



## COMPARATIVE STUDY OF CLINICAL & FUNCTIONAL OUTCOME BETWEEN TWO METHODS OF FIXATION CLOSED AND OPEN OF PEDIATRIC UNCOMPLICATED SUPRACONDYLAR FRACTURE OF HUMERUS

Dr. Rabah Abdulla AL- Ebadi F.I.C.M.S (Ortho)\*, Dr. Saif Nadhim Al-Assaf M.B.Ch.B. and Dr. Ghaith Yaseen Qasim C.A.B.S.

Al Jumhoori Teaching Hospital, Orthopedic Department, Mosul, Iraq.

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\*Corresponding Author: Dr. Rabah Abdulla AL- Ebadi F.I.C.M.S (Ortho)

Al Jumhoori Teaching Hospital, Orthopedic Department, Mosul, Iraq.

### ABSTRACT

**Background:** Supracondylar fractures of the elbow are common in children. Their treatment is controversial when displacement has occurred whether open or closed reduction. **Objectives:** To compare the difference in clinical and functional outcome of treating children with closed, uncomplicated supracondylar fractures, Gartland type III & IV, aged from 5-12 years by two surgical techniques for reduction, closed reduction with percutaneous fixation and open reduction with pinning. **Patients and Method:** The study is prospective case series study carried out in orthopedic unit in Al-Jumhoori Teaching Hospital Mosul, Iraq. From January 2022 to January 2023. The total number of patients were fifty Pediatric patients suffered from closed, uncomplicated supracondylar fractures Gartland type III & IV aged from 5-12 years. Group A 23 patients treated with closed reduction with percutaneous pinning, while group B 27 patients were treated by open reduction with pinning. Follow up for 6 months done for each patient. The results of reduction assessed clinically depending on Flynn Criteria and functionally depending on m-DASH score. **Results:** In-group A show excellent results in 18 patients (78.26%) and only one patients (4.34%) had fair to poor results. While in-group B excellent in 17 patients (62.96%) and 3 patients (11.10%) had fair to poor results of 6 months follow-up period. Functional disability at the end of 6 months follow-up period assessed by Modified Disabilities of arm, shoulder & hand were significantly lower in closed reduction group with mean  $\pm$ SD of  $5.1 \pm 1.6$  in comparison to open reduction group  $15.4 \pm 3.33$ . **Conclusion:** Closed reduction and pinning is superior to open reduction regarding clinical and functional outcomes of pediatric supracondylar fracture of humerus Gartland type III & IV.

**KEYWORDS:** Supracondylar fracture, Percutaneous pinning, Closed reduction, Open reduction.

### INTRODUCTION

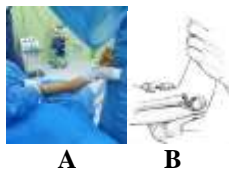
Pediatric supracondylar fractures of humerus (SCFH) are common injuries among children.<sup>[1]</sup> It is the most common fracture around the elbow in children.<sup>[2,3]</sup> SCFH are caused by fall on out stretched hand and is divided into two types, extension type and flexion type. About (96%) of SCFH are extension type and further classified as described by Gartland according to the degree of displacement of the distal fragment.<sup>[3,4]</sup> SCFH in children should be handled properly to prevent complications like elbow stiffness, varus & valgus deformities, compartment syndrome, neurovascular compromise and Myositis ossificans.<sup>[2]</sup> There are different treatment modalities available for the management of SCFH in children, like side arm traction, overhead skeletal fraction, closed reduction and casting, closed reduction

and percutaneous pinning and open reduction and internal fixation.<sup>[5]</sup> Type III & IV supracondylar humeral fractures in children are usually treated by closed reduction and percutaneous K-Wires fixation, but open reduction and fixation is performed if an adequate reduction cannot be obtained by closed manipulation.<sup>[6,7]</sup> Closed reduction and two crossed K-Wires one medial and one lateral percutaneous fixation under image intensifier is the treatment of choice.<sup>[6,8,9]</sup> After surgical treatment either by closed or open technique results were categorized into excellent, good, fair or poor reduction based on criteria of Flynn criteria.<sup>[1]</sup>

