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"Outcome of Open Reduction and Internal Fixation in Late Presentation of Fracture Lateral Condyle of Humerus in Paediatric Age Group"

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Abstract
Introduction : Fracture of the lateral condyle of humerus constitute around 13-18% of elbow injuries, with the peak incidence occurring at the age of 6-7 years. The management of fresh displaced fractures of less than 3 weeks duration is not controversial as it is generally agreed that it should be treated by osteosynthetic procedures. Nondisplaced or minimally displaced (<2mm) fractures, treated with simple immobilization with posterior splint along with close follow up and repeat radiographs appears adequate. Displaced fracture are treated with open reduction and fixing internally by suture fixation , Kirschner's wire fixation, preferably with two Kirschner's wires; and screw fixation. Aims & Objectives : Assessment of results in late presentation of fracture lateral condyle of humerus in terms of functional and radiological outcome and complications treated with open reduction and internal fixation & proper intervention in the specific direction could improve functionality & to minimze related complications. Materials & Methods : All patients attending in Orthopaedics emergency and O.P.D. of pediatric age group (5-12 yrs) with late presentation of fracture lateral condyle humerus in Jacob et al. stage – 2 and stage-3. Study period:-January, 2014 to June, 2015 with the sample size of 20 patients. & study design was Institution based prospective study (case series). The patients were evaluated both clinically and radiologically at regular interval and result was analysed after application of appropriate statistical tests.Results : Total 20 patients were included in the study during the stipulated time frame satisfying the inclusion criteria. Age of the patients under study varied from 5 years to 12 years. Mean age is 6.3 years. Majority (50%) of cases were in the age group 5-7 years. The study shows Male predominance (60%), because of increased exposure to outdoor activities. The study shows , the predominant mode of injury (50%) was fall from height. In my study , left side was more commonly involved (60%) than right (40%). In our study, 10 patients (50%) had been operated between 3-5 weeks. Mean value of injury-surgery interval was 6.05 weeks. There were full range of motion in 12 (60%) patients and restriction of terminal elbow motion were in 5 (40%) patients. There was no case of gross restriction of elbow motion. Final result was excellent in 60% patients (12), good in 20% patients (4), fair in 15% patients (3) and poor in 5% patients (1).

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I. Introduction

Fracture of the lateral condyle of humerus constitute around 13-18% of elbow injuries, with the peak incidence occurring at the age of 6-7 years. The management of fresh displaced fractures of less than 3 weeks duration is not controversial as it is generally agreed that it should be treated by osteosynthetic procedures.[1]Nondisplaced or minimally displaced (<2mm) fractures, treated with simple immobilization with posterior splint along with close follow up and repeat radiographs appears adequate. Displaced fracture are treated with open reduction and fixing internally by suture fixation , Kirschner's wire fixation, preferably with two Kirschner's wires; and screw fixation. [2] The problem arises when the patient presents late due to socioeconomic reasons, lack of awareness, missed diagnosis, or improper initial treatment. If sophisticated surgical treatment is unavailable, these fractures may go untreated or unrecognized for prolonged periods. These

fractures are easily missed and when not managed appropriately can displace. Missed fracture is a common cause of nonunion and subsequent deformity.

A late presentation leads to difficulty in management due to displacement of the fragment as a result of the pull of the common extensors, incongruous reduction of articular surfaces, injury/early closure of the epiphyseal growth plate, and possible damage to vascular supply because of stripping of soft tissue attachments. For these reasons, when the patient presents at 3–12 weeks, the controversy is with regard to whether to treat these fractures by nonoperative or operative methods. If these fractures are treated nonoperatively, the various possible complications are nonunion, malunion, deformity at the site, instability of the elbow joint, stiffness, cubitus valgus/varus, and tardy ulnar nerve palsy [3].

The restoration of function after a neglected distal humerus fracture presents a formidable challenge to the surgeon because of both the complexity of the regional anatomy and the proximity of numerous neurovascular structures. Inadequate or unstable fixation, a failure to reposition the articular fragments anatomically, prolonged post-operative immobilization, or the development of soft-tissue complications will result in substantial disability for the patient [4].

But as it is an epiphyseal injury, accurate reduction and internal fixation should be done so that the long term complications could be prevented. As the lateral condyle also take parts in lower humerus growth, trochlear and capitular maldevelopment may result in absence of osteosynthesis and hence, fish tail deformity, radial head mal-development/dysplasia, varus instability of joint, restriction of rotatory motion of forearm and nerve palsy [5]. In late presentations, the dilemma varies between osteosynthesis of the fracture fragment or correction of elbow deformity with osteotomies and ulnar nerve transposition or sometimes both procedures combined [6]. In this study an attempt was made to evaluate the outcome of open reduction and internal fixation in cases of late presentation of fracture lateral condyle of humerus in pediatric age group (5-12 years).

I .Milch classification [2] : It is based on wheather or not the fracture extends through or around the capitellar ossific nucleus.Type-I : Fracture line extends through the capitellar ossific nucleus : (Salter –Harris type-IV). Type -II: Fracture line extends into the area of trochlea ;(Salter-Harris type-II).

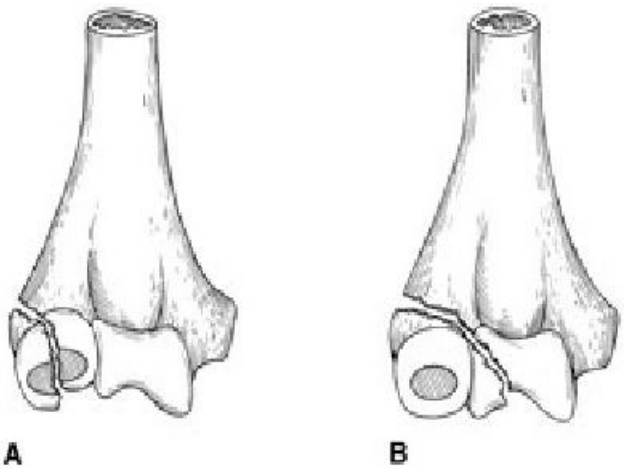

Figure-5: Showing A) Milch's type-I fracture, B) Milch's type-II fracture.

