

Gartland's Type III Supra Condylar Fracture of Humerus in Children Treated with Open Reduction and Internal Fixation with Cross K-Wire Fixation: A Prospective Study

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ABSTRACT

To evaluate the short term results of open reduction and internal fixation with cross k-wires in type III supracondylar fracture of Humerus in children in our setup.

PATIENTS & METHODS: This prospective study was conducted at Department of Orthopaedic Surgery & Traumatology, Liaquat University of Medical & Health Sciences, Jamshoro from March 2012 to March 2014. Total forty-seven patients with type III supracondylar Fracture Humerus were evaluated in this series. All were treated with open reduction & internal fixation with cross k-wires. The children followed regularly and the cosmetic and functional results assessed according to the Flynn criteria.

RESULTS: The mean age in our series was 7.4 years. There were 35 boys and 12 girls. The most common mode of injury 72.34% was fall during play. In 95.75% of our cases injury was extension type and in 4.25% flexion type. Grade I pin tract infection was noted in only 3 patients. 69% cases have excellent cosmetic and functional results, 22% were having good cosmetic and functional results according to Flynn Criteria.

CONCLUSION: Open reduction and internal fixation with cross k-wires produce excellent to good results in Gartland type III supracondylar fracture especially in the areas where image intensifier facilities are limited.

KEYWORDS: Gartland's Type III, Humerus, Supracondylar fracture, Cross K-wires.

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INTRODUCTION

The most common fracture around the elbow in children is supracondylar fracture of the Humerus, almost 3% of all pediatric fractures (1), if not managed properly can lead to severe complications compromising & resulting arterial injury, Volkman ischemic contracture, nerve damage, myositis ossificans and mal-union (2). This fracture is most common in ages 5-8 years i.e., first decade of life. Mechanism of injury is mostly fall on outstretched hand in 97% - 99%, leading to extension type of injury and could be due to fall on point of flexed elbow in 2.2%, leading to flexion type (3). Commonly used classification system is one suggested by Gartland (4). Type I is undisplaced fracture, type II – displaced Supra condylar fracture with posterior cortex being maintaining contact and type III totally displaced Supra condylar fracture with gap in between the fragments.

The management strategy may be side arm traction, overhead skeletal traction, closed reduction and slab immobilization, closed reduction with percutaneous k-wire fixation or open reduction and internal fixation

with k-wires (1,5,6).

Type III Supra condylar fracture of Humerus, most of the times, treated with open reduction and internal fixation with k-wires to achieve optimum results and to prevent complications, if image intensifier is not available.

The aim of this study was to evaluate the short-term results of open reduction and internal fixation in type III Supra condylar fracture of Humerus in children with k-wires in our setup.

PATIENTS & METHODS

This study was conducted at Orthopaedic Department of Liaquat University of Medical & Health Sciences, Jamshoro from March 2012 to March 2014.

A total fifty patients with displaced Gartland's type III supracondylar fracture of Humerus were included in this study. Three were lost in follow up leaving forty-seven patients. These were treated by open reduction and internal fixation with cross k-wires.

All the patients were admitted either through emergency department with acute presentation or from out

patients department presenting within first week of injury.

Primary splintage was done after assessing distal neuro-vascular status and patient sent for radiography. On X-ray (anterio- posterior and lateral views), the fracture identified and classified according to Gartland's classification. After admission informed written consent taken and the patient and parents encouraged to move the fingers.

The cases were operated under general anesthesia. Tourniquet applied and the extremity prepared from axilla to fingertips.

The Cambell's posterior incision made from olecranon's tip about 5 cm proximally in the arm, subcutaneous tissue incised in line of longitudinal incision. Ulnar nerve identified, and retracted away from operation field. A tongue shaped flap of triceps aponeurosis incised from olecranon tip, and then fracture was exposed with subperiosteal elevation of the soft tissue putting Hoffman's retractor. Hematoma evacuated. Fragments freed of any soft tissue interposition. Pushing the proximal fragment posteriorly and reducing the distal fragment into place by traction on the forearm to reduce extension injuries. Similarly pulling the proximal fragment anteriorly and manipulating the distal fragment to reduce flexion injuries. Special consideration given to the proper alignment of the medial edge. Following reduction two krischner wires passed. One from the lateral epicondyle across the fracture line anchoring the medial cortex. A second krischner wire passed through the medial epicondyle anterior to the ulnar nerve and cross the fracture into the lateral cortex of the proximal fragment. After satisfactory pin fixation elbow extension done to judge the carrying angle and the wires then cut short and the ends of the wires bent and left outside the skin. Tourniquet then released, circulation checked and hemostasis secured. Wound closed over the suction drain. The upper extremity supported in posterior plaster slab at 90° elbow flexion and forearm in supination.

