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Original Research Article

Evaluation and Outcome of CRIF with Kirschner wire in Gartland Type II & III Supracondylar Fracture of Children in Level-II & III Hospital in Bangladesh

Dr. Ataul Haque[1*], Dr. Md. Munzur Rahman[2], Dr. Kazi Shahadat Hossain[3], Dr. Md. Zafar Imam[4], Dr. Md. Mahfuzzaman[5], Dr. Md. Abdullah Al Maruf[6], Dr. Md. Murshidul Haque[7]

[1]Medical Officer (Orthopaedic Surgery), Modernized District Hospital, Joypurhat, Bangladesh
[2]Assistant Professor, Department of Orthopaedic Surgery, Rajshahi Medical College, Rajshahi, Bangladesh
[3]Associate Professor, Department of Orthopaedic Surgery, Mainamoti Medical College, Camilla, Bangladesh
[4]Senior Consultant (Orthopaedic Surgery), Modernized District hospital, Joypurhat, Bangladesh
[5]Consultant, Department of Orthopaedic and Traumatology, SIBL Foundation Hospital, Dhaka, Bangladesh
[6]Clinical Staff, Department of Orthopaedic Surgery, Asgar Ali Hospital, Dhaka, Bangladesh
[7]Junior Consultant, Department of Orthopaedic Surgery, 250 Bedded General Hospital Jamalpur, Mymensingh, Bangladesh

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Abstract: ***Introduction*:** Supracondylar fractures are one of the most common elbow fractures in children, and they require prompt diagnosis and treatment. It's frequently linked to neurovascular, functional, and deformity issues. ***Objectives:*** To examine the demographics, clinical characteristics, and treatment outcomes of patients who had closed reduction and splinting, percutaneous pinning stabilization, or Open Reduction and Internal Fixation (ORIF). ***Materials and Methods:*** A multicenter nonrandomized quasi-experimental prospective study was undertaken in Rajshahi Medical College Hospital and Sador Hospitals in Rajshahi Division Joypurhat in Bangladesh from January 2018 to December 2020. The participants had to have a Gartland type I, II, or III fracture and be between the ages of 2 and 13 years old. The trial group consisted of 40 patients with an average age of 7.5 years. ***Results:*** All of the fractures were closed, with 02 flexions and 38 extension types. Two Gartland type I fractures 2 (5%), 24 (60%), and 14 (35%) had type II and III fractures, respectively. 2(5%) of type ll patients received cast immobilization, 8(20%) of type ll patients received closed reduction and splinting, 22(55%) of type ll patients received crossed k-wire, and 8(20%) of type ll patients received CRIF with an image intensifier, respectively. According to Flynn's criteria, our research yielded 34 (84.7%) excellent, 4 (10.2%) decent, 2 (5.1%) fair results. ***Conclusion:*** The patient's age, fracture pattern, and deformity status should all be considered while treating a supracondylar fracture. When closed reduction and stabilization with percutaneous wiring are unsuccessful, open fractures with concomitant neurovascular problems ORIF should be preferred.

Keywords: Supracondylar fracture, Closed reduction, K-wire fixation.

INTRODUCTION

A supracondylar fracture, which occurs when a child falls on their outstretched hand, is the most common fracture around the elbow in children. This fracture was reported to account for roughly 60% of elbow fractures and 13% of all fractures in children of all ages. The majority of this happens between the ages of 5 and 7, and it is more common in boys. Extension or flexion injuries are the most prevalent kind of supracondylar fractures, accounting for 97 percent to 99 percent of all cases. Displacement is mainly posteromedial in extension-type injuries.

