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SUPRA-CONDYLAR HUMERUS FRACTURE (SCHF) IN CHILDREN, MANAGED BY CLOSE REDUCTION AND INTERNAL FIXATION BY K WIRE, AN OUTCOME STUDY.

Orthopaedics

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ABSTRACT

Supra condylar humerus fracture (SCHFs) is one of common (approx. 3%) injury in child age group. Inadequate anatomical reduction and delay in management leads to deformity & disability with growth of child. The type of injury, displacement of fragment, age of child and delay in treatment affect the management outcome. The study is aimed to evaluate an outcome of SCHFs in children (Gartland, Gr.II&III) [1] managed by CRIF with k-wire fixation. **Material:** The out of 121 children aged 2-13 yrs of both sex attended this hospital during last three years, only 71 children (treated by CRIF with k-wire and 6 mths follow up) were studied. The relevant clinical/radiological (pre/post operation), function (Flynn's criteria) details from their records were analysed[2]. **Results:** 71 children aged 4-13 yrs, Male : Female and Right :Left elbow involvement ratio was 1.8 : 1. A history of fall from height (plant twig) on out-stretched hand resulting extension type (Gartland II B) in 44% cases and injury to nerve in 7% cases. The post operation complication was a mild pin tract infection in 10% and insignificant loss of flexion-extension arc carrying angle. At 6mths follow up, the functional outcome was excellent in 86% cases without any significant impact of K-wire construct used. **Conclusion:** SCHFs is still common in rural children due to fall from tree twig and report to hospital after 2-3 days after treatment/manipulation locally, who otherwise needed CRIF with K-wire. The CRIF with K-wire irrespective of construct, gives excellent clinic-radiological outcome in 86% cases without complications.

KEYWORDS

Supra Condylar Humerus Fracture (SCHF), Close reduction and internal fixation(CRIF), K-wire, Carrying Angle, Flynn's Criteria,

INTRODUCTION

Of elbow injuries, the supra condylar humerus fracture (SCHF) is common in children (3% approx.).Inadequate and delayed management may cause lifelong deformity and disability, may impact socioeconomic status of an individual. The optimum management of SCHFs in children aims perfect anatomical reposition of the fragments usually by closed manipulation. If for any reasons, it is found impossible to achieve this goal, there are two alternatives, open reduction or immobilization in the unreduced position (Attenborough C.B,1953) [3]. Better results by per-cutaneous pinning or open reduction and internal fixation with K-wires in displaced extension type of supracondylar fracture in his study [4,5].

The management depends on type of injury and fragment displacement (Gartland classification). Depending on fracture stability and likely chance of its displacement, percutaneous k-wire fixation after close reduction may be needed. The deformities of elbow namely cubitus varus/ valgus, hyperextension etc. and to impair elbow functions are not uncommon. In a biomechanical model study, four osteosynthesis techniques for stabilizing SCHFs in children were compared and found that, the crossed k-wires have the highest stiffness and lowest loss of reduction under cyclic loading [6]. Similar functional and radiological outcomes in both the constructs and methods of fixation (lateral and cross k-wire) were also reported [6,7]. In a meta-analysis of randomized clinical trials, a satisfactory functional results in terms of elbow functions, risk of neurological injury and loss of reduction are reported[13].

Amongst management of fracture SCHFs by the close reduction and fixation by K wire, there is conflicting literature on the best configuration of K wires. To evaluate post operative and short term (6mths) outcome of SCHFs (Gartland Gr. II&III) in children managed by close reduction and per-cutaneous k-wire fixation, irrespect to the construct, this study has been undertaken.

MATERIAL & METHOD

The records of all cases of SCHF attended in OPD/IPD of Hind Institute of Medical Sciences, Mau Ataria, Sitapur, India; a tertiary care teaching hospital located in a rural area of central India, and were managed during last three years January,2019 to December 2021 were included in the study.

The records of these cases were critically analysed. Out of 121 such children aged between 2-13 yrs, only 71 children who fulfilled our set norms, inclusion/exclusion criteria (children with displaced SCHFs), managed by close reduction and fracture stabilization by per-cutaneous k-wire were included in the study and constitute our study population.

The minor gaps in the available records (especially follow-ups), if any were filled by collecting information during follow ups and over phone. The relevant clinical details (pre/post operation), follow-ups record and functional and radiological outcome were collected, tabulated and analysed.

The fracture severity (Gartland classification), fracture, stabilization construct, surgery time, clinico-radiological fracture union, short term (6 mths) functional outcome (Flynn's criteria) [2] etc. were taken in to account for the study. A standard protocol of physiotherapy during six months of post surgery period was followed by all children of study population irrespective to k-wire construct used..