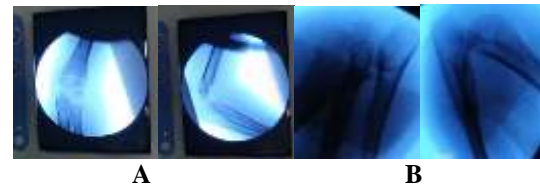
### PATIENTS AND METHODS

The study is prospective case series study carried out in orthopedic unit in Al-Jumhoori Teaching Hospital

Mosul, Iraq. From January 2022 to January 2023. The Mosul Ethical Research Committee and Directorate of Health in Ninawa approve this study. Fifty children suffered from closed, uncomplicated SCFH Gartland type III & IV and aged from 5-12 years were participated in the study. The patient's age divided into 3 groups 5-7 years, 8-9 years & 10-12 years, thirty-one male and 19 female. Patients with Gartland type I & II, Patients with open fracture, supracondylar fractures with other associated injuries and fracture more than 1 week duration were excluded from the study. Patients divided into two groups. Group A 23 patients treated with closed reduction with percutaneous pinning, while group B 27 patients were treated by open reduction with pinning, follow up for 6 months done for each patient. A verbal consent obtained from patient's legal guards before participating in the study. All patients assessed for neurovascular status, AP & Lateral radiographs done for all cases before surgical intervention. The entire patient initially splinted with an above elbow back slab in a position of 20 to 40 degrees of elbow flexion with elevation of the affected limb. In-group A the patients were treated by Closed method under general anesthesia; prophylactic antibiotic was given within one hour prior to the induction of anesthesia. In a supine position, the fractured elbow placed on a radiolucent arm board. The back slab opened in the operating room. The entire arm draped and prepped. Traction applied in 20 degrees elbow flexion to avoid injury to the neurovascular structures by the proximal fragment with grasping the forearm by the surgeon and applying counter traction in the axilla by the assistant. Then with the elbow extended, varus and valgus malalignment corrected. By direct movement of the distal fragment, any medial or lateral translation corrected and confirmed by C-Arm image intensifier. Then with continuing traction by the non-dominant hand, the surgeon applied a posterior force to the proximal fragment by the fingers of the dominant hand while applying simultaneous anterior pressure to the olecranon by the surgeon's thumb. Concurrently, with the non-dominant hand, the elbow gradually flexed Fig. (1), the reduction confirmed by C-Arm image intensifier in AP, lateral, and oblique views Fig. (2), our criteria for a good reduction were Baumann's angle is more than 10 degrees; the AHL intersects the capitellum and intact medial and lateral columns on oblique views.



**Fig. (1):** Maneuver of reduction: A. Traction at 20 degrees of elbow flexion. B. Flexion of the elbow while pushing the olecranon anteriorly by the thumb.



**Fig. (2):** A. Reduction confirmed by C-arm image intensifier AP and lateral views. B. Lateral and medial oblique views to see the lateral and medial columns.

Then the elbow was hold or strapped in the position of hyper flexion to maintain the reduction during pinning. Our criteria for pin placement were maximal separation of the pins at the fracture sites, no matter if the pins are parallel or divergent, adequate bone is engaged in the distal and proximal fragments. Then the reduction was confirmed by C-Arm image intensifier in AP, lateral and oblique views. Under fluoroscopy, stability of the fracture assessed by stressing the fracture in varus and valgus. A K-wire inserted from lateral epicondyle to engage the medial cortex of the proximal fragment. To put the medial pin, certain precautions followed to minimize iatrogenic ulnar nerve injury. Sweeping the soft tissues posteriorly by the thumb away from the medial epicondyle to protect the ulnar nerve, due to anterior displacement of the ulnar nerve with flexion, the elbow extended and the medial pin placed. The medial pin inserted anterior to the medial epicondyle and the reduction confirmed by fluoroscopy, and vascular status checked. The wires bent and cut 2 cm off the skin. A sterile gauze applied around the wires. A well- padded back slab applied in 50-70 degrees of elbow flexion. All patients discharged home after one day and put on oral antibiotic for seven days Fig. (3).



