Outcome of Open Reduction and Internal Fixation of Gartland Type III Supracondylar Fractures of The Humerus in Children Using Crossed K Wires Via Medial Incision

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ABSTRACT

Objective: To assess the Radiological & Functional outcome of open reduction and internal fixation with crossed K Wires in Gartland type III displaced Fractures Supracondylar humerus in children using medial approach.

Method: It was a descriptive study conducted on 95 patients with displaced supracondylar fractures of the humerus Gartland type III in children. All patients were managed with open reduction and internal fixation using crossed K Wires via medial approach.

The most common mechanism of trauma was fall while playing; fall from height and road traffic accident. The mean follow-up time was six months and results were assessed according to Flynn's criteria.

Results: Total 95 patients with closed supracondylar fractures of the humerus Gartland type III were included in this study. Male to female ratio was 56:39 (59 %:41 %). A total of 50 (52.6 %) patients got trauma to their right elbow while left elbow was involved in 45 (47.4 %) of cases. The mean age of the patients was 7.5±SD2.08 years. 60 (63.15%) patients gained excellent results according to Flynn's criteria while 17 (17.90%) patients had good and 13 (13.69%) patients achieved satisfactory results. Only 5 (5.26%) patients had poor results. The main cause of poor results was late presentation and initial quack management. No case of neurovascular injury and cubitus varus deformity was reported. All patients were happy with their scar appearance.

Conclusion: Management of displaced supracondylar fractures of the humerus in children with Open reduction and internal fixation using medial incision is simple, safe and straightforward, providing more anatomical reduction and functional outcome with good scar cosmoses.

Keys words: Supracondylar fractures of humerus; medial incision, Open reduction.

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INTRODUCTION

Supracondylar fractures of humerus is one of the most common injury presenting in orthopedic trauma and it account for 17 % of all pediatric fractures.[1] In developed countries, most of the displaced fractures are managed by closed reduction and internal fixation with K wires in accident and emergency department.[2]

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However, in developing countries most of the patients presented late that lead to open surgical intervention.[3] Late presentation means fractures presenting two days after injury.[4] Furthermore, failure of closed reduction and non-availability of C Arm in Emergency department also rule out closed reduction. In that situation, open reduction internal fixation is the only choice to gain anatomical reduction. The common age for fractures supracondylar humerus is 5-8 years.[5] Most of the fractures (98%) are usually extension type.[6] Different approaches used for ORIF are posterior [7], lateral,[8] medial,[9] combined medial and lateral and anterior.[10] As posterior approach is through triceps muscle and it can

lead to postoperative stiffness, so it is mostly abandoned by surgeons.[7] Although anteromedial approach gives good visualization of neurovascular structures but excessive wound retraction may lead to ulnar nerve injury. In anterior and lateral approach, medial column is not visible and as in most supracondylar humerus fractures medial column is comminuted and tilted, so it may lead to higher incidence of cubitus varus.[10] Blind insertion of medial pin can also carry of ulnar nerve palsy. Medial approach provides good opportunity of direct ulnar nerve visualization throughout the surgery as well as best possible anatomical reduction of medial column comminution. Medial approach also provides good view of anterior and posterior surfaces of elbow joint.

METHODS

This descriptive study was conducted in department of Orthopedic surgery Azad Kashmir Combined Military Hospital(AKCMH) Muzaffarabad between June 2016 to December 2017.Gartland classification was used to c;assify the fracture(table III.) Ninety-five patients with closed supracondylar fractures humerus Gartland type III were admitted. Informed consent was taken from patient's parents or guardians. Only patients presented within first week of injury were included in this study. No case of open fracture or associated with neurovascular injury, presented later than one week were included in this study. All cases were operated by same surgeon to rule out any surgeon related variant. There were 56 boys and 39 girls. The mode of injury was fall from trees (n=44), fall on hand while playing(n=36), road traffic accidents(n=10) and others (n=05). Mean age was 7.50 years±2.05 years.88 (92.7%) patients were presented with extension type while 07 (7.3%) had flexion type fractures. All fractures were managed by open reduction internal fixation with K wires using medial approach. The average time between admission and surgery was 48 5thours. All patients were followed up for a period of 06 months. Immediate post op x-ray was taken. K wires removed at 4^{th} week and range of motion exercises were started. Baumann's angle was measured. Patients were followed up regularly at one month interval to assess range of motion. Follow up x- rays were taken to assess Baumann's angle, and patients were also asked about scar cosmoses.

