

COLLEGE OF HEALTH SCIENCE, DEPARTMENT OF ORTHOPEDICS & TRAUMATOLOGY

Functional Outcome of Open Reduction and Pinning of Supracondylar Humeral Fracture in Children Treated in Tikur Anbessa Specialized Hospital: A 5 year's retrospective study

By: BISRAT TILAYE, MD

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By: BISRAT TILAYE, MD

Advisor; Dr. BIRHANU, MD, ASSOCIATE PROFFESSER OF PEDIATRIC ORTHOPEDIC SURGEON

ADDIS ABEBA,

ETHIOPA

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ADVISOR'S APPROVAL SHEET

This is to certify that the thesis entitled **". Functional Outcome and Associated Factors of Open Reduction and Pinning of displaced Supracondylar Humeral Fracture in Children Treated in Tikur Anbessa Specialized Hospital from September, 2019 to September , 2024, Addis Ababa, Ethiopia"** is submitted in partial fulfillment of the requirements for the Specialization Certificate in Orthopedic surgery to the department of orthopedic surgery and Traumatology, Addis Ababa University college of health science and has been carried out by Bisrat Tilaye under my supervision. Therefore, I recommend that the student has fulfilled the requirements and hence hereby can submit the Thesis to the Department.

Birhanu, MD		
Name of Major Advisor	**Signature**	**Date**

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Abbreviation/Acronyms

AAU…….. Addis Ababa university

CMHS……College of medicine and health sciences

CRPP……Closed reduction and percutaneous pinning

FDI……... Fall down injury

HIMS…… Health Information Management Service

NDMC ……National Data Management Center for health

ORPP……. Open reduction and percutaneous pinning

RTI……. Road Traffic injury

SCHF……Supra condylar humerus fracture

SDG……. Sustainable and Developmental Goal

SPSS……Statistical Package for the Social Sciences

TASH……. Tikur Anbessa Specialized hospital

WHO…… World health Organization

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Abstract

Background: Supracondylar humeral fractures are the most common type of elbow fracture in children. This study aims to assess the outcomes and evaluate the correlating factors of displaced supracondylar fractures treated with open reduction and percutaneous pinning (ORPP) over a five-year period at Tikur Anbessa Specialized Hospital, Addis Ababa, Ethiopia.

Methods: We conducted a retrospective cross-sectional study of patients admitted to Tikur Anbessa Specialized Hospital who underwent ORPP from September 2019 to September 2024. Clinical data were obtained from theater logs, inpatient and outpatient department (OPD) records. Elbow range of motion and carrying angle were measured directly using goniometry. Data were analyzed using SPSS version 27, with both bivariate and multivariate analyses performed to assess the effects of independent and dependent variables.

Results: In our study, 94.4% of patients treated with ORPP had a satisfactory outcome, while 5.6% had an unsatisfactory outcome. According to Flynn's criteria, the functional outcomes were classified as follows: 58.3% good, 19.4% excellent, 16.7% fair, and 5.6% poor. Multivariate analysis revealed that for each additional year of a child's age, the range of motion decreased by 2.9% compared to the contralateral limb (p=0.029, 95% CI: 0.002-0.402).

Conclusion: The majority of children with displaced supracondylar humeral fractures treated with ORPP achieved satisfactory outcomes, comparable to standard management practices in developing countries. Age was significantly associated with an unsatisfactory outcome.

1.Introduction

1.1. Background Information

Childhood injury has one of the major causes of morbidity, disability and mortality throughout the world(1–4).The leading causes of injuries in the population aged 0-19 years worldwide are falls and road traffic injuries. Global health estimate released in 2023 by World health organization road traffic injuries caused 50 deaths from 100,000 population in 2019, of these 16 deaths in 100000 population were children aged 0-15years. Although the incidence of injury constant worldwide, disability and mortality decreased in developed country from 2009 to 2019. The burden has worsened in middle- and low-income countries where more than 95% death of injuries. (5) In Ethiopia, injury caused about 25 thousand deaths among 0-14-year-olds in Ethiopia in 2015. The number of incidence childhood injuries and death rate because of injuries increased. The leading cause of fatal child unintentional injuries in Ethiopia was road-traffic injuries. (6)

Among all kind of injuries fracture is one of the common childhood injuries associated with significant mortality and morbidity unless treated. Fractures of the distal radius and ulna are the most common types of fractures worldwide, followed by distal humerus fractures. (7–10)However, some studies, including those from Ethiopia, suggest that distal humerus fractures are the most prevalent.(11–13) Supracondylar fractures of the humerus are the most common elbow fractures in children, with a peak incidence occurring between the ages of 5 and 7 years.(14,15)

Most fractures occur on the left or nondominant side, and traditionally, males are more predominate than female.(7,8) However recent study in USA and Europe shows prevalence become equalizing.(16,17) Extension fractures account for approximately 98% of these injuries.(13,17–19)

Fractures are classified by their displacement in the sagittal and coronal planes, with potential involvement of neural or vascular structures. The Gartland classification systems the commonly used for supracondylar humeral fractures in children. It is reliable and categorizes fractures based on displacement into three types: type I (non-displaced), type II (displaced with an intact posterior

cortex), and type III (completely displaced). (20) In 2006, Leitch et al introduced a new type IV fracture, in which the periosteum is completely torn, which leads to a high instability of the fracture both in flexion and extension(21)

In Ethiopia, the highest proportion of the population are children and adolescent. Study conducted in our hospital revealed that supracondylar fracture of humerus being the most common, but there is limited information of treatment outcomes. (12)This study aims to evaluate the functional and cosmetic outcomes, associated factors and related complications of open reduction and pinning of displaced supracondylar humeral fractures in TASH, Addis Ababa, Ethiopia. Also aim to address gaps in the existing literature, providing a baseline for future research at local hospitals.

