

CLINICAL AND RADIOGRAPHICAL EVALUATION OF DISPLACED  
SUPRACONDYLAR HUMERUS FRACTURES IN CHILDREN WITH OPEN REDUCTION  
AND INTERNAL FIXATION FROM LATERAL APPROACH AT DR. SOEDIRMAN  
HOSPITAL IN KEBUMEN

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ABSTRACT

Supracondylar humerus fracture is the most common elbow fracture in children. This fracture requires proper diagnosis and treatment, otherwise it can cause functional impairment and complications. This study aims to assess outcome of displaced supracondylar humerus fracture in children by open reduction and pinning from lateral approach. This research was descriptive quantitative using a retrospective method. All cases Gartland type III of supracondylar humerus fractures in children at Dr. Soedirman Hospital in Kebumen for 2015-2020, treated with open reduction and internal fixation from lateral approach. Outcomes were assessed according to the Flynn's criteria and Mayo Elbow Performance Score. There were 59 patients, the age 3-15 years and the mean age 6.8 years. More cases were found in boys (59.3%) than girls (40.7%). The most common type of fracture was extension (98.3%). The side of fracture was more the left and was the non-dominant extremity (56%). No infection, vascular and nerve injuries. According to Flynn's criteria, cosmetic outcome in 55 of the 59 patients (93.2%) was excellent, in 4 patients (6.8%) good (P=0.051). Also, the functional outcome in 59 patients (100%) were excellent. According to MEPS scoring, functional outcome in 58 patients (98.3%) was excellent and 1 patient (1.7%) had good. Overall, all cases were judged satisfactory (P=0.043). Treatment of supracondylar humerus fractures in children with open reduction and internal fixation from lateral approach is a safe with good clinical and radiographic results and can be applied.

**Keywords:** Supracondylar Fractures, Open Reduction, Lateral Approach, Children.

## INTRODUCTION

Supracondylar humerus fracture is the most common elbow fracture in children that it includes about 60% of the elbow fractures and 13%-15% of all pediatric fractures. Most occurs in the ages of 5-7 years old, more often in boys, and it predominantly involves non-dominant hands in almost all studies. Supracondylar humerus fractures are caused by fall onto an out stretched hand and divided into two types, extension type and flexion type. About 96% of supracondylar humerus fractures are extension type and are further classified as described by Gartland according to the degree of displacement of the distal fragment (Bayusentono et al., 2021; Fatmawati, 2020; Wahyudi, 2019). The extension type fracture is classified according to the standard Gartland classification in which, Type I is non-displaced, Type II is displaced but posterior cortex intact and Type III is completely displaced fracture. Supracondylar humerus fracture often instills a sense of apprehension in the treating surgeon with regards to the potential complications like neurovascular injuries, Volkmann's ischemia, malunion and cubitus varus or valgus. The prevalence of vascular injury in fracture around the elbow is estimated about 12-20%. The incidence of traumatic and iatrogenic nerve injuries with this fracture have been recorded as 12%-20% and 2%-6%, respectively (Azlar et al., 2017).

This fracture requires proper diagnosis and treatment, otherwise it can cause functional impairment and complications. Closed reduction percutaneous pinning (CRPP) is a treatment choice for SCH fractures often used in Gartland type I and II fractures, and open reduction

internal fixation (ORIF) treatment is used in patients with open fractures, ischemic hand and failure of revascularization, failed closed reduction. However, CRPP is often unfeasible in regions/countries with limited settings due to the unavailability of intraoperative fluoroscopic imaging (ex: C-arm) (Lestari et al., 2018; Mahartha et al., 2013). Thus, open reduction surgery is the only choice in this situation. Treatment is performed with open reduction and internal fixation are various surgical approaches for supracondylar humerus fractures. Several approaches that are commonly used are lateral, medial, anterior and posterior approaches. However, the most common is the posterior and lateral approaches. One technique of ORIF is from lateral approach, because less soft tissue dissection is needed and damage of ulnar nerve will be prevented with this technique. For cases who need ORIF, lateral approach is a less invasive with minimum soft tissue dissection in comparative with posterior approach. This later is associated with triceps muscle dissection or splitting, and more post operative adhesion (Santoso, 2017).

