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Original Research Article

A Comparison of the Functional Results Following Closed Reduction of Displaced Paediatric Supracondylar Humerus Fractures Mended with Two Lateral or Crossed Percuteneous Kirschner-Wire

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Conflict of interest: Nil

Abstract

Objective: To assess the functional results of percutaneous cross-K wire fixation for humerus fractures of Gartland types II and III.

Methods: 70 patients with supracondylar humeral fractures who received closed reduction and fixation by two crossed Kirschner wires were included in this prospective research carried out by SCB Medical College, Cuttack from January 2021 to April 2022. Children under the age of 14 who had closed fractures of Gartland types II and III were included, however patients who had open, irreducible fractures due to vascular injury were excluded. The patients' functional status was evaluated using Flynn's criteria after a 12-month follow-up period.

Results: The patients' average age was 8.0 years. Among 42 children (59.7%), trauma sustained while playing was the primary cause of injury, and 28 (57.4%) of the fractures were of the Gartland type III variety. All children's unions occurred within 5-7 weeks after birth. According to the functional outcome, 40 (51%) participants had excellent results, 20 (31%) good results, 10 (18%) fair results, and none had bad results according to Flyn's Criteria.

Conclusion: A satisfactory functional outcome, brief hospital stays, and few problems are the consequences of percutaneous Kirshner wire fixation.

Keywords: Kirschner Wire, Closed Percutaneous Reduction, Supracondylar Humerus Fracture.

Introduction

The second most frequent fracture in children overall and the most frequent around the elbow joint is the supracondylar humerus fracture [1; Figure 1]. The incidence increases throughout the course of the first five years, peaking in children between the ages of 5 and 7 [2]. Ninety-five percent of these fractures fall into one of two categories: flexion or extension deformity. According to the degree of displacement, Gartland divided the world into three categories in 1959 [3]. Type IV

was added by Leitch et.al, in 2006, and it was distinguished by being unstable in flexion and extension as a result of a circumferentially ineffective periosteal hinge [4].

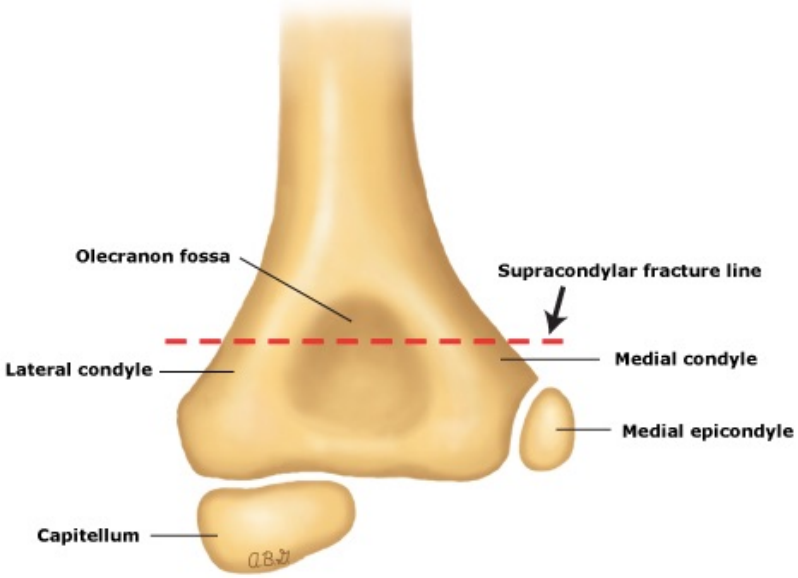


Figure 1: Supracondylar humerus fracture

Direct trauma can cause comminution-type injuries or frequently indirect low-energy injuries, such as falls on an extended hand [5]. If not adequately managed, a number of problems may develop, including cubitus varus, Volkmann's ischemia contracture, myositis ossificans, neurovascular damage, and malunion [6]. The goal of treatment is to have an anatomical reduction while also preventing cubitus valgus or varus deformity and achieving a favorable functional outcome. After the fracture has been reduced, casts and plaster of Paris immobilization are typically no longer employed because of their complications [7].

