

Treatment of Old Supracondylar Fractures of Humerus In Children

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ABSTRACT

- Objective** To study the outcome of open reduction and fixation with K wires of supracondylar fractures of humerus in children presenting between 2–14 days after injury.
- Study design** Case series.
- Place & Duration of study** Department of Orthopaedics, B.V.Hospital Bahawalpur, from April 2009 to March 2010.
- Methodology** This study included patients with displaced extension type supracondylar fracture of the humerus (Gartland type III) who presented between 2-14 days post injury. Open reduction and internal fixation (ORIF) with crossed K-wire was done. The results were assessed by the criteria described by Flynn et al and Mark et al. The average age of patients was 4.5 year. The average hospital stay was 2 days (range 1–3 day). The average duration of follow-up was 15 months (range: 12-24 months).
- Results** Forty patients were managed during the study period. Eighteen (45%) patients had excellent results with less than 5 degree loss of range of motion and minimal loss of carrying angle; thirteen (32.5%) had good results out of which seven had less than 10 degree loss of carrying angle and six had less than 20 degree loss of motion. Six (15%) had fair results due to transient nerve lesions. One of the six patients had 30 degree loss of motion. The remaining three (7.5%) had poor results due to varus deformity that needed corrective surgery.
- Conclusions** Delayed presentation of displaced supracondylar humerus fractures in children did not increase complication rates or unsatisfactory results following an open reduction and internal fixation with K wires. It is a safe and effective method of treatment even with delayed presentation of supracondylar fractures of humerus in children.
- Key words** Supracondylar fracture, Humerus, Children, Open reduction, Internal fixation.

INTRODUCTION:

Supracondylar fractures of the humerus are the most common fractures around the elbow in children. According to Boyd and Altenberg these fractures account for 65.4% of upper extremity fractures in children.¹ Gartland proposed a classification for these fractures: type I, Undisplaced; type II, displaced with the posterior cortex intact; and type III, completely

displaced with no cortical contact.² It is generally agreed that closed reduction and percutaneous pinning under fluoroscopic guidance is the procedure of choice for the treatment of fresh displaced fractures.³ In the developing world, proportion of delayed presentation is much higher because of poorly developed health delivery system and patients reaching the tertiary care centers from long distance. Same is the situation in Pakistan. The management guidelines are not clear for the patients who present late.⁴

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Fractures that present late are difficult to treat because of excessive swelling and may be associated

with complications, such as neurovascular injury and compartment syndrome. There is fear of perioperative and late postoperative complications like iatrogenic nerve injury, Volkmann's ischemic contracture, cubitus varus deformity, elbow stiffness and myositis ossificans. Other studies have described high perioperative complication rate with delayed elective surgery but none has evaluated the long term functional outcome of the patients.⁵

Late presentations, defined as more than 2 days after injury, are commonly treated by continuous traction, with consequent prolonged hospitalisation.⁶ Alternatively, they are allowed to malunite and treated later by corrective osteotomy.⁶ A higher incidence of stiffness, neurological and vascular complications, and failure of closed reductions are encountered in late-presenting cases, particularly after repeated manipulations. Operative interventions risk further stiffness and myositis ossificans. Continuous traction has the disadvantages of prolonged hospitalisation, frequent radiographic analyses, and inadequate reduction.^{6,7}

The purpose of this study was to evaluate the clinical and radiological outcome and complications following open reduction and internal fixation of old supracondylar fractures in children.

METHODOLOGY:

It was a case series conducted between April 2009 and March 2010. Forty-six children with unilateral fractures were treated with ORIF (from 2 to 14 days after injury) for a displaced extension type supracondylar fractures (Gartland type III). Six patients were lost to follow-up and were excluded from the study. The remaining 40 patients were followed up for a minimum period of 12 months and formed the basis of this study.

The radiographs of elbow both anteroposterior and lateral views were reviewed and angles measured. Range of motion of elbow (flexion/extension) at presentation and at final follow up was recorded. Open reduction under general anaesthesia and fixation with two or three K-wires were performed. Under tourniquet control, Kocher lateral J approach was used.⁸ Radiographs of opposite elbow were also taken to measure normal Baumann's angle for that patient and for assessment of adequacy of postoperative fracture reduction.

An above elbow plaster slab was given in 45° flexion of the elbow. Stitches removed after two weeks and physiotherapy started after three weeks onwards. K-wires were removed at 4 weeks after obtaining an x-ray to assess union and myositis ossificans.