This study aims to assess outcome of displaced supracondylar humerus fracture in children by open reduction and pinning from lateral approach to evaluate both clinical and radiographic results of supracondylar humerus fractures.

## LITERATURE REVIEW

Fracture is a term for loss of continuity of bone, cartilage, either total or partial. Fractures are also known as fractures, usually caused by trauma or physical exertion, the strength, angle, force, condition of the bone, and the soft tissue around the bone will determine whether the fracture is complete or incomplete. Fractures also involve the surrounding muscle tissue, nerves, and blood vessels because the bone is fragile but has enough strength and spring force to withstand it, but if the external pressure that comes is greater than the bone can absorb, then there is trauma to the bone resulting in damage or loss. breakdown of bone continuity. A fracture is a separation or fracture of a bone (Oryan et al., 2015; Wedel & Galloway, 2013).

Patients who have problems in the musculoskeletal area require surgery that aims to improve function by restoring motion, stabilizing, reducing pain, and preventing the worsening of musculoskeletal disorders. One of the most common surgical procedures is internal fixation, also known as ORIF (Open Reduction Internal Fixation) surgery. Open Reduction Internal Fixation (ORIF) is a type of surgery with internal fixation that is performed when the fracture cannot be reduced sufficiently by close reduction, to maintain the correct position of the fracture fragment. The function of ORIF is to maintain the position of bone fragments so that they remain fused and do not experience movement. Internal fixation is an intra medullary nail, usually used for long bone fractures with a transverse fracture type. Open Reduction Internal Fixation (ORIF) is a medical surgical procedure, whose

action refers to open surgery to adjust the bones, such as that required for some fractures, internal fixation refers to the fixation of screws and plates to enable or facilitate healing (Budhiparama et al., 2021; Suwaryo et al., 2022).

## METHODS

This research was descriptive quantitative using a retrospective methods. Inclusion criteria were All cases Gartland type III of supracondylar humerus fractures in children at the Dr. Soedirman Hospital in Kebumen for January 2015 to December 2020. In cases where the patient was treated by open reduction and internal fixation, the surgical approach was through the lateral incision on the lateral condyle with a mild tilt toward the anterior. The control radiological were performed for the third and sixth months post operatively. The clinical evaluations were performed for all patients at the end of the sixth month. The flexion, extension, supination and pronation were investigated and the limitation of each was recorded in degree. The clinical evaluation of angular deformity (varus or valgus) was performed and the carrying angle in both sides was measured by goniometer. The radiographic assessment was carried out after the sixth month by investigating the humeroulnar angle and Baumann angle in AP view and, humerocapitellar angle in lateral view. The result were assessed according to the Flynn's criteria and Mayo Elbow Performance Score.

This study was approved by the Ethics Committee of and, an informed consent was taken from the patients.

**RESULT**

There were 59 patients, the age 3-15 years old and the mean age of the patients was 6.8 years old. More cases were found in boys (59.3%) than girls (40.7%). The most common type of fracture was extension (98.3%). The side of fracture was more the left and was the non-dominant extremity (56%). The mechanism of injury in 29 patients (49.2%) was due to fall while playing, in 26 patients (44.1%) was fall from height and in 4 patients (6.8%) it was due to the motor vehicle accident. Internal fixation is performed using lateral pins in parallel or across (2 or 3 pins). There were no postoperative complications such as vascular injury, nerve injury and infection is seen in the patients. For all 59

patients, the *humero-ulnar* and *Baumann angles* angle in AP view and *humero-capitellar angle* in The LAT display was measured on radiological results at the end 6th month. Table IV, show maximum, minimum and the average value of the angles mentioned above. Fracture union occurs in all patients at 3 - 5 week.

According to Flynn's criteria, cosmetic outcome in 55 of the 59 patients (93.2%) was excellent, in 4 patients (6.8%) good (P=0.051). Also, the functional outcome in 59 patients (100%) were excellent. According to MEPS scoring, functional outcome in 58 patients (98.3%) was excellent and 1 patient (1.7%) had good. Overall, all cases were judged satisfactory (P=0.043).