Figure-1: According to Gartland's classification, there are several different types of supracondylar fractures

***Corresponding Author:** Dr. Ataul Haque

The Gartland [2] classification system is straightforward and frequently used. In contrast to non-displaced type I fractures, type II fractures are displaced with varying degrees of angulation, but the posterior cortex remains intact. Type ll fractures are displaced and do not make contact with the cortical bone. The radial nerve, median nerve, and brachial artery may be compressed between the fracture fragments as a result of type injury [3]. The prevalence of vascular involvement in elbow injuries has been estimated to be between 12 and 20%. 1. The risk of compartment syndrome is increased when a supracondylar fracture is combined with a forearm fracture. According to Flynn JC et al., [4], the incidence of cubitus varus after therapy was 5%, while Arino VL et al., [5] found it to be around 21%. Closed reduction and splinting Dunlop traction, and olecranon traction are among the therapy options available, however, they all have drawbacks. Closed reduction and Kirschner wire fixation, with a variable number of pins and arrangement, are the favored methods medial and lateral wires, or solely lateral wires, might be parallel or crossing. Irreducible fractures, vascular compromise, and open injuries [6] are the most common reasons for open reduction. The goal of this study is to look at the demographic and clinical characteristics of patients who had a supracondylar fracture and were treated with closed reduction and splinting closed reduction and percutaneous wiring, or ORIF with k wire.

MATERIALS AND METHODS

From January 2018 to December 2020 Researchers at Rajshahi Medical College Hospital and Sador Hospitals in Rajshahi Division Joypurhat in Bangladesh. The ethical review committee was consulted once the study protocol had received departmental approval. Before any patient was enrolled in the trial, written informed permission was obtained. The study included forty patients aged 2 to 13 years old, with an average age of 7.5 years, who presented to the hospital with a supracondylar fracture. Patients over the age of 13 years who had a supracondylar fracture were excluded from the study. Demographic information was gathered through notes and radiography. A thorough history was compiled. from the records. The place of the injury, the mechanism of injury, and the period since the injury were all investigated. The deformity, swelling around the elbow, tenderness, movements of the elbow, any associated head injury or fracture of other bones, the limb's vascular status, capillary refilling, radial, and ulnar artery pulsation, and the limb's vascular status, capillary refilling, radial, and ulnar artery pulsation were all assessed from the notes. In the emergency room, AP and lateral radiographs were taken. The x-ray fracture was classified using Gartland's categorization system. The clinical and radiological characteristics, as well as the complications and outcomes, were evaluated. The treatment was determined on the type of fracture. Two patients with type I fractures was treated with a long arm posterior cast with an elbow in 90-degree flexion and forearm in neutral rotation, a collar and cuff sling, and plaster instructions given to the patient attendant, who was advised to check for tightening or loosening after two days and then remove the cast after four weeks. To assess healing, an X-ray was taken again, and active range of motion exercises was begun. Twenty-four of the fractures were type ll. After admittance, the patient was given nothing to eat. Under general anesthesia, closed reduction was achieved by the surgeon providing longitudinal tension to the forearm and the assistant delivering counter traction to the psoas. The medial and lateral displacements were corrected by applying valgus or varus force to the fracture site, then the distal fragment was pressed anteriorly and the elbow was held above 90 degrees of flexion. C-arm fluoroscopy was used to verify the decrease. The posterior cast was put with an elbow in 120-degree flexion and a forearm in full pronation to test vascular status. This approach was used to treat eight patients, and 14 of them required percutaneous cross k wire fixation. Kirschner's wire of 1.5 to 2.5 mm was placed and examined in c-arm fluoroscopy once a sufficient reduction was obtained. To avoid ulnar nerve damage, proper precautions were performed. The pins were sliced through the skin.

Figure-2: (a) X-ray of a supracondylar fracture with two percutaneous K wires in place. (b) X-ray of a supracondylar fracture treated with two cross K wires using ORIF

The introduction elbow is stretched after the pin, and the carrying angle is measured and compared to the normal. Two types II fracture patients received ORIF with two cross k wires and were monitored for 24 to 72 hours before being discharged. 14 patients had type ll fractures, with 8 requiring closed reduction with

percutaneous k wire fixation and 6 requiring ORIF with two cross k wires due to failure of the closed reduction attempt. Under general anesthesia and tourniquet control, the patient was placed in a prone position with the elbow supported by a sandbag, and the posterior Campbell approach was utilized to dissect the skin and subcutaneous tissue. The ulnar nerve was then discovered and observed, and the triceps muscle was raised from both ends. Cleaning, reduction, and fixation with two crossed k wires were performed on the fracture margin. The wires' ends were outside the skin, which will make removal easier. With the elbow in 90-degree flexion and the forearm in neutral, the posterior cast was attached.

