
ORIGINAL ARTICLE

CLINICAL STUDY OF MANAGEMENT OF FRACTURE OF SUPRACONDYLAR HUMERUS DISPLACED GARTLAND TYPE-III/ UNSTABLE GARTLAND TYPE-II IN CHILDREN'S BY CLOSED REDUCTION AND PERCUTANEOUS K-WIRE FIXATION

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ABSTRACT: OBJECTIVES: To assess the ability of closed reduction and percutaneous K-wire fixation, to obtain and maintain adequate reduction and thereby achieve satisfactory results. **METHODS:** The present study consists of 30 patients of Gartland type-3/unstable type-2 supracondylar fracture humerus who are treated with closed reduction and percutaneous K-wire fixation in Government General Hospital, Vijayawada from 01-07-2012 to 31-06-2014. **RESULTS:** There was no problem in union. Patients were graded by Flynn's criteria with excellent results in 87%, fair in 10% and poor in 1%. Only 3 patients developed cubitus varus deformity and one developed nerve palsy, which recovered subsequently.

KEYWORDS: Supracondylar humerus, K-wire fixation.

INTRODUCTION: The history of fracture is time immemorial. As man evolved from quadruped to biped the purpose of forelimbs in animals is changed from mere walking to prehension of hands in human beings. Whenever a person falls, instinctively it is the hand that comes for protection; hence it is the bones of upper limb that are likely to be fractured. Treatment of fractures dates back to SUSHRUTHA, an ancient Indian surgeon who is credited with the treatment of fractures. Similarly in ancient Greek, HIPPOCRATES advocated methods in the treatment of fractures, some of which are still in vogue.

At the turn of century, Sir. Robert Jones echoed the current opinion of that era about elbow injuries when he stated "The difficulties experienced by surgeons in making an accurate diagnosis, the facility with which serious blunders can be made in prognosis and treatment and the fear shared by so many of the subsequent limitation of function, serve to render injuries in the neighbourhood of elbow less attractive than they might otherwise have proved". These concerns are applicable even in the modern era. The presentation of a child with a swollen injured elbow still brings some feeling of anxiety to the treating orthopedic surgeon. Injuries of the elbow lead to chronic pain and permanent restriction of motion limiting the use of hand in most activities.

Positioning of hand for grip and prehension is dominated by freedom of motion at the elbow. Basic daily activities, from eating to perineal hygiene, requires a wide range of positions and movements at the elbow in both flexion and extension and fore arm rotations.

Supracondylar fractures of humerus are most common fractures around elbow in children.¹ they are one of the largest sources of serious problems and treatment controversy in childhood fractures.²

ORIGINAL ARTICLE

This study has been undertaken to observe the results of the management of supracondylar fractures of humerus Gartland type III/Unstable Supracondylar type II by closed reduction and percutaneous K-wire fixation.

AIMS AND OBJECTIVES:

1. The role of closed reduction and percutaneous k-wire fixation in displaced Supracondylar fractures of humerus in children under c-arm control.
2. To restore the carrying angle, Baumann's angle within 3 to 5 degrees of that of normal side and normal olecranon fossa alignment in displaced fractures to prevent Cubitus varus deformity.
3. To study the complications of those fractures.

MATERIALS AND METHODS: The present study consists of 30 patients of Gartland type-3/unstable type-2 supracondylar fracture humerus who are treated with closed reduction and percutaneous K-wire fixation in Government General Hospital, Vijayawada from 01-07-2012 to 31-06-2014.

Inclusion Criteria:

1. Gartland Type 3/Unstable Type 2 supracondylar fracture of humerus.
2. Open humeral growth plate.
3. Unilateral extension type supracondylar fractures of humerus.

Exclusion Criteria:

1. Children with Gartland type 1 and stable type 2 supracondylar fracture of humerus.
2. Children with failed closed reduction (which required open reduction)
3. Open fractures.

Statistical Analysis of Cases: Thirty cases of Gartland Type 3 supracondylar fractures in children are selected for treatment in our series by the method of closed reduction and percutaneous K-wire fixation of distal humerus under c-arm control in the Department of Orthopaedics at Government General Hospital, Vijayawada during the period.

The majority of the patient are in the age group of 4 to 7 yrs. The average age in our study is 5 yrs. The majority of the patient is male children about 3 times more than the females. The left side injuries are more common than the right side injuries. The extension type of supracondylar fractures more common than flexion type supracondylar fractures. Posteromedial type of displacement more common than posterolateral type of supracondylar fractures. Four cases were associated with the compound injury. It is of grade-I compound. It was treated as a closed fracture after the fracture is reduced. But the movement are restricted in these cases.

