STUDY OF SUPRACONDYLAR FRACTURE OF HUMERUS IN CHILDREN BY OPEN REDUCTION AND INTERNAL FIXATION WITH K-WIRES

Rajeev Kumar Roy[1], Mahesh Prasad[2]

[1]Senior Resident, Department of Orthopaedics, Nalanda Medical College Hospital, Patna, Bihar.
[2]Assistant Professor, Department of Orthopaedics, Nalanda Medical College Hospital, Patna, Bihar.

ABSTRACT

BACKGROUND

Supracondylar fractures of humerus is one of the commonest injury. It constitutes about 65 of all fractures around the elbow in children. Displaced supracondylar fracture of humerus requires accurate anatomical reduction and internal fixation to prevent complications. So, in this study, we evaluated the results of open reduction and internal fixation with K-wires in the displaced (Gartland's type III) supracondylar fracture humerus in children.

MATERIALS AND METHODS

Fifty cases of displaced (Gartland's type III) supracondylar fractures treated by open reduction and internal fixation with K-wires were studied between February 2015 to December 2016 at Nalanda Medical College Hospital, Patna. Cases were followed for an average of 24 months.

RESULTS

We came across 32 male patients and 18 female patients. Majority of the cases (40) were due to fall on outstretched hand involving relatively younger patients. At the end of 3 months, all except four patients could be mobilised independently without any support. We did not come across complications like nonunion and failure of fixation. One case had superficial infection, which was treated with antibiotics.

CONCLUSION

Open reduction and internal fixation with K-wires is the most commonly accepted treatment of displaced supracondylar fracture humerus in children.

KEYWORDS

Supracondylar Fracture Humerus, K-Wire, Internal Fixation, Gartland's.

HOW TO CITE THIS ARTICLE: Roy RK, Prasad M. Study of supracondylar fracture of humerus in children by open reduction and internal fixation with K-wires. J. Evid. Based Med. Healthc. 2017; 4(41), 2484-2487. DOI: 10.18410/jebmh/2017/491

BACKGROUND

Supracondylar fracture of humerus is one of the commonest injury around elbow in children. It constitutes about 65% of all the fractures around the elbow in children. The incidence rate increases in the first 5 years of life to peak between 5-7 years of age.[1] The supracondylar fracture of humerus demand great care in treatment, because if it is not treated properly, it may give rise to complications such as Volkmann's ischaemic contracture, neurovascular injury, myositis ossificans, stiffness of elbow and malunion (cubitus varus or gunstock deformity).[2] It needs accurate anatomical reduction and internal fixation, so 'not bad for a supracondylar fracture' attitude is no longer acceptable.[3] Various modalities of treatment have been proposed for the treatment of displaced supracondylar fractures of the humerus in children such as closed reduction and plaster of Paris slab application, skin traction, overhead skeletal traction, closed reduction and percutaneous pin fixation and open reduction with internal fixation. Closed reduction with splint or cast immobilisation and treatment with traction has earlier been recommended for displaced supracondylar fractures, but difficulty in reduction, loss of reduction during follow-up leads to malunion and elbow stiffness. Earlier, there was a reluctance to recommend open reduction of supracondylar fracture. But, now a lot of changes has taken place in orthopaedics. A better understanding of biomechanics, quality of implants, principles of internal fixation, soft tissue care antibiotics and asepsis have all contributed to improved outcome. Thus, we have advanced from the conservative approach to open reduction and internal fixation in fractures as an acceptable mode of treatment. Our objectives were to study age, sex and side incidence of supracondylar fracture of humerus and average time duration for union of these fractures after surgical treatment of supracondylar fracture of humerus by open reduction and internal fixation with K-wires along with any complications they may arise.

Financial or Other, Competing Interest: None.
Submission 27-04-2017, Peer Review 09-05-2017,
Acceptance 13-05-2017, Published 20-05-2017.
Corresponding Author:
Dr. Rajeev Kumar Roy,
Flat No. 503, J-complex, Arya Samaj Mandir Road,
Beside Lane No. 10, Patna-801503.
E-mail: rajeevroy05@gmail.com
DOI: 10.18410/jebmh/2017/491

MATERIALS AND METHODS

Fifty closed extension type of supracondylar fractures (Gartland's type III) of the humerus were treated by open reduction and internal fixation with K-wires between February 2015 to December 2016 at Nalanda Medical College Hospital, Patna.