1.2. Statement of the problem

In Ethiopia, supracondylar fractures are very common (12,13) however, there is a limited data on treatment outcomes. Only one retrospective study done on outcome of supracondylar fracture treated with open reduction and pinning and associated factors at Bahir Dar university has 90% satisfactory outcome. (22)

Treatment of displaced supracondylar humeral fractures remains a challenge for orthopedic surgeons because of marked swelling, difficult to reduce and maintain stability till fracture healed, particularly in low-income countries(23). Studies from the USA, Europe, and Asia typically recommend closed reduction and pinning as the standard treatment for displaced fractures. (24–26)However, in resource-limited countries like Ethiopia, where facility may not be available, to implementing this standard treatment can be challenging.

There is scarcity of data on treatment outcomes of displaced supracondylar fracture of humerus in Ethiopia. So, this study aims to determine the functional outcome and associated factors of supracondylar humeral fractures after open reduction and pinning, it also will help to fills the existing gap of literature and used as baseline study in our hospitals for future other studies.

1.3. Significance of the study

There is scarcity of study which shows the outcome of displaced supracondylar fracture after open reduction and pinning and associated factors contributing to it. This study will deliver information about current management modality, identify associated factors, contributing complications, create awareness for health care professionals (residents, consultants, and physiotherapist) and helpful for policy makers. This study is the first in assessing functional outcome of displaced supracondylar fracture of the humerus which will help as a base line for future studies.

2. Literature Review

The elbow joint is a complex articulation of three bones that allows motion in all three planes. The unique articulating surface of the distal humerus is attached to the shaft through the medial and lateral columns. These two columns are separated by a thin area of bone, which consists of the coronoid fossa anteriorly and the olecranon fossa posteriorly. This thin area is the weak link in the distal humerus and is where supracondylar humeral fractures originate.

Supracondylar humeral fractures are the most common pediatric elbow fractures. It accounts 60% of all elbow fractures in children and majority of these fractures result from a fall on an outstretched hand, which causes hyperextension of the elbow.(10,12,13,23,25) Supracondylar fractures are divided into extension and flexion types, with extension-type fractures accounting for 97-98% of cases resulting from a fall on an outstretched hand.(13,15,25,27)

In European study-Switzerland, revealed that most supracondylar fractures occurred in males (56.7%) and the mean age was 5.8years. Falls were found to be the major cause of elbow joint fractures in this study.(24) Other study done in Asia -Nepal, showed SCHF affect boys more than girls and the most common age group was 5-10years.(10) A study done in Brazil, revealed most

of patient with SCHF were male (56.9%) and peak age was 3-7.8years. fall was major cause of fracture and left side (51.8%) more prevalent.(15)

In east Africa-Tanzania a retrospective study done 2019 demonstrated a ratio of boys to girls 1.2:1 and peak age were 5-10 years.(28) Other study in Rwanda revealed children aged 6-10 years were predominantly affected and boys to girl's ratio of 1.9:1. Falls were major cause of injury and left limb affected more than contralateral. (29)

In Ethiopia. A one-year prospective study done in Ethiopia in 2008 showed that most SCHF occurred (74%) in male and in age group 5-10 years (75%). Falls most common cause of injury

+++(96%) and non-dominant upper limb predominantly affected. (13)

Supracondylar humerus fracture classified based on the severity of displacement of the fracture for purpose of management. Most commonly used Gartland classification of extension-type supracondylar humeral fractures into three types: Type I (non-displaced), Type II (displaced with an intact posterior cortex), and Type III (completely displaced without cortical contact).(20) Additionally, Type IV, described by Leitch et al., is considered to be a multidirectional destabilizing fracture.(21)

Treating a displaced supracondylar fracture is one of the most challenging tasks for orthopedic surgeons due to the difficulty in reducing and maintaining stability in a significantly displaced fracture with associated soft tissue swelling. There is also controversy regarding the management of displaced supracondylar humeral fractures, which can be carried out through either open or closed reduction with percutaneous pinning. Open reduction and pinning are preferred in cases of fractures associated with vascular damage, open fractures, and failed closed reduction, and they are also used in resource-limited settings where facilities may not be available.