Two cases which are type 1 compound fractures are associated with radial nerve palsy in posteromedial displacement fracture which are recovered in 3 weeks (neuropraxia). No case was complicated by vascular deficit. Two cases which are type 1 compound fell down from the tree, 12 cases are injured while they are going on bicycle. Remaining 26 cases, they fell down while playing at home or school. All the patients fell down on outstretched hand.

GRADING OF OUTCOME IN SUPRACONDYLAR FRACTURES OF HUMERUS: Results are graded according to the following functional gradings.

ORIGINAL ARTICLE

Excellent: Carrying angle loss 0 to 5° restriction of elbow motion 0-5°.

Good: Carrying angle loss 5 to 10° restriction of elbow motion 5-10°.

Fair: Carrying angle loss 10 to 15° restriction of elbow motion 10-15°.

Poor: Carrying angle loss more than 15° restriction of elbow motion more than 15°.

Overall grading of patients according to the Flynn's criteria.³

Grading	Cosmetic factor (Carrying angle loss)	Functional factor (Range of movement loss)	Over all No. (%)
Satisfactory			
Excellent	0-5°	0-5°	26 (87%)
Good	6-10°	6-10°	0(0%)
Fair	11-15°	11-15°	3(10%)
Unsatisfactory			
Poor	>15°	>15°	1(3%)

DISCUSSION: Supracondylar fractures are the commonest fractures around the elbow in children. They are difficult to reduce, often have reduction loss, malunion, stiffness, neurological deficit and vascular complications.² Immobilization in cast has been the standard treatment for undisplaced fractures, but for displaced fractures it remains controversial. Closed reduction and percutaneous pinning provides the best cosmetic and functional results. However, some fractures are irreducible by closed means. Open reduction and pinning is therefore recommended for supracondylar fractures and for those with vascular injury or compound fracture.⁴ Late presentations, defined as more than 2 days after injury, are commonly treated by continuous traction, with consequent prolonged hospitalization.⁵ Alternatively, they are allowed to malunite and treated later by corrective osteotomy. 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, resort to frequent radiographic analyses, and inadequate reduction.

Supracondylar fracture of the humerus is one of the commonest elbow injuries in children. The average age being 5 years. Only recently has much attention been paid to the problem of malreduction of Supracondylar fractures of humerus in children. In the past, cubitus varus or cubitus valgus frequently was thought to occur because of growth arrest of distal humeral epiphysis, rather than because of the malreduction of the fracture (Watson-Jones).⁶

Importance of Accurate Reduction: Extension of the elbow joint is limited by the olecranon process locking in the olecranon fossa of humerus. If Supracondylar fracture unites with the lower fragment of humerus carrying the olecranon fossa tilted forwards 30°, this locking occurs 30° before the normal limit of extension movement is reached. Similarly uncorrected backward tilting of lower fragment causes permanent limitation of flexion. Moreover, if the fracture unites with the lateral tilting of lower fragment, the forearm bones are carried laterally with it and there is corresponding degree of cubitus valgus.

None of these tilts were corrected by later growth of bone. Correction of any rotatory deformity is of equal importance to the reduction of anteroposterior and lateral tilt, and can be easily missed

ORIGINAL ARTICLE

unless reduction X-Rays are carefully assessed. If rotator malalignment is not corrected, it may result in an apparent cubitus varus or it can accentuate the deformity of valgus or varus tilt.⁷ It is important therefore, in supracondylar fractures to secure perfect realignment of fragments as far as angulation and rotation are concerned. Lateral or medial shift and anteroposterior displacement alone are not important. In manipulative reductions of supracondylar fractures, the procedure to be followed for correction of displacement, angulation and medial or lateral tilt of fragments is uniformly accepted by most authors (Rockwood C.A. Jr. et. Al 1984).⁸ The controversy exists with regards to placing the forearm either in supination or pronation. In postero-medial displacement, where medial periosteal hinge is intact, placing the forearm in pronation will tighten the hinge and stabilize the fragments. Conversely postero-lateral displaced fractures are stabilized by placing the forearm in supination (Rang M, 1974).⁹ It was noted that placing the forearm in supination along with Dunlop traction tend to force the distal fragment into varus irrespective of initial displacement (D' Ambrosia, 1972).¹⁰ Repeated episodes of manipulation increases the soft tissue injury and enhance the complication rate.