**Fig. (3):** AP and Lateral view of elbow shows Reduction held with two crossed K-wires (Restoration of Baumann angle).

In-group B the patients were treated by open method under GA; prophylactic antibiotic was given within one hour prior to the induction of anesthesia. In a supine position, the back slab opened in the operating room. The entire arm was draped and prepped, tourniquet inflation. Through a posterior approach to the distal arm and elbow a longitudinal incision is made, carry the soft-tissue dissection, and retract the ulnar nerve medially, incise the triceps muscle in a tongue shape pedicle, and reflect it posteriorly and inferiorly to expose down to the sub periosteal area and the distal humerus fracture Fig. (4). Clean away any debris, including small hematomas and fracture fragments. Expose both fragments, and gently reduce the epiphyseal separation. Insert crossed Kirschner wires through the lateral and medial humeral

condyles. Irrigation of the wound and closure by layers. The wires bent and cut 2 cm off the skin. A sterile gauze applied around the wires. Apply a posterior splint with the elbow at 50 to 70 degrees of flexion. Removal of the tourniquet, and checking of the radial pulse.



**Fig. (4): Posterior approach with triceps reflecting technique.**

Then, all patients kept in the surgical ward for 24 hours for observation of vascularity and swelling of the operated limb, instruct the family about follow up program, checking radiograph was taken after operation and 7 days post op, the K-wires were removed 25 days post op while cast removed after 30 days in both groups, instruct about wound care of pin site entrance. The follow up program include assessment of neurovascular status, assessment of Carrying & Baumann angle, incidence of infection and passive range of movement.

Clinical assessment of both elbows of all patients done 3 months and 6 months post operation. The examination includes range of motion, measurement of the carrying angle with a goniometer and examination of the distal neurological status. Accordingly, the results we categorized into excellent, good, fair or poor reduction based on Flynn criteria. Loss of movement and changes in carrying angle recorded in 5° intervals. The lesser of the two measurements adopted as the overall rating of the affected elbow. Any child with a varus deformity rated as poor. The data were collected by interviewing child's parent or care-giver using modified disability of arm, shoulder & hand (m-DASH) questionnaire. Modification of DASH performed in order to make it appropriate to children age. It consisted of 10 questions answered by child or parent. Five grade scales used for the first three questions, while three-grade scale adopted for the rest of questions. This based on the fact that it is

difficult for the child to differentiate between grades. The DASH score scaled between 0 and 100. Higher scores indicate worse function, and lower scores indicate better function relating to upper-extremity disability. All items must be complete for a score to be calculated. The assigned values for all completed responses simply summed and averaged, producing a score out of five. This value then transformed to a score out of 100 by subtracting one and multiplying by 25. This transformation done to make the score easier to compare to other measures scaled on a 0-100 scale. The data processed by the use of statistical package SPSS ver. 23 (Chicago Inc. Ill). Different descriptive statistical methods used to summarize and tabulate the data.  $\chi^2$  test was used to assess the significance of differences of proportional data between closed and open reduction group. Mann-Whitney test used to compare the difference of continuous non-parametric data (m-DASH) between closed and open reduction group. P- Value <0.05 was considered statistically significant.