A systematic review of open reduction and pinning for severely displaced supracondylar humeral fractures in children, conducted in Madrid, Spain, found statistically significant overall results in favor of open reduction. The review suggested starting with closed reduction and, if it fails after two attempts, proceeding with open reduction and pinning.(30)

A systematic review and meta-analysis conducted by Lin-Guo et al. in Tinjan Hospital, China, included six clinical studies with 581 patients. The review, comparing different management strategies for supracondylar humeral fractures in children, showed no significant difference between outcomes of closed reduction and pinning versus open reduction and pinning. The authors concluded that closed reduction and pinning are comparable to open reduction and pinning, recommending closed reduction initially, with a move to open reduction if necessary.(31)

A retrospective study conducted in India revealed that 95.5% of patients achieved satisfactory outcomes following primary open reduction and percutaneous pinning. Author suggests Open reduction of displaced supracondylar fracture is a safe primary treatment option and the fears of significant complications are unfounded. Reduction of the medial column under direct vision virtually eliminates the risk of cubitus varus. (32) Another prospective study conducted in India on patients with displaced supracondylar fractures treated with open reduction and crossed percutaneous pinning via a lateral approach found that 90.4% of cases achieved satisfactory outcomes(33)

A recent study conducted in India on displaced supracondylar humeral fractures (SCHF) treated with both closed reduction and open reduction with pinning reported a 98.6% satisfactory outcome, showing no significant difference between the surgical approaches or types of reduction. For severely displaced fractures, the data indicated that an open approach for crossed K-wires was associated with fewer complications and improved clinical outcomes compared to closed reduction.(34)

In addition to technique of reduction there are also factors associated with outcome of displaced supracondylar fracture.

A retrospective study in the USA examined 297 pediatric patients with closed Gartland type III supracondylar humerus fractures who underwent surgical treatment. The results revealed that complications were more prevalent among boys and older children. This suggests that these groups may require closer observation and tailored management strategies post-surgery. (35)

A retrospective study in USA found that children over 8 years old have poorer outcomes after open supracondylar humerus fractures. These older children experience more frequent fractures and require more pins for surgical fixation. Although nerve injury rates are similar across age groups, older patients are more likely to develop elbow stiffness, leading to a greater need for physical therapy. This emphasizes the need for age-specific treatment strategies(36)

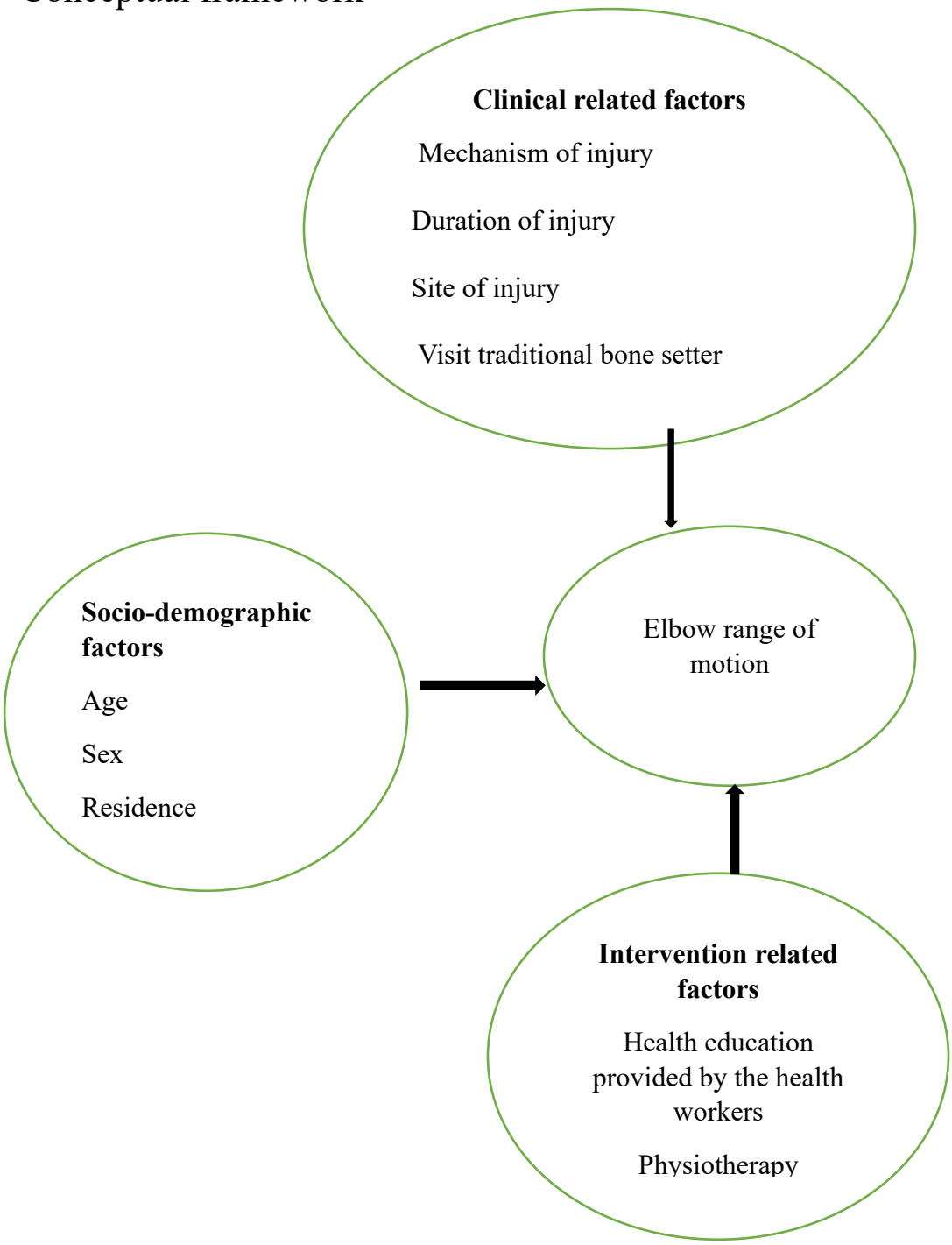
A UK study found satisfactory outcomes in pediatric patients with Gartland type III and IV supracondylar humerus fractures, showing consistent results across various ages and sexes. The severity of displacement, whether type III or IV, was the only significant factor influencing these outcomes. This emphasizes the importance of assessing displacement when evaluating treatment results.(37)

