

## Fracture Patterns in Type 3 Supracondylar Humerus Fracture and their Functional Outcome after Surgery

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Received: 26-01-2023 / Revised: 24-02-2023 / Accepted: 20-03-2023

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Conflict of interest: Nil

### Abstract

Supracondylar humerus fracture in children is one of the most common fractures around elbow. In this study, we followed up all the children (3-12 years) with type 3 supracondylar humerus fracture fixed by CRIF method for the period of 8 months post-surgery. We studied the 6 different patterns of type-III supracondylar humerus fracture (extension type) in children and analysed their fracture patterns and functional outcomes. From the study it found that the Typical transverse type (65.3%) are the most common type in coronal view and Low sagittal type (70.8%) is most common type in sagittal view. Out of 100 % (72), no coronal deformity observed in 61.1 % (44) of cases, Based on Baumann's angle in AP radiograph of elbow, Varus deformity with 19.4% (14) cases and Valgus deformity with 12.5% (9) cases were observed. 75% of medial oblique fracture, 57.9% of lateral oblique fractures, 57.4% of typical transverse fractures, 50% of high fractures, 58.8% of low sagittal, 57.1% of high sagittal fractures showed excellent functional outcome independently. Since, the Chi-Square value is  $> 0.05$ , they are not significantly related. Hence, the fracture type had no influence over the functional outcome.

**Keywords:** Supracondylar humerus fracture, Baumann's angle, Valgus, Varus.

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### Introduction

A supracondylar humerus fracture is a type of fracture that occurs in the upper arm bone, specifically the humerus bone, just above the elbow joint. This type of fracture is more common in children, and typically occurs as a result of a fall onto an outstretched hand, elbow or shoulder.

Symptoms of a supracondylar humerus fracture may include pain, swelling, and difficulty moving the affected arm or elbow. In more severe cases, there may be visible

deformity or a protrusion of the bone through the skin [1].

Treatment for a supracondylar humerus fracture may involve immobilization of the affected arm in a cast or splint, or in some cases, surgery to realign the bone fragments and stabilize the fracture with pins, screws, or plates. Physical therapy may also be recommended to help restore range of motion and strength in the affected arm after the fracture has healed [2].

There are several types of supracondylar humerus fractures based on the severity and displacement of the bone fragments. These types include [3,4]:

1. Type I: This is a non-displaced fracture where the bones are still aligned.
2. Type II: This is the most common type of supracondylar humerus fracture. It involves a displaced fracture where the bone fragments are still in contact with each other, but there is some angulation or separation.
3. Type III: This is a severe displaced fracture where the bone fragments are completely separated and not in contact with each other.
4. Type IV: This is a rare type of supracondylar humerus fracture where the bone is shattered into many pieces.
5. Type V: This type of fracture involves damage to the blood vessels and nerves around the elbow joint in addition to the bone fracture. It is considered an emergency and requires immediate medical attention.

The type of fracture will determine the appropriate treatment plan, including whether or not surgery is necessary.

### Materials and Method

This study was conducted for 2 years August 2020 to July 2022. For this study, 72 Children undergoing surgical fixation in Department of Orthopaedics, Govt Medical College Kozhikode for type III supracondylar

humerus fracture (extension type) were selected

### Inclusion Criteria

- Children aged 3-12 years.
- Closed type supracondylar fracture
- Children with type 3 supracondylar fracture
- Children with extension-type supracondylar fracture.
- Children undergoing surgical fixation.
- Willing for giving consent.

### Exclusion Criteria

- Children Age less than 3.
- Children Age greater than 12.
- Secondary types of supracondylar fracture.
- Fractures with intercondylar involvement
- Not willing for giving consent.

After getting permission from the Institutional Ethics Committee, Institutional Research Committee, of Govt. Medical College, Kozhikode for the study, the proforma was used for collecting data regarding patient details, pre-op x-ray, post-op xray, post op functional outcome of limb. Data is collected only after obtaining consent from the patients. Confidentiality of the patient details will be maintained.

### Observation and Results

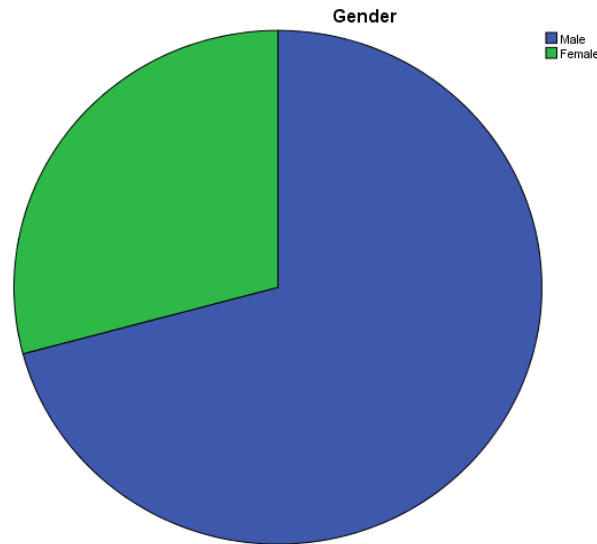
Total of 72 children were included from 3 to 12 year of age with Mean age was 6.9 years (Table-1). Out of 72 children, 70.8 % (51) were male and 29.2% (21) were female (Table-2 & Fig -1).