**RESULTS**

Fifty children with SCFH were eligible to participate in the current study and meeting the study criteria. The studied sample subdivided into two groups according to the method used for reducing their fractures. Group A treated by closed method while group B were treated by open method of reduction. The demographic characteristics of studied sample (age at the time of injury and gender) is shown in Table 1. The age of studied sample ranged from 5 -12 years with mean & SD of (6.38) years and (1.34) years respectively. After dividing age into 3 groups reveal that more than half of patients (52%) were from the age group 5-7 years age group while lowest proportion (20%) were from age group 10-11 years. The differences of proportion of age groups between both reduction techniques was statistically non-significant. The studied sample consists of 31, (62%) male and 19, (38%) female. There was slight male preponderance in both groups and male: female ratio was 1.6:1.

**Table 1: The demographic characteristics of the studied sample of children with supracondylar fracture of humerus.**

| Characteristics          | Method of reduction                   |                                    | Total<br>N =50<br>No % | P-<br>Value |
|--------------------------|---------------------------------------|------------------------------------|------------------------|-------------|
|                          | Closed<br>reduction<br>N =23<br>No. % | Open<br>reduction<br>N =27<br>No % |                        |             |
| <b>Age group (years)</b> |                                       |                                    |                        |             |
| 5-7                      | 12 52.17%                             | 14 51.85 %                         | 26 52%                 | 0.7         |
| 8-10                     | 7 30.43 %                             | 7 25.92 %                          | 14 28%                 | 0.07        |
| 11-12                    | 4 17.39 %                             | 6 22.22 %                          | 10 20%                 | 0.08        |
| <b>Gender</b>            |                                       |                                    |                        |             |
| Male                     | 14 60.87 %                            | 17 62.96 %                         | 31 62%                 | 0.8         |
| Female                   | 9 39.13 %                             | 10 37.04 %                         | 19 38%                 | 0.7         |

The site of injury and the dominant hand of the studied patients shown in Table 2. Around two third of fracture involved the right arm in this series and represent (64%) of the patients. The dominant hand of children was the right in (90%) of patients. Slight higher proportion of injuries in dominated hand was found in opened

reduction group 25 (92.6%) in comparison to closed reduction group 20 (86.95%) but the difference was statistically not significant (p-value = 0.2). Also reveals that around 3 quarters of patients sustained the injury due to fall on outstretched hand.

**Table 2: The site of injury, dominant hand of patient, and mode of injury of the studied sample of children with supracondylar fracture of humerus.**

| Characteristic        | Method of reduction                  |                                    | Total<br>N =50<br>No % | P-<br>Value |
|-----------------------|--------------------------------------|------------------------------------|------------------------|-------------|
|                       | Closed<br>reduction<br>N =23<br>No % | Open<br>reduction<br>N =27<br>No % |                        |             |
| <b>Site of injury</b> |                                      |                                    |                        |             |
| Right                 | 14 60.86 %                           | 18 66.66 %                         | 32 64 %                | 0.2         |
| Left                  | 9 39.14 %                            | 9 33.33 %                          | 18 36%                 | 0.1         |
| <b>Dominant hand</b>  |                                      |                                    |                        |             |
| Right                 | 20 86.95 %                           | 25 92.60 %                         | 45 90 %                | 0.3         |
| Left                  | 3 13.05 %                            | 2 7.40 %                           | 5 10%                  | 0.08        |
| <b>Mode of injury</b> |                                      |                                    |                        |             |
| F.O.O.S.H             | 16 69.56 %                           | 21 77.77 %                         | 37 74 %                | 0.1         |
| F.F.H                 | 5 21.74 %                            | 6 22.23 %                          | 11 22 %                | 0.8         |
| R.T.A                 | 2 8.70 %                             | 0 0                                | 2 4 %                  | 0           |

F.O.O.S.H (fall on outstretched hand), FFH (fall from height), RTA (road traffic accident).