A prospective study conducted in rural India found that 36.12% of patients initially sought treatment from traditional bone setters before visiting a hospital. These patients experienced poorer outcomes compared to those who presented early for medical care. The study emphasizes the importance of timely intervention and also highlights the need for education within families about the benefits of seeking professional medical treatment promptly.(38)

A retrospective and cross-sectional observational study at the University Teaching Hospital of Kigali, Rwanda, demonstrated that the clinical outcomes of open reduction were comparable to those of closed reduction and pinning. The study emphasized that early surgery (within 4 days) and effective postoperative follow-up were key factors in achieving favorable clinical results.(38)

A retrospective study in Ethiopia found that patients who visited traditional bone setters had poorer outcomes compared to those who did not. It highlights the need for increased awareness of modern medical options and improved access to healthcare services. (22)

Conceptual framework



3. Objective of the study

3.1 General objective

To assess the overall functional and cosmetical outcomes after open reduction and pinning in the management of supracondylar fractures.

3.2 Specific objective

To determine functional outcome of open reduction and pinning in children with supracondylar humeral fracture treated at Tikur Anbessa Specialized Hospital

To identify associated factors with outcome of open reduction and percutaneous pinning in children with supracondylar humeral fracture treated at Tikur Anbessa Specialized Hospital

To assess related complications for open reduction and pining

4. Methodology

Study setting - This study was conducted at Orthopedic and Traumatology Department of Tikur Anbessa Specialized Hospital, Addis Ababa University, Ethiopia.

Study Design – We employed a retrospective cross-sectional and observational study to evaluate patients with Modified-Gartland Type III and IV supracondylar humeral fractures treated with open reduction and pinning

Study period -was conducted from September 2019– September 2024.

Source population -All children presented to TASH with diagnosis of supracondylar humeral fracture

Study population -All children admitted with diagnosis of displaced supracondylar humeral fracture treated with open reduction and pinning that fulfill inclusion criteria.

Inclusion Criteria: All patient of either gender of age under 15 years with supracondylar fracture of humerus in a period of less than three weeks of presentation with displaced supracondylar fracture (Gartland type III and IV) diagnosed on X-ray intraoperatively and were included in the study.

Exclusion Criteria: Any patient with open or closed Gartland type-III and IV fracture associated with neurovascular injury, fractures greater than three weeks duration, previous fracture in the same elbow, open fracture or associated ipsilateral fractures were excluded from the study

Sample size determination -

The minimum number of samples required for this study will be determined by using single population proportion formula.

$$n = \frac{\left(Z_{\alpha/2}\right)^2 p(1-p)}{d^2}$$

Where;

n- is the sample size,

α -is the critical value corresponding to 95% confidence interval (CI),

p- is the estimated prevalence rate for the population, -0.5

d- the margin of error to be tolerated for which 5% is taken. - 0.05

Zα/2 - the standard normal variable at 1-α % confidence level -1.96

$n= ((1.96)^2 * (0.5*0.5))/0.05^2 = 384$

The total number of supracondylar fractures is around 436 in our hospital.so. since this number is below 10,000, used the following correction formula for the sample size determination.

S=n/(1+n/N)

n=384

N=436

S=384/ (1+384/436) =203

S=203 adding 10% for non-response rate, Therefore the required sample size of this study was 224.

Sampling technique

All Gartland type III and IV supracondylar treated with ORPP

Data collection

We reviewed the medical records of patients who had at least 6 months of follow-up. Inclusion criteria encompassed patients with Modified-Gartland Type III and IV fractures who underwent open reduction and pinning. We excluded patients with neurovascular impairment, fractures delayed beyond 3 weeks, and those with concurrent upper limb fractures. All patients were treated in a consistent operating room environment and received uniform postoperative care. All surgery done by pediatric orthopedic surgeon. We collect data using structured questionnaire which includes: -sociodemographic characteristics, disease condition, treatment condition, and outcome measuring questions. The data collected were: gender, age, diagnosis, hospital details, operation time, and follow up, from the medical records and operation logs. Other clinical data collected face to face at OPD measuring range of motion of elbow and carrying angle with goniometer as compared with contralateral.