II. Jakob et al. classification [2]: It is based on amount of fracture displacement. Stage-I : Undisplaced fracture ,articular surface intact. Stage -I : Displaced fracture , articular surface disrupted. Stage -III: Condylar fragment is totally displaced and rotated.

Stage-I Stage-II Stage-III

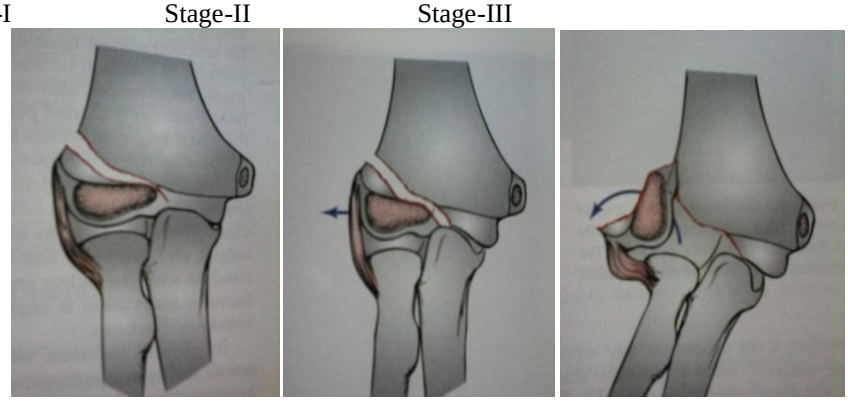

Figure-6: Showing Jakob et al. classification of fracture lateral condyle humerus [2].

Saraf S et al.[1], 2011:

Excellent to good results were observed in all the five patients presenting at 3–4 weeks post injury. In the patients presenting at 5–8 weeks, the results were excellent in one, good in four, fair in three, and poor in one patient. The fracture united in all cases; however, malunion was observed in four patients. The fractures that were operated at 9–12 weeks showed good results in one case, fair result in three cases, and poor result in three cases. Osteonecrosis of the lateral condyle in one patient, premature fusion in two patients, pin tract infection in three patients, and gross restriction of elbow movements in three patients were the major complications in this group.

Mahmood K et al.[3] , 2014 :

Twenty five children (18 boys and 7 girls) with mean age 6.5 years (range 4.3-11 years) underwent surgery. Twenty three (92%) children completed the study while two (8%) were lost to follow up. Overall excellent results were achieved in majority (73.9%, n= 17) of patients while good, fair and poor results were reported in 3(13%), 2(8.6%) and 1(4.3%) patients respectively. Avascular necrosis of the fragment was documented in 1(4.3%) patient, premature fusion of the physis in 1(4.3%) limitation of elbow movements in 6(26%) while alteration in carrying angle was reported in 3(13%) patients.

Muhammad H et al.[4], 2012:

50 cases of neglected fractures of lateral humeral condyle of pediatric age group were treated with open reduction and internal fixation and the outcome was evaluated in terms of pain relief, range of motion and union of the fracture. Follow up at the end of two months revealed excellent out come in 68% patients, good outcome in 14% patients, fair in 10% patients and poor in 8% patients. Our study showed excellent outcome of neglected fractures of lateral humeral condyle when treated with open osteosynthesis.

Kumar N et al.[5], 2015:

Twenty children having fracture of lateral condyle of humerus with duration of trauma more than 3 week were included in the prospective study. Age ranged from 5 years to 15 years. All patients were treated by open reduction and internal fixation using k wires and ulnar peg graft. The follow-up period was over 1 year. all fractures united with 92% excellent, 5% good, and 3% poor results. Poor results were associated with greater displacement of fracture, prior repeated attempts of close reduction, and history of massage.

Agarwal A et al.[6], 2012:

There were 19 boys and 3 girls. Follow up averaged 33 months. Pain (n=9), swelling (n=6), restriction of elbow motion (n=6), prominence of lateral condylar region (n=4), valgus deformity (n=4) were the main presenting symptoms. Ulnar nerve function was normal in all patients. There were nine Milch type I and 13 type II fractures. Union occurred in 20 cases. One case had malunion and in another case there was resorption of condyle following postoperative infection and avascular necrosis. Prominent lateral condyles (4/12), fish tail appearance (n=7), premature epiphyseal closure (n=2) were other observations. LES averaged 8.12 (range, 6.66-9.54) at final follow up.

Shabir AD et al.[8], 2015:

20 patients ranging from 3 years to 13 years were included in the study. All patients presenting after more than 3 weeks of trauma were included in the study. There were 12 boys and 8 girls. The fractures were difficult to classify radiologically in view of the delay. However an assessment was still attempted. There were 4 fractures which matched the Milch type 1. All the others were classified as Milch type 2. The average delay in the presentation was 6.2 weeks [3-16 weeks]. 8 cases had visited local bone setters initially, 6 had not consulted anyone and tried home remedies, 4 patients had displaced in the plaster splint and 2 had been missed by the treating doctors. At final follow up, the mean carrying angle in the fractured elbow was 6 degrees (range from 0 to 12 ^{O}), and 7^{O} (range from 5 to 10 ^{O}) in the other elbow. The range of motion improved by an average of 60 ^{O} from an average of 45 ^{O} preoperatively to 105 degrees postoperatively. Union occurred in 18 cases from 6-24 weeks with an average of 10 weeks.

Bae KC et al.[9], 2008:

Eight children underwent late ORIF ($>$3 weeks) of a displaced LCF ($>$2.5 mm) of the humerus between 3 weeks and 5 weeks after injury. Clinically, results were excellent in 6 cases and good in 2 cases. There was no serious complication, including nonunion and avascular necrosis (AVN), though 2 cases had a slight fishtail deformity and mild carrying angle loss due to overgrowth of the lateral condyle fragment.

Pant A et al.[10], 2013:

There were 14 males and 4 females with a mean age of 7 years and 3 months (range 4-14 years). Among the nine (50%) patients who presented between 5 to 8 weeks after injury, the results were excellent in 3, good in 4, fair in 1 and poor in 1 patient. Excellent to good results were seen in all the five (27%) patients presenting

between 3-5 weeks of injury. Among four (23%) patients out of total 18 patients who presented between 9-12 weeks of injury, 2 had poor results and 1 each had good and fair results. Maximum number of patients had Jacobs type 2 fractures. In our study 25% of these patients had showed excellent results, whereas only 12.5% of patients with type 3 fracture showed excellent results. Fourteen (n=14) patients underwent internal fixation with K wire and in four patients' fixation was done by cancellous screws. The commonest complication seen was pin tract infection (n=10), followed by occasional pain (n=5) around the elbow. There were no cases of osteonecrosis.

