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Functional Outcome of K-Wire Fixation of Supracondylar Fracture of Humerus (Type-III) in the Children Following Six Months

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Abstract

Supracondylar fracture is an injury to the humerus or upper arm bone just above the elbow. It is most common type of upper arm injury in children. Mostly caused by fall on outstretched elbow or direct blow to the elbow and mostly treated by k-wire in the children due to good results post-operatively. The objective of my study was to assess the functional outcome of k -wire fixation after supracondylar fracture of humerus (type-III) following six months. A descriptive case-series, a total sample of 20 cases of k-wire fixation after supracondylar fracture of humerus following six months in the children were included in the study, whose functional range were within 90-120 children of both sex, between age under 12 years were included. Study results showed 40% children with no difficulty, 45% with mild difficulty, and 15% with moderate difficulty. Overall, there were good functional outcome. The Current study concluded that, there was good Functional outcome of supracondylar fracture of humerus (type-III) with k-wire fixation following six months in children.

Keywords: Supracondylar Fracture of Humerus, K-Wire Fixation, Modified DASH Score

INTRODUCTION

Supracondylar fracture of humerus is extra-articular fracture of humerus which mostly affects the distal metaphyseal area of humerus. It is a fracture of immature skeleton, which is most commonly seen in the young children and teenagers. Upper limb fractures are more common in the age group of 5-10 years. Two types of fractures in the elbow are most common, one is extension type fracture and the other is flexion type fracture. Extension type fracture of supracondylar is common, approximately about 97.8%. Aliakbar, A. H., & Witwit, I. H. (2019). Classification system used for the extension type injuries is Wilkins modified of Gartland classification system. There are three types of fractures in this classification. Type I fractures are not displaced. Type II fractures are displaced with angulation and intact posterior cortex. Type III fractures is displaced fracture and cortical is not intact. Displaced fracture of humerus is usually treated by pinning crossed wire fixation and k wire fixation overhead skeletal traction. Effects of the treatment after procedure are accessed by Flynn's criteria. Flynn's criteria are used to measure functional outcome of supracondylar fracture of humerus by checking carrying angle and range of motion. Mulpuri, K., & Wilkins, K. (2012). Supracondylar fracture of humerus occurs as the result of Trauma, falling from height or leisure activities and during sporting activities. Incidence of this fracture is 177.3per 100,000 annually. Treatment of this fracture is based on the severity of the injury. This fracture can cause vascular compromise of the effected limb, which can cause loss of nerve or disruption the muscular function. Mostly treatments have complications especially invasive or operative treatment. Complications for supracondylar fracture of humerus are cubitus varus deformity, loss of mobility, absence from school and can affect the child and his family social and emotional health. The mostly used treatment is open/close reduction and internal fixation of supracondylar fracture of humerus. Mulpuri, K., & Wilkins, K. (2012). Open reduction with k -wire fixation is standard treatment and effective in the management of this type of fracture, avoiding deformity and gain functional range of elbow movement. It is more effective in the Gartland's type III fracture of humerus in the children. This procedure reduces the risk of complications because of better anatomical reduction. Vikram, K. H., & Raorane, H. (2019). Modified

questionnaire in clinical evaluation and estimation of importance of physical therapy in SCFH in children, Early rehabilitation results in better functional outcome of elbow. Rehabilitation should be started within 15 days after removing immobilization. Živković, V., & Nikolić, D. (2008).