When surgery is necessary, the best method for treating Gartland types II and III fractures is closed reduction and image intensifier-guided percutaneous K. wire fixation, but there is disagreement regarding the best pin shape (lateral versus crossing) and timing of operation [8]. Crossed pin wires provide good stability biomechanically despite the risk of iatrogenic ulnar nerve injury [9].

The purpose of this study was to evaluate the use of cross K. wires for displaced supracondylar humeral fractures.

Methods:

Study Design: This was a prospective study carried out in SCB Medical College, Cuttack from January 2021 to April 2022

Methodology

Fractures were organised using Gartland's classification. Under general anaesthesia and following a thorough clinical evaluation and X-rays, a closed reduction was performed using C arm fluoroscopy. Kirchner wires of a diameter of 1.0 mm or 2.5 mm were arranged crosswise. The child was released from the hospital two days after the operation following a check-up X-ray, and elbow physical therapy was started following the removal of the back slab, which typically takes one week. In the third and fourth postoperative weeks, patients were monitored. X-ray pictures were used to assess the callus surrounding the fracture, particularly in lateral views, and any indications of a pin-hole infection were looked for. After callus formation, which

typically occurs 3 to 4 weeks following fixation, K. wire was withdrawn, and physiotherapy was resumed. After five months, the carrying angle and elbow range of motion were assessed and rated using Flynn's criteria [10]. All patients were followed for at least five months. Informed written consent was given by the parents of every patient.

Sample Size: 70 kids with supracondylar humerus fractures treated percutaneously with two crossed Kirschner wires following closed reduction were included in this study.

Inclusion Criteria: Age under 14 and having a closed fracture of Gartland types II and III were the inclusion criteria.

Exclusion Criteria: Fractures involving vascular injury, open fractures, tightly irreducible fractures, and medical ineligibility were the exclusion criteria.

Statistical Analysis: In order to evaluate the data, SPSS version 23 was used.

Ethical committee: The study was approved by The Ethical Committee of SCB Medical College, Cuttack

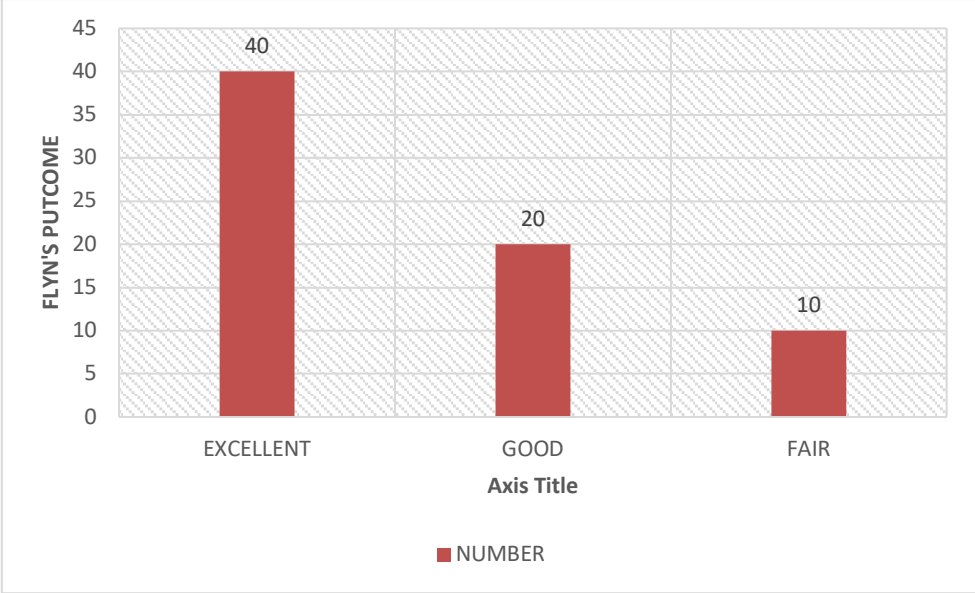
Results

There were 26 women and 44 men among the 70 patients. A majority of the patients—35 out of 70—were between the ages of 2 and 6 (46.2%). It was 8.0 years on average. All children between the ages of 5-7 showed consolidation. The most common fracture type was a Gartland type III fracture (57.4%), and the primary source of injury was trauma sustained when a child was playing. K. wires migration and superficial pin tract infection were frequent side effects (Table 1).