The clinical assessment of SCFH at the end of three months and six months follow-up period respectively, show that range of motion in closed reduction group was significantly higher than those underwent open reduction p-value = 0.04 Table 3. Range of motion further improved in closed reduction group at the end of six-month follow-up period and reaches 100%. A similar raise was observed in open reduction group but it reach only to 85%. Baumann carrying angle at the end of 3

months was 69.5±8.3 in close reduction group while 68.9±6.8 in open reduction group and the difference was statistically not significant. The angles were the same at 6 months follow up for both groups. Three months was enough to reach 100% consolidation in both techniques. Two patients develop pin tract infection in-group A (8.70%), and another (28.70%) patient developed neurological deficit ulnar nerve palsy while none of group B developed these complications.

**Table 3: Comparison of range of motion, Baumann carrying angle, union rate and post-operative nerve injury between closed and open reduction supracondylar fracture of humerus in children at different follow up period.**

| Characteristics                     | Method of reduction       |                            | Total<br>N = 50<br>No % | P-value |
|-------------------------------------|---------------------------|----------------------------|-------------------------|---------|
|                                     | Group A<br>N =23<br>No. % | Group B<br>N = 27<br>No. % |                         |         |
| <b>Range of motion</b>              |                           |                            |                         |         |
| 1 <sup>st</sup> follow –up          | 21 91.30 %                | 21 77.77 %                 | 42 84 %                 | 0.03    |
| 2 <sup>nd</sup> follow –up          | 23 100 %                  | 23 85.18 %                 | 46 92 %                 | 0.04    |
| <b>Baumann’s. angle</b>             |                           |                            |                         |         |
| 1 <sup>st</sup> follow –up          | 69.5 ± 8.3                | 68.9 ± 6.8                 |                         | 0.83    |
| 2 <sup>nd</sup> follow –up          | 69.5 ± 8.3                | 68.9 ± 6.8                 |                         | 0.83    |
| <b>Union rate</b>                   |                           |                            |                         |         |
| 1 <sup>st</sup> follow –up          | 23 100%                   | 27 100%                    | 50 100%                 | -       |
| 2 <sup>nd</sup> follow –up          | 23 100%                   | 27 100 %                   | 50 100%                 | -       |
| <b>Pin tract infection</b>          |                           |                            |                         |         |
| 1 <sup>st</sup> follow –up          | 2 8.70 %                  | --                         | 2 4 %                   | -       |
| 2 <sup>nd</sup> follow –up          | - -                       | --                         | --                      | -       |
| <b>Post Op. ulnar nerve injury.</b> |                           |                            |                         |         |
| 1 <sup>st</sup> follow –up          | 2 8.70 %                  | --                         | 2 4 %                   | -       |
| 2 <sup>nd</sup> follow –up          | - -                       | --                         | --                      | -       |

Flynn et al. criteria used to summarize the clinical outcome of both techniques. The results of 1<sup>st</sup> assessment

reveal that closed reduction with percutaneous wire fixation show higher excellent results in 17 patients

(73.91%) in comparison to open reduction where excellent result were in 13 patients (48.15%) and the difference was statistically significant p-value = 0.01 Table 4. Despite of raises in percentage of excellent

result of reduction in open reduction group after 6 months post op, close reduction remain superior to open reduction.

**Table 4: Comparison of clinical outcomes using Flynn et al. criteria between closed and open reduction supracondylar fracture of humerus in children at different follow –up period.**

| Characteristics                                     | Method of reduction                |                                | Total<br>N= 50<br>N % | P-<br>value |
|---|------------------------------------|--------------------------------|-----------------------|-------------|
|   | Closed reduction<br>N= 27<br>No. % | Open reduction<br>N=27<br>No % |                       |             |
| <b>1<sup>st</sup> follow – up period (3 months)</b> |                                    |                                |                       |             |
| Excellent   | 17 73.91%                          | 13 48.15 %                     | 30 60 %               | 0.01        |
| Good  | 4 17.39 %                          | 9 33.33 %                      | 13 26 %               | 0.02        |
| Fair  | --                                 | --                             | --                    | -           |
| Poor  | 2 8.70 %                           | 5 18.51 %                      | 7 14 %                | 0.05        |
| <b>2<sup>nd</sup> follow – up period (6 months)</b> |                                    |                                |                       |             |
| Excellent   | 18 78.26 %                         | 17 62.96 %                     | 35 70 %               | 0.09        |
| Good  | 4 17.39 %                          | 7 25.92 %                      | 11 22 %               | 0.1         |
| Fair  | 1 4.34 %                           | 1 3.70 %                       | 2 4 %                 | 0.6         |
| Poor  | --                                 | 2 7.40 %                       | 2 4 %                 | -           |