We applied the modified Flynn criteria, a widely recognized method for evaluating outcomes in supracondylar humerus fractures. This approach focuses on both functional and cosmetic outcomes, specifically assessing range of motion and alterations in the carrying angle.

Table 1 Modified Flynn criteria

Results	Rating	Loss of motion	Loss of carrying angle
Satisfactory	Excellent	0° -5°	0° -5°
	Good	5-10°	5-10°
	Fair	10-15°	10-15°
Unsatisfactory	Poor	>15°	>15°

Operational definition

Displaced supracondylar humeral fracture is when there is loss of contact between the distal and proximal segment on AP or /and lateral x ray interpreted by a senior resident or consultant orthopedic surgeon.

A satisfactory outcome following a supracondylar humerus fracture is defined as maintaining elbow range of motion within 15 degrees of the expected norm and/or a change in the carrying angle of 15 degrees or less, as assessed by a clinician during an outpatient assessment.

An unsatisfactory outcome following a supracondylar humerus fracture is defined as either a loss of elbow range of motion exceeding 15 degrees or a change in the carrying angle greater than 15 degrees, as evaluated by a clinician during an outpatient assessment.

Data analysis

Data were entered and analyzed using SPSS version 27.the effect of independent variables assessed with bivariate regression analysis and multivariate analysis. A p-value of < 0.05 was considered to constitute a statistically significant difference. Data were presented in form of tables, bars and pie charts.

Data Quality Control

Continuous evaluation and tallying of the collected data carried out by principal investigators

Ethical consideration

This retrospective study analyzed existing data collected from surgical logbooks, medical records, and interviews. It did not influence patient treatment and any potential risks to patient safety were considered minimal. The study received a written informed consent from the department's ethical review committee. Data privacy and confidentiality were ensured through anonymous data recording, analysis, and manuscript writing. Participants family were informed about the study we got written informed consent from patient’s family.

Dissemination plan

The final result from the study will be submitted to Department of Orthopedics and Traumatology, Tikur Anbessa Hospital, Addis Ababa University in the form of written report and will be presented for the concerned bodies.

5. Result

1.Sociodemographic characteristics of the study participants

In this study ,72 children with supracondylar fracture managed with open reduction and pinning found in the study period from September 2019-September 2024. The age range of patients in our study was from 2 to 13 years, with a mean age of 6.4 years. Most patients fell within the 5 to 10-year age range (50%). Most children with supracondylar humerus fracture of elbow were male (70.8%). Majority of patients are from Addis Ababa Except 3 children who come from rural, all come from capital city, Addis Ababa. The mechanisms of injury were fall down injury at school (55.6%) and at home (40.3%).

Table 2: Sociodemographic characteristics of study participants

Variable		Number	Frequency (%)
Age(year)	<5	31	41.3%
	5-10	36	50.0%
	11-15	5	6.9%
Sex	Male	51	70.8%
	Female	21	29.2%
Residency	Urban	69	95.8%
	Rural	3	4.2%
Location of trauma	School	39	55.3%
	Home	30	40.3%
	Recreation	3	4.4%

2.Characterstics of supracondylar fracture of patients

Most of supracondylar fractures humerus of this study was due to fall dawn injury (97.2%) and most were left side of humerus which account 69.4%. Although, all fracture has significant displacement with no cortical contact radiologically, six fractures (8.2%) had periosteal disruption in every dimension intraoperatively (Gartland type IV). Significant number (34.7%) of patients were visit traditional bone setter before they went to nearby health center or hospital. For fifty-eight supracondylar fractures of humerus open reduction and pinning were done with in first seven days of the injury. For rest fourteen fractures has done after seven days after the

edema subsided. seventy eight percent of open reduction and pining of supracondylar fracture surgery completed within one hour.

Table 3:characteristics of supracondylar fracture of participants

Variable		Frequency n (%)
Side of injury	Left	50(69.4%)
	Right	22(30.6%)
Duration from injury to surgery theater	<7days	58(80.6%)
	>7days	14(19.4%)
Displacement	Gartland type III	66(91.7%)
	Gartland type IV	6(8.3%)
Visit traditional bone setter	Visit	25(34.7%)
	No visit	47(65.3%)
Duration of surgery	<60 min	56(77.8%)
	>60 min	16(22.2%)
Hospital stays	<72 hrs.	44(61.1%)

	>72hrs	28(38.9%)
Return to activity (school)	3-6weeks	55(76.4%)
	>7weeks	17(23.6%)

3. Fracture outcome according of modified Flynn criteria

This study showed that 94.4% of the fracture had satisfactory result according to modified Flynn criteria. Four patients had unsatisfactory outcome. Of these three has significant loss of range of motion of elbow and one patient has develop heterotrophic ossification.

