CODEN [USA]: IAJPBB ISSN: 2349-7750

INDO AMERICAN JOURNAL OF
PHARMACEUTICAL SCIENCES

http://doi.org/10.5281/zenodo.3364712

Available online at: http://www.iajps.com ***Research Article***

DETERMINANTS OF POST-PROCEDURAL SURGICAL OUTCOME AMONG PEDIATRIC PATIENTS UNDERGOING OPEN REDUCTION INTERNAL FIXATION FOR SUPRACONDYLER FRACTURE OF THE HUMERUS (GARTLAND TYPE – III CLASSIFICATION)

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Article Received: May 2019 **Accepted:** June 2019 **Published:** July 2019

Abstract:

Background: *Supracondylar fracture of Humerus in children is the second most common fracture around the elbow joint and is also called first decade injury typically affecting non-dominant arm Its incidence is reported to be as high as 308/100,000 per year. Despite effective surgical interventions, the best outcome isn't always achieved owing to a variety of factors.*

Objective: *To identify the determinants of post-procedural surgical outcome among pediatric patients undergoing open reduction internal fixation for supra-condyler fracture of the humerus (Gartland type – III classification).*

Methodology: *This prospective cohort was conducted upon a sample of 30 pediatric patients (chosen via simple random sampling), admitted through both out-patient and casualty departments of orthopedic unit-1 Liaquat University Hospital Hyderabad/Jamshoro after taking written informed consent from parents/guardians. Our study entailed the operative treatment i.e. open reduction internal fixation with two cross pin fixation or two lateral pinning in supracondylar fractures of humerus (Gartland type III). Functional outcomes were assessed at each follow-up visit and recorded on pre-structured questionnaire. Data was analyzed using SPSS v.21 & Microsoft Excel 2016.*

Results: *Among, the 30 pediatric patients, 19 were males while the remaining 11 were females. Good outcome was seen in 21 patients while 9 patients had an excellent outcome. Among the hypothesized determinants of post-procedural outcome, type of surgery (fixation with two cross pin fixation or two lateral pinning), delay in presentation to the hospital, age of the patients were significant, while others such as child gender, weight and serum calcium levels were not significant determinants.*

Conclusion: *After careful consideration, it can be concluded delay in presentation to the hospital should be avoided following supra-condyler fracture of the humerus, as it may adversely affect the post-procedural outcome. Lateral pinning too proved to be a superior surgical approach and thus should be adopted for said fractures among pediatric patients.*

Keywords: *Supra-Condyler Fracture, Lateral Pinning, Cross-Pinning, Open Reduction – Internal Fixation & Pediatric Orthopedic Surgery.*

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Please cite this article in press Hussain Bux Palh et al., ***Determinants of Post-Procedural Surgical Outcome among Pediatric Patients Undergoing Open Reduction Internal Fixation for Supracondyler Fracture of the Humerus (Gartland Type – III Classification).,*** *Indo Am. J. P. Sci, 2019; 06(07).*

INTRODUCTION:

Supracondylar fracture of humerus has been defined as the fracture occurring in distal third of humerus with line of fracture lying just proximal to bone mass of the trochlea and capitellum and often runs through the parts of coronoid and olecranon fossae where fracture line is generally transverse. [1] Supracondylar fracture of humerus is among the commonest fractures around elbow in children. [2, 3]

Supracondylar fracture of Humerus in children is the second most common fracture around the elbow joint and is also called first decade injury typically affecting non-dominant arm. Its incidence is reported to be as high as 308/100,000 per year. Despite effective surgical interventions, the best outcome isn't always achieved owing to a variety of factors. [4]

The mean age of children presenting with Supracondylar fracture is between 5-10 years. [5] The most common mechanism of Supracondylar fractures is the history of fall on outstretched hands where child tries to protect himself/herself from falling by extending their arms. [6] Due to fall, there is increased extensive force on anatomically weak area of the olecranon fossae, where the Supracondylar region of humeral bone can be as thin as 1mm. [7] The hyperextension of the elbow joint with vertical stress causes Supracondylar fracture of humerus bon. [8] According to the mechanism of injury, the Supracondylar fractures of humerus are divided in to two categories i.e. extension type about (95-98%) and flexion type about (2-5%). [9]

The extent of injury may not be appreciated radiologically because humeral epiphysis, especially in young patients, are cartilaginous hence abnormal radiographs are compared with normal radiographs of elbow joint comparing two side paying particular attention to alignment of humerus, capitular osific nucleus and radius. [10]

Serious complication can develop if treatment is not done properly. There are numerous series discussing management of Supracondylar fractures but no single method of management is found to be suitable for all Supracondylar fractures of humerus in children. [11]

METHODOLOGY:

This prospective cohort was conducted upon a sample of 30 pediatric patients (chosen via simple random sampling), admitted through both out-patient and casualty departments of orthopedic unit-1 Liaquat University Hospital Hyderabad/Jamshoro after taking written informed consent from parents/guardians. Our study entailed the operative treatment i.e. open reduction internal fixation with two cross pin fixation or two lateral pinning in supracondylar fractures of humerus (Gartland type III). Functional outcomes were assessed at each follow-up visit and recorded on pre-structured questionnaire. Data was analyzed using SPSS v.21 & Microsoft Excel 2016.