**Table 1. Distribution of Patients based on age**

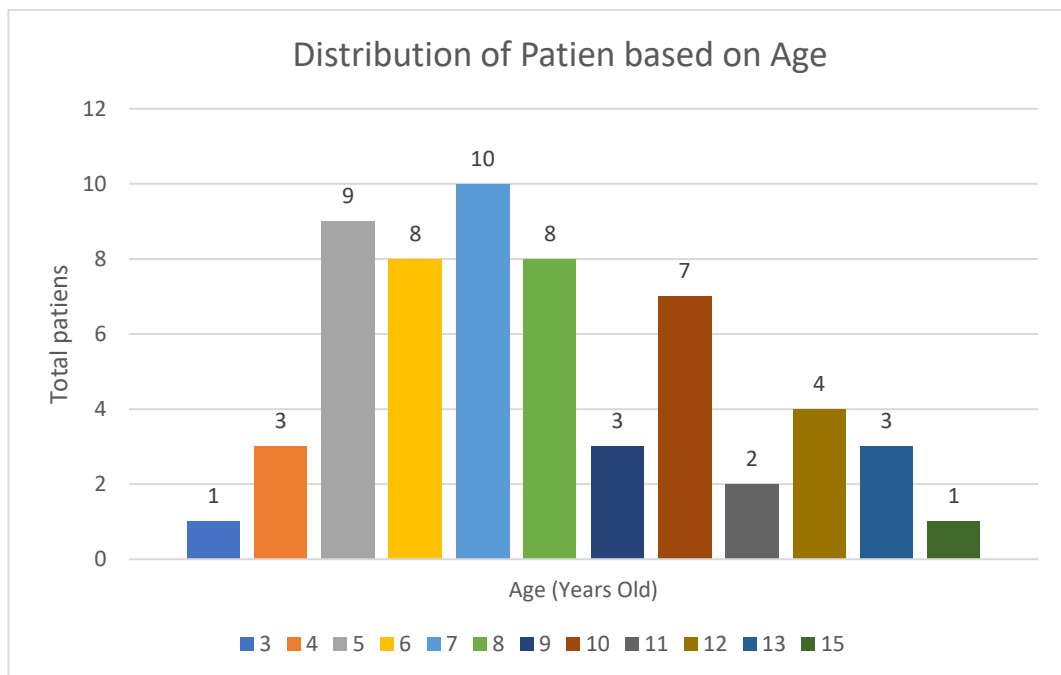
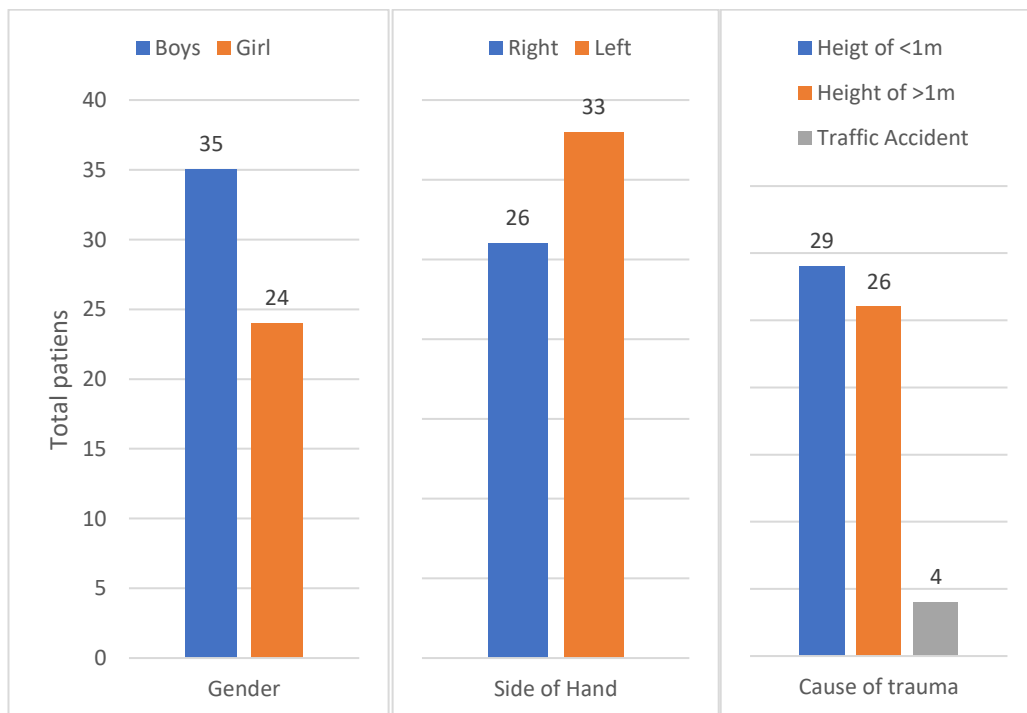


