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A clinical study of displaced supracondylar fracture of humerus in children treated with closed reduction and percutaneous pinning in vims, Bellary

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Abstract

Supracondylar humerus fractures are the commonest type of elbow fracture in children and adolescents. Supracondylar fractures in children should be handled properly to prevent complications like Volkmann's ischemic contracture, elbow stiffness, varus or valgus deformities, compartment syndrome, neurovascular compromise and myositis ossificans. Incidence of supracondylar fracture is higher in boys. Left is more common than right side. Anatomical reduction is the key to obtaining good results. The results obtained in this study shows that anatomical reduction with K-Wire is the first treatment of choice for Type II and Type III fractures. Hence from our study, we observed that closed reduction and percutaneous pinning under C - arm guidance is a simple, cheap and effective method of treatment of displaced supracondylar fracture (type II and type III) humerus in children with relatively fewer complications.

Introduction

Mercer Rang uses the old saying. Pity the young surgeon whose first case is a fracture around the elbow, as an introduction to his chapter on elbow fractures for good reason. Though common—fractures about the elbow account for 5% to 10% of all fractures in children—the unique anatomy of the elbow and the high potential for complications associated with elbow fractures make their treatment anxiety producing for many orthopaedic surgeons. Supracondylar fractures of the humerus are the most common type of elbow fracture in children and adolescents. They account for 50% to 70% of all elbow fractures and are seen most frequently in children between the ages of 3 and 10 years, the high incidence of residual deformity and the potential for neurovascular complications make supracondylar humeral fractures a serious injury.[1,2]

Pitfalls in the management occur frequently and continue to trouble the doctor caring for these patients, especially with respect to displaced supracondylar fractures.[3]

But many methods have been proposed such as closed reduction and plaster of paris slab application, skin traction, overhead skeletal traction, open reduction and internal fixation, and closed reduction and percutaneous pin fixation.[4]

Supracondylar fractures in children should be handled properly to prevent complications like Volkmann's ischemic contracture, elbow stiffness, varus or valgus deformities, compartment syndrome, neurovascular compromise and myositis ossificans.

For this reason, percutaneous pinning techniques have become the treatment of choice for most supracondylar fractures.[5] Original cross pinning technique of Swenson[6] continued to be used with excellent results and negligible morbidity with the help of modem imaging techniques and improved power equipment's.

Percutaneous Pinning as compared to Open Reduction Internal Fixation has less chances of elbow stiffness and is cost effective in terms of no use of suture material, prolonged prophylactic antibiotics and short hospital stay.[7] So, open reduction has been reserved for open fractures, irreducible fractures and those associated generally with vascular complications.[1,7]

Methodology

This is a descriptive study, the patients admitted to Department of orthopaedics at vijayanagar institute of Medical Sciences, Bellary with displaced supracondylar fracture humerus in children 2-13yrs during the period from SEPTEMBER 2011 to SEPTEMBER 2013 were selected. All patients who were operated during this period were included in the study.

Inclusion criteria

a) Age between 2yrs-13 yrs.
b) Patients with both the sexes are included in the study.
c) Patients with closed fractures.
d) Unstable supracondylar fracture Gartland's type II and III
e) Patients fit for surgery

Exclusion criteria

a) Irreducible fractures.
b) Stable supracondylar fractures (Gartland's type 1).
c) Open fracture.
d) Associated with Neurovascular compromise

All the patients selected for this study were admitted in Vijayanagar Institute of Medical Sciences, Bellary and a detailed history and examination of the patient was done according to the protocol. The required information of the patient was recorded. The patient radiographs were taken in AP and lateral views. The diagnosis made

with clinical examination and X-ray. In this study, supracondylar fracture of humerus was classified according to Gartland's Classification.

All patients were taken for elective or emergency surgery as soon as possible after necessary routine investigations and radiographic preoperative work-up. Patient's attendants were explained about the nature of the injury, its possible complications and about the need for the surgery and complications of surgery. Written and informed consent was obtained from the parents of the children before surgery. All patients were given prophylactic antibiotic therapy; Intra-venous antibiotics were used. It was administered according to body weight of the children, prior to induction of anesthesia and continued post- operatively for 3 days in closed reduction cases. In closed reduction cases antibiotics were withdrawn after 3 days and oral antibiotics were given for further 5 days.

Surgical procedure

Anaesthesia

General Anaesthesia, brachial block.