All cases were operated under general anaesthesia as well as use pneumatic tourniquet when applicable. Duration of surgery from skin to skin was also noted using tourniquet clock. Patient was put in supine position. The whole upper limb was scrubbed thoroughly and tourniquet was applied higher above. After draping the injured limb was placed on side table in abduction and external rotation position. Under aseptic technique 4 to 5 cm medial incision was given started from tip of medial condyle proximally about 1 cm anterior to midline. After incision in skin and subcutaneous tissue ulnar nerve was identified throughout the incision but kept within its facial layer. Plane between triceps and brachialis was opened. The proximal fractured fragment pushed through brachialis was delivered gently through incision and ends were cleaned. The distal fragment was then cleared with the help of periosteum elevator. The elbow was kept in 30 to 40 degree flexion throughout procedure to avoid traction on neurovascular structures. Anatomical reduction was achieved by holding proximal fragment with bone holding forceps while distal fragment was brought in place using gentle manipulation of elbow in flexed position to avoid traction on neurovascular bundle. Medial column was restored as accurate as possible and held in place with a K wire. Lateral column reduction was checked indirectly with help of index finger while anterior and posterior surface of joint was directly visualized. A second K wire was also passed through lateral column and position confirmed with Image intensifier. Flexion, Extension, supination and pronation of elbow joint were checked. Above elbow back slab applied with elbow in semi prone position at 90 degree. Neurovascular status of the patient's limb was assessed after recovery from anaesthesia. Drain was removed after 24 hours. Immediate post-operative X-ray was taken and check for Baumann's angle. Stitch removed at two weeks interval while wires removed at four-week interval. Patients were taught range of motion exercises under supervision of our Rehab department for next eight weeks with regular checkup at four weeks interval. All patients were assessed clinically as well as radiologically at three months and six months. This information was recorded. **1**. Baumann's angle (carrying angle) **2**. Passive range of motion (flexion, extension, supination and pronation) **3**. Cosmeses questions. Flynn's criterion was used to assess the results as Excellent, Good, Fair and Poor[11]. In Flynn's criteria, functional outcome and cosmetic factors are assessed: -any deviation of carrying angle radiologically and loss of flexion/extension clinically. SPSS version 22 was used to analyse data, mean. Standard deviation(SD) was determined for numerical

variables like age and time of K Wire removal. Percentage was used for qualitative variable e.g Gender, Fracture type and outcome.

RESULTS

We achieved good anatomical reduction in all cases. No case of postoperative neurovascular injury was noted .A total of 60 patients (63.15%) regained excellent range of motion in all flexion, extension, supination and pronation in eight postoperative weeks, 17 patients (17.9%) had good while 13 patients (13.69%) had fair outcome [Table: I]. Only 05 (5.26%) patients had restricted range of motion but it was due to late presentation and initially management by quacks. Duration of surgery from skin to skin was 25 to 45 minutes. In all cases K Wires were removed at four weeks. 14 patients developed superficial pin tract infection that was managed by simple dressings only. All patients or their guardians were happy with scar appearance.

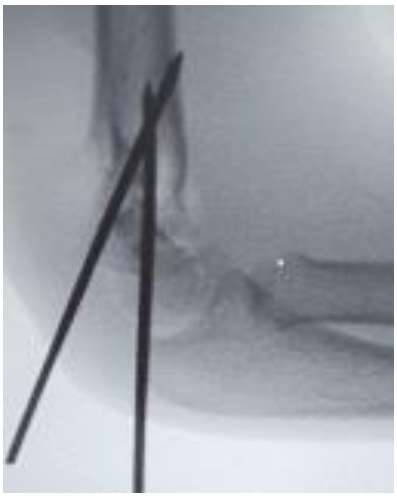
Table I: Results according to Flynn's criteria grading system:(N=95)