Literature Review

A study was conducted in June 2010 and published in j child orthopedia by sven young et.al to deformity and functional outcome after treatment for supracondylar fracture in children. 139 tested for Supracondylar fracture of humerus 40 treated with plaster cast 46 with the overhead skeletal traction and 45 with cross wire fixation. 8 were treated with open reduction and crossed wires. The introduction of crossed wire fixation had significantly reduced the number of hospital stay. The rate of nerve injuries Cartland type 3 fracture is high. Nilsen, P. T., & Engesæter, L. B. (2010). A retrospective study was conducted by Alaa a. Hassan in 2019 and published in European journal of orthopedic surgery and traumatology to evaluate open versus closed reduction with k wire fixation of displaced supracondylar fracture of humerus. A total of 25 female population size was taken and the results of both the groups were almost same, there were no significant change in the outcome. Hussein al-Algawy, A. A., Aliakbar, A. H., & Witwit, I. H. (2019). A study was conducted in International journal of orthopedic science published in 2019 by the Dr.guru prasad sultanpurker et.al to determine the clinical outcome of treatment of supracondylar fracture of humerus after open reduction internal fixation with k wire, patients were included in the study and outcome was accessed by Flynn's criteria. In our study of 50 cases, all were closed Gartland's type III fractures with mean age of 6.3 years, posteromedial displacement in 32 patients. 4 patients had associated distal end radius fracture. Majority of patients operated on 2nd day and discharged on 3rd postoperative day. 32 had 0-5° loss of range of motion, 36 had 0-5° loss of carrying angle. 6 patients had superficial pin tract infection, 4 had traumatic median nerve palsy, 4 had migration of K-wire, 2 had Cubitus varus deformity and 2 had loss of motion >15. The results shows, this method is more effective and safe. It is predominant in 4-6 years age group of male, elbow stiffness is less as compared to other methods. Sultanpurkar, G. P., Reddy, M. M. K (2019). A study was conducted in OMC hospital Lahore in May 2020 by Mohammad Khalid Syed et.al published in PJMHS to determine functional outcome in displaced supracondylar fracture of humerus fixed with 2 close cross k wires in children presented between 2-4 weeks. 15 patients were taken and all shows fair results .neurovascular injury was noted.

(ARIF) In 2020 a study was conducted by DR.TH parakashappa et.al published in the international journal of orthopedic science to evaluate the functional outcome of surgical management in supracondylar fracture of humerus. A prospective study was done on 30 child age of 5-12 years diagnosed with the supracondylar fracture of humerus and was treated with close/open reduction of internal fixation with k wire fixing medial condyles with early mobilization of elbow. A follow up of 6 months was done post operatively. Clinical and radiological assessment was done by using Flynn's criteria. It was concluded that open/close reduction with k-wire fixation is surgery of choice for complete or partial supracondylar fracture of humerus. Carrazzone, O. L., Mansur, N. S. B., (2021).

A prospective interventional study was conducted in department of orthopedics a tertiary referral hospital of western Rajasthan from June 2018 to November 2019 by Dr. Kuldeep et.al in July 2020 to evaluate the functional and radiological outcome of closed reduction and percutaneous pinning of supracondylar fracture of humerus in children age aged 5 to 15 years. Most of the supracondylar fractures of the humerus cases were between 5-7 years of age, according to modified Flynn criteria, most cases showed excellent results (73.33%), 13.33% cases showed good results, 8.89% cases showed fair results and 4.44% cases showed poor results. Two cases (4.4 %) had pin tract superficial infection. No other complications were recorded. Closed reduction and crossed percutaneous pinning under C-arm guidance is an effective management technique of type II and type III Gartland supracondylar fractures of the humerus in children. Dhankhar, K., Bhati, M., Singh, D., (2020). A retrospective study, level III was conducted in 2013 by Ramji Lal Sahu and published in Nigerian Medical Journal to assess the outcome of percutaneous k-wire fixation in pediatric supracondylar fracture of humerus. One hundred seventy patients were recruited from Emergency and outpatient department having closed displaced Supracondylar fractures of humerus in children. They were treated either with medial-lateral pin fixation (n = 85) or with 2lateral pin fixation (n = 85). All patients were operated under general anesthesia. All patients were followed for 6 months. Results were analyzed using Flynn's criteria. The lateral percutaneous pinning technique of displaced Supracondylar fractures of the humerus offers a viable alternative to the crossed pinning group as it offers the same stability without the incipient risk of iatrogenic ulnar nerve injury. Sahu, R. L. (2013).