II. Materials And Methods

Study area:- Department of Orthopaedics, Radiology and Physiotherapy in Burdwan Medical College and Hospital.

2.Study population:-All patients attending in Orthopaedics emergency and O.P.D. of pediatric age group (5-12 yrs) with late presentation of fracture lateral condyle humerus in Jacob et al. stage – 2 and stage-3.

Inclusion criteria:
a. Patients within paediatric age group (5-12 yrs.)
b. Patients presented with fracture lateral condyle of humerus in between three to twelve weeks after trauma, in Jacob et al. stage-II and stage-III.
c. Patients should be physically and mentally fit for surgery.

Exclusion criteria:
a. Patients with serious co-morbidities.
b. Patients with other fracture in the same limb.
c. Pathological fracture.

3. **Study period**:-January, 2014 to June, 2015.

4**. Sample size:-** 20 patients.
5**. Sample design**:- Patients matching the inclusion criteria were consecutively included in this study till the desired sample size was obtained.
6. **Study design** :- Institution based prospective study (case series).

7. Parameters studied:-
Parameters for specific objective no.-1:
a. Residual deformity
b. Pain
c. Range of motion of elbow joint
d. Union time
e. Activity
Parameters for specific objective no.-2:
a. Callus formation in skiagram
b. Rotation
c. Residual deformity in skiagram
Parameters for specific objective no.-3
a. Pin tract infection
b. Non –union
c. Osteomyelitis.

8. Study tools:-
a. Kirschner's wire (1.8 mm.)
b. Hand drill
c. Skiagrams
d. Wire cutter
e. Cancellous screw(4 mm.)
f. Screw driver
g. Pointed reduction clamp.

9. **Study technique**:
The study was conducted after approval from Ethics committee of Burdwan Medical College&Hospital. Patients satisfying the inclusion criteria were evaluated both clinically and radiologially. Informed consent was obtained from the subjects before conduction of the study.

10. **Plan for analysis of data**:-
The patients were evaluated both clinically and radiologically at regular interval and result was analysed after application of appropriate statistical tests.

Protocol of management:
After thorough evaluation of the fracture the necessary investigations were done.
Pre Operative investigations:
Hb%, TC, DC, ESR
FBS, Urea, Creatinine
Serological test: HIV I&II, HBsAg, Anti HCV
Skiagram: Chest X Ray –PA View, Skiagram of affected elbow (AP/Lat View)
ECG- 12 Leads
The patients were then referred to the Anaesthesiologist for proper pre-anaesthetic check-up & after obtaining fitness, patients were posted for surgery. Informed consent was taken prior to surgery.
Operative procedure:
After administration of successful anesthesia (regional/general), patients were placed in supine position on the operation table. The limb to be operated was positioned on a side arm rest. All the surgeries were performed under tourniquet control.
All the patients had open operated by the lateral approach. While achieving anatomical reduction, care was taken to do minimal soft tissue stripping especially on the posterior aspect of the fragment. In fractures where reduction was difficult multiple small incisions were given in the extensor muscles to achieve some lengthening of the aponeurosis. Taking care of the physeal plate the fracture fragments were cleared of any intervening fibrous tissue, the reduction was held temporarily by towel clamp and then secured by two Kirschner's wires placed either parallel or in a divergent manner starting from metaphysis to take purchase on the opposite cortex. Screw fixation was done in 2 patients where the fragments were big. Bone graft harvested from the proximal ulna was put in those patients who presented after 6 weeks of injury.
Before closure of the wound it was thoroughly lavaged with normal saline to remove all the debris from the joint space. The average operation time was one hour. Post operatively the limb was kept in above elbow plaster of paris (POP) posterior slab with 90^{o} flexion at elbow and forearm in neutral or slightly supinated position.
Postoperative evaluation & Care:
a) Distal neurovascular status checked and documented.
b) Active finger movements started as early as possible.
c) All the patients were discharged from the hospital after first satisfactory wound inspection on third postoperative day, when indicated.
d) Instructions were given for subsequent follow-up.
Follow up examination: The patients were followed up at 2, 4, 6, 8, 12 weeks, 6 months, 12 months and 18 months after surgery. The slab was removed at 4 weeks, after which gentle range of motion exercise was started. K-wires were removed at 6 weeks. Follow up skiagrams were taken at 6 weeks, 8 weeks, 12 weeks, 12months and 18 months in the post-operative period. The patients were assessed using the **"modified Agarwal et al. criteria" [10]**.

III. Results

The study was conducted among the children patients attending in Out Patient Department(OPD) who were admitted under Department of Orthopaedics in Burdwan Medical College & Hospital with late presentation (3-12weeks) of fracture lateral condyle humerus, between January, 2014 and June, 2015.

Total 20 patients were included in the study during the stipulated time frame satisfying the inclusion criteria.

1.Age:

Table- 1: Age Distribution of Study Population

Age groups (yrs.)	No. of patients	Percentages
5 - 7	10	50 %
8 - 10	6	30%

11 -12	4	20%
Total	**20**	**100%**

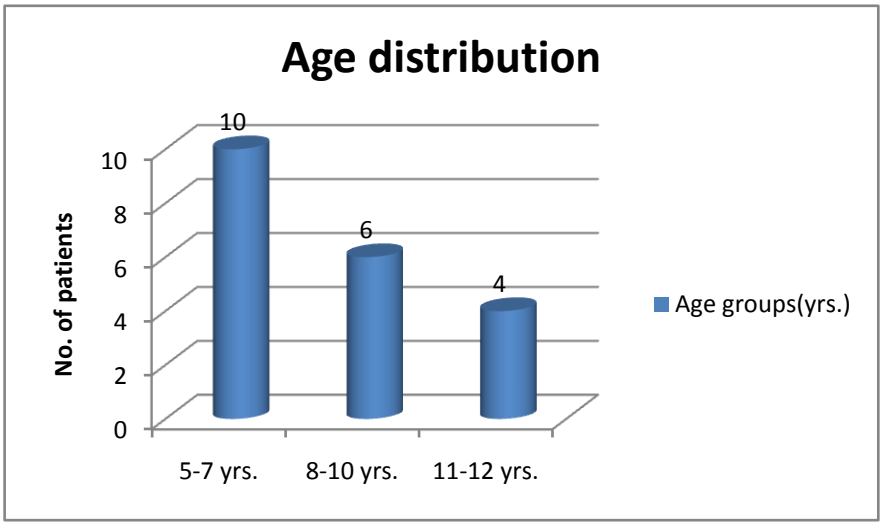

Chart 1: (Bar Diagram) showing age distribution of study Population

Age of the patients under study varied from 5 years to 12 years. Mean age is 6.3 years. Majority (50%) of cases were in the age group 5-7 years.