"Transcondylar or bicondylar" fractures of the humerus offered the most important stumbling block to reduction, not because the fragments cannot be brought end to end but because of difficulty in maintaining the reduction (John Dunlop, 1939)¹¹. The causes for difficulty in maintaining the reduction are:

- Upper and lower fragments became rotated in their relation to each other.
- The fracture surface at that particular level consists of an extremely thin cortex, rarely more than 4 to 5mm.
- Edema and haematoma at fracture site result in loss of reduction.

Many recent series have demonstrated a greatly increased incidence of cubitus varus in those patients treated by cast alone (Pirone A.M. et. Al 1988).¹² They also showed higher incidence of both early and late complication in their series. Management by traction, skin or skeletal, has been used for many years to achieve and maintain a reduction. It is still an effective method of treatment but has certain limitations. The foremost in this is the prolonged occupancy rate of hospital bed. In the presence of swollen elbow it is risky to apply skin traction as it is an encircling dressing. The traction itself may precipitate ischemia. Skeletal traction provides the best method of immobilizing a swollen elbow. The site of choice being through the olecranon. This can be done either with a horizontal K-wire or a vertical screw (Abraham et. Al, 1982).¹³ Both wire and screws tend to loosen and pullout with time, especially in an active child.

Our series consists of 30 cases of supracondylar fractures of humerus in children, treated by percutaneous pinning of distal humerus under C-arm control. We selected the cases which fall into Gartland Type III/Unstable Type II classification. The average group was found to be five years.

It was found that the in children was caused by low energy trauma. Most of them were a fall on outstretched hand. In our series 9 cases while they are going on bicycle, 2 cases fell down while playing at home or school. There was higher incidence of supracondylar fractures in males compare to females, 23 cases were males and 7 cases were females. In our series supracondylar fractures are common on left side with an incidence of 65%. Out of 30 cases 4 cases were compound injury which were of Grade I type. The rest were simple injuries. Almost all cases are admitted on the day of injury. We treated all the supracondylar fractures by the method of percutaneous K-wire fixation under C-arm control. One case developed ulnar nerve neuropraxia which were recovered post operatively. In nine cases there was obliteration of carrying angle.



Pre-operative X-rays



Post-operative X-rays

Comparison of Results with Other Series: Pirone et al (1988).¹² studied 230 supracondylar fractures in children treated by different methods. In percutaneous K-wire fixation 78%, skeletal traction 67% and open surgery 67% had excellent functional results. 2 patients had pin tract infection. Our study shows 70% excellent results, 16% good results, 10% of fair results & 4% of poor results.

Sutton et al (1992).¹⁴ study shows 66% of excellent results and 22% of good results our study shows far better results than this study with low complications.

Royce et al.¹⁵ reported 4 ulnar nerve palsies caused by the medial pin. In our study two patients had ulnar nerve injuries following medial pinning. Out of two patients one had ulnar nerve involvement in immediate post-operative period and one other had delayed ulnar neuropathy. All these nerve injuries resolved spontaneously.

Flynn et al (1974).³ reported 52 patients treated by closed reduction and blind pinning, 98% of his patients had satisfactory results. Two patients had loss of reduction and one patient had transient ulnar neuropathy.

ORIGINAL ARTICLE

SUMMARY AND CONCLUSION:

1. The Supracondylar fracture of the humerus is one of the commonest elbow injuries in children.
2. These injuries are most often caused by a fall on outstretched hand.
3. Supracondylar fractures should be considered important for the impairment of function of the affected extremity and should be treated as such without delay and perfectly.
4. The basis of the treatment is anatomical reduction of the fracture.
5. The closed reduction with splint or cast immobilization results in loss of reduction and necessitating for repeated manipulation. This will lead to stiffness of the elbow and epiphysis damage, the later leads to shortening of the forearm and arm.
6. The cast treatment is recommended for the undisplaced fracture only. When used for displaced fracture it may redis place again after the swelling has subsided.
7. The treatment with skeletal traction is indicated, when there is massive swelling of the elbow making it impossible to palpate normal bony points.
8. The difficulty in adequately stabilizing a closed reduction externally without resorting to extremes of positioning has led to the development of internal stabilization procedures.
9. The major advantages of percutaneous K-wire fixation are to achieve stability of fracture without resorting to extremes of position.
10. The supracondylar fractures fixed with pinning can be put in any desired position.
11. Use of one pin may cause loss of reduction. Use of medial and lateral pin fixation provides more stability than lateral pinning alone. The pins must continue into the opposite cortex to provide solid pin fixation. Smooth pins are preferred.
12. The percutaneous K-wire fixation is less expensive than traction, duration of patient stay in hospital is reduced, reduced postoperative complications such as stiffness of elbow and varus deformity. The restoration of movements is of full range with closed pinning than open reduction.

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ORIGINAL ARTICLE

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