ORIGINAL ARTICLE

Functional outcome of Medial–Lateral Pinning for Type III Gartland Pediatric Supracondylar fracture

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Abstract

Introduction: Supracondylar fractures of the humerus are the most common fracture of the elbow that accounts for more than 60–65% of all the fractures involving elbow region in children of 4 to 7 years of age.

Objectives: The main objective of this study was to assess the functional outcome of medial-lateral pinning for type III Gartland pediatric supracondylar fracture.

Material and Methods: A Descriptive case series was performed at the Department of Orthopedics and Spine Surgery, Ghurki Trust Teaching Hospital, Lahore from1st January 2021 to 30th January 2022. After getting approval from the hospital ethical committee, a total of 82 patients meeting inclusion criteria were taken from the Department of Orthopedics and Spine Center, Ghurki Trust Teaching Hospital, Lahore. After taking informed consent from patients and/or attendants, their demographic information such as name, age, gender, and address was noted. All surgeries were performed by a single consultant. Longitudinal traction with counter traction was applied. On inspection under image intensifier if fracture reduction is satisfactory then reduction was held stable with cross Kirschner wires (k-wires) of 1.5-2.0mm thickness. Both medial and lateral wires made an angle of 35-40o to the sagittal plane of the humerus. After passing k-wires through distal fragment, it should engage opposite cortex of proximal fragment 3.0cm above fracture line. K-wire should cross each other 1.5-2.0cm above the fracture line. The free ends of k-wires were cut and bent. Clinical assessment of reduction, degree of flexion and extension, and carrying angle made. Excellent functional outcome was determined in the 12th week as per operational definition.

Results: A total number of 82 cases were included in the study having supracondylar fractures among these majority were male children 59(72%) while fewer were female children as 23(38%) with an average age of 5.96±3.30 ranging from (1-13) years. The results revealed that out of 82 patients, the majority of the patients had the duration of fracture between the 1-4 days as 78(95.1%), 69(84.1%) reported the excellent functional outcome while only 13(15.9%) children did not report the excellent outcome it means they reported the good, fair and poor outcome. An insignificant association between gender, age, and duration of injury and excellent functional outcome was obtained (p-value ≥0.05).

Conclusion: The current study concluded that the medial and lateral pinning for type III Gartland pediatric supracondylar fracture is comparatively safe and efficient method to produce a good functional outcome with less incidence of complications in children.

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Introduction:

Supracondylar fractures of the humerus are the most common fracture of the elbow[1,2] that accounts for more than 60–65% of all the fractures involving elbow region in children of 4 to 7 years of age.[3,4] Gartland's classification is widely

opted to classify these fractures, as the Gartland type-I fracture is stable and not displaced, and varying degrees of displacement and angulation are present in Gartland type II, III, and IV fractures.[4,5]

Long arm cast, closed reduction, percutaneous pinning, open reduction and pin fixation, and external fixation are various surgical procedure to treat such fractures. The standard treatment for a completely displaced pediatric supracondylar humeral fracture is closed reduction and percutaneous pin fixation.[4,6] However, none of them have been accepted as a gold standard option.[4] Selection of treatment may be directed by the Gartland classification.[7] The widely adopted technique for the Gartland III extension kind consists of closed reduction and percutaneous pinning; the pin configuration can be 2 or 3 lateral pins or crossed pins. The ideal pin configuration has continually been problem to remarkable controversy. It is widely known that the placement of a medial pin incorporates the threat of iatrogenic ulnar nerve injury, while lateral pinning incorporates an improved threat of median neuropathy. Moreover, the gain of medial–lateral entry pin fixation might be expanded biomechanical stability, despite the fact that there may be the risk of iatrogenic ulnar nerve harm from the position of the medial pin.3This may be minimized by means of creating a small incision over the medial epicondyle, spreading the tissue, and ensuring the ulnar nerve is secured.

This classic method involves medial-lateral cross-pinning in which 1 pin is inserted from the lateral epicondyle and another one from the medial epicondyle.[8] A study reported that 83.87% of patients had excellent results treated with medial-lateral pinning for type III Gartland pediatric supracondylar fracture.[3]

The foundation of this study is to evaluatethe functional outcome of medial-lateral pinning for type III Gartland pediatric supracondylar fracture in our local population, as no study has specifically been done on medial-lateral pinning for type III Gartland so far. A study reported an excellent functional as 83.87%[3] of such complex forms of fracture. Through this study, if we also find a higher frequency of excellent results then in the future it can be used to treat such fractures. By doing this, we can minimize the risk of intraoperative ulnar nerve injury and can improve functional outcome.