2) Sex:

Table- 2 : Sex Distribution of Study Population

Sex	No of patients	Percentage
Male	12	60%
Female	8	40%
Total	**20**	**100%**

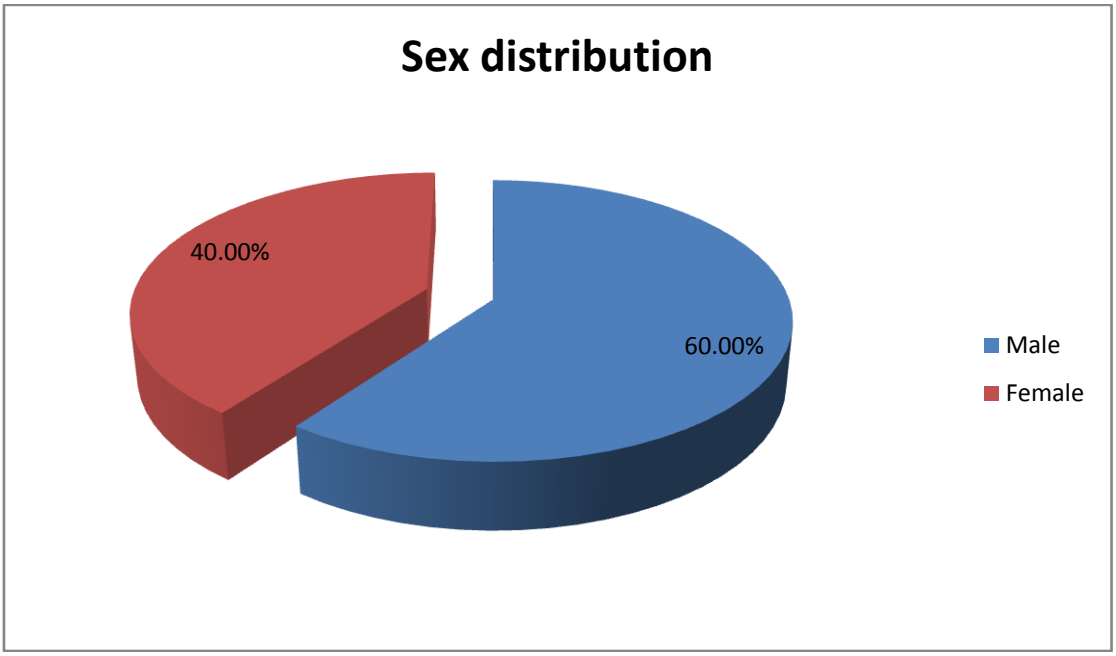

Chart 2: (Pie Diagram) showing Sex Distribution of Study Population

The study shows Male predominance (60%), because of increased exposure to outdoor activities.

3)Mode of injury:

Table- 3 : Mode of injury

Mode of injury	No. of patients	Percentage
Fall from height	10	50%
Sports related	6	30%
Vehicular accident	4	20%
Total	**20**	**100%**

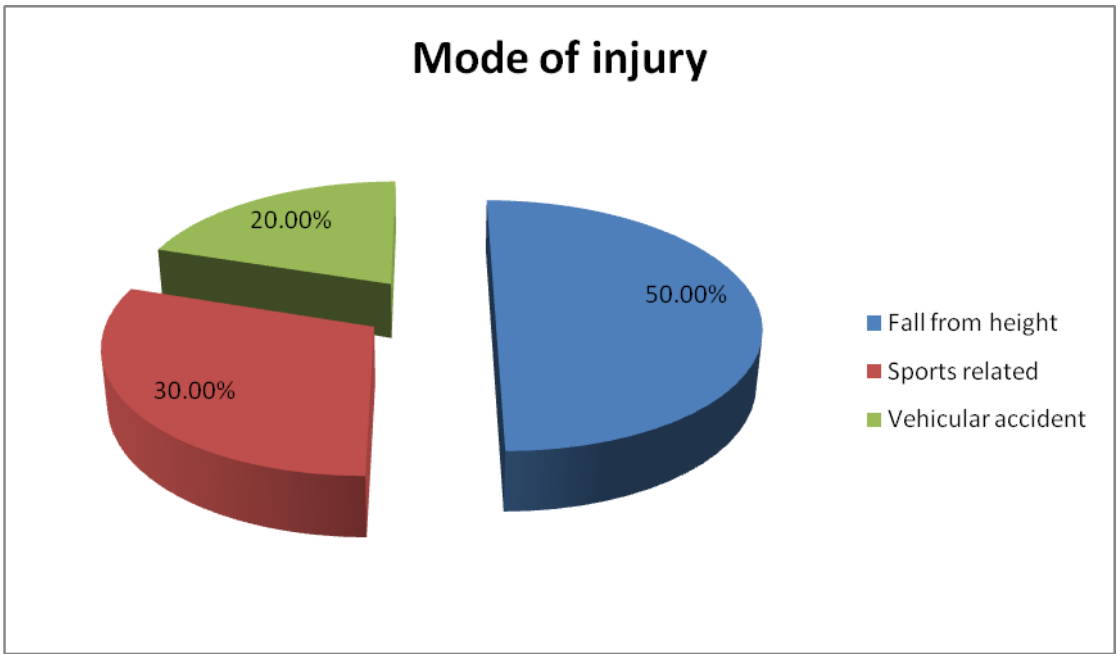

Chart 3: (Pie Diagram) showing mode of injury of study population

The study shows , the predominant mode of injury (50%) was fall from height.