Rationale

The previous literatures were lacking on focusing on specific type of supracondylar fracture of humerus, thus now the current study aims to assess functional outcomes of K-wire fixation after supracondylar fracture of humerus Type III, so that post-operative rehabilitation protocol can be developed accordingly in order to improve upper limb function and in return to work as soon as possible.

Objective

To assess the functional outcome of k -wire fixation of supracondylar fracture of humerus (Type-III) in the children following six months at GHURKI TRUST TEACHING HOSPITS

MATERIALS AND METHODS

Study Design

Descriptive Case Series

Study Duration

6 months (from September 2020 to March 2021)

Study Setting

Ghurki Trust Teaching Hospital (GTTH); Orthopedic & Spine center

Sampling Technique

Non-probability Convenient sampling technique

Sample Size

Sample size is calculated by using World Health Organization (WHO) sample size calculator under the following 177.3 per 100000 prevalence (Kishore, M. (2020). 95% confidence interval (1-α) and 0.10 precision (d). The sample size was 20.

$$\frac{Z^2 1-\mathrm{a}\ (1-p)}{d2}$$

(Sample size determination in health studies version 2.0.21 WHO)

Sample Selection Criteria

Inclusion Criteria

Children under age 12 years old

Supracondylar fracture of humerus,

Extension type fracture

Gartland classification, type III

Subjects elbow range between 90-120 post-operatively

Both arms are included either right or left

Exclusion Criteria

Any Orthopedic problems related to upper extremity.

Children with mental disabilities and congenital problems

Instrumentaion and Data Collection Procedure

In my study patients were included according to the inclusion criteria. Patients were informed about the research purpose and data for their inclusion in the research was obtained from the orthopedic department of Ghurki trust teaching hospital (GTTH) and contacted to the patients via telephone. Patients were explained about the questionnaire and its questions in the simplest and easiest way. Data gathered by using modified DASH Score.

Data Analysis

Data was analyzed by using Statistical Package for Social Sciences (SPSS) version 21. The study variables were presented in the form of descriptive statistics (tables, graphs, and percentages) and frequency tables (percentage, frequency)

Ethical Consideration

Permission was obtained by the Ethics Committee of LCPT for data collection. The questionnaire was provided with written consent forms explaining the nature and purpose of study and patients participated in the research by their own will. Patients were reassured that all provided information will not be disclosed and shall remain confidentia

RESULTS

Age of Patients

The minimum age of participants in the study was 4 and the maximum age was 10 with mean age of 5.75 and standard deviation of 1.51.

Table 1. Descriptive statistics of age

	N	Mean	Std. Deviation
Age in years	20	5.75	1.51

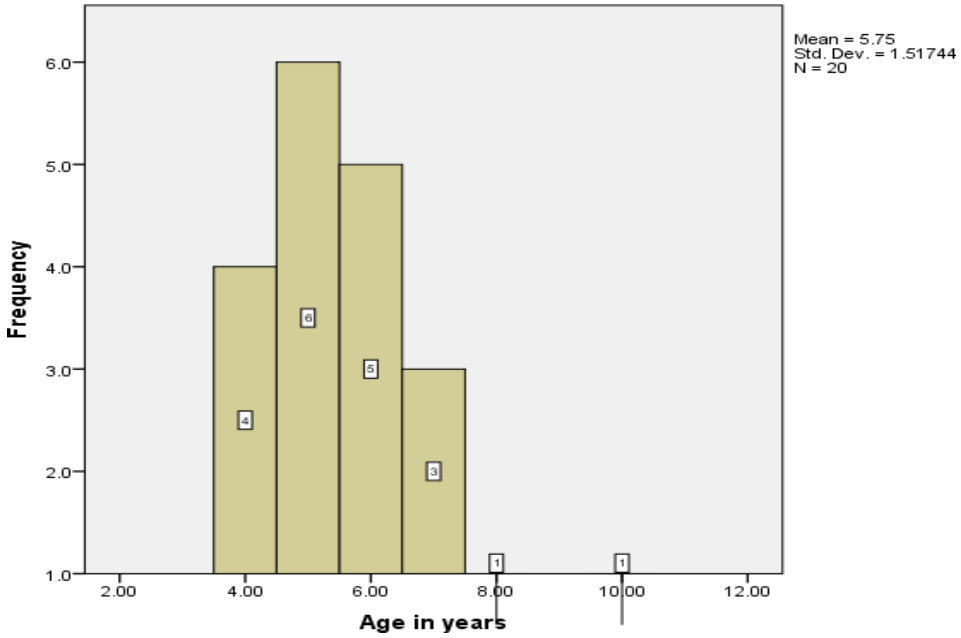

Figure 1. Histogram showing age of patients.

