OUTCOME ASSESSMENT OF CLOSED REDUCTION INTERNAL FIXATION WITH PER-CUTANEOUS KIRSCHNER'S WIRE FIXATION FOR GARTLAND TYPE II, TYPE III FRACTURES OF DISTAL HUMERUS IN CHILDREN

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ABSTRACT

Background: Distal humeral fractures are a common form of fracture in children, with the majority occurring supracondylar. Supracondylar fractures are frequently the result of trauma, most frequently falls. It is a medical emergency that requires prompt identification and treatment in order to avoid serious repercussions. Treatment techniques recommended range from non-reduction and immobilization to open reduction and internal fixation. Kirschner wire (K-wire) repair of displaced supracondylar fractures following closed reduction has been the preferred treatment for over 50 years. The purpose of this study was to investigate the functional outcome of crossed K-wire fixation in supracondylar fractures in children.

Study Setting: Orthopedic unit 1, Mayo Hospital Lahore

Method: The prospective study was done at the Department of Orthopedics from May 2015 to November 2017. It was concluded that when juvenile displaced supracondylar humeral fractures are handled percutaneously with crossed K-wire fixation, the functional prognosis is good. 83 children with supracondylar fractures were included in the study. They were fixed percutaneously using crossed K-wires. Following that, patients were tracked to ensure an acceptable functional outcome using Flynn's criteria. SPSS 21.0 was used for data entry and analysis.

Result: Eighteen people were enrolled in the study. The mean age standard deviation of the population in this study was 7.033.39 years. Males made up 56.6 percent of the study participants, while females made up 43.4 percent. 71.1 percent of patients had Gartland class II fractures, while 28.9 percent had Gartland class III fractures. 43.4 percent sustained an injury as a result of a fall while playing, and 19.3 percent fell from a height. 80.7 percent had a favourable functional outcome.

Conclusions: It was concluded that when juvenile displaced supracondylar humeral fractures are handled percutaneously with crossed K-wire fixation, the functional prognosis is satisfactory.

I. INTRODUCTION:

The elbow joint is the second most often fractured area of the upper limb in children, with 85 percent of fractures occurring in the distal humerus, and these distal humeral fractures are typically supracondylar. Supracondylar humeral fractures are one of the most common but hardest to treat fractures in children, accounting for around 3% of all fractures1. The majority of the time, the injury is caused by direct or indirect trauma, such as falls, which result in comminution or open fractures. This form of fracture necessitates prompt diagnosis and management due to the possibility of serious neurovascular damage, malunion, and contractures2.

The primary goal of timely management is anatomical reduction (because malunion and cubitus varus remodelling do not occur naturally with growing) and function restoration. The initial examination should
involve a thorough check of the patient's neurological and vascular systems. The optimal manner of treating this sort of fracture has long been a point of contention. Numerous methods have been proposed, including closed reduction and immobilisation in a plaster cast, ulnar traction with the elbow flexed, Dunlop's skin traction, percutaneous Kirschner (K-wire) traction, and finally open reduction and internal fixation. Currently recommended reductions range from none to open reduction and internal fixation.

Stabilization using pins reinforces fractures that have already been minimised by cast immobility, and so is recommended. Percutaneous pinning is a procedure that includes inserting metallic pins or K-wire into fracture fragments to provide support. For almost 50 years, K-wire fixation of displaced supracondylar humerus fractures in children has been performed due to its great efficacy, low cost, convenience of use, decreased postoperative hospitalisation, and low risk of sequelae.

The purpose of this study was to investigate the functional result of percutaneous crossed K-wire fixation in supracondylar humeral fractures in children. Thus, the findings of our study may justify the use of K-wires as the preferred technique of therapy in our community.

II. METHODOLOGY:

This was a prospective observational study done from May to November 2018 at the department of Orthopedics unit. The hospital's ethical review board granted approval, and the participant's parent/guardian provided informed consent. All fractures were evaluated clinically and radiographically and classified using Gartland's categorization system. During this six-month period, all children with supracondylar humeral fractures (Gartland type II and III), aged 2-12 years, were included in the study, regardless of gender. Children who did not provide informed consent by their parents/guardians were omitted.

Multiple or open fractures, Gartland type I fractures, fractures that were more than four days old, and fractures associated with neurovascular damage were also excluded. The study enrolled a total of 83 patients. The following information was gathered: basic demographics, mechanism of damage, and Gartland categorization. All patients got prophylactic antibiotics prior to surgery. Manual reduction was performed preoperatively following general anaesthesia. Within seven days of hospital admission, patients underwent percutaneous crossed K-wire fixation.

Patients were discharged on the third postoperative day and were followed up on a regular basis. At the 1st and 3rd weeks, clinical and radiological examinations were performed. Patients were advised to return for a follow-up visit on the sixth postoperative week to have their wires removed. Union, loss of elbow range of motion,
carrying angles on both sides were noted. The site of the pin tract was examined for evidence of infection. The end outcome, i.e. an acceptable functional outcome, was examined on the same day\textsuperscript{9}.

This outcome was determined using Flynn's criteria, which evaluates fractures on the basis of their functional and cosmetic components (both further divided into good, moderate, and poor which we did not assess). The functional component quantifies the sagittal plane motion arc, encompassing flexion and extension, whereas the cosmetic component quantifies the carrying angle. A motion loss of 15 degrees and a carrying angle loss of 15 degrees (as determined by clinical examination using a goniometer) were deemed satisfactory, whereas a greater loss in either was deemed unsatisfactory\textsuperscript{10}.