Material and Methods:

A Descriptive case series was performed at the Department of Orthopedics and Spine Surgery, Ghurki Trust Teaching Hospital, Lahore from1st January 2021 to 30th January 2022. A total of 82 cases were taken using 95% confidence levels and 8% margin of error and excellent results as 83.87%.[3] Non-probability consecutive sampling was used. The inclusion criteria of the study were1-13 years old patients, patients having supracondylar type III Gartland fractures of the humerus, and patients who presented within 1 week of the injury. Patients with open fractures, patients having supracondylar fractures with associated other fractures (polytrauma and patients presented with compromised distal neurovascular status were excluded from the study.

After getting approval from the hospital ethical committee, a total of 82 patients meeting inclusion criteria were taken from the Department of Orthopedics& Spine Surgery, GTTH Lahore. After taking informed consent from patients and/or attendants, their demographic information such as name, age, gender, and address was noted. All surgeries were performed by a single consultant. Under general anesthesia, aseptic measures will be ensured. Longitudinal traction with counter traction was applied. The elbow joint was kept in full extension with the forearm in supination to disimpact the fracture. This was assessed by an image intensifier. Valgus and varus force will be applied to correct lateral or medial displacement. After that, angulation was corrected by flexion to 120o at the elbow joint maintaining constant traction. External and internal rotation are applied at the arm to correct posteromedial or posterolateral displacement respectively. At this point,the forearm was pronated to lock the posterior and medial soft tissue

Table 1:Demographic characteristics of cases with Supracondylar Fracture

Variables	Categories	n%	Mean±S.D (Range)
Gender	Male	59 (72)	
	Female	23(28)	
Age (years)	1-5	42 (51.2)	5.96±3.30 (1-13) years
	6-10	27 (32.9)	
	11-13	13(15.9)	
Duration of fracture (in days)	1-4	78(95.1)	1.52±1.34 (1-7) days
Excellent Functional outcome	Yes	69(84.1)	
(Flynn's Criteria)	No	13(15.9)	

Table 2:Stratification of excellent functional outcome with respect to the demographic profile of patients

Parameters	Categories	Yes	No	Value
Gender	Male	48 (81.4)	11 (18.6)	0.268
	Female	21 (91.3)	2 (8.7)	
Age (Years)	1-5	37 (88.1)	5 (11.9)	0.262
	6-10	23 (85.2)	4(14.8)	
Duration of Injury (days)	1-4	65 (83.3)	13 (16.7)	0.373
	5-7	4 (100)	0 (0)	

hinges. On inspection under image intensifier if fracture reduction is satisfactory then reduction was held stable with cross Kirschner wires (K-wires) of 1.5-2.0mm thickness. The first wire was inserted from the lateral epicondyle. Then medial k-wire was inserted after giving a stab incision about medial epicondyle (≈1.0 cm) and spreading the soft tissue to prevent iatrogenic ulnar nerve injury. Both lateral and medial wires made an angle of 35-40° to the sagittal plane of the humerus. After passing k-wires through distal fragment, it should engage opposite cortex of proximal fragment 3.0cm above fracture line. K-wire ought to cross each other 1.5-2.0 cm over the break line. The free ends of k-wires were cut and bent. Clinical assessment of reduction, degree of flexion and extension, and carrying angle made. Excellent functional outcome was determined in the 12th week as per operational definition. The data were collected on the attached proforma. SPSS version 25.0 was used to enter and analyze the data. Mean±S.D was calculated for age and duration of the injury. Frequency and percentages were used for gender and frequency of excellent functional scores. Chi-square test was applied to takea p-value ≤ 0.05 as significant.

Results:

A total of 82 patients were included in this study having supracondylar fractures among these majority were male children 59(72%) while fewer were female children as 23(38%) with an average age of 5.96±3.30 ranging from (1-13) years when age distribution the patients diagnosed with supracondylar fracture then majority children were in between the age range of 1-5 years as 42(51.2%) and minority 13(15.9%) were in between the age range 11-13 years.

The results indicated the distribution of patients according to the duration of injury and excellent functional outcome using Flynn's criteriaand the results revealed that out of 82 patients, the majority of the patients had the duration of fracture between the 1-4 days as 78(95.1%) while fewer had the fracture duration between the range of 5-7 days as 4(4.9%), out of these 82 cases, 69(84.1%) reported the excellent functional outcome while only 13(15.9%) children did not report the excellent outcome it means they reported the good, fair and poor outcome as shown in table-1.