**Table 1: Age distribution**

Mean	6.917
Median	7.000
Std. Deviation	2.5384
Minimum	3.0
Maximum	12.0

**Table 2: Gender distribution**

	Frequency	Percent
Male	51	70.8
Female	21	29.2
Total	72	100.0

**Figure 1: Pie chart of gender distribution**

Out of 72 children, 28 (38.9%) were right sided fracture and 44(61.1%) were left sided fracture (Table -3).

**Table 3: Side distribution**

	Frequency	Percent
Right	28	38.9
Left	44	61.1
Total	72	100

There are 4 patterns in AP view (Table-4, Fig-2).

**Typical transverse fracture:** This type of fracture occurs when a bone breaks straight across its shaft (long, narrow part) perpendicular to its long axis. This type of fracture is commonly seen in long bones such as the femur or humerus. This type of fracture was observed in the 65.3 %(47) of the children.

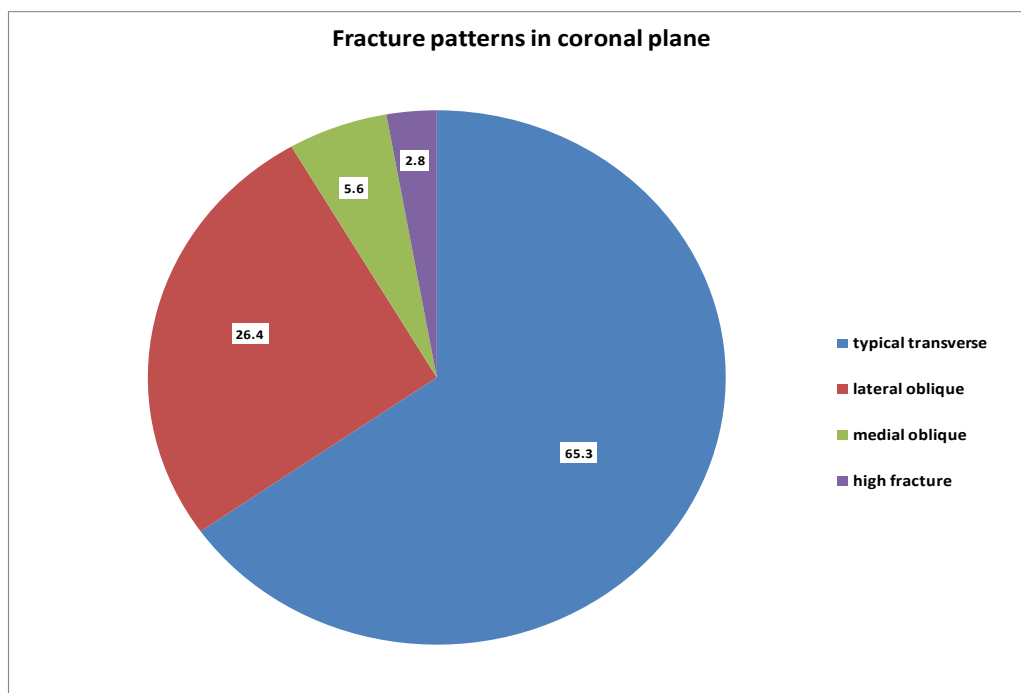
**Lateral oblique fracture:** This type of fracture occurs at an angle across the bone's shaft, with the fracture line running from the outside towards the inside. Lateral oblique fractures are often seen in bones that have been twisted or rotated, such as the fibula. This type of fracture was observed in the 26.4 % (19) of the children.

**Medial oblique fracture:** This type of fracture occurs at an angle across the bone's shaft, with the fracture line running from the inside towards the outside. Medial oblique fractures are also often seen in bones that have been twisted or rotated, such as the tibia. This type of fracture was observed in the 5.6 % (4) of the children.

High fracture: This type of fracture occurs in the upper part of a bone, such as the head or neck of the femur or humerus. High fractures can be particularly dangerous and may require surgery to repair. This type of fracture was observed in the 2.8% (2) of the children.