The patient's arm kept elevated, the neurovascular status recorded and encouraged to move the fingers. Antibiotics given per-operatively continued intravenously for first twenty-four hours according to the body weight of the patient. Suction drain removed on 2nd post-operative day and patient discharged.

Condition of the wound and neurovascular status of the affected extremity recorded and posterior slab re-applied.

The K-wires removed at third or fourth week without any anesthesia. Elbow mobilized allowing active range of motion; posterior slab kept for another one week for protection.

Check X-rays taken immediately post-operatively, at

one week, three weeks, six weeks and then at three months intervals.

Follow-up conducted at 2 months, 3 months & 6 months; later on only those cases with minimum of 4 months follow-up included in this study. Normal range of elbow movements and normal carrying angle noted with the help of a standard goniometer. At each follow-up AP and Lateral X-ray views of the injury side and anterioposterior view of the normal elbow taken. Restriction of range of movements of injured elbow recorded and any change in carrying angle noted by comparing the Baumann's angle on the anterioposterior X-ray views of both elbows.

At follow up visits patient assessed according to Flynn criteria (7). According to this criteria function of elbow is graded in 5^o intervals of loss of total arc of flexion and extension and the cosmetic appearance of elbow is graded in 5^o intervals of change in carrying angle. As our study is limited to 25 months, so major changes which usually results in remodeling over later period of growth spurt could not be assessed so only functional factor is encountered because a patient may have deformity with good function or no deformity with poor function.

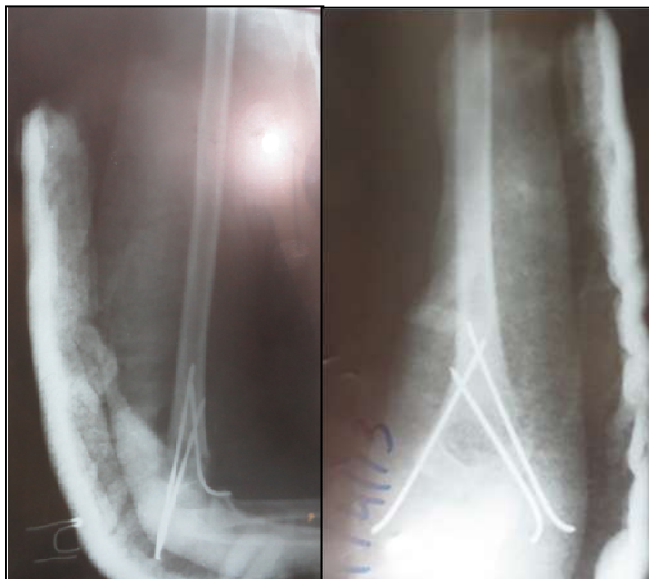
Flynn (et al) criteria for grading

Grading	Cosmetic Factor (Loss of Carrying Angle)	Functional Factor (Loss of Motion in Degrees)
Excellent	0-5	0-5
Good	6-10	6-10
Fair	11-15	11-15
Poor	> 15	> 15

FIGURE I:



FIGURE II:



RESULTS

In this study of 47 children, the age group of our patients ranged from 2 to 12 years with an average of 7.4 years. There were 4 patients (8.52%) within 2-3 years age group.

Nine patients (19.14%) were 4-6 years of age. There were 27 (57.45%) cases whose age range was 7 to 9 years; about 76.5% of the patients were of the age group between 4 to 9 years (Table I).

There were 35 (74.5%) boys and 12 (25.5%) girls (Table II).

Thirty-three (70.21%) patients had the left sided injury and remaining fourteen (29.79%) suffered from the fracture of the right Humerus (Table III).

Most common mode of injury was fall during play involving 34 (72.34%) children. The next common mode of injury was fall from height 9 (19.14%) children. Two (04.26%) children got injury in road traffic accidents and remaining two (04.26%) injured secondary to the direct blow on the posterior aspect of the elbow (Table IV).

Except the two (4.25%), which were of flexion type, remaining forty-five (95.75%) of fractures in our study were of extension type (Table V).

Ipsilateral fractures of the long of forearm were seen in two patients. There were three children showing soft tissue injuries, one with a small abrasion over the left lower leg. Other with minor wounds over the palm of the hand and the third one showed 0.5 cm skin deep cut over the left knee.

Thus the overall incidence of associated injuries was 10.64%.

No head injury was found associated with these

fractures in our patients (Table VI).

Three patients (6.38%) presented with the sign of brachial artery injury. In one patient radial pulse was completely missing and in other two it was palpable but feeble. All these signs disappeared following operation as the hematoma was evacuated and swelling subsided. Peroperatively no direct injury to vessel wall was observed.