Measurement of outcome of interest:

A detailed history of the patients along with general physical and systemic examination, preoperative evaluation recorded in the case sheet was studied. The age, sex, mode of injury; side affected; dominant or non-dominant hand; duration since injury; open/closed; neurovascular status; other associated injury, co-morbidities; pre-operative radiographs, Gartland classification date and procedure performed; complications etc were collected in the pretested data collection form.

Radiological assessment

Radiographic assessment done at follow-up during 4,8,16 and 24 weeks were included in the study. Radiographs were done in standard projections: Antero-posterior image with the extended elbow, forearm in neutral position; lateral projection, the elbow in flexion if possible up to 90°. Follow up radiographs were assessed for fracture union time, Baumann's angle and anterior humeral line (AHL).

The Baumann's angle is angle between long axis of humeral shaft & growth plate of lateral condyle (70-75 degrees). (Figure 1) During final followup

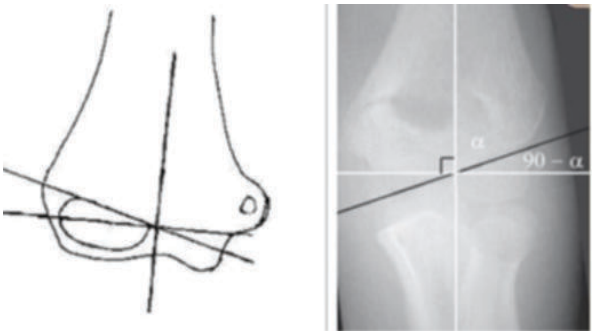


Figure1
(i.e 24 wks) were recorded and a difference of more than 5° between two measurement (Baumann's angle of both upper limbs) was considered significant [5,7].

The anterior humeral line (AHL) is a line drawn along the anterior cortex of the distal humerus on the lateral radiograph of the elbow [7]. For the study the capitellum is divided into three equal parts (Figure 2). The relationship betweenAHL and capitellum was classified as anteriorly loss (AL), anterior third (A), middle third (M), posterior third (P) and posteriorly loss (PL).

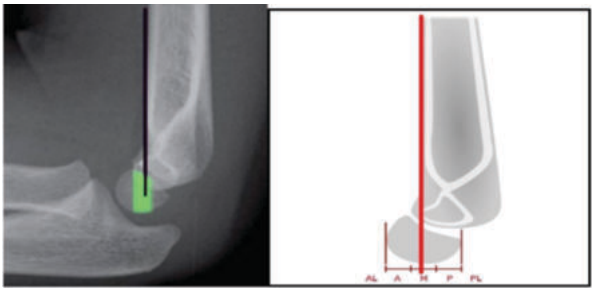


Figure2

Functional assessment

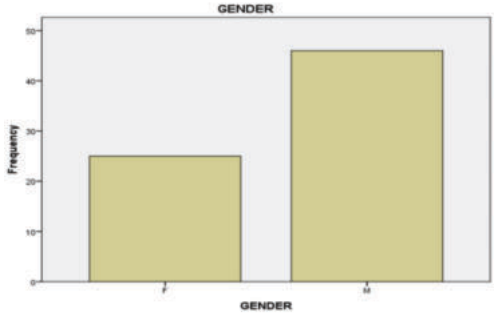
Functional assessment was done at follow up during 4, 8, 16, 24 wks. Flynn's criteria was used for the functional assessment [2].(Appendix A)

Appendix A

Result	Ratings	Cosmeticfactor Carrying-angle loss(degrees)	Functional factor Movement loss(degrees)
Satisfactory	Excellent	0to5º	0to5º
	Good	5to10º	5to10º
	Fair	10to15º	10to15º
Unsatisfactory	Poor	>15º	>15º

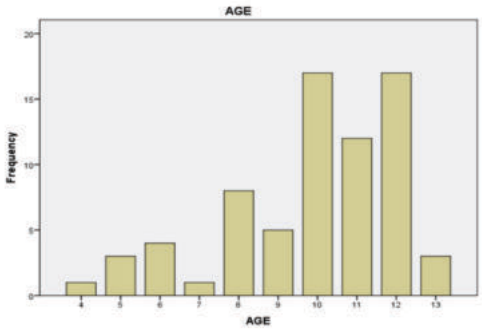
RESULTS

The children with SCHFs in the study population were in the age range of 4-13 yrs (majority in 10-12 yrs) with average age of 9.9 yrs. Their M:F and their side involved ie. Right: Left elbow predilection was 1.8:1.0.