4) LIMB INVOLVEMENT

Table - 4 : LIMB INVOLVEMENT

Side	No. of patients	Percentage
Right	8	40%
Left	12	60%
Total	**20**	**100%**

Limb involvement:

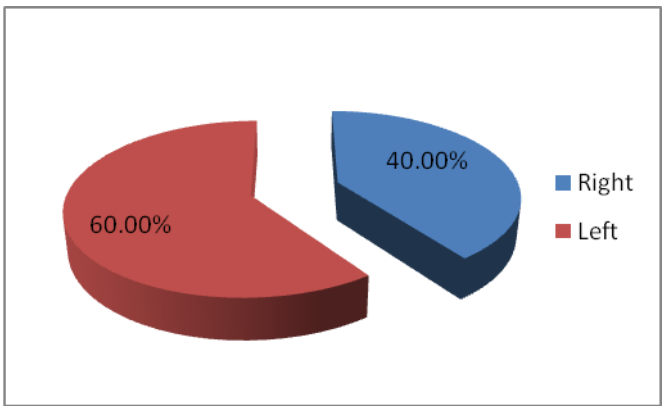

Chart 4: (Pie Diagram) showing limb involvement

In my study , left side was more commonly involved (60%) than right (40%).

5) MILCH'S CLASSIFICATION OF FRACTURE

Table- 5: Milch Classification of fracture at the time of injury

Milch type	No. of patients	Percentage
Type -I	6	30%
Type-II	14	70%
Total	**20**	**100%**

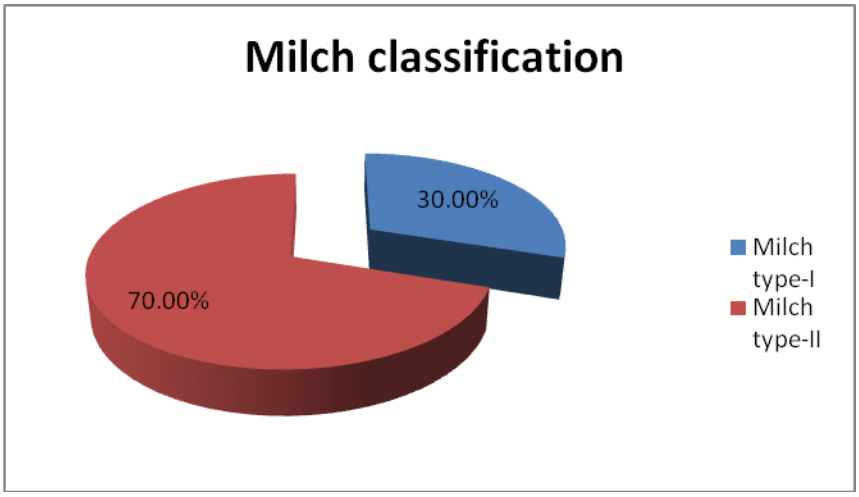

Chart 5: (Pie Diagram) showing Milch Classification of fracture patients.

The study shows majority of cases had Milch type-II fracture (70%).

6)Jakob et al. staging of fracture:

Table -6: Jakob et al. staging of fracture

Stage of fracture	No. of patients	Percentage
Stage-I	0	0%
Stage-II	14	70%
Stage-III	6	30%
Total	**20**	**100%**

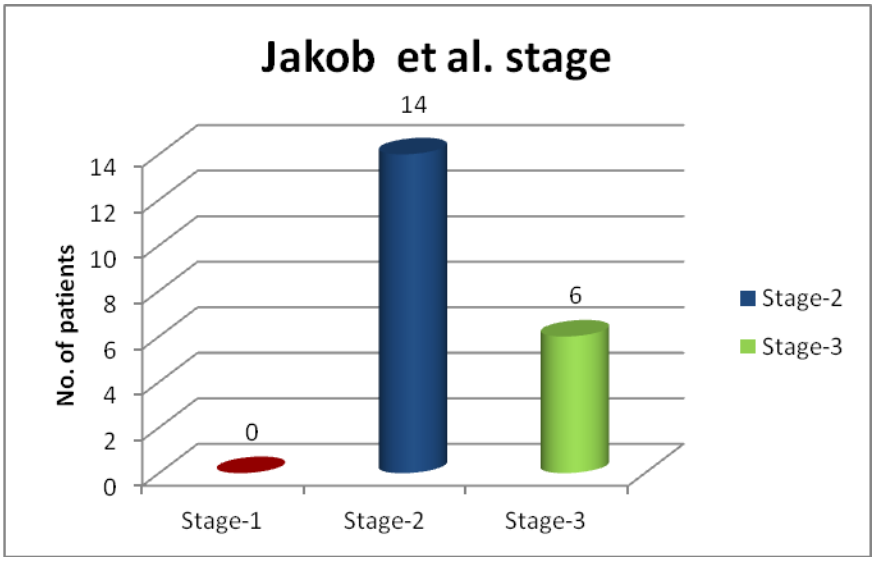

Chart 6: (Bar Diagram) showing Jakob et al. stage of fracture patients.

The study shows majority of cases (70%) were in stage-II.

7) Interval between trauma & surgery:

Table -7 : Interval between trauma & surgery

Interval (weeks)	No. of patients	Percentage
3 - 5	10	50%
6 - 8	6	30%
9 -12	4	20%
Total	**20**	**100%**

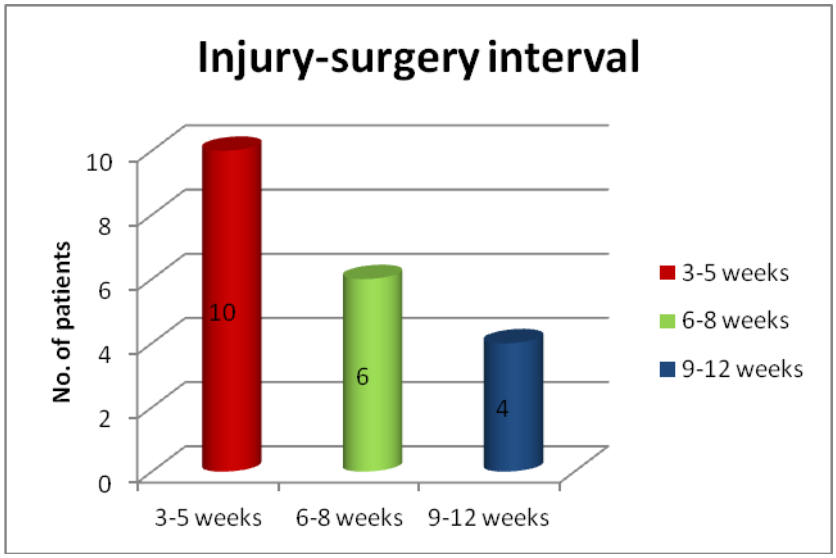

Chart 7: (Bar Diagram) showing injury- surgery interval (ISI).