Neurological deficits associated with these fracture were evident in five of our patients. There were three median nerve palsies. All were neuropraxias and completely recovered; no ulnar nerve or anterior interosseous nerve injury was encountered.

In three (6.38%) patients superficial pin tract infection was seen. In four (8.45%) patients stitch abscess developed which settled with antibiotics. No deep wound infection was encountered.

In 69% cases the change in carrying angle was only 0-5° giving excellent cosmetic results. In 22% cases the change in carrying angle was 6°-10° with good cosmetic result. In 9% cases, the change in carrying angle was more than 15° with unsatisfactory results.

The average value of carrying angle of normal elbow in our patients was 9.76°.

The average range of movements in normal elbow in our patients was 0-136°. In 32 cases the loss of flexion – extension arc was only 0-5°. Thus 69% of the patients regained excellent function at the elbow joint following fracture. There were other 10 (22%) cases, which showed good functional result by only 6°-10° loss of range of elbow joint movements. Thus 91% of the patients obtained excellent to good functional recovery.

9% cases showed unsatisfactory results with loss of more than 15° of flexion – extension arc movements at the elbow joint.

TABLE I: AGE INCIDENCE

Age Group	No of Patients	% Age
2-3 years	4	8.52%
4-6 Years	9	19.14%
7-9 Years	27	57.45%
10-12 Years	7	14.89%
Total	47	100%

TABLE II: SEX INCIDENCE

Age Group	No of Patients	% Age
Male	35	74.5%
Female	12	25.5%
Total	47	100%

TABLE III: SIDE INVOLVED

Age Group	No of Patients	% Age
Left	33	70.21%
Female	14	29.79%
Total	47	100%

TABLE IV: MODE OF INJURY

Age Group	No of Patients	% Age
Fall during play	34	72.34%
Fall from height	06	19.14%
Road traffic Accident	02	4.26%
Direct Blow	02	4.26%
Total	47	100%

Mode of Injury

■ Fall during play ■ Fall from height ■ Road traffic Accident ■ Direct Blow

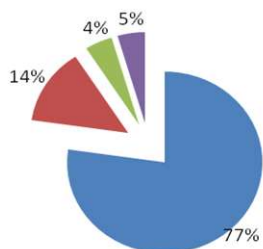


TABLE V: TYPE OF FRACTURE

Type	No of Patients	% Age
Extension	45	95.75%
Flexion	02	04.25%
Total	47	100%

TABLE VI: ASSOCIATED INJURY

Associated Injury	No of Patients	% Age
Ipsilateral fracture of forearm bones	02	4.26%
Soft Tissue Injuries	3	6.38%
Head Injury	Nil	Nil
Total	5	10.64%

DISCUSSION

Children tend to protect themselves with their out stretched arms, when they fall, thus accounting for vulnerability of the extremities to fracture.

The most common fracture around the elbow in children is supracondylar fracture of Humerus. (1)

The transformation area between the tubular and flat bone of distal Humerus between the olecranon and coronoid fossae, just proximal to the articular surface, is the vulnerable area of supracondylar fracture.

This anatomical architecture makes it difficult to reduce the fracture, even more difficult to maintain the reduction.⁸

Goal of treatment is anatomical reduction and stabilization, prevention of complication and early restoration of function. Management of supracondylar fracture of Humerus in children varies with the severity of displacement. Undisplaced and displaced with intact posterior cortex can be satisfactorily treated by conservation measures alone. Displaced supracondylar fracture creates a great problem in their management because they are difficult to reduce and to keep them immobilized by close method, so to get optimal results and minimal complications the displaced supracondylar fractures of Humerus in children usually require open reduction and internal fixation with k-wires.

Percutaneous pinning under image intensifier is technique of maintenance of reduction, is least traumatic and less time consuming with best reported results in displaced supracondylar fracture of Humerus in children, but it requires image intensifier, which is not available in most of the hospitals and also there is risk of ulnar nerve injury during insertion of pins.⁹

Numerous reports are available in literature demonstrating that primary open reduction and pin fixation of displaced supracondylar fracture of Humerus in children produce good results.¹⁰⁻¹⁵

In Gartland's type III supracondylar fracture of Humerus in children, the mean age of our patients is almost compatible with other series.^{16,17}

The gender ratio in our series was 3:1 and this male predominance was also noted in other studies.^(16,17,18)

Forty-five (95.75%) patients in our study were extension type whereas only two (4.25%) were of flexion type of Gartland's type III supracondylar fracture of Humerus in children. In other series the incidence of flexion type of fracture was 13%, 0% and 5% respectively.^{8,18,19}

Superficial pin tract infection was noted in 3 (6.38%) patients in our cases, which responded well to oral antibiotics. Same sort of infection was noted in 40%, 13.3%, 8% and 14.2% respectively.^{8,17,20,21}

The overall results we obtained are 69% excellent, 22% good results and in 9% we get unsatisfactory results. The results in our series are compatible with other national and international studies.

