

The Influence of Surgical Intervention Time for Supracondylar Fractures of the Humerus in Children

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ABSTRACT

Supracondylar fractures of the humerus are the most common elbow fracture injuries in children. Despite the frequency of these injuries, vascular and orthopaedic surgeons have long debated the management of these fractures. This study aims to look at the effects of the surgical intervention time on how the patient is treated and the complications after surgery. This is a retrospective study of children under 12 years of age who received hospital care due to a supracondylar fracture of the humerus at the University Trauma Hospital for the period January 2021 - November 2022. Data analysis for the 90 patients considered shows that the time of surgical intervention varies from 0 to 13 days, with an average of 1.6 days. The analytical results show that there is a negative relationship between the time of surgical intervention and the method of treatment; for patients who were treated with "closed repair and plaster cast", the time of surgical intervention is about 2.2 days less than for patients treated with "open reduction stabilised with K-wires" (p-value=0.00) while this time decreases up to 0.5 days for patients treated with "closed reduction stabilised with K-wires" (p-value=0.09). Also, the analytical results show that patients with longer surgical time intervention had complications (p-value = 0.00), emphasising the importance of surgical time intervention. The results of the study show that the average time intervention for these fractures at the University Trauma Hospital in Tirana is relatively high compared to the existing literature, thus

increasing the possibility of complications and the patient's well-being.

Keywords: Supracondylar fractures of humerus, elbow fracture, children

THE BACKGROUND INFORMATION

Supracondylar humerus fractures (SCHFs) are common injuries in children and represent about 3% of all fractures; they are the second most common fracture, the most common fracture in children under 8 years of age, the most common fracture of the elbow [1 - 5]. Due to the proximity of nerves and vascular structures to the elbow joint, neurovascular damage often complicates these fractures.

Despite the frequency of these injuries, vascular and orthopaedic surgeons have long debated the management of these fractures [6-8]. As the first stage in the management, closed replantation combined with cast or stabilisation with percutaneous rods is used. Only when the pulse is persistently absent (with good perfusion) after this reduction is the patient considered for further exploratory procedures.

The main concern with delayed treatment is the failure of closed repositioning due to swelling, the need to revert to open repositioning, and the neurovascular complications that can occur over time [9, 10]. Studies have shown that children who undergo surgery more than 8 hours after

trauma are more likely to require open repair compared to those who undergo surgery earlier after injury (8 hours or less) [11].

At the University Trauma Hospital in Tirana, the only tertiary hospital in Albania that accepts and treats approximately 8,150 trauma cases per year, open repair is the main method used due to the lack of conditions in the emergency operating room. The existing literature on Albanian cases of Supracondylar Fractures of the Humerus in Children is very limited, and a study on the effects of surgical intervention time on the patient's treatment and post-operative complications is missing. Such a study has special importance not only in the field of applied medicine but also for Albanian policy-making, highlighting the areas where to invest in the future.

THE METHOD USED

This is a retrospective study of children under 12 who received hospital care due to a supracondylar fracture of the humerus at the University Trauma Hospital from January 2021 - November 2022. After review, the clinical data were reviewed for 90 patients who have fulfilled 2 criteria: 1. Patients hospitalised in an emergency department or recommended by regional hospitals in Albania; and 2. Patients diagnosed with SHF.

The data collected are related to general demographic characteristics (age and

gender), general information on the fracture (side and cause of injury) and the method of treatment, which consists of: 1. open reduction stabilised with K-wires; 2. closed reduction stabilised with K-wires; and 3. closed repair with cast.

The statistical analysis consists of a descriptive and analytical analysis of the data. The main variable of this study is the surgical time intervention and looks at the association it has with treating supracondylar fractures of the humerus and complications after surgery.

To analyse if there is an association between the surgical time intervention and the treatment of supracondylar fracture of the humerus in children under 12 years of age, regression analysis (OLS - Ordinary Least Squares) was used. Variables are considered statistically significant for a p -value < 0.05. Regarding ethical considerations, this study was conducted according to the protocol of the Declaration of Helsinki, ensuring the anonymous use of patient data for research purposes.

THE RESULTS

Descriptive Data Analysis

Descriptive data analysis gives us an overview of the data used for this study. The data presented in table 1 show the demographic data of the patients, the state of the trauma caused, the treatment method, the degree of damage and the time of the surgical intervention.

Table 1. The description of the Data

The variables	Mean	Standard Deviation	Min	Max
Age	7.48	(2.81)	2	12
Gender (Female = 1; Male = 0)	0.37	(0.48)	0	1
Side of injury (Right = 1; Left = 0)	0.49	(0.50)	0	1
Cause of injury (Fall =1; Accident =0)	0.98	(0.15)	0	1
If the patient had complications after surgery	0.02	(0.15)	0	1
Days of hospital stay	3.87	(3.56)	1	28
Method of treatment				
Closed reduction stabilised with K-wires	0.24	(0.43)	0	1
Open reduction stabilised with K-wires	0.40	(0.49)	0	1
Closed repair and plaster cast	0.36	(0.48)	0	1
Time of surgical intervention	1.59	(2.05)	0	13

Note: The number of observations is 90 patients. The data is for January 2020 - November 2022.