	Outcome	**Motion loss (cases)**	**Carrying angel loss (cases)**
1	Excellen*t*	60 (63.15%)(0 -5°)	75 (78.95%) 0 -5°
2	Good	17 (17.90%) (6-10°)	8 (8.42%) 6-10°
3	Fair	13(13.69%) (11-15°)	12 (12.63%)11-15°
4	Poor	5(5.26%) (>15°)	0 (0%) >15°

Table II: Gartland classification of Supracondylar fractures humerus

Picture I : Truama X Ray

Picture II: post Op X ray AP view



Picture III: Post Op Lateral view

Picture IV: Picture

Picture V: Follow up X ray

Picture VI: Follow Up Patient

Picture VII: Follow up patient

DISCUSSION

Supracondylar fractures humerus is one of the most common fractures in children below 12 years of age. Management of suprscondylar humerus(SCH) fractures Gartland type III is also challenging. There is not a single surgical approach for open reduction and internal fixation as well as configuration of K wires. Closed reduction and percutaneous K wires fixation is associated with 4 to15 % chances of iatrogenic ulnar nerve injury.[11] Furthermore, swelling around elbow joint also make procedure difficult. As the fracture is associated with medial column comminution as well as internal rotation of distal fragment, that can lead to loss of carrying angel. It is one of the most common late complication. [12,13] In most of the cases medial tilt may not be appreciated on plain X ray and only seen when elbow is extended and forearm supinated, that may need re-reduction.[13] In such cases open reduction and internal fixation is the best option.[13,14] Furthermore, cases presented late or already mismanaged by quacks also need open reduction and internal fixation. Although it may be associated with risks of infection but the improved outcome and decreased chances of neurovascular complications outweigh the risks.[15] It is also a safe procedure.[16]One of the most common complication of open reduction and internal fixation with posterior approach was myositis ossificans because posterior approach uses incision of triceps apponeurosis that lead to fibrosis and ultimately decreased range of motion. This complication is rarely seen with medial,[17] lateral[18] and anterior approach.[19] The medial approach provides an

excellent view of the whole elbow joint both anteriorly as well as posteriorly. Weiland reported higher incidence of cubitus varus with lateral approach.[20] The reason is that difficulty in judgment of medial column pathology.[20] Posterior approach has also been associated with significant incidence of cubitus varus complication.

In medial incision, we use a natural plane between brachialis and triceps without damaging the virgin tissue around elbow joint and neurovascular tissues anteriorly. This incision also provides good opportunity of direct visualization of ulnar nerve throughout the surgery along whole length of incision. Furthermore, direct anatomic reduction of fracture under vision minimize the chances of malunion. Open reduction also decompresses the hematoma so decreasing the chances of compartment.[21]

Sibley[22] reported significant loss of extension of elbow joint following K wire fixation using posterior approach. Gruber and Hudson[23] also reported extension loss. As posterior approach traumatizes the triceps muscle with significant motion loss.

At the time of six months most of the children regained full range of motion.(pictures I to VI) Late presentation and initial quack management was the main reason of decreased range of motion in about six patients in our study. As soft tissue trauma caused by injury and aggravated by tight bandaging by quack lead to muscle ischemia and finally fibrosis that is a main cause of reduced elbow joint movements. No case of iatrogenic ulnar nerve injury was reported that make this approach superior than lateral. Blind pinning in lateral approach is associated with 2-3% incidences of temporarily ulnar nerve injury.[24] Lyons[25] reported 5 % ulnar nerve injury incidences. Two patients developed cubitus Varus. All patient's guardians were satisfied with surgical scar.

CONCLUSION

We conclude that medial approach for open reduction and internal fixation of displaced supracondylar fractures humerus in children is safe, reliable method. It minimizes the risks of any iatrogenic neurovascular injury as well as help to gain excellent anatomical reduction with good cosmetics appearance of scar.

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Authorship and Contribution Declaration

Muhammad Shahbaz Raza, Conception and design, Acquisition of data & interpreted the data
Naveed Hussain, Revised the manuscript critically for important intellectual content
Shoukat Hayat Khan, Final approval of the version for publication
Zubair Ahmad Khan, Drafted the manuscript