

# Functional outcome of supracondylar humerus fractures in children at Sardjito General Hospital

Andika Dwicahyo, Sugeng Yuwana

## ABSTRACT

**Aims:** The objective of this research is to evaluate the long term functional outcome of the upper extremity after SCHF in children related to age, sex, left or right extremity, Gartland type, and intervention (operative/non-operative). **Methods:** 72 patients who presented to Sardjito general hospital emergency department unit with SCHF between December 2011 and December 2013 retrospectively reviewed for the functional outcomes. We reviewed their charts to assess several clinical parameters, including age, sex, left or right extremity, Gartland type, and intervention. The DASH questionnaire was administered in September 2014. We performed an analysis of variants (ANOVA) to determine the significance of these clinical parameters as they related to the DASH score for functional outcome. **Results:** From 72 patients, 71 meet the pediatric criteria and only 34 patients that respond to the interview for obtaining DASH score. Pediatric SCHF has good functional outcomes based on the DASH questionnaire (mean score  $1.59 \pm 1.67$ ). We obtained the following DASH scores:  $1.70 \pm 2.26$  for type I,  $1.125 \pm 1.36$  for type II and  $1.75 \pm 1.44$  for type III fractures. There was no statistical difference in functional outcome, regardless of

sex ( $p = 0.673$ ), age at injury ( $p = 0.173$ ), right/left extremity ( $p = 0.463$ ) or surgery ( $p = 0.760$ ). **Conclusion:** The functional outcomes after supracondylar fractures in children at Sardjito General Hospital is good based on the scoring system by DASH questionnaire. Gartland type classification, age at injury, sex, side of extremity injured, intervention, have no significance statistical differences. All patients achieved and maintained satisfactory reduction.

**Keywords:** Children, DASH score, Functional outcome, Supracondylar humeral fracture

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## INTRODUCTION

Supracondylar humerus fractures (SCHF) in children are a very common fracture that occur in pediatric population. This type of fractures usually extra-articular, different with the supracondylar fractures in adult. Return of elbow motion after treatment of supracondylar fractures in children has been well documented in the literature [1]. However, the return of elbow range of motion and function is commonly measured as an objective parameters, such as return of normal range of arc motion in the sagittal plane for flexion and extension movement [1].

Long term functional outcome using tools that already standardized has not been well documented in the literature. There's study that analyzed the correlation between the values of a modified Disabilities of the Arm, Shoulder and Hand (DASH) questionnaire and change of elbow function after supracondylar fractures of humerus [2]. But that study only addressed the flexion type SCHF, which only represents a small percentage of this kind of fracture. The authors concluded that the value of a modified DASH questionnaire correlates with objective indicators of elbow function after a flexion type SCHF in children. One of a standardized and well-validated tool to measuring functional disability is DASH questionnaire to achieve the DASH score values.

Bot et al. evaluated the clinimetric quality of 16 self-administered shoulder disability questionnaires, including DASH, the Shoulder Pain and Disability Index and American Shoulder and Elbow Surgeons Standardized Shoulder Assessment Form [3]. The DASH questionnaire tool received the best ratings for clinimetric purposes [3]. That's the reason the author using the DASH questionnaire as a preferred functional outcome tool as it is region-specific and well-validated for measuring functional disability.

The aim of this present study is to provide a retrospective, longitudinal evaluation of functional outcome in a children population after treated for supracondylar humerus fracture, using the DASH score for standardized measure of outcome. The other purpose is to determine whether factors such as age at injury, sex, side of extremity injured, Gartland type classification, and surgical versus non-surgical intervention could predict the long term functional outcomes in pediatric population.

## MATERIALS AND METHODS

We collected and reviewed the cases of children with supracondylar humerus fracture who came to our emergency department unit between December 2011 and December 2013 retrospectively. From medical records, we gathered and reviewed their data of age, sex, classification of fracture severity, operative or non-operative treatment intervention. A DASH questionnaire was administered in September 2014 by the parents of the patients with the present of the child. For more appropriate regarding age reason, the sex-related question was removed from the questionnaire. The optional work module and the optional sports/performing arts module in the original DASH questionnaire were not used.

The DASH score is scaled between 0 and 100, and a more higher scores indicate the worse function while the lower scores indicate the better function relating to upper-extremity disability.

The inclusion criteria in this study were all supracondylar humerus fracture in patients younger than

18 years of age at the time of injury, and already agreed to join the study and the consent was obtained from parents. The patients with age more than 18-year-old were excluded from the criteria.

## Statistical analysis

For statistical analysis, we use an analysis of variance (ANOVA) to compare statistically the mean DASH scores and correlation with sex, side of extremity, operative and non-operative intervention, and the age at the time of injury. The significance results considered at  $p < 0.05$ .

