STUDY OF MANAGEMENT OF SUPRACONDYLAR FRACTURES HUMERUS BY PERCUTANEOUS PINNING

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ABSTRACT: Immobilization in cast has been standard treatment for undisplaced supracondylar fracture of humerus. Closed reduction and percutaneous pinning provides the best cosmetic and functional results. The fracture can be fixed with pinning in any desired position. Use of medial and lateral pin fixation provides more stability. The pins must continue into the opposite cortex to provide good fixation. Smooth pins are preferred and restoration of movements is full range with closed pinning than open reduction.

KEYWORDS: Percutaneous Pinning.

INTRODUCTION: Government General Hospital, Vijayawada is the one of biggest teaching hospital in the state of Andhra Pradesh. It is premier institute to which patients are referred from Krishna, West Godavari and East Godavari districts. The Department of Orthopedics has been a dynamic specialty rendering its services effectively and efficiently to the patients coming to this hospital. An exhaustive range of fractures around Elbow present themselves at our institution, many of which require accurate reduction and internal fixation. Because of the proximity of crucial Neuro-Vascular structures, a thorough knowledge of anatomy if essential. Accurate reduction and stable fixation of bony injuries can often optimize ultimate function and limit long-term disability. Supracondylar Fractures of Humerus is one of the few fractures which when treated well may not bring credit to a reputed Surgeon, but, if it is not handled properly, it can definitely bring discredit to a well-reputed Surgeon. Supracondylar Fractures of Humerus are most common fracture around elbow in children1. They are one of the largest sources of serious problems and treatment controversy in childhood fractures.

MATERIALS AND METHODS: A prospective study in children with Gartland Type 3/unstable 2 Supracondylar Fractures treated at GGH Vijayawada. 23 cases of males and 7 cases of females were studied. Almost all the cases were admitted on the day of injury. We treated all the cases by the method of Percutaneous K-wire fixation under C-arm control. One case developed ulnar nerve neuropraxia which was recovered post-operatively. In 9 cases there was obliteration of carrying angle.

STATISTICAL ANALYSIS OF CASES:

| AGE Group (yrs) | No. of Cases | Percentage |
|-----------------|--------------|------------|
| 4 to 5          | 15           | 50         |
| 6 to 7          | 15           | 50         |

TABLE 1: AGE Incidence
The majority of patients are in the age group of 4 to 7 years. The average age in 5 years.

**TABLE 2: Sex Incidence**

| Sex   | No. of Cases | Percentage |
|-------|--------------|------------|
| Male  | 23           | 76         |
| Female| 7            | 24         |

The majority of the patient is male children about 3 times more than the females.

**TABLE 3: Side Incidence**

| Side | No. of Cases | Percentage (%) |
|------|--------------|----------------|
| Right| 12           | 40             |
| Left | 18           | 60             |
The left side injuries are more common than the right side injuries.

| Type     | No. of Cases | Percentage (%) |
|----------|--------------|----------------|
| Extension| 30           | 100            |
| Flexion  | 0            | 0              |

**TABLE 4: Type of the Supracondylar Fractures**

The extension type of supracondylar fractures are more common than flexion type supracondylar fractures.
Table 5: Type of Displacement

| Displacement      | No. of Cases | Percentage (%) |
|-------------------|--------------|----------------|
| Posterolateral    | 12           | 40             |
| Posteromedial     | 18           | 60             |

Posteromedial type of displacement more common than Posterolateral type of supracondylar fractures.

Figure 5

Grading of Outcome in Supracondylar: Fractures of Humerus

Table 6: Modified criteria for grading outcomes (Flynn et al)

| Result          | Rating   | Cosmetic Factor | Functional factor |
|-----------------|----------|------------------|-------------------|
|                 |          | Carrying angle loss | Motion Loss      |
| Satisfactory    | Excellent| 0 to 5           | 0 to 5           |
|                 | Good     | 5 to 10          | 5 to 10          |
| Unsatisfactory  | Fair     | 10 to 15         | 10 to 15         |
|                 | Poor     | Over 15          | Over 15          |
Results are graded according to the following functional gradings.

**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°.

| Grading   | Cosmetic factor (Carrying angle Loss) | Functional factor (Range of movement Loss) | (Overall 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%)          |

Overall grading of patients according to the Flynn’s criteria

| Complications                                    | No. of patients |
|--------------------------------------------------|-----------------|
| Stiffness (range of movement loss >15°)           | 2               |
| Cubitus varus (carrying angle loss >15°)          | 3               |
| Nerve palsies                                   | 1               |
| Avascular necrosis of trochlea                   | 0               |
| Pin tract infection                             | 1               |
| Compartment syndrome/Volkmann’s ischaemic        | 0               |
| Contracture                                     |                 |
| Myositis ossificans                             | 0               |
RESULT AND CONCLUSION: The supracondylar fracture fixed with pinning can be put in any desired position. Use of one pin may cause loss of reduction.\(^{(1)}\) 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.\(^{(2)}\) Smooth pins are preferred and restoration of movements is of full range with closed pinning than open reduction.\(^{(3)}\)

DISCUSSION: Immobilisation in cast has been the standard treatment for undisplaced fractures, but for displaced fractures it remains controversial.\(^{(4)}\) Closed reduction and percutaneous pinning provides the best cosmetic and functional results.\(^{(5)}\) However, some fractures are irreducible by closed means.\(^{(6)}\) Open reduction and pinning is therefore recommended for supracondylar fractures and for those with vascular injury or compound fracture.\(^{(7)}\) Late presentations, defined as more than 2 days after injury, are commonly treated by continuous traction, with consequent prolonged hospitalization.\(^{(8)}\) Alternatively, they are allowed to malunite and treated later by corrective osteotomy.\(^{(9)}\) A higher incidence of stiffness, neurological and vascular complications, and failure of closed reductions are encountered in late-presenting cases, particularly after repeated manipulations.\(^{(10)}\) Operative interventions risk further stiffness and myositis ossificans. Continuous traction has the disadvantages of prolonged hospitalisation, resort to frequent radiographic analyses, and inadequate reduction.\(^{(11)}\)