Inclusion Criteria

1. Age <14 years.
2. Irreducible fracture by closed reduction.
3. Closed supracondylar fractures without vascular compromise.
4. Closed fractures.

Exclusion Criteria

1. Age >14 years.
2. Open fractures.
3. Fracture with neurovascular compromise.

All patients selected for this study were admitted in Nalanda Medical College Hospital and examined according to protocol and associated injuries if any were noted. Anteroposterior and lateral x-rays were taken. Above elbow POP slab was applied and after proper investigations, patients were taken for elective surgery at the earliest without closed reduction. All fractures were classified according to Gartland's classification chart-

Type I - Nondisplaced.
Type II - Displaced (with intact posterior cortex).
Type III - Displaced (no cortical contact).

Operative Technique

Under general anaesthesia, patients were put in lateral position with fractured elbow facing the upward. The standard posterior Campbell's approach was used in all patients. Ulnar nerve was identified and isolated. Triceps muscle was vertically split to expose fracture site. Haematoma was evacuated and saline wash was given to clearly visualise fractured site. Fracture was reduced and reduction was assessed by taking into consideration the medial and lateral pillar anatomy.

Once good reduction was confirmed, the lateral pin was placed first through the apex of the lateral epicondyle. The medial pin was placed at the center of medial epicondyle taking great care of ulnar nerve. The fractures were secured with 1.2-2.0 mm K-wires depending upon the age of the patient. Fracture stability was assessed, the elbow extended and carrying angle was assessed as compared to that non-affected side. The pins were bent and cut-off outside the skin to allow removal in the outpatient department without anaesthesia. Tourniquet was released and bleeding was secured. Wound was closed in layers and sterile dressing was applied. Postoperatively, the extremity was placed in posterior POP splint with elbow flexed to 90° and patient was shifted to the ward after recovery from anaesthesia. Dressing of the wound was done after 72 hours and stitches were removed on 12th postoperative day. Patients were called for follow-up after 3 weeks and the POP slab was removed. Active range of motion exercises were encouraged and patient were asked to avoid massage and passive stretching of elbow joint. The K-wires were removed after 4-6 weeks with further follow ups done at 12 weeks and 24 weeks. The patients were examined clinically and radiologically, assessed for range of motion and carrying angle. The final results obtained were evaluated as per Flyyn's criteria.[4] The results were graded as excellent, good, fair and poor according to loss of range of motion and loss of carrying angle.

RESULTS

Observation and analysis of results were done in 50 patients who were operated in our hospital in relationship to age, sex, type of injury, side of fracture, fracture pattern, associated injuries, time of surgery, duration of hospital stay, complications of treatment and functional outcome.

In our series, majority of patients, 30 (60%) were found to be between age group of 4-6 years (Table 1). The least number of cases are found in the age group between 12-14 years. The average age of the patient was 7 years. Majority of the patients were males, i.e. 30 (60%) and 20 (40%) patients were females. The commonest cause of injury was fall on outstretched hand while playing 30 patients, followed by fall from bicycle in 17 patients, and in three patients, it was due to fall from tree (Table 2). There was a left-sided predominance (38 patients, 76%) compared to the right side (12 patients, 24%). In our study, we had 30 patients with posteromedial displacement and 20 patients with posterolateral displacements. Majority of the patient underwent surgery on third day of hospitalisation. Postoperative complications ranging from traumatic median nerve palsy, superficial pin tract infection, iatrogenic ulnar nerve palsy, migration of K-wires and malunion were encountered (Table 3). Forty patients had loss of range of motion between 0-5°, 10 patients had >15° loss of range of motion. Thirty patients had carrying angle loss of 0-5°, four had >15° and remaining 16 patients 6-15° carrying angle loss.

Functional results based on Flynn's grading system showed that we had 90% (45 patients) satisfactory results and five patients with unsatisfactory results (Table 4).