CONCLUSION

Open reduction and internal fixation with crossed k-wires produce excellent to good results in Gartland's type III supracondylar fracture of Humerus in children especially in the areas where image intensifier facilities are limited.

REFERENCES

1. Hakeem A, Khan NU, Gul T, FaheemUllah, Closed reduction and percutaneous pinning with crossed K-wires in type III supracondylar fractures of the humerus in children. Pak J Surg. 2010;26(1):10-12.
2. Hussain S, Ahmad MF, Khalid, Waqas. Displaced supracondylar fractures of humerus in children treated with open reduction and cross k-wire fixation. JPMI. 2010;24(04): 301-6.
3. Din SU, Shahab F, Rehman KU, Hussain K. Supracondylar humeral fracture in children: management by percutaneous lateral-entry pin fixation. J Postgrad Med Inst 2014; 28(1):103-6.
4. Gartland JJ. Management of Supracondylar fracture of humerus in children. Surg: Gynecol Obstet. 1959; 109:145-54.
5. Khan NU, Askar Z, Ullah F. Type-III supracondylar fracture humerus: results of open reduction and internal fixation after failed closed reduction. RMJ. 2015; 35(2):156-159.
6. Wael A El-Adl, Mohammed A. Results of treatment of displaced supracondylar humeral fracture in children by percutaneous lateral cross-wiring technique. Strategies Trauma Limb Reconstr. 2008;3:1-7.
7. Flynn JC, Mathews JG, Benoit RL. Blind Pinning of displaced supracondylar fractures of the humerus in children. J bone Joint Surg Am. 1974;56:263-273.
8. Boparai R, Sharma R, Kapila R, Pandher DS, Diwan RP. supracondylar fracture in children closed reduction VS open reduction. Indian J Orthop. 2006; 40:103-7.
9. Ramji Lal Sahu. Percutaneous K-wire fixation in paediatric Supracondylar fractures of humerus: A retrospective study. Niger Med J. 2013;54(5):329-334.
10. Osman M, Al-Hadi. Percutaneous lateral cross-pinning of paediatric supracondylar humeral fractures. Egypt Othop J. 2014; 49:188-92.
11. Ivanka Madjar-Simic, AdnanaTalic-Tanovic, et al. Radiographic assessment in the treatment of supracondylar humerus fractures in children. Acta Inform Med. 2012; 20(3):154-159.
12. Irena Krusche-Mandl, Silke Aldrian, et al. Crossed pinning in paediatric supracondylar humerus fractures: a retrospective cohort analysis. Int Orthop. 2012;36(9): 1893-1898.
13. Matthew D. Abbott, Lucas Buchler. Gartland type III supracondylar humerus fractures: outcome and complications as related to operative timing and pin configuration. J Child Orthop. 2014;8(6):473-7.
14. Topping RE, Blanco JS, Davis T (1995) Clinical evaluation of crossed pin Versus lateral pin fixation in displaced supracondylar fractures of the humerus. J Pediatr Orthop. 15; 435-439.
15. Tahir A, Majid F, et al, Treatment of Old Supracondylar Fractures of Humerus In Children. Journal of Surgery Pakistan (International). 2012;17(4):135-8.
16. Asiflqal M, Maliket NI. Outcome of open reduction and cross k-wires fixation in displaced supracondylar fractures of humerus in children. Isra medical J. 2011Dec; 3(3):97-100.
17. Gowda PM, Mohammed N. A Study of Supracondylar Fractures of Humerus in Children by Open Reduction and Internal Fixation with Kirschner Wires. Indian Journal of Clinical Practice 2014;25(6): 572-6.
18. P. Pavan Kumar, K. Kedar. Study Of Management Of Supracondylar Fractures Humerus By Percutaneous Pinning. JEBMH. 2015; 2(11):1612-20.
19. Lal K, Laghari MA, et al. Supracondylar Fracture of Humerus in Children Treated with closed Reduction and Percutaneous Cross Pinning vs. Two Lateral Pinning. JLUMHS. 2014;13(02):71-5.
20. Ashok R Nayak, K Natesh et al. Is Closed Manipulative Reduction and Percutaneous Kirschner Wiring of Supracondylar Humeral Fracture in Children as Day-Care Surgery a Safe Procedure? Malaysian Orthopaedic Journal. 2013;7(3):1-5.
21. Dharmadevan SV, Ghosh S, et al. Management of displaced supracondylar fracture of the Humerus in children. Saudi J Sports Med. 2015;15:193-8.



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