. Pirone AM et al³ found superficial infection in about 2% cases without any deep infection or septic arthritis and also found cubitus varus in 14% cases. In this

series 2.5% patients had developed cubitus varus deformity that was in type III fracture treated with closed reduction and percutaneous k wire fixation. The deformity occurs as a result of displacement of distal fragment in medial direction and also inadequate reduction of internal rotation. Elbow stiffness was found in 1(2.5%) case. After physiotherapy stiffness was improved. According to Flynn's criteria our study shows 82.5% excellent, 10% good and 5% fair and 2.5% poor result. Khan HD et al¹⁵ reported excellent and good results were achieved in 73.4% cases. Although supracondylar fracture humerus are common in children, management of the injury and treatment of the complications are still controversial. Anatomical reduction, kirschner wire fixation with special attention given to soft tissues and careful monitoring of neurovascular function are key to management of this injury in children.

Conclusion

Treatment plan of supra condylar fractures should be decided according to patient age, soft tissue conditions, fracture pattern and deformity status. Closed reduction and percutaneous wiring provides an effective and safe treatment for this type fracture. When closed attempt failed or open fracture and associated neurovascular complications ORIF should be preferred.

References

1. Ucar BY, Demirtas A, Ucar DE. Treatment approaches and outcomes in childhood supracondylar humerus fractures. *J of European Review for Medical and Pharmacological Sciences* 2012; 16:936-41.
2. Minkowitz B, Busch MT. Supracondylar humerus fractures. Current trends and controversies. *Ortho Clin North Am* 1994; 25:581-94.
3. Pirone AM, Graham HK, Krazbick Ji. Management of displaced extension type supracondylar fracture of the humerus in children. *J Bone Joint Surg Am* 1988; 70:641-50.
4. Flynn JC, Mathews JG, Benoit RL. Blind Pinning of displaced supracondylar fracture of the humerus in children. Sixteen years' experience with long term follow up. *J Bone joint surg Am* 1974; 56:263-72.
5. Arino VL, Liuch EE, Ramirez Am et al. Percutaneous fixation of supracondylar fracture of the humerus in children *J bone Joint surg Am* 1977; 59-A:914-6.
6. Pretorius JL, Rollinson P, Rasool MN. Outcome of displaced supracondylar fractures in children after manipulation and backslab. *SA Orthopaedic Journal Summer* 2015; 14(4):35-41.
7. Park CB, Kim Pt, Park IH et al. Completely Displaced supracondylar humerus fracture in children; results of open reduction versus closed reduction. *J Orthop Sci* 2003; 8:137-41.
8. Ankar WN, Habela NM, Skaggs DL et al. Loss of Pin fixation in displaced supracondylar fractures in children: causes and prevention. *J Bone Joint Surg Am* 2007; 89:3-717.
9. Hadlow AT, Devane P, Nicol RO. A Selective treatment approach to supracondylar fracture of the humerus in children. *J Pediatr Ortho* 1996; 16:104-6.
10. Celiken O, Pestilci FI, Tuzuner M. Supracondylar fracture of the humerus in children: Analysis of result in 142 patients; *J Orthop Trauma* 1990; 4(3):265-9.
11. Dua A, Eachempati KK, Malhotra R et al. Closed reduction and percutaneous pinning of displaced supracondylar fractures of the humerus in children with delayed presentation. *Chin J traumatal* 2011; 14:14-9.

12. Cheng JC, Lam TP, Maffuli N. Epidemiological features of supracondylar Fracture of the humerus in chinese children. *J Paedial Orthop B* 2001; 10:63-7.
13. Lee SS, Mahar AT, Miesen D et al. Displaced pediatric supracondylar humerus fractures: Biomechanical analysis of percutaneous pinning technique. *J Pediatric Ortho* 2002; 22(4):440-3.
14. Dunlop J. Trans condylar fracture of humerus in childhood *J Bone Joint Surg* 1939; 21A:59.
15. Khan HD, Shah FA, Ullah K. Outcome of supracondylar fractures of humerus in children treated with open reduction and internal stabilization with cross Kirschner wires. *J of Surgery Pakistan* 2011; 16(4):157-60.