**Table 4: Distribution of fracture patterns in coronal plane**

	Frequency	Percent	Valid Percent	Cumulative Percent
typical transverse	47	65.3	65.3	65.3
lateral oblique	19	26.4	26.4	91.7
medial oblique	4	5.6	5.6	97.2
high fracture	2	2.8	2.8	100
Total	72	100	100	



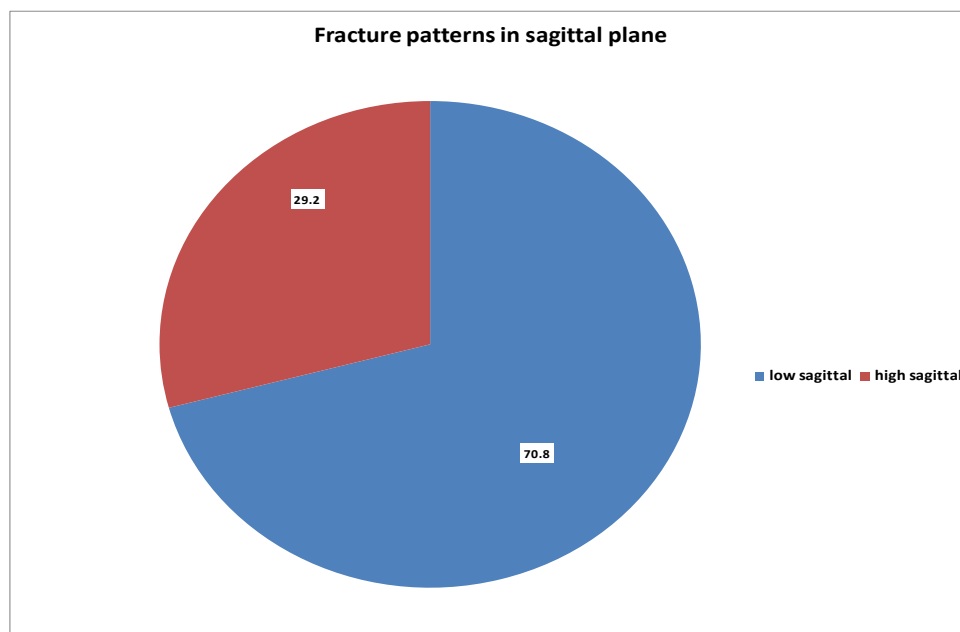
**Figure 2: Pie chart of fracture patterns in coronal plane**

There are 2 patterns in Lateral view (Table-5, Fig-3). Low sagittal fractures typically involve the lower part of the leg, and treatment may involve immobilization, surgery, or both. 70.8%, children are suffering from a low sagittal fracture

29.2%, children are suffering from a high sagittal fracture, which typically involve the upper part of the leg, may experience significant loss of function and mobility. Treatment typically involves surgery to stabilize the fracture and restore the joint, and rehabilitation may be required to regain strength and mobility in the affected area.

**Table 5: Distribution of fracture patterns in sagittal plane**

	Frequency	Percent	Valid Percent	Cumulative Percent
low sagittal	51	70.8	70.8	70.8
high sagittal	21	29.2	29.2	100
Total	72	100	100	



**Figure 3: Pie chart of fracture patterns in sagittal plane**

Postoperative coronal deformity distribution (Table – 6) refers to the distribution of different types of coronal deformities that occur after surgical treatment of a fracture. The following percentages indicate the distribution of postoperative coronal deformities:

- Neutral: 61.1% This means that the majority of patients who undergo surgical treatment for a fracture have a neutral coronal alignment postoperatively. Neutral alignment refers to the alignment of the bone that is within the normal range of angulation.
- Loss of carrying angle: 25% Some patients may experience a loss of carrying angle after surgery. The carrying angle is the angle formed by the long axis of the humerus and the forearm. A loss of carrying angle occurs when the angle becomes smaller than normal or even becomes negative.
- Valgus: 5.6% Valgus deformity is characterized by an outward bowing of the bone, resulting in an increased angle between the bone and the midline of the body.
- Varus: 8.3% Varus deformity is characterized by an inward bowing of the bone, resulting in a decreased angle between the bone and the midline of the body.

**Table 6: Statistics of Postoperative coronal deformity distribution**

	Frequency	Percent	Valid Percent	Cumulative Percent
Neutral	44	61.1	61.1	61.1
loss of carrying angle	18	25	25	86.1
Valgus	4	5.6	5.6	91.7
Varus	6	8.3	8.3	100
Total	72	100	100	

Postoperative radiological coronal deformity distribution (Table – 7) refers to the distribution of different types of radiological coronal deformities that occur after surgical treatment of a fracture.