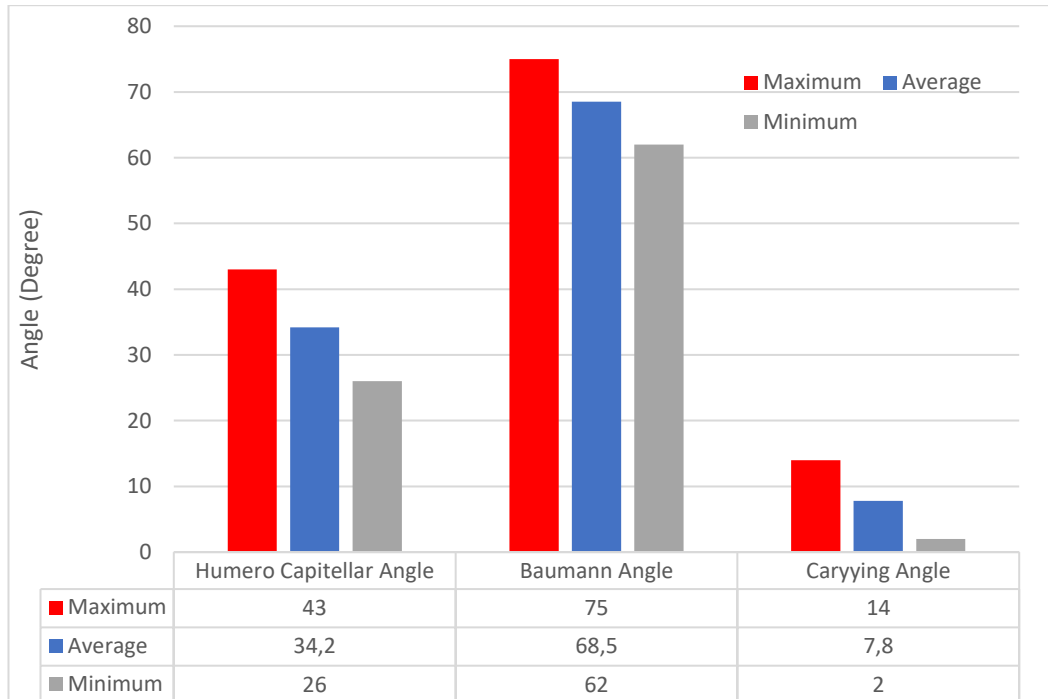
Table 2. Frequency of Patiens based on age

Age (Years Old)	Frekuens	Percentage
3 y.o	1	1.7%
4 y.o	3	5.1%
5 y.o	9	15.3%
6 y.o	8	13.6%
7 y.o	10	16.9%
8 y.o	8	13.6%
9 y.o	3	5.1%
10 y.o	7	11.9%
11 y.o	2	3.4%
12 y.o	4	6.85%
13 y.o	3	5.1%
15 y.o	1	1.7%
<b>Total</b>	<b>59</b>	<b>100%</b>