III. STATISTICAL ANALYSIS

IBM Statistical Package for the Social Sciences (SPSS) Statistics for Windows, version 21.0, was used to enter and analyse data from all participants (IBM Corp., Armonk, NY, US). The mean and standard deviation of quantitative data such as age, surgery duration, elbow mobility, and carrying angles were calculated. For qualitative factors such as gender, side of upper limb affected, Gartland class, method of injury, and outcome variable according to Flynn's score, frequencies and percentages were computed. To determine the effect of effect modifiers on the outcome, age, gender, Gartland class, and mode of injury were stratified using the Chi square test with a p-value of 0.05 considered significant\textsuperscript{11}.

IV. RESULT

This study comprised 83 patients who met the inclusion and exclusion criteria. The study population's mean standard deviation age was 7.0363.390 years. According to demographic data analysis, 41 youngsters were under the age of six and 42 were six years and older\textsuperscript{12}. Males made up the majority of the youngsters. The majority of children (n=61, 73.4 percent) had left sided fractures, while the majority of the study population (n=59, 71.1 percent) had supracondylar fractures, whereas 28.9 percent (n=24) had Gartland class III fractures. Numerous children (43.4 percent) sustained injuries as a result of a fall while playing, while 16 (19.3 percent) sustained injuries as a result of a fall from height. The duration of the surgery was also recorded, with an average of roughly 29 minutes\textsuperscript{13}.

Three individuals (3.6 percent) experienced postoperative complications such as superficial pin tract infection (treated with antibiotics), whereas five patients sustained ulnar nerve damage (6.02 percent ). Union was accomplished in all patients upon clinical and radiological evaluation during the last follow-up. According to the study of outcome variable frequency at the last follow-up, 67 (80.7%) children had an acceptable functional outcome\textsuperscript{14} shown in the table below:

<table>
<thead>
<tr>
<th>CHARACTERISTICS</th>
<th>FREQUENCY</th>
<th>%</th>
</tr>
</thead>
</table>

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When the outcome was compared to other patient characteristics, as indicated in table below, no significant correlation was discovered.14

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>SATISFACTORY FUNCTIONAL OUTCOME</th>
<th>P-VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>YES</td>
<td>NO</td>
</tr>
<tr>
<td>GENDER</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>37</td>
<td>10</td>
</tr>
<tr>
<td>Female</td>
<td>30</td>
<td>06</td>
</tr>
<tr>
<td>AGE (IN YEARS)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 6 years</td>
<td>34</td>
<td>07</td>
</tr>
<tr>
<td>&gt; 6 years</td>
<td>33</td>
<td>09</td>
</tr>
<tr>
<td>FRACTURE CLASSIFICATION</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gartland class II</td>
<td>59</td>
<td>71.1</td>
</tr>
<tr>
<td>Gartland class III</td>
<td>24</td>
<td>28.9</td>
</tr>
<tr>
<td>MECHANISIM OF INJURY</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fall while playing</td>
<td>36</td>
<td>43.4</td>
</tr>
<tr>
<td>Fall from height</td>
<td>16</td>
<td>19.3</td>
</tr>
<tr>
<td>Road traffic accident</td>
<td>14</td>
<td>16.8</td>
</tr>
<tr>
<td>Blunt trauma</td>
<td>17</td>
<td>20.5</td>
</tr>
</tbody>
</table>
V. DISCUSSION

When the functional outcome was measured in the current investigation, appropriate results were found\textsuperscript{15}. The majority of the sample (80.7 percent, n=67) demonstrated a satisfactory functional outcome using Flynn's criterion. The epidemiological results presented in this series are congruent with those published before. Boys outnumber girls by a margin of 57\%.\textsuperscript{3,4,18} A probable explanation is that boys are more likely to suffer from these fractures due to their involvement in more rigorous sports and physical activities. This study observed a left-sided predominance\textsuperscript{16}, which is consistent to the work of Barr et al. and Naik et al.

The mean age of the patients in this study is nearly identical to that of other studies on the same subject, which is approximately seven years. The age group of five to eleven years has a higher level of activity than preschool children, which may explain why the majority of children in the current study were of that age. Other research found that the average age was also between six and eight years\textsuperscript{17}.

The K-wire fixing technique can be used in a crossing or parallel configuration. We used the crossing technique. There is no conclusive evidence indicating which method is the superior one. The crossover approach utilises a medial and lateral wire, whereas the parallel method utilises two lateral wires. While the crossover technique gives higher stability, the parallel technique is associated with a lower risk of iatrogenic nerve injury. In this study, postoperative evaluation revealed iatrogenic ulnar nerve injury in five patients (6.02 percent), but hand function was satisfactory at the last follow-up. Ulnar nerve damage is a frequent complication of this type of surgery and has been documented in past research\textsuperscript{18}.

Supracondylar fracture reduction using a closed approach with percutaneous pinning has almost always produced favourable results when compared to alternative modalities of therapy\textsuperscript{19}. Similar to our study, Tiwari et al. observed an overall satisfaction rate of 88 percent, with 42 percent being excellent, 30\% being good, and 6\% being fair. Another study found that over 90\% of individuals had a favourable to excellent outcome. Similar findings were discovered on an exhaustive review of the literature. This demonstrates that crossed wire fixation is a safe and effective therapeutic option for Gartland type II and III fractures. Gartland type I was omitted since it is typically treated cautiously.

Our study was restricted by the small sample size and the fact that it was conducted in a single tertiary care setting\textsuperscript{20}.

VI. CONCLUSION:

As previously reported, we observed a favourable outcome using Flynn's scoring method when supracondylar humeral fractures of Gartland type II and III were handled with closed reduction followed by percutaneous K-wire application. Our populations need larger investigations\textsuperscript{21}.
REFERENCES:


