



A Prospective study of Post Treatment Residual Deformities in Supracondylar Fractures of Humerus in Children

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ABSTRACT

Introduction- Although supracondylar fractures constitute a large chunk of pediatric fractures in orthopedics emergency there has not been any consensus on the mode of management with treatment undergoing evolution. Fracture is notorious for difficulties it presents like stiffness, malunion, nerve injuries, VIC. Our study aims to bring consistency to management. Material and method- Our study is of 40 children with supracondylar fracture humerus who came in emergency. After examination treatment was done with closed reduction and POP cast application or closed reduction and percutaneous k-wire fixation or open reduction and k-wire fixation. Result was assessed via Mitchell and Adams criteria (1961). Result- Closed reduction with POP cast gave good results in type 1 fractures whereas closed reduction with k-wires gave an excellent result in type 2 and open reduction and k-wire fixation gave generally excellent result with type 3 along with closed reduction. Conclusion- Closed reduction with POP cast is carried out in type 1 unless medial comminution is seen. Closed reduction with percutaneous k-wire should be carried out in all cases of type 2 and 3 fractures. Open reduction with k-wire fixation be done in those cases where closed reduction is not achieved.

KEYWORDS : supracondylar fractures, Baumanns angle, Mitchell and adams criteria

Introduction- In India as worldwide supracondylar fractures of humerus constitute a large chunk of pediatric fractures reporting to the orthopedic emergency ward. The management of such fractures has been subject to great many changes over the last century. Supracondylar fractures are most common in 4- 12 years age group mostly resulting from fall on outstretched hand while playing.

This fracture has been notorious as it presents with difficulties in reduction and complications like loss of reduction, stiffness, malunion, nerve and arterial involvement and occasionally even Volkmann's ischemia. As a result there are no specific guidelines for the treatment of the same.

Theories for the fracture to be common have been given- constant remodeling because of growing age causes the cortices to be thin and also because of the biconcave surface, hyperextension at the elbow joint at the time of fall causing extension type of supracondylar

Fracture. Various modes of treatment have been used to treat supracondylar fracture but no one method is suitable for the management of all types of fractures.

In the Indian context, factors like delay in reporting to hospital after injury, socioeconomic factors and also the treatment advocated by bone setters (pehalwan) contribute to various kinds of post treatment residual deformities in children which can lead to further surgery or disability in future life.

The main motive behind this study was the fact that accurate reduction and its assessment is not an easy task in any sitting in a case of supracondylar fractures.

Aims and objectives- To evaluate the various treatment modalities of supracondylar fractures of humerus based on clinical outcome. To evaluate the role of Baumann's angle in accurate reduction of displaced supracondylar fractures.

Material and method- This study was done on 40 subjects having supracondylar fractures treated from December 2012 upto august 2014 whose age varied from 2- 13 years and were diagnosed and classified into type 1, type 2 and type 3 fractures according to the modified Gartland's classification. Fractures which were associated with head injuries and which were treated elsewhere and fractures older than 15 days were excluded from the study.

As the subjects of our study were minor a well-informed written valid consent was taken from their parents. All the cases were treated by a single orthopedic surgeon. After clinical and radiological assessment, method of treatment was decided according to the modified Gartland's classification.

Type 1 – POP casting for three weeks.

Type 2 – closed reduction and POP casting/ percutaneous k- wire fixation.

Type 3 – closed reduction/ open reduction and k- wire fixation.

The final choice of treatment depended upon the operating surgeon's discretion.

The fractures were treated with closed reduction technique as described by Sir John Charnley (1961), percutaneous cross pinning with k- wires of 1.5, 2 & 2.5mm thickness in cases of collapse of the closed reduction and open reduction with k – wire fixation in cases of inability to reduce the fracture by closed method.

Open reduction with k- wire fixation was done by combined or medial/ lateral approach and in case of vascular compromise anterior approach was used. In case of flexion type of supracondylar fracture open reduction was done using the anteromedial approach. All the patients were given a POP cast in 90 degrees flexion and mid prone position of forearm for 3-4 weeks after which the k- wires (if done) were removed (depending upon the union) and intermittent active

physiotherapy of the elbow started.