Figure-3: a) Preoperatively enlarged elbow; b) supracondylar fracture treated with two percutaneous K wires

Drains were removed after 48 hours, stitching was completed after the second week, and the k wire and splint were removed after four weeks. The first surgical day was followed by check x-rays at 4 weeks, 3 months, and 6 months. Every case was followed up on for 12 to 18 months. At the end of the six months, the patients were assessed. At that time, radiographs of both elbows were taken and the carrying angle and range of motion of the elbows were examined clinically and radiologically. Flynn's criteria [6] were used to evaluate the clinical outcome, which was then compared to the normal elbow.

RESULTS

During the trial, forty children with unilateral supracondylar fractures were treated. With a mean follow-up of 14.5 months, all of the patients had complete documentation. The average age at the time of injury was 7.5 years, with 32 (80 percent) boys and 8 (20 percent) girls. There were 25 left-sided fractures (62.5%) and 15 right-sided fractures (37.5%). 20 (50%) sustained an injury while playing, 12 (30%) fell from a height, and 8 (20%) were involved in traffic accidents. All of the fractures were closed. The most common types of injuries were extension (38%) and flexion (2%). (5 percent). There were no open wounds or fractures present. A neurological examination was documented in all patients with paresthesia, and avascular examination was documented in all patients with a vascular examination in 6 (33.33 percent) of the patients, there was a faint radial pulse. Gartland Type I 2 (5%), type II 24 (60%), and type-ll 14 were used to categorize fractures (35 percent). For type ll and III fractures, a total of 38 patients (95%) underwent operative surgery. Closed reduction and plaster immobilization were performed in 8 (20%) instances, closed reduction and crossed k-wire fixation were performed in 22 (55%) patients, and open reduction and crossing k-wire stabilization were required in 8 (20%) fractures. The majority of procedures are completed on the day of admission 30. (75 percent). Patients were carefully followed for 12 to 72 hours before being discharged in 36 cases (90 percent). Two instances had ulnar nerve neuropraxia before surgery, and two more had it after surgery, for a total of four cases with ulnar nerve neuropraxia. Two (5%) of the patients had a superficial wound infection that was treated with an oral antibiotic and removed when the k wire was removed. Closed reduction and percutaneous pinning were used to treat one (2.5 percent) patient who had developed cubitus varus deformity due to a type III fracture. Elbow stiffness was discovered in 1 (2.5%) of type III fracture cases treated with ORIF. When there is a loss of more than 25 degrees of flexion or extension or both, we term it elbow stiffness. Within 4 to 6 weeks after surgery, the fracture had healed. Our results were outstanding in 34 (84.7%), good in 4 (10.2%), acceptable in 2 (5.1%), according to Flynn's criterion (2.5 percent).

Table-l: Treatment methods for supracondylar fractures (n=40)

Treatment	Type of fracture		
	I	**II**	**III**
Plaster cast immobilization	02	00	00
Closed reduction and immobilization	00	08	00
Closed reaction and crossed k-wire Fixation	00	14	08
Open reduction and k-wire fixation	00	02	06

Table-II: Various case complications (n=40)

Complications		No of cases
Vascular injury		00
Volkmansischaemic contracture		00
Nerve injury	Radial nerve	00
	Median nerve	00
	Ulnar nerve	04(10%)
Myositis ossificans		00
Elbow stiffness		01(2.5%)
Cubitus varus		01(2.5%)
Cubitus valgus		00
Superficial pin tract infection		02(5%)

Table-III: Patients were graded using Flynn's criteria (n=40)

Grading	Cosmetic factor (Degrees)	Functional factors (degrees)	Number of patients
Excellent	0-5	0-5	34 (85%)
Good	6-10	6-10	03 (7.5%)
Fair	11-15	11-15	02 (5%)
Poor	>15	>15	01 (2.5%)