Gender

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	F	28	33.3	37.3
	M	47	61.3	100.0
	Total	75	100.0	



AGE-Frequency Table					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	4	1	1.3	1.4	1.4
	5	3	4.0	4.2	5.6
	6	4	5.3	5.6	11.3
	7	1	1.3	1.4	12.7
	8	8	10.7	11.3	23.9
	9	5	6.7	7.0	31.0
	10	17	22.7	23.9	54.9
	11	12	16.0	16.9	71.8
	12	17	22.7	23.9	95.8
	13	3	4.0	4.2	100.0
	Total	71	94.7	100.0	
Missing	System	4	5.3		
Total	75	100.0			

The average time gap between injury to report our centre was 3-4 days (range 1 to 7 days). In most of cases, prior to our definitive treatment, some manipulation and splinting was tried locally. In majority (44%), there was a history of fall from height (plant twig) on out-stretched hand, extension type injury (Gartland II B). In 5 cases, there was an injury to the nerve also, preoperatively. For stabilization of fracture both cross K-wire and lateral entry divergent K-wire (2-3) were used, based on surgeon's preference..

DISCUSSION

The superiority of fixation by K wire over POP immobilization without fixation after close reduction of SCHFs is already established [1[. Amongst different treatment methods, better results by percutaneous pinning or open reduction and internal fixation with K-wire has been reported by Pirone AM et al.,1988 [4]. In the present study, the outcome (clinico-radiological) of management of SCHFs in children by close reduction with per-cutaneous fixation by K-wire (irrespective of construct ie cross k-wire or divergent k-wire through lateral entry) in 71 such children was studied.

For stabilization of fracture both cross K-wire and lateral entry divergent K-wire (2-3) were used, based on surgeon's preference but without much significant difference in their outcome. Mohabey A et al.,2020 [8] and Radaideh AM et al.,2022 [9] reported outcome similar to us while taking parameters like pre and post-intervention, Baumann angle, scores for pain, function, stability and range of motion. There was no statistical difference regarding Mayo elbow performance scores (MEPS) and Baumann angle outcome (clinico-radiological).

Pirone AM et al reported better results by percutaneous pinning for open reduction and internal fixation with K-wires in displaced extension type of supracondylar fracture as compared to management without fixation with K wire [4], but such comparison was not done in our study. An average operation time was approx. 30 minutes under short GA without much difference to type of construct used. This finding is contrary to others who reported more operating time in cross k-wire construct[10], which may be due to our exposure and practice of the technique. Only complication was pin tract infection in 7 cases and average loss of flexion-extension arc 4.5-5 degree, with only 3 degree loss of carrying angle at 6 months follow up (at average age of 12 yrs) and excellent functional outcome in 85% cases keeping 10 cases outcome of fair/unsatisfactory, aside (Flynn's functional criteria). Mazda K et al., 2001 [5] reported good or excellent results (Flynn's criteria) in 96% of patients against 85% in our study. In our Gartland type 3 cases, the findings are similar to the findings of Ayas MS, et

al.,2021 [11]. Similar to our findings, El-Geuoshy AM et al., 2021 reported good results in terms of stability, duration of bone healing, reduction loss and neuro-vascular injuries, irrespective of construct (k-wire) used in managing children's SCHFs. Similar to our findings, no statistical significant difference in outcome of K-wire construct (used for fixation) in terms of Flynns criteria was noted by Lal K, et al., 2021[10]. However, his finding of less operative time in percutaneous cross pinning is contrary to our finding. Zhao H et al, 2021[12] also reported similar outcome in respect to carry angle, Baumann angle, Flynn scores, infections, and other complications in his meta-analysis of SCHFs in children managed with percutaneous K-wire fixation.

CONCLUSION

SCHF is still a common elbow injury in rural children due to fall from tree twig and used to report to appropriate medical facility after 2-3 days after undergoing manipulation/ splinting by local bone setter, who otherwise requiring specialized management by close reduction with internal fixation by K-wire. The K-wire construct (cross or lateral entry divergent k-wire) used in fracture stabilization has hardly any significant impact on its outcome and complications for six month post operative at least as per our study. To assess the outcome (clinico-radiological)of management/ intervention, Flynn's criteria and post op follow up x-rays evaluation on standard parameters, are a must.

Conflict of interest –nil

Funding for study-nil

Ethical Clearance- Institutional Ethical committee clearance obtained.

Justification of paper-

The Supra Condylar Humerus Fractures(SCHFs) in children is one of common injury leading to deformity and disability, if not managed in time and by appropriate manner. Close reduction and internal fixation(CRIF) by k-wire with different construct is common practice but still controversial in its outcome. Study support the CRIF with k-wire irrespective of construct without significant difference in outcome and complications.

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Disclosure of interest-

The authors declare that they have no competing interest.
The authors received no funding to perform this study.

Ethical approval:

The study was approved by the institutional ethics committee

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