The patients were asked to follow up at 1st, 2nd, 4th and 6th weeks and then monthly afterwards. At 4 weeks the cast was cut, the k- wires removed and the patient was assessed for ROM, neurovascular status and mid arm circumference. Physiotherapy was advised at 4 weeks and the patient was assessed at 6 weeks again for ROM, neurovascular status and mid arm circumference and carrying angle (if applicable) and Baumann's angle. The results obtained were graded according to *Mitchell and Adam's criteria* (1961) into excellent, good and poor.

Excellent – change in carrying angle <5 degrees, loss of range of motion <10 degrees and no symptoms.

Good – change in carrying angle 5 – 15 degrees, loss of range of motion 10 – 20 degrees and no symptoms.

Poor – change of carrying angle or loss of range of motion greater than the above limits, any notable symptoms.

Results- On evaluating 40 supracondylar fractures it was observed that Type 3, Gartland's classification, fracture was the commonest with 65% of fractures being of that type. The mode of treatment which was followed for majority of type 1 fractures was closed reduction with cast application, whereas for type 2 & type 3 majority of cases were managed by closed reduction and percutaneous pinning. The outcome as per Mitchell and Adams criteria were in majority of cases excellent to good with poor results seen in a few cases of Type 3 fractures managed by closed reduction and percutaneous pinning along with flexion type injuries. The change in the Baumann's angle was on an average found to be 6-8° with maximum change seen in type 2, 3 and flexion type injuries. Type 1 and type 2 had no postoperative complications, whereas type 3 had cubitus hyperextendus, 2 had pin tract infection, while cubitus valgus and varus was seen in 1 patient each. The flexion type injury was characterized with post-operative stiffness.

Discussion- It was noted that out of 40 patients, 25 were male and 15 were female, this is in accordance to the general observation that boys are more affected than girls which could be because of the fact that boys tend to be more active in outdoor sports. 95% of the fractures were of extension type and only 5% were flexion type this finding is in general agreement with widely reported figures in series by henriksson (1966) fowles and kassab (1974), wilkins (1996) for extension type fractures. According to gartlands classification 65% of supracondylar fractures were type 3 Posteromedial displacement was almost thrice as common as posterolateral displacement in our series, this is in general agreement with observation by henriksson (1966), Boyd and aronson (1992) and elbahri et al (2007), and 15% each of type 2 and type 1. 6 patients were classified into type 1 and all were treated with closed reduction and cast, 6 were classified as type 2 out of which 1 was treated with closed reduction and cast and 5 were treated with closed reduction with k- wires. 26 patients were graded as type 3 out of which 17 were treated with CRIF with k- wires and 9 were treated with ORIF with k- wires.

All 6 patients of type 1 fractures which were treated with POP cast, 5 showed excellent results and one showed good result with a mean change of Baumann angle of 6.6 degrees with a standard deviation of 3.08 degrees. Out of 6 patients of type 2 fractures, 5 treated with CRIF showed excellent results and one treated with closed reduction showed good result with a mean change in Baumann angle 7.33 degrees with a standard deviation of 2.33 degrees, one good result was due to loss of flexion of around 15 degrees. Out of the 26 patients of type 3 fracture, 17 were treated with CRIF out of which 15 showed excellent results, 1 showed good and 1 showed poor, the good result was due to the loss of flexion of 18 degrees and one poor result was due to the reversal of the carrying angle. The 9 patients who were treated with ORIF, 7 showed excellent results and 2 showed good results, out of the 2 good results of ORIF one had a loss of flexion of 12 degrees and the other had a loss of extension of 10 degrees, mean change in Baumann angle was 6.34 degrees with a standard deviation of 4.56 degrees. Out of 2 patients of flexion type fractures which were treated with ORIF, 1 showed good and 1 showed poor results the poor result was due to loss of flexion of 12 degrees and loss of extension of 10 degrees.

No operative complications were seen in type 1 and 2 fractures. In type 3 fractures 1 patient showed cubitus varus deformity, 1 showed cubitus valgus deformity, 2 had pin tract infections and 3 had cubitus hyperextendus. In flexion type fracture 1 patient had stiffness. There were no cases of iatrogenic neuropraxia.