Histogram showed the mean 5.75 and standard deviation 1.517 of the participant

Gender of Patients

The total number of males was 14 with mean of 10.47 and standard deviation of 2.87 and standard error mean is 0.76. The total numbers of female were 6 with mean 10, std.2.12 and std. Error mean was 0.86.

Tabel 2. Descriptive statistics of gender

Gender	N	Mean	Std. Deviation	Std. Error Mean
Male	14	10.47	2.87	.76
Female	6	10.00	2.12	.86

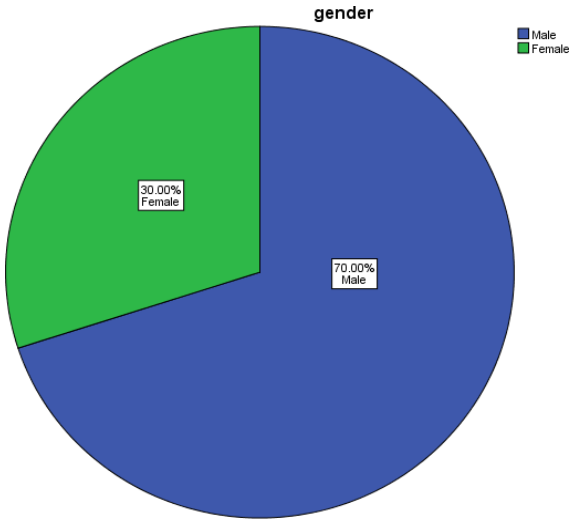

Figure 2. Pie chart showing Gender of patients 3- FRACTURE SIDE

The descriptive statistics of fracture side shows left side fracture is more common than the right side. Right side with mean 10.22 (n=9) with standard deviation 2.19 and std. error mean is 0.73. Left side with mean 10.42(n=11) standard deviation was 3.03 and St. Error mean was 0.91.

Table 3. Descriptive statistics of fracture side

Fracture side	N	Mean	Std. Deviation	Std. Error Mean
Right	9	10.22	2.19	.73
Left	11	10.42	3.03	.91

Frequency of Writing

The children were with no difficulty in writing with maximum percentage 55% (n=11).

Table 4. Frequency of writing

Writing	Frequency	Percentage (%)
No difficulty	11	55.0
Mild difficulty	6	30.0
Moderate difficulty	3	15.0

Overhead Activity

The children having mild difficulty in placing objects on shelf above head were 60% (n=12).

Table 5: Frequency of placing an object the shelf above your head.

Placing an object, the shelf above your head	Frequency	Percentage (%)
No difficulty	4	20.0
Mild difficulty	12	60.0
Moderate difficulty	4	20.0

Turning a Key

The children with 60% (n=12) were having no difficulty in turning a key.

Table 6. Frequency of turning a key.

Turning key	Frequency	Percentage (%)
No difficulty	12	60.0
Mild difficulty	6	30.0
Moderate Difficulty	2	10.0

Carrying a Heavy Object

The children with 55% (n=11) were having mild difficulty in carrying a heavy object over 10 lbs.

Table 7. Frequency of carrying a heavy object (over 10 lbs.)

Carrying heavy object	Frequency	Percentage (%)
No difficulty	1	5.0
Mild difficulty	11	55.0
Moderate difficulty	6	30.0
Severe difficulty	2	10.0

Doing Your Hair

There was no difficulty in 60% (n=12) children in washing or blow drying head.

Table 8. Frequency of wash or blow dries your hair.