Table 4 fracture outcome according to modified Flynn criteria

Outcome	**Flynn criteria**		**n-72**	**Frequency %**
	Rating	Loss of ROM		
Satisfactory	Excellent	$<5^0$	40	55.6
	Good	$6\text{-}10^0$	15	20.8
	Fair	$11\text{-}15^0$	13	18.1
Unsatisfactory	Poor	$>15^0$	4	5.6

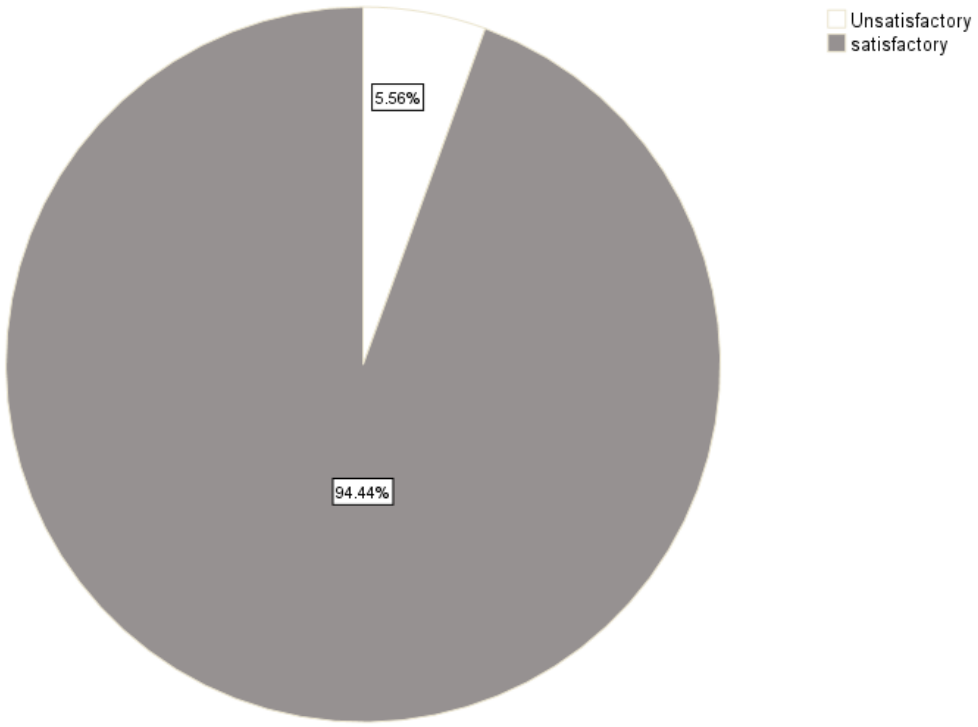


Figure 1: outcome of supracondylar fracture according to Flynn criteria

The figure below showed that 55.6%,20.8%,18.1% and 5.6% of the supracondylar humeral surgery had an excellent, good, fair and poor outcome respectively.

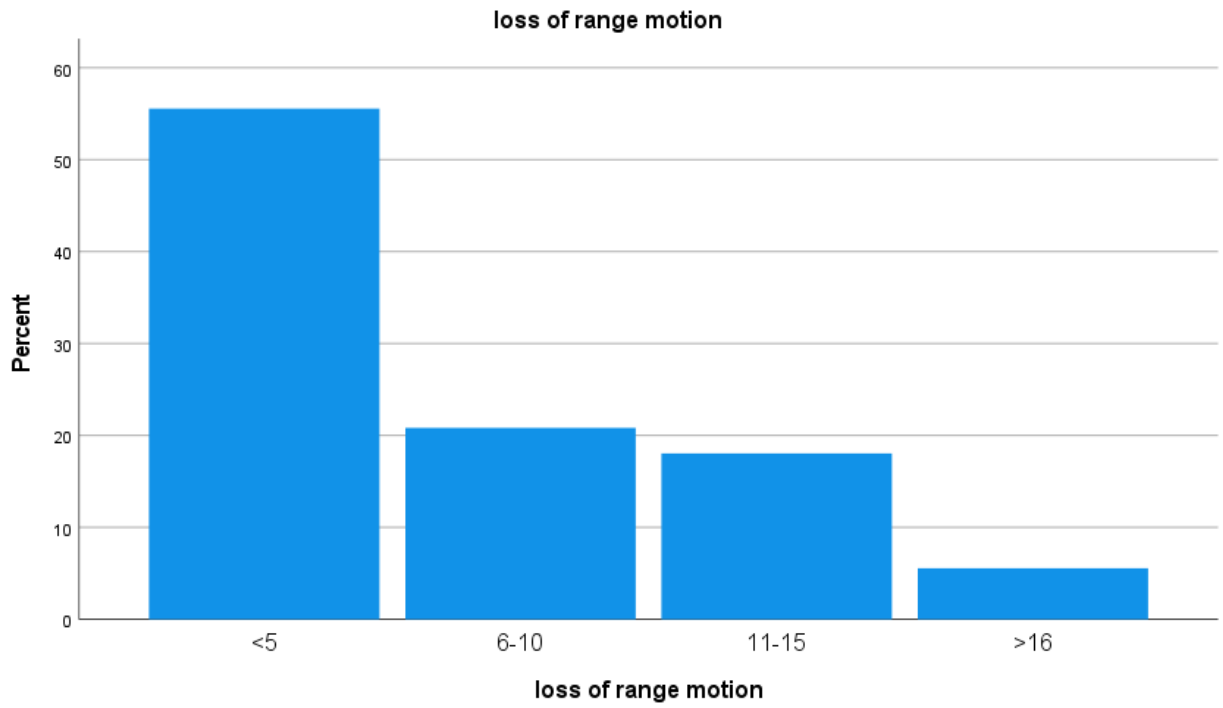


Figure 2 outcome of loss of ROM of participant based on Flynn criteria

We also measured the carrying angle of both elbows (the injured and the healthy one) at time of data collection. A result showed that 45 patients (62.5%) had reduction between 0° and 5°, 22 patients (30.6%) had reduction between 6° and 10°, 2 patients (2.8%) had reduction between 11° and 15°, and 3 patients (4.2%) had reduction of carrying angle above 15°.