M-DASH questionnaire used to assess the restoration of function of upper extremity after reduction of supracondylar fracture. Total score of m-DASH inversely related to the degree of disability. Results reveal that patients in the closed reduction group had lower values of all the questions of m-DASH questionnaire in comparison to the group of open reduction. After summing the responses to all items and

transforming total score out of 100, results reveal statistically significant higher score of m-DASH in-group B in comparison to group A in the first follow-up period. Dramatic reduction of m-DASH score in closed reduction group at the end of 6 month and it come closer to zero i.e. no disability; persistence of higher score of m-DASH in open reduction even after 6 month of operation some disability Table 5.

**Table 5: Comparison of functional performance using (m-DASH) score between Group A & Group B at different follow-up period.**

| Characteristics            | Method of reduction                    |                                     | Total<br>N =50<br>Mean. SD | P- value |
|----------------------------|--|-------------------------------------|----------------------------|----------|
|                            | Closed reduction<br>N = 23<br>Mean. SD | Open reduction<br>N = 50<br>Mean.SD |                            |          |
| <b>m-DASH score</b>        |  |                                     |                            |          |
| 1 <sup>st</sup> follow-up  | 13.2 2.4                               | 25.6 1.3                            | 21.3 3.0                   | 0.01     |
| 2 <sup>nd</sup> follow -up | 5.1 1.6                                | 15.4 3.3                            | 11.4 2.2                   | 0.02     |

**DISCUSSION**

Closed reduction and K. wire fixation of SCFH in children is a rapid and effective technique especially for Gartland type III fractures. Advantages of percutaneous pinning include rapidity, no soft tissue dissection and minimal disturbance of fracture hematoma, which result in a minimal risk of infection and rapid healing. Drawback are more X-ray exposure and risk of iatrogenic ulnar nerve injury, which is avoidable by putting 2 or 3 wires laterally. The open technique allows accurate fracture reduction and avoidance of ulnar nerve injury, but is associated with increasing risks of infection, motion range limitation and unsightly or painful scars. The main objectives of treatment of displaced supracondylar fracture in children are the avoidance of complications that include infection, nerve injury, deformities, prevention of contracture, and restoration of normal function by least invasive, time and resources consuming measures.<sup>[10]</sup> In this study, the best

results achieved by closed reduction and wire fixation as judged by the high incidence of excellent results and the low incidence of poor results. This is consistent with conclusion made by Davis et al,<sup>[11]</sup> However, it is in consistent with the finding of Smith et al,<sup>[12]</sup> who report non-significant differences. There was male predominance in our study, with 31 male patients 62% and 19 female 38%, possibly due to the more active male child and this is close to a study done by Mangwani J. et al.<sup>[13]</sup> Regarding the mean age of fracture, most of our patients were in the age group 5-7 years 52% and a study done by Pavone et al shows the mean age was 6.26 years,<sup>[14]</sup> which was similar to the result of this study. In this study, the fractures are more common on the right side 64% and 36% on the left side well. This is not going with study done by Abubeih et al that shows the left side more affected than right side,<sup>[15]</sup> this could be due to short sample of patients or incidentally happen due to selected cases that match the inclusion criteria. A