Blow- drying hair	Frequency	Percentage (%)
No difficulty	12	60.0
Mild difficulty	3	15.0
Moderate difficulty	5	25.0

Washing Your Back

The children with no difficulty were 50% (n=10). There were 20 to 25% children with mild to moderate difficulty.

Table 9. Frequency of washing your back

Washing back	Frequency	Percentage (%)
No difficulty	10	50.0
Mild difficulty	5	25.0
Moderate difficulty	4	20.0
Severe difficulty	1	5.0

Manage Transportation Needs

The children with no difficulty in managing transportation needs (getting from one place to another) were 45% (n=9) and maximum children were with no difficulty.

Table 10. Frequency of managing transportation needs (getting from one place to another)

Frequency of managing transportation needs	Frequency	Percentage (%)
No difficulty	9	45.0
Mild difficulty	6	30.0
Moderate difficulty	4	20.0
Severe difficulty	1	5.0

Frequency Of Pain

The children were having mild arm shoulder or hand pain 50% (n=10).

Table 11. Frequency of arm, shoulder, or hand pain

Arm, shoulder, or hand Pain	Frequency	Percentage (%)
None	7	35.0
Mild	10	50.0
Moderate	3	15.0

Frequency of Pain on Activity

The 45% (n=9) children were having no pain in arm, shoulder, or hand pain when performing any specific activity.

Table 12. Frequency of arm, shoulder, or hand pain when you performed any specific activity

Pain in arm, shoulder or hand performing specific activities	**Frequency**	**Percentage (%)**
None	9	45.0
Mild	6	30.0
Moderate	5	25.0

Frequency of Stiffness

The children were having mild stiffness in arm, shoulder, or hand 40% (n=8).

Table 13. frequency of stiffness in arm, shoulder or hand

Stiffness in arm, shoulder or hand	Frequency	Percentage (%)
None	5	25.0
Mild	8	40.0
Moderate	6	30.0
Severe	1	5.0

Functional Outcome

These are the interpretations of modified-DASH Score. Participants faced no difficulty after k-wire fixation after six months were 8 (40%), mild difficulty were 9 (45%) and with moderate difficulty were 3 (15%).

DISCUSSION

Modified DASH score was used for the evaluation of functional outcome of supracondylar fracture of humerus with k-wire fixation six months post-operative. Study was conducted in the orthopedic department of Ghurki trust teaching hospital Lahore. The population of this study was based on children. As the previous studies subjects that the functional outcome of supracondylar fracture of humerus is good with k wire fixation and for assessment modified DASH score is used for children and it consists of 10 questions. 20 patients participated in my research and were explained about the research procedure and purpose of study. Patients who full filled the criteria were asked about their condition and improvement by using modified DASH score for the evaluation. My study results showed good results after six months of post-operative with k wire fixation of supracondylar fracture (type-III) and contrast in this study was less sample size due to COVID-19 pandemic and patients were not physically present for the assessment. Data was collected via telephone and patients were explained about the participation and use of data for research purpose. Patients with functional range between90-120 were included and all the

orthopedic problems of upper extremity other than the supracondylar fracture of humerus and children under 12 years old were included. Interpretations of modified DASH-Score are no difficulty, moderate difficulty and severe difficulty. Mostly patients showed mild difficulty in functional activities of daily living and were able to participate in the community level activities after six months of k- wire fixation (type-III fracture). Čolović, H., Stanković, I., Dimitrijević, L., Živković, V., & Nikolić, D. (2008).

CONCLUSION

The current study concluded that, there was good functional outcome of supracondylar fracture of humerus (type-III) with k-wire six months following in children.

Limitations

Reduced sample size due to COVID-19.

Results of my study cannot be generalized due to small sample size.

Recommendations

Sample size should be larger for the next study so that the results can be generalized.

Other methods of fixation of supracondylar fracture of humerus can be included and made a comparison between them.

Longer duration follow up (1 to 2 years) of patients can be included in the next study.

Future studies should focus on functional range using Flynn's criteria

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