IMPORTANCE OF ACCURATE REDUCTION: Extension of the elbow joint is limited by the olecranon process locking in the olecranon fossa of humerus.\(^{(12)}\) 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.\textsuperscript{(13)} 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.\textsuperscript{(14)} None of these tilts were corrected by later growth of bone. Correction of any rotatory deformity is of equal importance to the reduction of antero-posterior and lateral tilt, and can be easily missed unless reduction X-Rays are carefully assessed. If rotatory malalignment is not corrected, it may result in an apparent cubitus varus or it can accentuate the deformity of valgus or varus tilt.\textsuperscript{(15)} 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.\textsuperscript{(16)}

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.\textsuperscript{(17)} The average age group was found to be five years. It was found that the injury 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.\textsuperscript{(18)} 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.\textsuperscript{(19)}

**COMPARISON OF RESULTS WITH OTHER SERIES:**

Prione et al (1988) 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 at (1992) study shows 66% of excellent results and 22% of good results our study shows far better results than this study with low complications.

Herzenberg et at (1988) showed that the application of crossed medial and lateral pins to be a more stable configuration bio-mechanically.

Royce et al reported 4 ulnar nerve palsies caused by the medial pin. In our study two patients had ulnar nerve injuries following medial pining. Out of two patents 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) reported 52 patients treated by closed reduction and blind pining, 98 percent of his patients had satisfactory results. Two patients had loss of reduction and one patient had transient ulnar neuropathy.
BIBLIOGRAPHY:

1. Mulhall KJ, Abuzakuk T, Curtin W, O'Sullivan M, Galway. Outcome of primary O.R.I.F. in type III supracondylar fractures of the humerus. Journal of Bone and Joint Surgery. 1998; 80-B (3S): 284
2. Kasser RJ. Percutaneous pinning of supracondylar fractures. Instructional Course Lectures 1992; Vol 41.
3. Aranson DD, Prager PI. Supracondylar fracture of humerus in children - modified technique for closed pinning. Clinical Orthopaedics and Related Research 1987; 219: 174-83.
4. Paradis G, Lavallee Py Gagnon/V and Lemire L. Supracondylar fracture of humerus in children: technique & results of crossed percutaneous k-wire fixation. Clinical Orthopaedics and Related Research 1993; 297: 231 - 7.
5. Laer LV and Lampert C. Fractures of humerus in children. In Flatow EL and Ulrich C, editors. Musculoskeletal trauma series – Humerus. Oxford: Butterworth – Heinemann. 1996; 192-6.
6. James H Beaty and James R Kasser, elbow developmental anatomy and ossification centres Pg.No. 529-533 (Rockwood & Wilkins).
7. Wilkins KE, Fractures & dislocations of elbow region. Part 2; fracture of the distal humerus. Supracondylar fractures, in Rockwood Jr CA, Williams KE and Beaty JH, editors. Fractures in children. Philadelphia; J.B.Lippicot.1996; 669-752.
8. Hadlow AT, Devane P, Nicol RO. A selective treatment approach to supracondylar fracture of the humerus in children. Journal of Pediatric Orthopaedics. 1996; 16(1): 104 -6
9. Zionts LE, McKellop HA and Hathaway R. Torsional strength of pin configuration used to fix supracondylar fracture of humerus in children. Journal of Bone and Joint Surgery; 76 - A: 253 - 6.
10. S Terry Canale, Campbell 11th edition, 1580-98. Supracondylar Fracture of Humerus in Children.
11. Flynn JC, Matthews JG and Benoit RL. Blind pinning of supracondylar fracture of humerus in children. Journal of Bone and Joint Surgery 1974; 56-A: 263-72.
12. Bennett GC, Chhabda P, Pandis V. The management of displaced supracondylar fractures of the humerus in children by open reduction and internal fixation. Journal of Bone and Joint Surgery. 1998; 80-B (1S): 58.
13. Lins RE, Simovitch RM and Waters PM. Pediatric elbow trauma. Orthopaedic Clinics of North America. 1999; 30 (1): 119-32.
14. O'Hara LJ, Barlow JW, Clarke NMP. Displaced supracondylar fractures of the humerus in children: audit changes practice. Journal of Bone and Joint Surgery 2000; 82-B (2): 204-10.
15. Sutton WR, Greene WB, Georgopoulos G and Darner on TB Jr. Displaced supracondylar humerus fractures in children, a comparison of results and costs in patients treated by skeletal traction versus percutaneous pinning. Clinical Orthopaedics and Related Research 278:81-87, 1992.
16. Mazda K. Systemic pinning of displaced extension type of fracture of humerus in children - a prospective study of 116 consecutive patients. Journal of Bone and Joint Surgery 2001; 83-B: 888-93.
17. Kennedy JG et al. Evaluation of role of pin fixation versus collar and cuff immobilisation in supracondylar fractures of the humerus in children. Injury 2000; 31: 163.
18. Chen RS, Liu CB, Lin XS, Feng XM, Zhu JM and Ye FQ. Supracondylar extension fractures of the humerus in children. Journal of Bone and Joint Surgery [Br]; 83-B: 883 – 92.
19. Williamson DM et al. Normal characteristics of the Baumann's (humerocapitellar) angle: an aid in assessment of supracondylar fractures. Journal of Pediatric Orthopaedics 1992; 12: 636-9.

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