In my study, 10 patients (50%) had been operated between 3-5 weeks. Mean value of injury-surgery interval was 6.05 weeks.

8) Range of elbow motion:

Table - 8: Range of elbow motion

Range of elbow motion	No. of patients	Percentage
Full range of motion	12	60%
Limitation of terminal range of movement(up to 15 ^{O})	5	25%
Limitation of terminal range of movement(up to 25 ^{O})	3	15%
Gross restriction of range of motion (restriction more than 30 ^{O})	0	0%
Total	**20**	**100%**

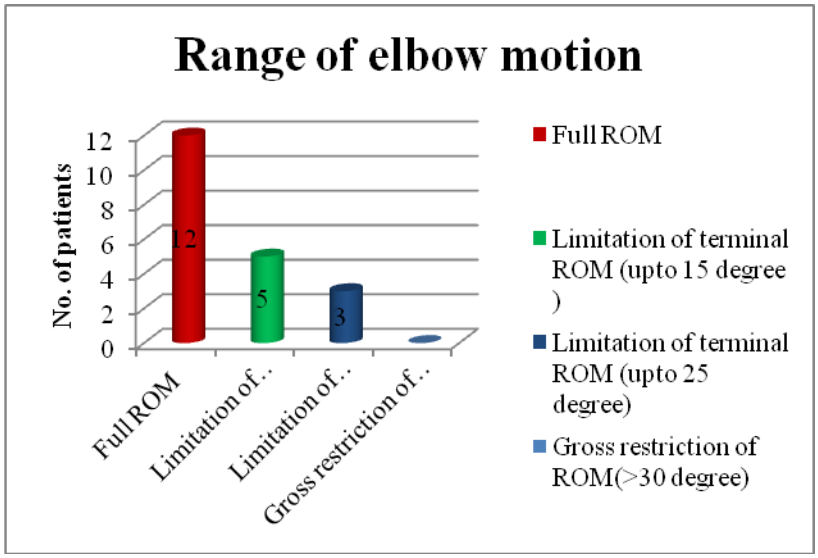

Chart 8: (Bar Diagram) showing range of elbow motion.

There were full range of motion in 12 (60%) patients and restriction of terminal elbow motion were in 5 (40%) patients. There was no case of gross restriction of elbow motion.

9) Results according to delay between injury and operative procedure:

Table-9: Results according to delay between injury and operative procedure

Delay between injury and surgery (in weeks)	Number of patients	Results			
		Excellent	Good	Fair	Poor
3 -5	10	10	0	0	0
6 -8	6	2	2	2	0
9 -12	4	0	2	1	1
Total	**20**	**10**	**6**	**3**	**1**

Results according to injury - surgery interval

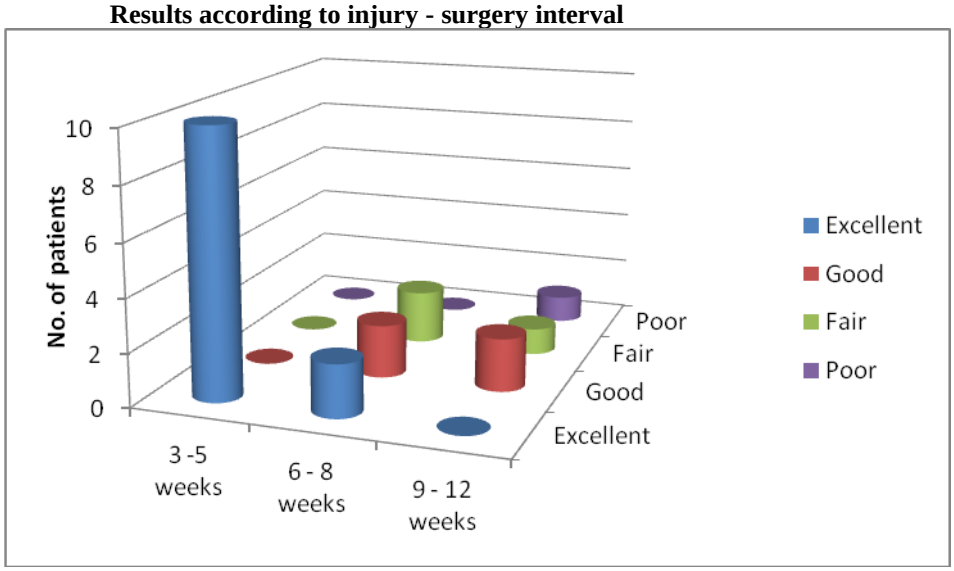

Chart-9 :(Bar diagram) showing results according to injury and surgery interval.

Results were excellent to good in those who were operated upon within 3-8 weeks after injury.

10) Results according to stage of displacement(Jacob et al.):

Table-10 : Results according to stage of displacement (Jacob *et al*.)