Inclusion Criteria:

1. All children aged 4 years to 10 years.
2. Supracondylar fractures having Gartland classification type III.

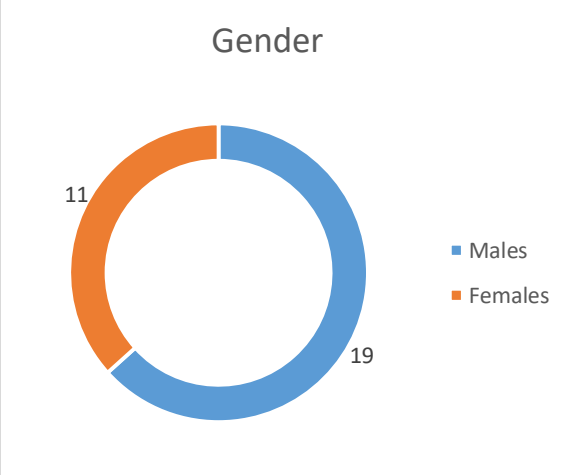
Exclusion Criteria:

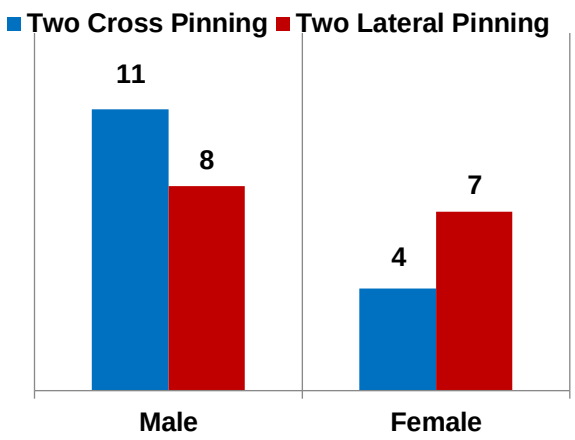
1. Cases with poly-trauma.
2. Any pathological fracture.
3. Infection at the site of fracture.
4. Open fracture.

Outcome	**Rating**	**Cosmetic factor (carrying angle loss in degrees)**	**Functional factor (movements loss in degree)**
Satisfactory	Excellent	0–5	0–5
	Good	6–10	6–10
	Fair	11–15	11–15
Unsatisfactory	Poor	>15	>15

RESULTS:

Among, the 30 pediatric patients, 19 were males while the remaining 11 were females.





Good outcome was seen in 21 patients while 9 patients had an excellent outcome. Among the hypothesized determinants of post-procedural outcome, type of surgery (fixation with two cross pin fixation or two lateral pinning), delay in presentation to the hospital, age of the patients were significant, while others such as child gender, weight and serum calcium levels were not significant determinants.

Post - Procedural Outcome	Type of Procedure		Age		Time Delay	
	Lateral Pinning	Cross Pinning	Up to 5 years	6 to 10 years	Present	Absent
Poor	0	0	0	0	0	0
Fair	0	0	0	0	0	0
Good	8	13	12	9	15	6
Excellent	7	2	1	8	2	7

DISCUSSION:

Supracondylar fractures are typically seen in younger children and are uncommon in adults. Almost 90% of them are seen in children younger than 10 years of age. [12] Basically, the age is a key factor in the incidence of supracondylar fractures. These types of fractures occur more frequently in skeletally immature children with the peak age between 6 and 7 years of age. This is because, the supracondylar area is undergoing remodeling during this age years and is typically thinner with a more slender cortex and hence predisposing to fracture of this area. [13]

The typical mechanism of injury is a fall on outstretched hand (FOOSH) with hyperextension load on the arm. The distal fragment displaces posteriorly in over 95% of cases. [14] With fall on outstretched hand, as the elbow is forced into hyperextension, the olecranon serves as a fulcrum and there is stress on the distal humerus thus leading to fracture. [15] Children younger than 3 years usually incur this injury from falling from a height of less than 3 feet. Older children sustain fractures from falls from greater heights of playground, if the hand is in a supine position and usually leads to postero-lateral displacement. If the hand is in pronated position then a postero-medial displacement occurs which is more common. Direct trauma or a fall onto a flexed elbow seldom occurs resulting in a 'flexion' type injury (2%) with anterior displacement. [16]

After complete history, clinical assessment and diagnosis, the elbow is splinted in a comfortable position (approximately 200– 300 of flexion) to temporarily stabilize the limb. Splinting in full elbow extension is contraindicated because it stretches the neurovascular bundle over the fracture site in displaced or unstable supracondylar fractures. The application of a comfortable, wellpadded and properly applied splint is a critical part of the initial management of these injuries regardless of definitive treatment. [17]

Despite literature being devoid of investigations pertaining to determinists of post-procedural outcome, this research gives novel insight into the role of delayed presentations, age of individuals. There is ample evidence supporting either of the two procedures employed in the research but this research suggests that lateral pinning produces excellent outcome more often.

CONCLUSION:

After careful consideration, it can be concluded delay in presentation to the hospital should be avoided following supra-condyler fracture of the humerus, as it may adversely affect the post-procedural outcome. Lateral pinning too proved to be a superior surgical approach and thus should be adopted for said fractures among pediatric patients.

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