Table 1: Baseline Characteristics of the patients

Criteria	Type	Number	Percentage
Age	2-6 years	30	46.2%
	7-11 years	22	35.2%
	12-16 years	18	18.6%
Gender	Female	26	43.6%
	Male	46	65.4%
Type of Fracture	Gartland Type II	25	42.6%
	Gartland Type III	45	57.4%
Name of Injury	Fall from height	10	13.6%
	Bicycle Trauma	45	59.4%
	Sports Trauma	15	27.0%
Complication	Varus Malunion	2	1.1%
	Pin tract infection	24	31.2
	K-wire Malfunction	20	27.8%
	Nerve injury	0	0

After the pins were removed and a daily dressing was applied, oral antibiotic supplements helped the infection cure well. Flynn's grading system for functional outcomes revealed that 40 (51%) patients had excellent results, 20 (31%) acceptable results, 10 (18%) fair results, and none of them had bad results (Graph 1).



Graph 1: Functional Outcome using Flynn's grading

Discussion

Over the past ten years, it has been clear that percutaneous cross K. wire fixation is more effective for fracture healing and function than other existing treatment options, such as casting [11]. This study's outcome is comparable to that of the Lucas Moratelli et al. 2019 study, although it is inferior to that of Shamim et al. 2016 [12,13]. The bulk of the fractures in this study (81.2%) occurred in the non-dominant hand, and all of the fractures were extension kinds. These findings are consistent with those of Moratelli et al. [12] and Cekanuska et al. [14].

42 children in this study (59.7%) experienced an injury while playing. The findings of this study contradict those of Gopinath et al., who found that 80% of injuries were caused by falling from a height [15]. Around two-thirds of the patients (57.5%) have Gartland type III, which contradicts the findings of the study by Moratelli et al. [12].

Although clinical and biomechanical investigations have shown that the use of two crossed pins did not increase fracture stability in comparison to two parallel lateral pin configurations, some surgeons have utilised two crossed pins with success [8,12,16]. K-wire pinning did not change the results, according to a study by Moratelli et al., with the exception of raising the risk of ulnar nerve injury [12]. As a result of our nerve palpation before to inserting the medial pin, none of the 70 patients in our study exhibit any signs of ulnar nerve injury. This agrees with the findings of earlier investigations [17].

In our study, the most common issue was a pin tract infection in 31.2% of cases, which is greater than in studies by Bhat et al. [13] and Zamzam and Bakarman [18]. The high percentage of patients with pin site infections was caused by poor personal hygiene, as all of the patients came from low-income families and showed no concern for the cleanliness of the pin insertion site when the arm was covered by the back slab. After the pins are removed, full healing takes place because all infections were superficial and were treated with oral antibiotics. There were no cases of profound infection, and the results were consistent with other research [13,18].

In comparison to studies by Sahu [19] and Lee et al. (7%) and K. wire movement was observed in 27.4% of patients without loss of reduction. [20] Similar to Lee et al [21], the cause of the high percentage is owing to

sensitivity from ulnar nerve injury during the insertion of K. wires.

Flynn's system of grades showed that 51% of patients had great results, 31% had good results, and only 18% had fair results. This study findings differ with those of Moratelli et al. [12] and Sahu [19] and Dekker et al. [22], which are both lower. None of our patients experienced bad outcomes, and they were consistent with earlier research by Moratelli et al. [12], Sahu, 19 and Dekker et al. [22].

The most significant impairment following this malunited fracture is considered to be cubitus varus deformity. Cubitus varus only occurred in 2 patients (1.1%) in this outcome. Compared to Kallio et al. [23], this was higher. This study and the study by Aronson et al. support the notion that cubitus varus is a result of inadequate reduction [24,25].

Conclusion

A favorable functional outcome, brief hospital stays, and few problems were seen after percutaneous k. wires fixation for supracondylar humerus fractures of Gartland types II and III. It is accepted as a suitable technique for treating these fractures.

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