## RESULTS

A total of 72 patients with supracondylar humerus fracture that documented in our hospital between the time frame intended in our study. One patient was excluded because he didn't meet the age criteria (age more than 18 years). 37 patients did not respond because they had moved away or changed phone numbers without providing an update in the medical record system, leaving 34 patients for analysis.

Of the 34 patients included in the study (Table 1), 24 (71%) were male and 10 (29%) were female. We subdivided patients by fracture type: 10 (29%) had type I, 8 (24%) had type II and 16 (47%) had type III fractures. Patients were further subdivided by sex, right or left extremity, intervention (operative vs. nonoperative) and age at time of injury (Table 1). There was a higher incidence of SCHF in boys (71%) than in girls, and the left elbow was more commonly injured than the right elbow (76%).

An Analysis of Variants (ANOVA) was used to determine the significancies between the DASH score as a functional value with other clinical parameters. The results reported that no significance difference statistically in functional outcome between sex ( $p = 0.673$ ), age at injury ( $p = 0.173$ ), right or left extremity ( $p = 0.463$ ) or surgery ( $p = 0.760$ ; Tables 1 and 2).

## Levene's test of equality of error variances<sup>(a)</sup>

Dependent Variable: DASH

F	df1	df2	Sig.
1,842	19	14	124

Tests the null hypothesis that the error variance of the dependent variable is equal across groups

## Tests of between-subjects effect

Dependent Variable: DASH

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Noncent. Parameter	Observed Power <sup>(a)</sup>
Corrected Model	56.119 <sup>(b)</sup>	19	2.954	1.145	0.405	21.753	0.426
Intercept	43.860	1	43.860	17.002	0.001	17.002	0.969
Sex	0.480	1	0.480	0.186	0.673	0.186	0.069
Extremity	1.470	1	1.470	0.570	0.463	0.570	0.108
Intervention	0.250	1	0.250	0.097	0.760	0.097	0.060
Gartland	3.063	2	1.532	0.594	0.566	1.187	0.129
Age	10.278	2	5.139	1.992	0.173	3.984	0.342

<sup>a</sup>Computed using alpha = ,05

<sup>b</sup>R Squared = 0.608 (Adjusted R Squared = 0.077)

Table 1: Patient Distribution

Sex	Gartland Type I	Gartland Type II	Gartland Type III	Total
Male	6 (60%)	6 (75%)	12 (75%)	24 (71%)
Female	4 (40%)	2 (25%)	4 (25%)	10 (29%)
Extremity	10	8	16	34
Left	8 (80%)	6 (75%)	12 (75%)	26 (76%)
Right	2 (20%)	2 (25%)	4 (75%)	8 (24%)
Intervention	10	8	16	34
Operative	-	3 (38%)	13 (81%)	16 (47%)
Non Operative	10 (100%)	5 (62%)	3 (19%)	18 (53%)
Age (Months)	10	8	16	34
0-30	0	0	0	0
31-60	3 (30%)	2 (25%)	4 (25%)	9 (26%)
61-120	5 (50%)	5 (63%)	6 (38%)	16 (47%)
>120	2 (20%)	1 (13%)	6 (38%)	9 (26%)
Total	10	8	16	34

Table 2: Patient Distribution (DASH SCORE TOTAL)

Sex	Type I (Mean ± SD)	Type II (Mean ± SD)	Type III (Mean ± SD)	Total
Male	1.6667 ± 2.06559	1.000 ± 1.54919	1.5833 ± 1.56428	1.4583 ± 1.64129
Female	1.7500 ± 2.87228	1.5000 ± 0.70711	2.2500 ± 0.95743	1.9000 ± 1.79196
<b>Extremity</b>				
Left	1.5000 ± 2.13809	1.1667 ± 1.47196	2.0000 ± 1.53741	1.6538 ± 1.69570
Right	2.5000 ± 3.53553	1.0000 ± 1.41421	1.0000 ± 0.81650	1.3750 ± 1.68502
<b>Intervention</b>				
Operative	-	1.0000 ± 1.00000	1.3846 ± 1.32530	1.3125 ± 1.25000
Non Operative	1.7000 ± 2.26323	1.2000 ± 1.64317	3.3333 ± 0.57735	1.8333 ± 1.97782
<b>Age</b>				
0-30	-	-	-	-
31-60	4.0000 ± 2.64575	1.5000 ± 0.70711	2.5000 ± 1.29099	2.7778 ± 1.85592
61-120	1.0000 ± 1.41421	1.2000 ± 1.64317	2.5000 ± 0.83666	1.6250 ± 1.40831
>120	0.0000 ± 0.00000	1.2000 ± 1.64317	0.5000 ± 1.22474	0.3333 ± 1.00000
Total	1.7000 ± 2.26323	1.1250 ± 1.35620	1.7500 ± 1.43759	1.5882 ± 1.67183