All children were followed up at the out patient clinic at 3 weeks, 6 weeks, 3 months, 6 months, 1 year then finally after 2 years. At each follow-up, the carrying angle, range of motion of both the elbows and distal neurovascular status were recorded. Outcome was graded according to the criteria cited by Flynn et al and Mark et al.

RESULTS:

There were 26 boys and 14 girls in this series. In 33 patients the fracture was displaced posteromedially, in 5 patients posterolaterally and 2 patients had posterior displacement. The average delay in presentation was 5 days (range: 2 to 14 days). Six patients had neurologic complications at presentation. Four had anterior interosseous nerve palsy while 2 had radial nerve palsy. The average age at the time of surgery was 4.5 year (range 2-9 year). The follow-up period ranged from 12-24 months, with an average follow-up duration of 15 months.

Thirty-seven patients were treated with 2 crossed K-wires. In 3 patients with unstable fracture, 2 lateral K-wires were employed in addition to medial K-wires. In 15 patients, a small medial incision was used over the medial epicondyle to retract the ulnar nerve and help in passing the medial pin. The average duration of plaster immobilization and pin fixation was 21 days (range: 19-28 days). There were 3 cases of superficial pin tract infection that were successfully treated by local dressing and antibiotics. No case of deep infection was encountered.

Full range of motion was achieved in 38 patients by the end of 3 months. Two patients had myositis ossificans and both had restriction of elbow flexion and extension. Both the patients presented more than 10 days following the fracture with history of repeated manipulations by quacks. All 6 patients with neurologic complications at presentation, recovered within 12 weeks except one who took 6 months to recover. None of the patients had postoperative neurovascular injury, compartment syndrome or Volkmann's ischemic contracture. The average duration of follow-up was 15 months (range: 12-24 months). Applying the criteria described by Flynn et al and Mark et al eighteen patients had an excellent result with less than 5 degree loss of range of motion and minimal loss of carrying angle with the Baumann angle within 4 degrees on the unaffected side (table I). The carrying angle as measured with a goniometer was within 3° of the unaffected extremity in these 18 patients at final follow-up.

Table I: Results According to the Outcome Criteria (n = 40)

Result grade	Flynn et al	Mark et al	Nature of Deficit
Excellent	18	18	----
Good	07	13	10 ⁰ loss of motion 5-10 ⁰ loss of carrying angle
Fair	12	06	Transient nerve lesion 15-20 ⁰ loss of motion
Poor	03	03	Cubitus varus deformity that required corrective surgery

Six patients had nerve palsies, four involving the median nerve and two the radial nerve. Six of the thirteen patients with good results would have been in the fair category using Flynn's criteria due to a loss of motion between 10 -20 degrees. Flynn's criteria do not include the neurovascular lesion. Only one patient with neurological lesion, the deficit lasted for a period of six months possibly due to a more serious injury (neurotmesis). In three cases the cubitus varus deformity was subsequently treated with corrective surgery. One patient with radial nerve palsy took almost six months to recover. The patient showed clinical evidence of nerve regeneration with a positive advancing Tinels' sign and also nerve conduction studies confirmed our clinical findings.

DISCUSSION:

According to the Flynn's criteria, our patients had more excellent results and fewer poor results with shorter hospital stay. Skin or skeletal traction requires a prolonged hospital stay and not all fractures presenting late are amenable by traction alone.^{9,10} Both modalities of traction are associated with a high incidence of cubitus varus. We consider operative treatment the best option for such late-presenting fractures as proposed by others.^{11,12}

Our study is comparable in results with other investigators. In our series, the delayed presentation on average was 5 days (range 2–14 days). Satisfactory range of movement was achieved within 3 months in 18 (45%) cases.¹³⁻¹⁵ Devnani reported that gradually reducing the fracture with traction reduced the risks related with delayed supracondylar humeral fractures.¹³ He had poor results in children with posteromedial angulation. Agus et al evaluated 13 children treated with closed percutaneous pinning after skeletal overhead traction. There were two fair functional results in that series.¹⁴ Lal and Bhan reported a series of 20 children with delayed open reduction for supracondylar humeral fractures. Of these patients, 35% had cubitus varus deformity and the loss of range of motion was 70%.¹⁵

Recently reported rates of pin-tract infection associated with percutaneous fixation ranged from 2.4 to 6.6%.^{16,17} Deep infections or osteomyelitis are rare following surgical treatment of displaced supracondylar humeral fractures. In our study, the infection rate was 6.5%. All these infections were pin tract and resolved with a course of oral antibiotics followed by pin removal after adequate bony healing.