DISCUSSION

Supracondylar fracture of humerus is the commonest injury around elbow in children.[1] Supracondylar fracture of humerus demand great care in treatment because if it is not treated properly, it may give rise to cubitus varus deformity, neurovascular compromise leading to VIC, difficulty in obtaining or maintaining reduction and poor late results because of stiffness of elbow or malunion.[2] Most frequently used methods of treatment are closed reduction and application of cast, closed reduction and percutaneous K-wire fixation and open reduction and internal fixation with K-wires.[5] The present study was undertaken to verify the claims of various authors regarding surgical management of supracondylar fracture humerus in children and outcome of

treatment of these fracture by open reduction and internal fixation with K-wires.

In our series of 30 patients, (60%) of the patients were between 4-6 years age group with an average age being 7 years. Majority of our patients, 30 (60%) sustained fractures due to fall while playing remaining due to fall from tree and from bicycle. In Edward et al series of 78 patients with supracondylar fractures, 69 patients sustained injury due to fall while playing. Fransworth et al[6] in her series, 70% of cases sustained fracture due to fall. In our study of 50 patients, 30 (60%) had posteromedial displacement, 20 (40%) had posterolateral displacement, which was consistent with other studies. In our study, three patients had fractures of distal end of radius on same side. In Mazda et al series of 116 patients, seven patients had ipsilateral forearm bone fracture. Pirone AM[5] et al in their series of 230 patients, observed 20 injuries of the ipsilateral forearm, 18 fractures of the distal third of the radius and ulna, one fracture of the middle third of radius and ulna and one Monteggia fracture dislocation. Millis et al noted 8.33% of associated fractures. Nineteen (63.4%) patients were operated on second day of hospitalisation in our study. In Ramsey et al,[7] study of 15 cases, all cases were operated within 24 hours of injury.

Age in Yrs.	No. of Patients	Percentage
4-6 Yrs.	30	60
7-9 Yrs.	10	20
9-14 Yrs.	10	20

Table 1. Age Wise Distribution of Patient

Nature of Trauma	No. of Patients	Percentage
Fall while playing	30	60
Fall from cycle	17	34
Fall from tree	3	6

Table 2. Mode of Injury

Complications	No. of Patients	%
Superficial pin tract infection	5	10
Iatrogenic ulnar nerve palsy	3	6
Migration of K-wire	4	8
Malunion	5	10

Table 3. Postoperative Complications in the Patients

Result	Rating	No. of Patients	%
Satisfactory	Excellent	30	60
	Good	12	24
	Fair	4	8
Unsatisfactory	Poor	4	8

Table 4. Functional Results Based on Flynn's Grading

Skaggs et al[8] in their study of 204 patients found that average interval between time of injury and operation was 1.4 days. In Weiland et al,[2] study of 58 cases, 51 patients underwent surgery within 24 hours. In our series, majority of patients were operated within 48-72 hours and delay in operation was due to late admission to hospital. In our series of 50 patients, about 70% of the patients were discharged within 2-3 days of operation and 15 patients discharged at 5 days due to presence of swelling. Regarding complications, three iatrogenic ulnar nerve palsies were encountered, although in our study, we isolated ulnar nerve during operation maybe due to over stretching of nerve.

CONCLUSION

During operation especially while putting K-wires on medial side and maybe also due to irritation of nerve by the K-wire postoperatively, but all patients recovered in a matter of 3-6 months. In Kumar et al series of 44 patients, five patients had postoperative temporary nerve palsy and they recovered full function. In a Weiland et al[2] series of 52 cases, he came across five preoperative neurological deficits. Two patients had combined radial and median nerve and one each of radial, ulnar and median nerve deficit. All patients recovered in 2 weeks postoperatively. In Srivatsava study group, 42.2% of the patients had nerve injury. We had five cases of superficial pin tract infection. In all cases, infection was subsided by treatment with proper antibiotics. Flexion and extension elbow exercises at the end of 3 weeks and K-wire were removed at 6 weeks and all patient showed radiological union at 6 weeks of follow-up. One patient had proximal migration of K-wire, which was removed later. Four patients had cubitus varus deformity. The results of our study showed favourably excellent results when compared together studies of open reduction and internal fixation with 92% satisfactory results according to Flynn's criteria of treatment of type III supracondylar fracture of humerus in children (Table 5). To conclude, open reduction and internal fixation with K-wires gives more stable fixation, better anatomical reduction with negligible complication. So, open reduction and internal fixation with K-wires is the most commonly accepted treatment of displaced supracondylar fracture humerus in children when done at appropriate time.

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