Jacob et al. stage	Number of patients	Results			
		Excellent	Good	Fair	Poor
Stage -2	14	10	4	0	0
Stage -3	6	0	2	3	1
Total	**20**	**10**	**6**	**3**	**1**

Results according to Jacob et al. stage of displacement

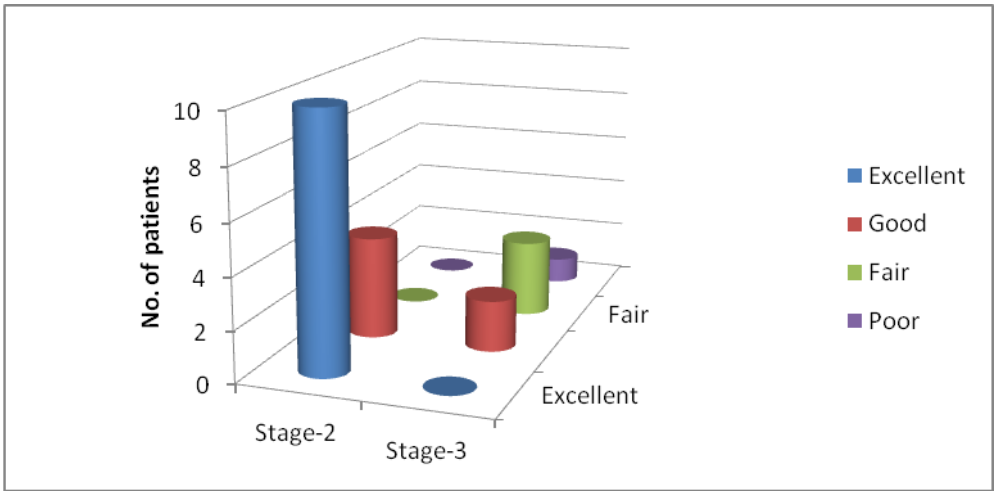

Chart-10: (Bar diagram) showing results according to Jacob et al. stage of displacement.

Results were better in those presenting with lesser degree of displacement (stage-II) of the fragments.

11) Complications encountered:

Table -1: Complications encountered

Complications	No. of patients	Percentages
Superficial pin tract infection	4	20 %
Osteonecrosis of distal fragment	1	5%
Lateral prominence	3	15%

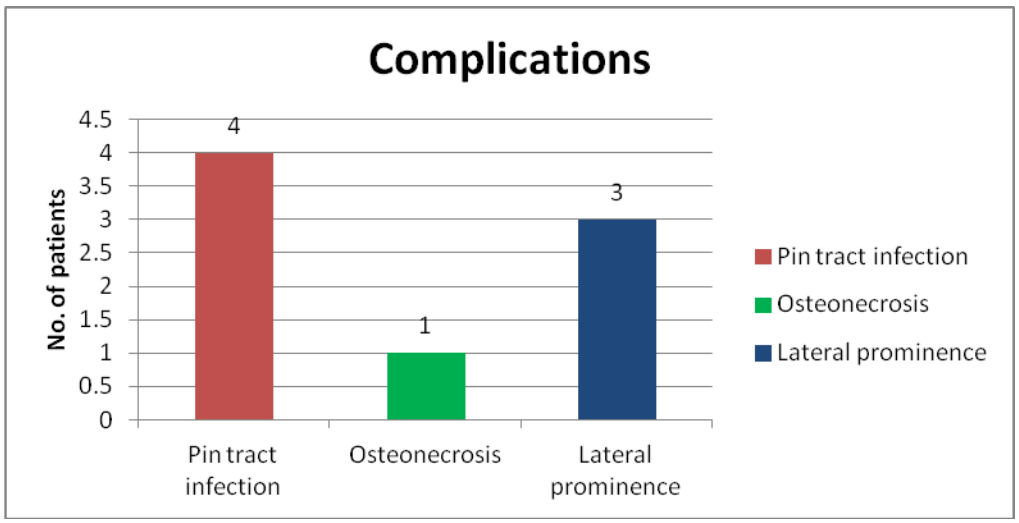

Chart-11: (Bar diagram) showing complications.

The most common complication superficial pin track infections, were in four patients (20%). Lateral prominence were seen in 3 patients (15 %) and osteonecrosis was seen in only 1 patient (5%) each.

12) Final results according to " modified Agarwal et al. criteria" :

Table-12: Final results according to " modified Agarwal et al. criteria".

Result	No. of patients	Percentage
Excellent	12	60%
Good	4	20%
Fair	3	15%
Poor	1	5%
Total	**20**	**100%**

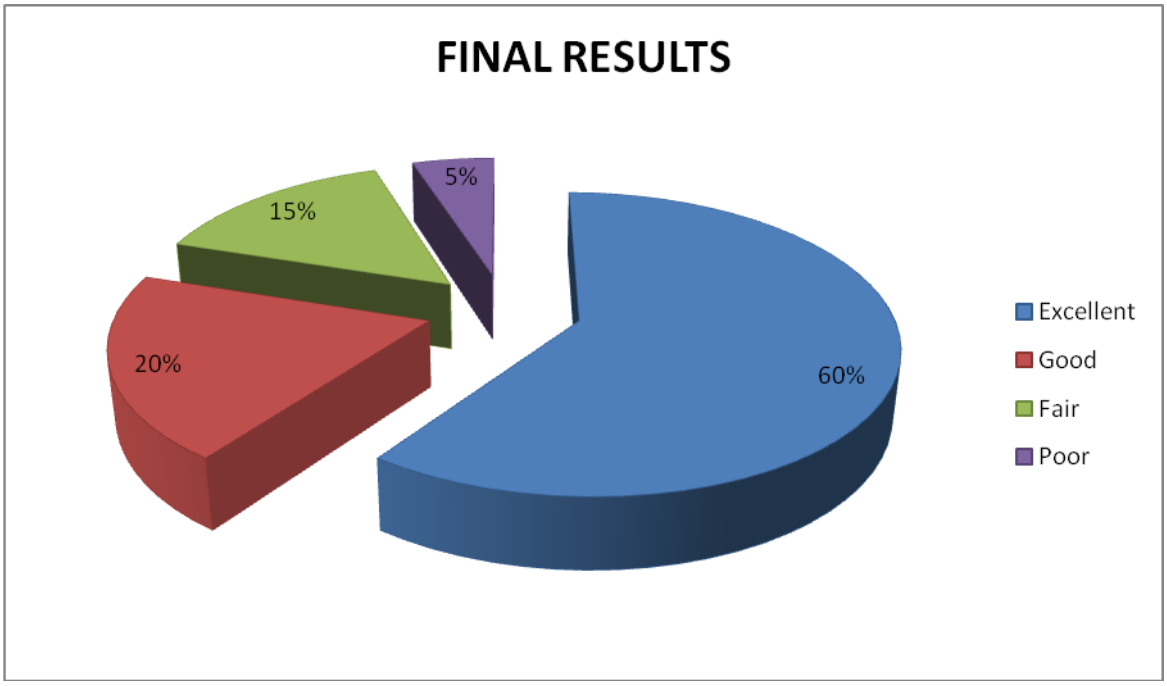

Chart-12: (Pie diagram) showing final results according to"modified Agarwal et al. criteria".