Results demonstrated stratification of gender, age, and duration of injury with excellent functional outcome and the results showed that among 59 male and 23 female patients, the majority of the patients reported the excellent outcome as 48(81.4%) and 21(91.3%) respectively and the insignificant association between gender, age, and duration of injury and excellent functional outcome obtained (p-value ≥0.05) as shown in table 2.

Discussion:

The ideal treatment for completely dislodged supracondylar cracks of the humerus (type III) expansion in children is shut decrease and percutaneous pin obsession. Discussion concerning the ideal procedure, whether parallel or crossed, is as yet far from being obviously true.[10]

According to previous research, biomechanical strength is the advantage of the medial-lateral pinning, while iatrogenic ulnar nerve harms might result from the insertion of the medial

pin. In comparison, lateral pin fixation has an advantage in preventing iatrogenic ulnar nerve damage, although the structure can be less biomechanically robust and does not provide torsional stability, for which some have proposed the addition of a third medial pin. A biomechanical analysis by Ziontset al.[11] showed that cross pinning in rotational testing, as well as loading of varus and valgus, was more stable than lateral pinning. Another study revealed no clinical difference between lateral and crossed pins.[10]

In our study, a total of 82 patients were included having supracondylar fracture (type III) among these majority were male children 59(72%) while fewer were female children as 23(38%) with an average age of 5.96±3.30 ranging from (1-13) years. Prashant et al.[3] conducted the similar study and findings shows that a total of 31 patients involved underwent medial-lateral entry, there were 22(70.97%) male and 9(29.03%) female children with an mean age of 8.55±2.33 years. Another study performed by De Gheldere and Bellan[12] to determine the outcome of type II and III Gartland fracture and the study reported the results in Gartland type III fracture that majority were female children while fewer were males as 22(55%) and 18(45%) respectively with an average age of 5.6±2.2 years. A recent study was performed by Moton et. al[13] and the study found that among the 83 children included in the study to assess the functional outcome in Gartland type III fracture, 47(56.6%) were male children while 36(43.4%) were female children with an mean age of 7.036±3.390 years.

In the current study, the age distribution of the patients diagnosed with supracondylar fracture then the results demonstrated that the majority of children were between the age range of 1-5 years as 42(51.2%) and the minority of 13(15.9%) were in between the age range 11-13 years. In another study, Moton et.al,[13] the distribution of patients according to age explored that the majority of patients had an age ≥6 years as 42(50.6%) while 41(49.4%) had an age ≤6 years.

In this study, the outcome was assessed using Flynn's criteria and the current study found that 69(84.1%) reported an excellent functional outcome while only 13(15.9%) children did not report an excellent outcome which means they reported a good, fair and poor outcome. According to the study of Prashant et al.,[10] the results demonstrated that 26(83.87%) cases reported the excellent outcome while 5(16.12%) reported a good outcome. De Gheldere and Bellan[12] investigated the outcome of type III fracture and the results revealed that 19(47.5%) children reported the excellent outcome while 21(52.5%) did not found as an excellent outcome. Moton et. al[12] reported the results of the functional outcome as satisfactory with a portion of 80.7%. Tiwari et al.[13] observed 88% satisfactory results in which 42% were excellent, 30% were good and 6% were fair. Recent research was performed by some researchers in 2020 to compare the three different approaches in pediatric Gartland type 3 supracondylar humerus fractures treated with cross-pinning and the study reported the result that using the medial approach, 92% of cases reported the excellent outcome while using the lateral approach, 92.3% children reported the excellent outcome.[14] This study also supported the evidence of previous literature and the insignificant association between demographic variables (gender, age) and functional outcome in Gartland type III fracture obtained (p-value ≥0.05).[10-14]

Conclusion:
The current study concluded that the medial and lateral pinning for type III Gartland pediatric supracondylar fracture is a safe and effective method to produce a good functional outcome with a low incidence of complications in children. But further studies should be conducted on a large population.

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Role and contribution of authors:
Hazrat Akbar, collected the data, references and did the initial write up.

Haseeb Elahi, helped in collecting the data, and also helped in introduction writing.

Jawadul Haq, helped in collecting the references and also helped in abstract writing.

Bilal Hassan, helped in collecting the data and also helped in discussion writing.

Bilal ud Din, critically review the article and made final changes.

Latif Khan, collected the references and also helped in material and methods writing.

Sadaf Saddiq, helped in collecting the data and references.

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