Table 3. Frequency of the Patiens



**Table 4. Measured Angles for the patients**



**Table 5. Flynn’s Criteria**

Result	Grading	Cosmetic factor Carrying angle loss (degrees)	Functional factor Movement loss (degrees)	Overall rating
Satisfactory	Excellent	0 to 5	0 to 5	The lower of the two ratings and the elbow with a varus deformity is automatically graded as poor
	Good	6 to 10	6 to 10	
	Fair	11 to 15	11 to 15	
Unsatisfactory	Poor	>15	>15	

**Table 6. Final result according to the Flynn’s criteria**

Grading	Cosmetic factor: Carrying angle loss (Number of cases)	Percentage (%)	Functional factor: Movement loss (Number of cases)	Percentage (%)
Excellent	55	93.2%	59	100%
Good	4	6.8%	-	
Fair	-		-	

Poor

-

-

Table 7. Final result according to the Mayo Elbow Performance Score

<i>Grading</i>	<i>Number of case</i>	<i>Percentage (%)</i>
Excellent	58	98.3
Good	1	1.7
Fair	-	
Poor	-	



Figure 1. Displaced supracondylar humerus fracture in a 6 years old patient



Figure 2. Post op. elbow radiography

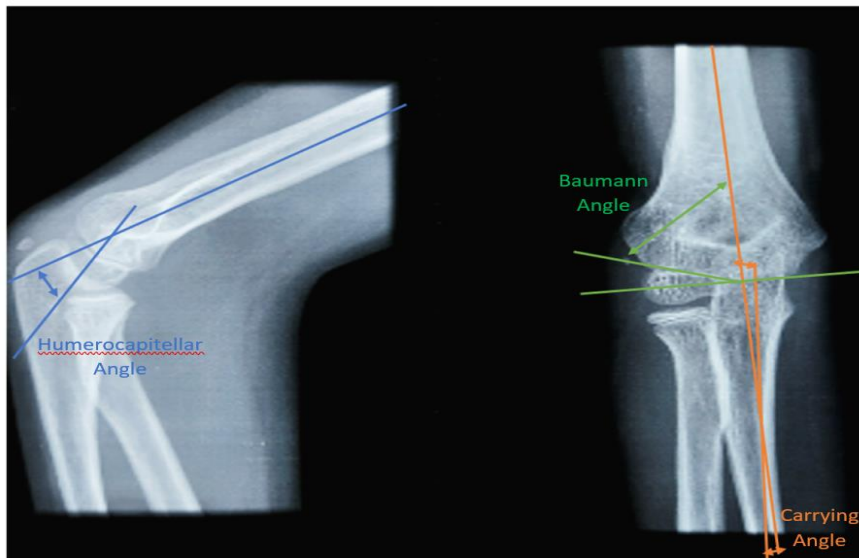


Figure 3. AP and LAT views of elbow after union of supracondylar humerus fracture

## DISCUSSION

Supracondylar humerus fracture is the type of elbow injury in children that most often requires operative therapy than other injuries. Approximately 60% to 70% of all elbow injuries in children occur between 5 and 7 years of ages. The SHF types that often require ORIF are those that fall into the Gartland classification type 3.

Surgical approach to the management of elbow injuries can be performed with the anterior, lateral, medial, or posterior approach. There is no clear evidence of which approach is superior based on functional, cosmetic, and radiological outcomes. Some of the common surgical approaches are the lateral and posterior approaches (Irianto et al., 2021; Şahin et al., 2017).

The lateral approach is quite popular because it has the least risk of damaging vital structures such as the ulnar nerve, brachial artery, and capsular ligament at the elbow

compared to other surgical approaches. Lateral approach can use pinning method with K-wire.

Medial and lateral cross pinning has been considered the most stable method from a biomechanical point of view (Laakso et al., 2011; Omid et al., 2008). In our study, lateral pinning using 2 or 3 pins was successfully applied to patients. In this context, the lateral approach to open reduction is pinning of the lateral side of the elbow. According to Flynn's criteria, the results show about 93.2% of treatments with satisfactory results.

## CONCLUSION

Treatment of supracondylar humerus fractures in children with open reduction and internal fixation from lateral approach is a good clinical and radiographic results, reliable and safe in terms of elbow function, neurovascular injury and infection issues.



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