4. Factors affecting outcome of supracondylar fracture of humerus surgery

The strength of association between independent variable and dependent outcome assesses by odd ratio and 95% confidence interval. Age, duration of injury from trauma to operation theater and post operative hospital stay have significant association with bivariate logistic regression analysis. Those factors were further assessed with multivariate logistic regression analysis and only age found to be statistically significant. As a child age increases by one year the range of motion decreases by 0.62^0 contralateral limb .0.621(95%CI: 0.393-0.982)

Table 5 associated factors of SCHF outcome after ORPP

Variables		Numbers	p-value	AOR with CI 95%
Age at time injury	<5year	31	0.042	0.621(0.393-0.982)
	5-10year	36		
	>10year	5		
Duration of injury	<60min	56	0.955	1.08(0.074-15.73)
	>60min	16		
Post op hospital stay	</=72hrs	44	0.482	0.408(0.034-4.97)
	>72hrs	28		

6.Discussion

Displaced supracondylar fractures of the humerus in children often lead to complications unless timely treated. The current treatment approach recommends closed reduction followed by percutaneous pinning, typically guided by imaging for accuracy.(14,25) In our study of 72 pediatric patients with displaced supracondylar humeral fractures treated with open reduction and diverging lateral pinning through a lateral approach, we found that 94.4% achieved satisfactory results according to the modified Flynn criteria, with 55.6% rated as excellent and only 5.6% rated as poor. Similar success rates were reported by Kumar et al. in India, where a study on displaced supracondylar fractures treated with open reduction and cross-pinning via a medial approach showed a 95.5% satisfactory outcome. However, they reported temporary ulnar nerve palsy in five patients postoperatively, whereas our study did not experience any nerve palsy or infections.(32)

Another study by Hussian et al. (34) in India reported a similar outcome of 90.6%, using the same surgical technique as ours, except for the pin cross configuration. This difference may account for the temporary ulnar nerve palsy observed in their study, which improved after pin removal. Patients with unsatisfactory results in their study had delayed presentations and were treated by traditional bone setters.

Our findings are consistent with a recent study by Hahn et al. in India(34), which reported a 98% satisfactory outcome after closed or open reduction using crossed pinning. For severely displaced fractures, their data indicated that the open approach for crossed K-wires resulted in fewer complications and better clinical outcomes compared to closed reduction.

Comparative results from Habumugisha et al.(29) highlight (91.4%) the effectiveness of early surgical intervention for pediatric supracondylar fractures in Rwanda. Interestingly, while their study did not identify a correlation between age and postoperative range of motion, our study found such a relationship, indicating that age may play a significant role in recovery outcomes.

A systematic review by Pretell-Mazzini et al.(25) in Madrid found that open reduction and pinning of severely displaced supracondylar humeral fractures in children yielded statistically significant positive outcomes. The review recommended starting with closed reduction, but if it fails after two

attempts, surgeons should proceed with open reduction to minimize further soft tissue injury and achieve better anatomic reduction.

We found that the majority of the patients were between 5-10 years old (50.0%) and predominantly male (70.8%). Similar demographic patterns were observed in Joshi et al.(10) Napal where 63% of cases involved male patients, and Wendling-keim et al in Switzerland (24)also reported a similar age and gender distribution. However, the male predominance was slightly higher in this study and previous study done in our hospital (TASH)(12,13), potentially reflecting local factors that influence injury exposure among children.

In terms of injury mechanisms, the majority of fractures in this study were attributed to falls. This aligns with the findings of Wendling-keim et al in Switzerland(24), Santos et al. in Brazil(15), Habumugisha et al. in Rwanda (29) Matari et al. in Tanzania(28) and Biruk et al in Ethiopia (13)

In this study, 69.4% of fractures were left-sided (non-dominant limbs), aligning with findings from Joshi et al. in Nepal(10), Santos et al. in Brazil(15), and Habumugisha et al. in Rwanda(29). The dominant right upper extremity tends to protect itself during falls, while the left upper limb, often hanging down, is more vulnerable to injury.

One notable finding in this study was that 34.7% of patients sought traditional bone setters before visiting the hospital. This rate is consistent with a study by Anjum et al(38) conducted in rural India found that 36.12% of patients initially sought treatment from traditional bone setters before visiting a hospital and patients experienced poorer outcomes compared to those who presented early for medical care. In contrast, other studies like Brubacher and Dodds (26) ,which reported a much lower incidence of traditional healer use in higher-income countries. This highlights a cultural factor influencing healthcare-seeking behavior in this region, possibly contributing to delays in receiving formal medical care, as seen in 19.4% of cases where surgery was performed more than seven days after the injury.