Technique of closed reduction and internal fixation

Traction along the longitudinal axis with elbow in extension and supination were given counter traction was given. Medial or lateral displacements were corrected by valgus or varus forces respectively. After that posterior displacement and angulation was corrected by flexing the elbow and applying posteriorly directed force from anterior aspect of proximal fragment and anteriorly directed force from posterior aspect of distal fragment. Reduction was confirmed under Image intensifier in both AP and Lateral views.

After confirming satisfactory alignment, reduction was maintained by percutaneous k-wire fixation. Above elbow posterior pop splint in 90° elbow flexion of forearm was applied.

Introduction of K-wires

Medial pin entry was from tip of the medial epicondyle and lateral pin was introduced from the center of the lateral condyle. Both pins were directed 40° to the humeral shaft in sagittal plane and l0° posteriorly. K-wire placement was checked in image intensifier in Antero posterior and lateral views in case of closed reduction. And precautions were taken to engage both cortices to cross above the fracture site and not to cross the olecranon fossa.

K – Wires were bent and kept at least l cm outside the skin. Dressing done.

Follow up

K-wires were removed at 3 Weeks post-operatively after x ray confirmation of satisfactory callus formation. Pop splint was discarded at the same time and physiotherapy advised.

Follow UP was done on O.P.D. Basis at 4th, 8th and 12th week post operatively.

The follow up was done by clinical and radiological evaluation, and results were based on:

- Pain
- Swelling
- Tenderness at fracture site
- Movements of the elbow
- Carrying angle of the elbow compared with normal elbow
- Rate of union

Functional Results

The final results were evaluated according to the criteria for grading outcomes Flynn el al[8] 1974. The results were graded as excellent, good, fair and poor according to loss of range of motion and loss of carrying angle.

Discussion

In this study, 35 children of Type II and Type III supracondylar fracture of humerus were treated with closed reduction and percutaneous K-wire pinning. The purpose of this study was to evaluate the efficacy of closed reduction and per cutaneous pinning and to access of carrying angle, loss of range of motion and to find out the complications encountered with this modality of treatment.

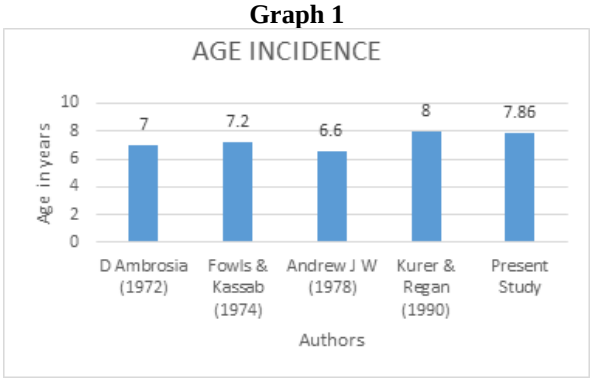
Age incidence

The Supracondylar fractures also occurred most frequently in Children between 5 and l0 years of age as reported in other studies. In this Present study the average age was 7.86 years which is similar to other studies.[9]

Table 1

Authors	Average Age (in Years)
D Ambrosia (1972)[10]	7
Fowls & Kassab (1974)[11]	7.2
Andrew J W (1978)[12]	6.6
Kurer & Regan (1990)[13]	8
Present Study	7.86

Graph 1



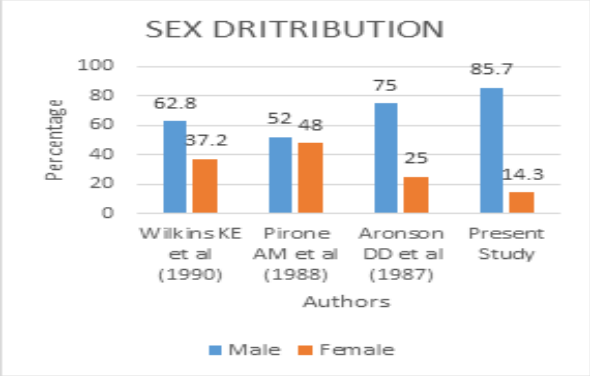
Sex distribution

Traditionally, boys have had a higher incidence of this type of fracture. In this present study, 30 (85.7%) were male patients and 5 (14.3%) were female patients, which is same as other studies, showing a male preponderance.