superficial pin tract infection developed in two case 4% in-group A with slight redness and little discharge, which resolved spontaneously with daily dressing and oral antibiotics and this is a good result in compare with a study by M Julfiqar *et al.* with superficial pin tract infection of 14.3%.<sup>[16]</sup> According to the collected data, an iatrogenic ulnar nerve injury developed in two cases (4%) in-group A and this is close to the study done by. Slobogean *et al.* reported that for every 28 case treated with cross pinning there is a case with iatrogenic ulnar nerve injury.<sup>[17]</sup> According to the current research, temporary elbow stiffness after the treatment of a supracondylar humeral fracture in a child is often a concern of parents.<sup>[18]</sup> Although the healing result of SCFH in children is excellent, but the time required for healing is controversial.<sup>[12]</sup> Smith conclude that 5 weeks is required to restore original elbow ROM after removal of long arm cast without physical therapy in their study in uncomplicated distal humerus supracondylar and lateral condylar fractures. However, they defined recovery as the return of 90% of original full range of motion. According to Spence *et al.*<sup>[19]</sup> time required for complete recovery is up to 1 year, despite of the rapid initial recovery in elbow motion. They notice in their study the occurrence of slow but progressive stage of improvement of full range of motion of elbow. Though, as no work without limitation, the limitations of the current study are relatively small sample size; intermediate follow-up period; the parents filled out the DASH questionnaire based on their perceptions of their

children's functioning; the validity of m-DASH questionnaire in this age group was not yet been formally validated. The current study follow-up period was limited to 6 months. Probably future longer follow-up can further clarify the relation between the type of procedure used for reducing SCFH and clinical and functional outcome of elbow. The measurement of patients' outcomes in modern orthopedic practice includes the use of scoring systems to determine general health, regional, joint- and disease-specific results.<sup>[20]</sup> Two types of questionnaires are available physician-rated and patient-rated questionnaires.<sup>[21]</sup> Physician-rated questionnaires use clinical and functional measurements. On the other hand, patient-rated questionnaires assess subjective component of a condition. Questionnaires must be properly validated in terms of consistency, sensitivity and reliability. Many scoring systems used for elbow disorders. However, only few of these validated, and many assess only few aspects of elbow function. The original DASH 30 items, the shorten form Quick DASH 11 items,<sup>[10]</sup> and modified DASH 10 items especially modified to make it suitable for children,<sup>[22]</sup> high correlation with clinical parameters, high sensitivity, validity and reliability. The current study reveals that modified DASH questionnaire correlates well with objective parameters of final status of elbow after SCFH in children. The benefit of the instrument come from broadening doctor assessment of injuries and its consequences and give new insight to the problem from the patient's perspectives.

## APPENDIX

### Questionnaire Form

|                              |  |                              |
|------------------------------|--|------------------------------|
| <b>Patient name:</b>         | <b>Age:</b>  | <b>Gender:</b>               |
| <b>Address:</b>              | <b>Tel. No.:</b>   | <b>Date of injury:</b>       |
| <b>Mechanism of injury:</b>  | <b>Fracture class:</b>   | <b>Hand dominance:</b>       |
| <b>Date of intervention:</b> | <b>Method of intervention:</b>                                     | <b>No. of screen shots:</b>  |
| <b>Duration of surgery:</b>  | <b>Time of pins removal:</b>                                       | <b>Time of cast removal:</b> |
| <b>Range of motion:</b>      | <b>Complications:</b><br>1 Infection<br>2 Deformity<br>3 Stiffness | <b>Family satisfaction:</b>  |

## CONCLUSION AND RECOMMENDATION

From the results obtained, closed reduction with pinning under fluoroscopy significantly have higher rate of excellent results in terms of clinical and functional outcome than open reduction and pinning for Gartland type III,IV SCFH in children. Most children or parents reported no functional interference of well-reduced SCFH treated by close reduction with normal social activities, sports or performing arts, activities of daily living including self-care, and no functionally limiting symptoms. The study recommend incorporating m-DASH questionnaire in the routine assessment of result of reduction of fracture of upper extremities as it is reflect the result of intervention from patient's perspective.

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