Lastly, age was found to significantly impact outcomes, particularly regarding postoperative range of motion. Similar outcome found in study by Abbott et al in the USA examined 297 pediatric patients with closed Gartland type III supracondylar humerus fractures who underwent surgical treatment. The results revealed that complications were more prevalent among boys and older

children(35)These findings are consistent with existing study by Fletcher et al. in USA found that children over 8 years old have poorer outcomes after open supracondylar humerus fractures. These older children experience more frequent fractures and require more pins for surgical fixation. Although nerve injury rates are similar across age groups, older patients are more likely to develop elbow stiffness, leading to a greater need for physical therapy. This emphasizes the need for age-specific treatment strategies.(36) Overall, this study supports the broader literature while also highlighting specific demographic, cultural, and regional factors that prepay a role in the management of supracondylar fractures.

7. Conclusion

Open reduction and pinning for displaced supracondylar humerus fractures (SCHFs) in children generally yield satisfactory outcomes, align with the standards observed in other developing countries. However, it is important to note that older children tend to have a higher incidence of unsatisfactory results. This underscores the need for tailored approaches when managing SCHFs in different age groups to optimize outcomes.

Study Limitations

Our study faced two main limitations: a small sample size and inadequate chart documentation.

Recommendations

We recommend increasing community awareness through health education initiatives. It is crucial to encourage prompt visits to healthcare facilities following injuries. Additionally, involving traditional bone setters in these awareness efforts could help them better identify cases that require referral rather than management in isolation.

Future studies should aim to include larger sample sizes to validate and expand upon our findings.

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9. ANNEXE

9.1 Consent form

Hello! My name is ……. I am here on behalf of Dr. Bisrat Tilaye resident of Addis Ababa University. He is conducting research for the partial fulfillment of second degree on Assessment of functional outcome and associated factors of supracondylar humeral fracture in children treated with open reduction and pinning. He has received permission from at Addis Ababa University and respective health hospital to conduct this study. The objective of this study is to Assess outcome and associated factors of supracondylar humeral fracture in children treated with open reduction and pinning at Tikur Anbessa Specialized Referral Hospital. You were selected for the study because you are client with supracondylar fracture and we hope that you will cooperate with us on yours follow up time. You will not be provided any incentives or payment to take part in this project. We assure all information gathered during the course of the study will be kept completely confidential. All the information that you are going to deliver to us will be coded for anonymity. Only the principal investigator and the research assistants collecting the data will have access to the data.

Would you be willing to participate? Yes …….1 No …….2

Having been well explained and informed of the intentions and benefits of the study, I voluntarily consent to participate in the study.

Clients' signature. _____ Date. _____

Data collector's name. _____ Sign ._____Date _____

10.Questionnaire

Retrospective study of outcome and associated factors of open reduction and pinning of displaced supracondylar fracture

Sociodemographic data

1. Patient information
    a. Age at the time of fracture:
    b. Gender:
        i. Male
        ii. Female
    c. Residency
        i. Urban
        ii. Rural
    d. Location of trauma
        i. School
        ii. Home
        iii. Recreational area
2. Trauma related factors
    a. Side of the injury: Right/Left
    b. Mechanism of Injury
        i. Fall down injury
        ii. Road traffic injury
        iii. Sport
        iv. others
    c. Associated Injuries
        i. No
        ii. Distal radius fracture
        iii. Brachial artery injury
        iv. Median nerve injury
        v. Ulnar nerve
        vi. Radial nerve
        vii. Vascular injury
    d. Type of Fracture (if classified in medical records):
        i. Open/closed
    e. Initial Displacement (if documented):
        i. Gartland type ll/lll/IV
    f. Duration of injury to surgery
        i. </=7days
        ii. >7days
    g. Visiting traditional bone setter
        i. Yes/no

3. Treatment
    a. Treatment approach
        i. Open Reduction and Internal Fixation (ORIF)
        ii. Closed Reduction and Percutaneous Pinning (CRPP)
    b. Surgeon Experience Level (Years of Experience)
    c. Anesthesia Type
        i. General
        ii. Regional
    d. Surgical Time (duration if documented) in minute

    e. Intraoperative Complications (if documented)
4. Post operative care
    a. Duration of Hospital Stay (if noted):
        i. <72hrs
        ii. >72hrs
    b. Immediate Postoperative Complications (if documented):
        i. Neurovascular Injury
        ii. Compartment Syndrome
        iii. Infection
        iv. Others (if recorded)
    c. Follow-up Period
    d. Assessment of outcome
        i. Loss of Carrying Angle
            1. 0-5o
            2. 6-10o
            3. 11-150
            4. >15o
    e. Functional Assessment
            Loss of ROM
            1. 0-5o
            2. 6-10o
            3. 11-150
            4. >15o
5. Patient satisfaction and quality of life
    a. Pain Levels
        i. Mild
        ii. Moderate
        iii. Severe
    b. Return to Activities of Daily Living in weeks
    c. Time to Return to School/Work (if noted) in weeks
6. Link to physiotherapy