Nerve injuries associated with displaced supracondylar humeral fractures are either associated with the trauma itself or associated with K wire insertion.¹⁸ A literature review demonstrated 3.6% iatrogenic nerve injury, with the ulnar nerve being involved in 81% of cases where K wires were inserted from medial side of elbow.^{18,19} In this series, we performed crossed K-wire configuration in all patients. We observed no iatrogenic nerve injury and the nerve injuries that existed pre-operatively were resolved within 3 months post-operatively except one case of radial nerve injury that was resolved at 6 months. Volkmann ischemic contracture is a rare event, with a prevalence of 0.5% or less according to Rang M.²⁰ In our study no case of compartment syndrome occurred.

CONCLUSIONS:

Open reduction and internal fixation is a better treatment option in type III displaced supracondylar fractures of the humerus in patients presenting late (2-14 days) after injury. There is low complication and high union rates.

REFERENCES:

1. Boyd HB, Altenberg AR. Fractures about the elbow in children. Arch Surg. 1944;49:213.
2. Gartland JJ. Management of supracondylar fractures of the humerus in children. Surg Gynecol Obstet. 1959;109:145-54.

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3. Sibinski M, Sharma H, Bennet GC. Early versus delayed treatment of extension type-3 supracondylar fractures of the humerus in children. *J Bone Joint Surg Br.* 2006;88:380-1.
4. Mazda K, Boggione C, Fitoussi F, Pennecot GF. Systematic pinning of displaced extension type supracondylar fractures of humerus in children. *J Bone Joint Surg Br.* 2001;83:888-93.
5. Lee SS, Mahar AT, Miesen D, Newton PO. Displaced pediatric supracondylar humerus fractures: biomechanical analysis of percutaneous pinning techniques. *J Pediatr Orthop.* 2002;22:440-43.
6. Shannon FJ. Dorgan's percutaneous lateral cross wiring of supracondylar fractures of the humerus in children. *J Pediatr Orthop.* 2004;24:376-9.
7. Skaggs DL, Hale JM, Bassett J, Kaminsky C, Kay RM, Tolo VT. Operative treatment of supracondylar fractures of the humerus in children: The consequences of pin placement. *J Bone Joint Surg Am.* 2001;83:735-40.
8. Chen RS, Liu CB, Lin XS, Feng XM, Zhu JM, Ye FQ. Supracondylar extension fracture of the humerus in children: Manipulative reduction, immobilization and fixation using a U-shaped plaster slab with elbow in full extension. *J Bone Joint Surg Br.* 2001;83:883-7.
9. Harwant S, Borhan TA. The efficacy of side arm traction in the reduction of supracondylar fracture humerus in children. *Med J Malaysia.* 2000;55:311-7.
10. Devnani AS. Late presentation of supracondylar fracture of the humerus in children. *Clin Orthop Relat Res.* 2005;431:36-41.
11. Prietto CA. Supracondylar fractures of the humerus: A comparative study of Dunlop's traction versus percutaneous pinning. *J Bone Joint Surg Am.* 1979;61:425-8.
12. Shoaib M, Hussain A, Kamran H, Ali J. Outcome of closed reduction and casting in displaced supracondylar fracture of humerus in children. *J Ayub Med Coll Abbottabad.* 2003;15:23-5.
13. Devnani AS. Late presentation of supracondylar fracture of the humerus in children. *Clin Orthop.* 2005;431:36-41.
14. Agus H, Kalenderer O, Kayali C, Eryilmaz G. Skeletal traction and delayed percutaneous fixation of complicated supracondylar humerus fractures due to delayed or unsuccessful reductions and extensive swelling in children. *J Pediatr Orthop Br.* 2002;11:150-4.
15. Lal GM, Bhan S. Delayed open reduction for supracondylar fractures of the humerus. *Int Orthop.* 1991;15:189-91
16. Boyd DW, Aronson DD. Supracondylar fractures of the humerus: a prospective study of percutaneous pinning. *J Pediatr Orthop.* 1992;12:789-94.
17. Cramer KE, Devito DP, Green NE. Comparison of closed reduction and percutaneous pinning versus open reduction and percutaneous pinning in displaced supracondylar fractures of the humerus in children. *J Orthop Trauma.* 1992;6:407-12.
18. Fowles JV, Kassab MT. Displaced supracondylar fractures of the elbow in children. A report on the fixation of extension and flexion fractures by two lateral percutaneous pins. *J Bone Joint Surg Am.* 1974;56:490-500.
19. Lyons J, Ashley E, Hoffer MM. Ulnar nerve palsies after percutaneous cross-pinning of supracondylar fractures in children's elbows. *J Pediatr Orthop.* 1998;18:43-5.
20. Rang M. Children's fractures. JB Lippincott, Philadelphia;1974:10.
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