## DISCUSSION

Fractures of supracondylar humerus occurred very common in children population. The classification system that widely used and recognized is the Gartland classification system, can be used in adult and also children population. Ideally the classification system should be both prognostic and also provide a guide to clinical management. In our study, there was no significance difference statistically in functional outcomes in all pediatric supracondylar humerus fracture despite the Gartland classification. It also demonstrated the same with other parameters, such as sex, side of extremities, intervention operative treatment or conservative, and age at the time of injury, all of these showed no correlation with functional outcomes. This supracondylar type of fractures in pediatric humerus, regardless of several parameters, tend to have good functional outcomes based on the DASH scoring system [4]. All of the fractures in this study achieved and maintained satisfactory reduction by either surgical or non-surgical (casting) and that the technique of reduction and subsequent treatment course uncomplicated.

In our hospital, the pediatric orthopedic surgeon also use the Gartland classification, but also considering other things to determine the surgery or conservatively and other clinical decision making, like the degree of displacement. For example, in the class II Gartland in supracondylar humerus fractures in children, we don't always treat this operatively, but with considering the degree of displacement or intersection of the anterior humeral line and capitellum. The Baumann angle as well as failure of close reduction also the consideration whether operative or non-operative treatment needs to be chosen. There was no significance difference in DASH scores ( $p = 0.760$ ) between patients treated operatively and those treated non-operatively. No difference in DASH scores statistically doesn't mean the surgery is not important in the management of pediatric supracondylar humerus fractures, but the most important goal that to be achieved is the adequate reduction for the good functional outcome [5]. Inadequate reduction can lead to potential functional long-term problems [6]. Gartland type II supracondylar humerus fractures is not an indication for surgery, but the degree of displacement should guide the management as this type of fractures tend to do well if adequate reduction is obtained and maintained and if it follows an uncomplicated course, as supported with the study by Heal et al. [7].

The study by Spencer et al. [1] demonstrated the effect of age and severity of fractures on the recovery of elbow motion. The severity determined by those requiring operative intervention. The results showed a 3–9% lower relative arc of motion of elbow at the follow up for patients older than 5-year-old, compared with the younger patients. A slower recovery in motion showed on patients which had more severity of fractures that required surgical intervention. The functional differences between

these groups using the DASH questionnaire was studied and concluded that despite the findings of Spencer et al. [1]. study, there was no statistical difference in functional outcome regardless of age or operative or nonoperative intervention with  $p = 0.760$  based on ANOVA analysis.

## LIMITATIONS

The fact that the type of our study was retrospective is one of the limitations. In some cases, the parents who filled the DASH questionnaire during the interview wrote it based on their perceptions of their children's functioning. Another limitation is the validity of using the DASH questionnaire in this young age group population. Although the DASH questionnaire has not yet been formally validated in this group, multiple studies have used this questionnaire for their pediatric populations samples [8, 9].

In our study, 37 patients failed to respond and there's one patient excluded because the age exceeded the inclusion criteria, it made the possibility for skewed data. Also, due to the small sample size in our study, there's a chance that the difference in DASH scores among the groups might be missed. We did not perform a subgroup analysis on the fractures treated with open reduction surgery, because the numbers of sample were too small, therefore it was difficult to make firm statistical conclusions. However, it was not the primary objective of our study and could be let gone, moreover, it represents a potential for future area of research.

## CONCLUSION

Return of elbow range of motion after having supracondylar humerus fractures in children has been well documented in the literatures. We found that overall, most parents and patients reported no functional difference with normal activity in social life, daily activity living including the self care, and no functionally limiting symptoms. This results achieved regardless of age at injury, sex, side of extremity, operative or conservative intervention or the severity based on Gartland classification. The satisfactory reduction achieved and maintained by either surgical or non-surgical. We suspect the adequate reduction is more important than simply considering the intervention treatment only by fracture type.

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### **Author Contributions**

Andika Dwicahyo – Substantial contributions to conception and design, Acquisition of data, Analysis

and interpretation of data, Drafting the article, Revising it critically for important intellectual content, Final approval of the version to be published  
Sugeng Yuwana – Substantial contributions to conception and design, Acquisition of data, Analysis and interpretation of data, Drafting the article, Revising it critically for important intellectual content, Final approval of the version to be published

### **Guarantor of Submission**

The corresponding author is the guarantor of submission.

### **Source of Support**

None

### **Consent Statement**

Written informed consent was obtained from the patient for publication of this study.

### **Conflict of Interest**

Authors declare no conflict of interest.

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