Table 2

Author	Male	Female
Wilkins KE et al (1990)[14]	62.8	37.2
Pirone AM et al (1988)[4]	52	48
Aronson DD et al (1987)[15]	75	25
Present Study	85.7	14.3

Graph 2



Mode of injury

Supracondylar fractures result from a fall on an outstretched arm in up to 70 percent of patients.[16] Most fractures in older children result from higher falls from playground equipment (e.g. monkey bars, swings) or other energy mechanism. In Edward E Palmar et al[17] series of 78 patients with supracondylar fractures 69 patients sustained injury due to fall while playing. Farnsworth CL et al[16] 29 (82.9%) patients had fall from height and 6 (17.1%) had fall while playing, which is similar to other studies.

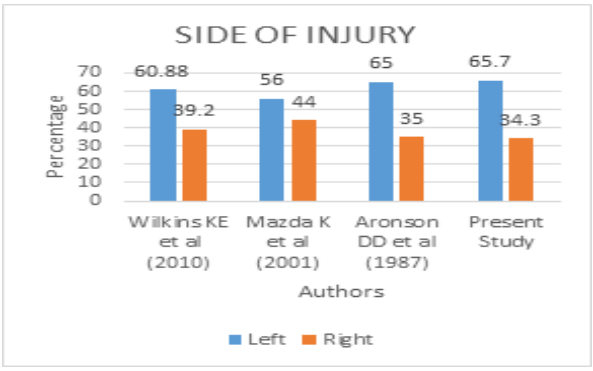
Side of injury

The non-dominant extremity is most commonly affected. In this study, 23 (65.71 %) had left sided injury and l2 (34.29%) of them had right Sided injury, the other series of study mentioned below also show a preponderance to left sided fractures.

Table 3

Author	Left	Right
Wilkins KE et al (2010)[9]	60.88	39.2
Mazda K et al (2001)[18]	56	44
Aronson DD et al (1987)[15]	65	35
Present Study	65.7	34.3

Graph 3



Type of fracture

In the present study, based on the Gartland's classification, 4 (11.43%) patients had Type II fracture and 31 (88.57%) of them had Type 3 fracture. Comparable to other studies.

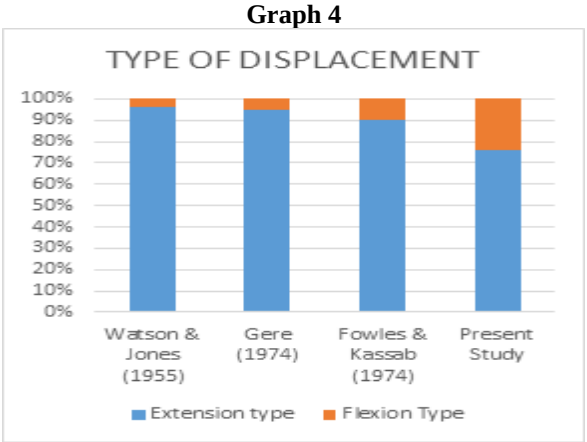
Type of displacement

In the present study 34 (97.15%) were extension type and 1 (2.85%) was flexion type.

Table 4

Author	Extension	Flexion Type
Watson & Jones (1955)[19]	96	4
Gere (1974)	95	5
Fowles & Kassab (1974)	90	10
Present Study	9.15	2.85

Graph 4



Pinning method

In the present study 31 of them underwent crisscross K wire pinning, 4 of them underwent lateral pinning.

Cross K wire fixation is a well proven standard procedure in the treatment of supracondylar humerus fracture of children. Weinberg et al. showed in their biomechanical study that crossed K-wires showed the highest stiffness and lowest loss of reduction under cyclic loading. The external fixators proved to be good alternatives.[20] In a study Zionts et al. compared crossed

K-wire technique with lateral K wire fixation alone. Greater stability was achieved with the cross pinning technique.[21] From the results of our study, we cannot state any clear advantage for lateral technique alone because of small number of study.

Functional outcome

In the present study, of the 35 cases, treated with 5 (l4.3%) lateral pinning showed excellent Satisfactory outcome and out of 31 (88.6%) treated with crossed K-wire crossed pinning cases - 26 (74.3%) showed Satisfactory and 4 (11.4%) showed Unsatisfactory. The difference in the functional outcome between the two groups lateral pinning and crossed K-wire crossed pinning was statistically significant, but we cannot state any on the clear advantage for lateral technique because of small number of study.