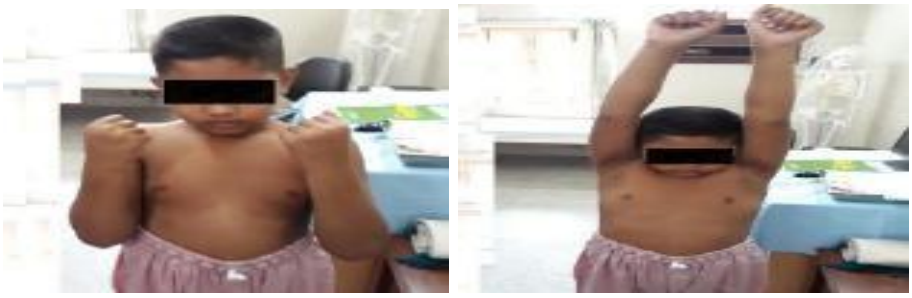

Figure-4: A clinical shot demonstrating the practical and aesthetic results

DISCUSSION

Supracondylar humeral fracture can be treated in a variety of ways, although no single procedure is ideal. The goal of treatment for a supracondylar fracture is to achieve complete anatomical reduction, full range of motion, and a functionally and cosmetically acceptable extremity. Closed reduction and percutaneous pinning are currently the recommended treatments in children [7]. Although this approach fails in approximately 15% of patients and necessitates adjustment of insufficient reduction or malposition of wires in 1-7 percent of patients [8], it is effective in around 15% of patients. For all types of fractures, Hadlow AT et al., [9] recently advised manipulation and immobilization in plaster. Even though 31% of children required additional surgical therapy and the development of varus abnormalities, The average age of damage in our sample was 7.5 years, which is consistent with earlier studies [10]. Our gender ratio was 4:1, which matches the findings of a Chinese study [11], which found that boys were more typically afflicted. The dominant arm was injured more frequently in this study, which was consistent with earlier studies [12]. In this series, 2 (5% of the children) had to type I fractures, 24 (60%) had type ll fractures, and 14 (35%) had type III fractures, which corresponded to other series [3, 11, 12]. Flexion-type fractures were seen in 2 (5%) of the patients, compared to 1% to 11% in the literature [13]. According to Dua et al., [11], closed reduction and in 22 (55%) of the cases, closed reduction and crossed k-wire fixation are successful. When close reduction failed, 08 (20%) patients required open reduction and crossed k-wire fixation. In the literature, open reduction rates range from 1.3 percent to 46 percent [13, 14], which is consistent with our findings. We used crossed k-wire because it provides more stability to the fracture; however, iatrogenic ulnar nerve injury can occur with this method. Pin fixation on the lateral side can prevent this, although it is less stable. According to Lee SS et al., [13], crossing k wire fixation gives higher torsional rigidity than lateral pin fixation. Six patients (33.33 percent) had an enlarged elbow with a feeble radial pulse. Emergency manipulative reduction with crossed k-wire fixation was performed under fluoroscopy, and the limb regained perfusion. Two patients (5%) had preoperative ulnar nerve neuropraxia, and two (5%) had iatrogenic nerve damage, but both were recovered after three months, which was similar to the 2 percent to 6% documented in the literature6. In this study, 2 (5%) of the patients experienced pin tract infections, which were treated with oral antibiotics after the k wire was removed. There was no evidence of deep infection or septic arthritis. In roughly 2% of patients, Pirone AM *et al*., [3] discovered superficial infection without any

deep infection or septic arthritis, as well as cubitus varus in 14% of cases. In this study, 2.5 percent of patients had cubitus varus deformity, which was treated with closed reduction and percutaneous k wire fixation in type III fractures. The deformity is caused by a medial displacement of the distal piece as well as an insufficient reduction of internal rotation. Elbow stiffness was discovered in 1 (2.5%) of the cases. The stiffness was reduced after physiotherapy. Our research yielded 82.5 percent great, 10% decent, 5% fair, and 2.5 percent poor results, according to Flynn's criterion. Khan HD et al., [15] reported that in 73.4 percent of instances, excellent or good results were obtained. Although supracondylar fractures of the humerus are prevalent in children, the injury's management and treatment of sequelae remain disputed. The therapy of this injury in children involves anatomical reduction, Kirschner wire fixation with special attention to soft tissues, and close monitoring of neurovascular function.

CONCLUSION

Supracondylar fracture therapy should be determined based on the patient's age, soft tissue problems, fracture pattern, and deformity status. This sort of fracture can be treated effectively and safely with closed reduction and percutaneous wiring. ORIF should be used when the closure effort fails or when there is an open fracture with accompanying neurovascular problems.

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