The following percentages indicate the distribution of postoperative radiological coronal deformities:

- Neutral: 49% This means that a significant percentage of patients who undergo surgical treatment for a fracture have a neutral radiological coronal alignment postoperatively. Neutral alignment refers to the alignment of the bone that is within the normal range of angulation.
- Valgus: 14% Valgus deformity is characterized by an outward bowing of the bone, resulting in an increased angle between the bone and the midline of the body. This indicates that a minority of patients experience a valgus deformity after surgery.
- Varus: 9% Varus deformity is characterized by an inward bowing of the bone, resulting in a decreased angle between the bone and the midline of the body. This indicates that a smaller percentage of patients experience a varus deformity after surgery.

**Table 7: Statistics of radiological coronal deformity**

	Frequency	Percent	Valid Percent	Cumulative Percent
Normal	49	68.1	68.1	68.1
varus	14	19.4	19.4	87.5
valgus	9	12.5	12.5	100
Total	72	100	100	

## Discussion

The mean age of these 72 children is 6.9 years. Agrawal *et al.*[5] in his study mean age was 8 years. Among these, 70.8 % (51) were male and 29.2% (21) were female. Mazda *et al.*[6] in his study 80% were male and 40% were female. Among the children, Left side fracture (61.1%) is more commonly involved than right side (38.9%). From the above patterns discussed, Typical transverse (65.3%) is more common than lateral oblique (26.4%), medial oblique (5.6%), high fracture (2.8%). From lateral radiograph, low sagittal (70.8%) is more common than high sagittal (29.2%). As per the study of Bahk *et al* [7] and Santosh *et al* [8] observed pattern was at following (Table- 8).

**Table 8: Observed pattern of fractures**

	Bahk <i>et al.</i>	Santosh <i>et al.</i>	Present study
Typical transverse	48.8	56	65.3
Lateral oblique	43.8	14	26.4
Medial oblique	3.9	20	5.6
High fractures	3.4	10	2.8
Low sagittal	60.6	62	70.8
High sagittal	39.4	38	29.2

Patients suffering from a typical transverse fracture (65.3%) can expect to recover full function and return to their normal activities within several months if they receive proper treatment and rehabilitation. patients suffering from a lateral oblique fracture (26.4%), may experience some loss of function depending on the severity of the

fracture and the location. Proper treatment and rehabilitation can help to minimize the loss of function and facilitate recovery. patients suffering from a medial oblique fracture (5.6%), may experience significant loss of function and may require surgery to realign the bones and restore function. Rehabilitation and physical therapy can play

a critical role in regaining strength and mobility in the affected area. Patients suffering from a high fracture (2.8%), particularly those involving the hip joint, can experience significant loss of function and mobility. Treatment typically involves surgery to stabilize the fracture and restore the joint, and rehabilitation may be required to regain strength and mobility in the affected area. 70.8% of children suffering from a low sagittal fracture, can expect to recover full function and return to their normal activities within several months if they receive proper treatment and rehabilitation. High sagittal fracture treatment typically involves surgery to stabilize the fracture and restore the joint, and rehabilitation may be required to regain strength and mobility in the affected area.

After closed reduction and percutaneous fixation, about 25% of cases reported loss of carrying angle that is one among 4 cases will result in loss of carrying angle. Varus deformity (loss of carrying angle more than 15 degree) was found in about 8.3% cases and valgus deformity in 5.6% cases.

Based on the Baumann's angle (64-81 degree), varus deformity (> 81 degree) is 19.4% and valgus deformity (<64 degree) is 12.5%. But, from the literature, it is said that, the Baumann's angle is mostly used for fracture reduction indicator and predictor of carrying angle. And it is usually compared to normal opposite side elbow. Hence, comparing the Baumann's angle may not be accurate here. The occurrence of postoperative radiological coronal deformities can affect the functional outcome of the patient, and therefore it is important to closely monitor and manage such deformities after surgery.

### Conclusion

This study shows that the Typical transverse type (65.3%) are the most common type of type 3 supracondylar humerus fracture that

represent approximately 65.3 % of all paediatric fractures in coronal view while Low sagittal type (70.8%) is most common type in sagittal view. It's important to note that these percentages are based on the limited information and are not definitive or representative of all cases. The functional outcome of a fracture will depend on individual circumstances, and proper treatment and rehabilitation can help to maximize the chances of a full recovery. 75% of medial oblique fracture, 57.9% of lateral oblique fractures, 57.4% of typical transverse fractures, 50% of high fractures, 58.8% of low sagittal, 57.1% of high sagittal fractures showed excellent functional outcome independently. Since, the Chi-Square value is > 0.05, they are not significantly related. Hence, the fracture type had no influence over the functional outcome.

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