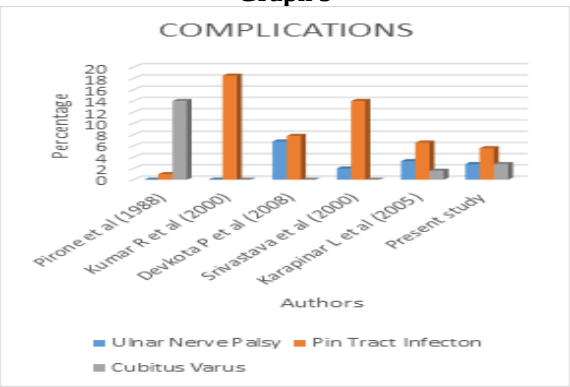
Post-operative complications

In the present study, 2 patient developed pin tract infection which was recognized by the presence of hypertrophic granulation tissue, which healed with antibiotic therapy. 1 patient developed cubitus varus deformity, but maintained good functional movement. 1 patient had iatrogenic ulnar nerve palsy.

Table 5

Authors	Ulnar Nerve Palsy (%)	Pin Tract Infection (%)	Cubitus Varus (%)
Pirone et al (1988)	0	1	14
Kumar R et al (2000)[22]	0	18.5	0
Devkota P et al (2008)[23]	6.8	7.8	0
Srivastava et al (2000)[24]	2	14	0
Karapinar L et al (2005)[25]	3.3	6.6	1.6
Present study	2.8	5.6	2.8

Graph 5



Range of limitation of flexion

In the present study, of the 35 cases, 26 (74.29%) patients had limitation of flexion b/w 0-10°, 7 (20.00%) patients had limitation of flexion b/w l0-20° and 2 (5.71%) patient had >20° limitation of flexion. Average loss 9.4°.

Table 6

Authors	Average Restriction on motion (in degrees)
Nacho JL e al (1983)	7.8
Present Study	9.4

Change in carrying angle

29 (82.9%) patients had change in carrying angle less than 5°. 3 (8.6%) of them had changes b/w 5-l0°, 1 (2.9%) of them had changes >10° and 2 (5.7%) of them had a fixed flexion deformity, because of which carrying angle could not be assessed.

Table 7

Authors	Carrying Angle loss (in degrees)
Nacht JL et al (1983)	5.8
Flynn JC et al (1974)	6.2
Present Study	3.8

Time of maximum range of movement recovery

Wang YL et al (2009) reported that the uncomplicated distal humerus supracondylar and lateral condylar fractures, it takes 5 weeks' time to restore original elbow range of motion (ROM) recovery after removal of long arm cast without physical therapy.[26]

In the present study, of the 35 cases, 4 patients had Type II fracture and 31 of them had Type III fracture. The average time for maximum range of movement recovery was 12.75 weeks for type II fracture and 16.0 weeks for type II] fractures. Excluding patients with fixed flexion deformity.

Results

In the present study, of the 35 cases, the clinical outcome grading was measured as per the Flynn et al criteria for grading outcomes; 22 (62.9%) of the patients observed excellent results and 5 (14.3%) of good results and 4 (11.4%) of the patients observed Fair results that is 31 (88.6%) of satisfactory results. Then 4 (11.4%) of the patients observed Poor results that is Unsatisfactory as per Flynn et al criteria.

The Clinical outcome is Compared between others study as given below:

Table 7

Treatment	Author	Total no	Grading (in number)			
			Excellent	Good	Fair	Poor
Percutaneous K-wire fixation	Pirone et al (1998)[4]	96	75	15	1	5
Percutaneous K-wire fixation	Flynn et al (1974)	52	42	7	1	1
Closed reduction and Percutaneous K-wire fixation	Present Study	35	22	5	4	4

Conclusion

- Supracondylar fracture of humerus is one of the commonest fractures in childhood.
- Incidence is higher in boys.
- Left sided injury is more common than right side.
- Due to the frequent occurrence of complications a detailed examination is a must in all cases. Anatomical reduction is the key to obtaining good results, which can be achieved by closed reduction and percutaneous pinning.
- By aforementioned surgical methods, early mobilization of the elbow, good range of movement and fewer complications were achieved.
- The results obtained in this study shows that anatomical reduction with K-Wire is the first treatment of choice for Type II and Type III fractures.
- Hence from our study, we observed that closed reduction and percutaneous pinning under (C - arm guidance is a simple, cheap and effective method of treatment of displaced supracondylar fracture (type II and type III) humerus in children with relatively fewer complications.

Clinical photographs

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