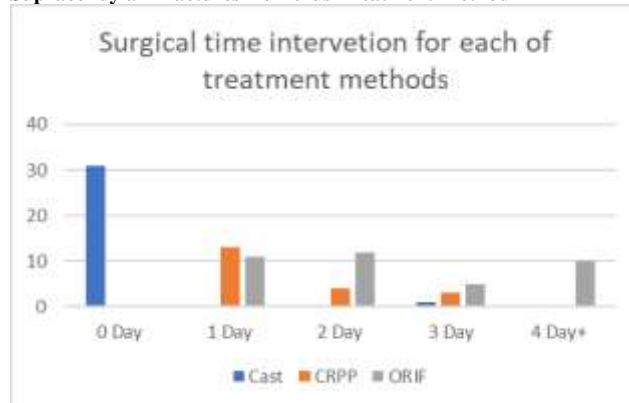
The results in the above table show that the average age of children is 7.5 years, and most accidents occur among male children

(63%). The results also show that the largest percentage of injuries resulted from falls

(98%), and a small percentage resulted from motor vehicle accidents.

Our data show that the surgical time intervention at the University Trauma Hospital varied from 0 to 13 days, averaging 1.6 days. In this group of children, treatment with "open reduction stabilised with K-wires" constitutes the largest percentage (40%) followed by "closed repair and plaster cast" (36%) and finally by "closed reduction stabilised with K-wires" (24%).

Figure 1. The Surgical Time Intervention for each of the Supracondylar Fractures Humerus Treatment Method



Note: The number of observations is 90 patients. The data is for January 2020 - November 2022.

The data show that the method of treatment with "closed repair and plaster cast" is an intervention that takes place on the same day of the injury (figure 1). As the graph in Figure 1 shows, with the increased days of stay in the hospital without receiving

treatment (or the corresponding intervention), the possibility of treatment with "open reduction stabilised with K-wires" has also increased. When the intervention was done only one day after the patient's arrival in the hospital, about 46% (11 out of 24 cases) of the patients were treated with "open reduction stabilised with K-wires", and this treatment has been increasing up to 100% when the treatment was done on the fourth day of arrival in the hospital or even later.

Analytical data analysis

The results show that the surgical time intervention is lower for patients treated with closed repair than those treated with open repair. The results presented in table 2 show that there is a negative relationship between the surgical time intervention and the treatment method "closed reduction stabilised with K-wires" and/or "closed repair and plaster cast". The results show that for patients who were treated with "closed repair and plaster cast" the surgical time intervention is about 2.2 days less than for patients who were treated with "open reduction stabilised with K-wires" (p-value=0.00), while this time decreases to 0.5 days for patients treated with "closed reduction stabilised with K-wires" (p-value=0.09).

Table 2. Results of the regression analysis for the association between the surgical time intervention with the treatment method of injury and post-operative complications.

Variables	Coef.	Std. err.	P-value	[95% conf. interval]
Age	0.00	(0.05)	0.98	-0.10 0.10
Gender (Female = 1; Male = 0)	-0.48*	(0.28)	0.09	-1.04 0.07
Side of injury (Right = 1; Left = 0)	-0.04	(0.27)	0.89	-0.57 0.50
Cause of injury (Fall =1; Accident =0)	-8.99***	(1.04)	0.00	-11.07 -6.92
If the patient had complications after surgery	-3.02***	(1.02)	0.00	-5.05 -0.98
Anchor: Open reduction stabilised with K-wires				
Closed reduction stabilised with K-wires	-0.46*	(0.34)	0.09	-1.13 0.22
Closed repair and plaster cast	-2.23***	(0.31)	0.00	-2.86 -1.60
Cons	11.54***	(1.05)	0.00	9.45 13.63

Note: The number of observations is 90 patients. **) indicate that the relationship is statistically significant at 5%; *) indicates that the relationship is statistically significant at 10%. The number of observations is 90 patients. The data is for January 2020 - November 2022.

The study's results show a negative association between the surgical time

intervention and the cause of the child's injury, where the accident results in the

faster surgical intervention compared to the fall (p -value=0.00). Also, the regression results show that patients whose surgical intervention time is longer they have had after surgery complications (p -value = 0.00), resulting that the surgical time intervention being a key factor in reducing later complications and success of treatment.

DISCUSSION

The analysis of the statistical data of this study is in accordance with the results of the literature on supracondylar fractures of the humerus in children aged up to 12 years. The average age of children treated at the University Trauma Hospital for the period January 2020 - November 2022 is 7.5 years, and the highest percentage of accidents are male children, with 63% (female = 37%) [3, 4, 12].

The data show that the time of surgical intervention varies from 0 to 13 days, with an average of 1.6 days. Treatment with "open reduction stabilised with K-wires" constitutes the largest percentage (40%), followed by "closed repair and plaster cast" (36%) and "closed repair and plaster cast" (24%). The data show that patients treated with the "closed repair and plaster cast" method are mainly done only when the intervention happened on the same day that patients were hospitalised.

As has been emphasised in the related literature so far, surgical time intervention is an important factor in how the patient is treated, in the progress of recovery and in the reduction of post-operative complications [10, 13]. However, there are studies that show that delays in the intervention of 6-21 hours do not affect complications or increase the need for open intervention [9, 14, 15, 16], where open intervention is always necessary after 32 hours [17]. The regression results of this study show that patients whose surgical time of intervention takes longer had an increased chance for later complications (p -value = 0.00), supporting the argument that the time of intervention significantly affects

the patient's recovery. Based on the literature, it is difficult to reach a final conclusion, although our recommendation, based on the results of this study, is to treat supracondylar humerus fractures as soon as possible, especially in children.

CONCLUSIONS

Supracondylar humerus fractures (SCHFs) are common injuries in children and represent about 3% of all fractures. This study has shown that the average age of injured children is 7.5 years, and there is a predominance of male children. The results of this study show that the average surgical time intervention for these fractures at the University Trauma Hospital in Tirana is relatively high, increasing the possibility of open surgical intervention, increasing the possibility of complications and negatively affects the patient's recovery.

Declaration by Authors

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