Final result was excellent in 60% patients (12), good in 20% patients (4), fair in 15% patients (3) and poor in 5% patients (1).

IV. Discussion

In a developing country like India it is not uncommon to see lateral humeral Condylar fractures presenting late after the initial injury due to various reasons. As the lateral condyle takes part in lower humeral growth and is an epiphyseal injury, osteosynthesis was done to prevent trochlear and capitular maldevelopment and other long term complications.

In my study, total 20 patients were included in the study satisfying the inclusion criteria.

Age of the patients in my study varied from 5 years to 12 years. Mean age is 6.3 years. Maximum incidence (50%) of was in the age group 5 -7 years. This finding matches with the study of Mahmood K et al. [3] where the mean age of patients was 6.5 years (range 4.3-11 years).

Sex distribution of patients (12 male & 8 female) in my study showed male predominance (60%). This findings are similar to that of Shabir AD et al. where the male predominance (male-12 & female-8) was evident. The study shows, commonest mode of injury was fall from height. 10 patients (50 % cases) got injury following fall from height while 6 patients (30% cases) and 4 patients (20%) got injuries due to sports related and vehicular accident respectively . This epidemiological data corroborates with study of Pant A et al. [10], where 55.5% cases were due to fall from height.

Left elbows were involved in 12 patients(60%) and right elbows were involved in 8 patients(40%) as in the study of Mahmood K et al. [3] (left-56% and right-44%).

At the time of initial presentation Milch type -II fractures was encountered predominantly (70% cases), while Milch's type-I fracture in 30% cases. This finding is similar to findings of Shabir AD et al. [8] where Milch type -II fracture also accounted for 70% cases.

According to Jacob et al. staging of fracture, majority of patients (fourteen cases) were in stage-II, while six patients were in stage-3.

In my study, Mean value of ISI was 6.05 weeks. Majority of patients (50%) had been operated between 3-5 weeks, where as six patients (30%) were operated between 6-8 weeks. Surgery was delayed to 9-12 weeks in four patient (20%).

This finding was similar to study of Shabir AD et al. [8] where the Mean ISI was 6.2 weeks. The delay is due to socioeconomic reasons, lack of awareness, missed diagnosis, or improper initial treatment.

\Bone grafting was required in 7 patients.

The mean healing time was 8 weeks . This was similar to the study of Mahmood k et al.[3] where it was also 8 weeks.

The average postoperative follow up period was 13.75 months (range: 10 to 18 months).

In my study, Union were achieved in all patients except one patient (case no.-1). Full range of motion were achieved in twelve (60%) cases. Restriction of terminal elbow motion were in five (40%) cases within the limited follow up period (18 months). There was no case of gross restriction of elbow motion. This findings corelates more or less with study of Agarwall N et al. [6].

By far the commonest complication was superficial skin tract infections (in 4 patients) which were cured on short course of antibiotics and regular dressing. Nonunion and osteonecrosis was noted only in one patient (5%) and lateral prominences were seen in three patients (15%). Mild loss of carrying angle due to lateral condylar overgrowth were noted in two patients (10%) , which is similar to the findings seen in the study of Mahmood K et al.[3].

There were no incidence of deep infection, neurovascular injury, malunion, fish tail deformity and early fusion of epiphysis.

The results were graded as excellent, good, fair and poor according to the "**modified Agarwal et al. criteria" [10]**. The final result was excellent in twelve patients (60%), good in four patients (20%), fair in three patients (15%) and poor in one patients (5%). The results were better in those who were operated upon within 3-8 weeks of injury as well as in those presenting with lesser degree of displacement of the fragment. This findings correlates with other study of Muhammad H et al.[4].

V. Summary

The study was conducted in Burdwan Medical College and Hospital, under Department of Orthopaedics. Twenty patients of paediatric age group who presented three to twelve weeks after injury, were included in my study. Age of the patients varied from 5 years to 12 years. Mean age was 6.3 years. Maximum incidence (50%) was in the age group 5-7 years. Sex distribution of patients (12male &8 female) showed male predominance (60%). Left elbow was more commonly involved (80%) than right (20%). The study shows, fall from height as the predominant mode of injury.

At the time of initial presentation Milch type -I fracture was encountered in six patients (30%) while Milch type-II was encountered in fourteen patients(70%) .According to Jacob et al. staging of fracture, fourteen patients (70%) were in stage-II and six patients (30%) in stage-III respectively.

Mean value of ISI was 6.05 weeks. Ten patients (50%) had been operated between 3-5 weeks whereas six patients (30%) were operated between 6-8 weeks. Surgery was delayed to 9-12 weeks days in 4 patients (20%). The above elbow posterior slab was kept for four weeks after which gentle range of motion exercise was started. The Kirschner's wires were kept for a period of six weeks in all patients. The mean duration of follow up was 13.75 months (range: 10 to 18 months).

Union were achieved in all patients except one (case no.18). Average healing times were 8 weeks. The most common complication was superficial pin tract infection, seen in 4 patients (20%). Other complications were nonunion and avascular necrosis in one patient (5%) and lateral prominence in three (15%) patients.

Based on **"modified Agarwall et al. criteria" [10]**, the final result was excellent in twelve patients (60%), good in four patients (20%), fair in three patients (15%) and poor in one patient (5%). The results were better in those who were operated upon within 3-8 weeks of injury as well as in those presenting with lesser degree of displacement of the fragment.

VI. Conclusion:

From the present study it may be concluded that open reduction and internal fixation with or without bone grafting in fractures of lateral condyle of humerus in paediatric age group yield excellent to good radiological and functional results in majority of late presented cases.

LIMITATIONS AND FUTURE SCOPE:

There were several limitations of this study. The sample size was too small. The duration of follow up was too short to conclude on final outcome because elbow takes a long time to achieve full function.

In future it may be solved by increasing the number of patients and duration of follow up period. Still we strongly recommend osteosynthesis is the modality of treatment in cases of late presentation of fracture lateral condyle humerus in paediatric age group.

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