Conclusion –In this study we conclude that treatment by POP casting is the standard treatment for type 1 fractures and it gave uniformly good results in our series. Fractures even minimally displaced should be checked for medial wall comminution and if found should be treated by percutaneous pinning. We found that treatment of type 2 fractures by closed reduction and percutaneous pinning is a safe method to prevent malunion. We had uniformly good results in type 3 fractures using closed reduction and percutaneous pinning and if closed reduction fails, open reduction should be carried out. The role of Baumann's angle in the prevention of cubitus varus is well established. In our study we reduced displaced type 2 and type 3 fractures to Baumann's angle equal to or less than 10° of the angle in the uninjured arm. Consequently we obtained just one case of cubitus varus.

Technical expertise is required to get good results in supracondylar fractures. General practitioner should be informed about the dreadful complications of this fracture so that they can recognize symptoms and refer the patients to specialist centers.

Table 1 – Postoperative complications

S.N.	Fracture type	Complications	No. of cases
1.	Type 1	Nil.	Nil.
2.	Type 2	Nil.	Nil.
3.	Type 3	Stiffness	0
		Cubitus varus	1
		Pin tract infection	2
		Migration of k- wires	0
		VIC	0
		Residual nerve palsy	0
		Myositis ossificans	0
		Cubitus valgus	1
		Cubitus hyperextendus	3
4.	Flexion type	Stiffness	1

Table 2 – Change in Baumann's angle.

Grade	Change in Baumann's angle	Standard deviation
Type 1	6.6	3.08
Type 2	7.33	2.33
Type 3	6.34	4.56
flexion	7	1.4

Figure Legends:

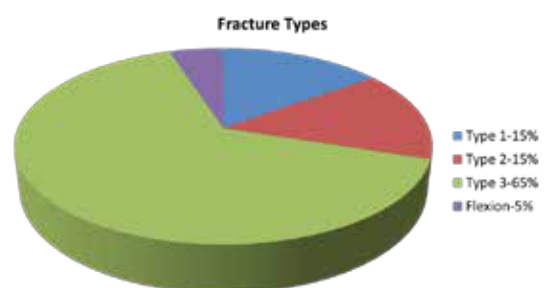


Figure 1: Fracture types

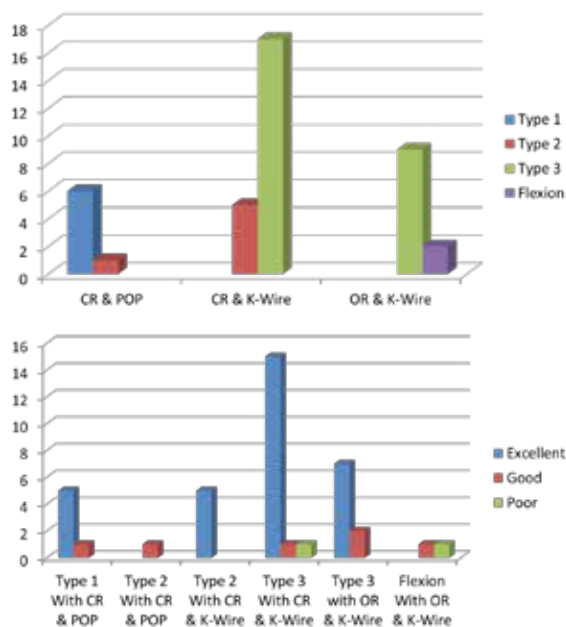


Figure 2: Mode of treatment which was followed.

Fracture types	Treatment done	Results
Type 1	Closed Reduction and POP casting(6)	Excellent(5) Good(1)
Type 2	Closed Reduction and POP casting(1)	Good(1)
Type 3	Closed reduction with Percutaneous K-Wire(5)	Excellent(5)
	Closed Reduction with Percutaneous K-Wire(17)	Excellent(15) Good(1) Poor(1)
	Open Reduction with Percutaneous K-Wire(9)	Excellent(7) Good(2)
Flexion	Open Reduction with Percutaneous K-Wire(2)	Good(1) Poor(1)

Figure 3: Outcome as per Mitchell and Adams criteria



Figure 4: A child with cubitus varus (8°) at 6 months post injury. X-ray showed marked sclerosis of growth plate.



Figure 5: Pre-op and Post-op X-ray of a 2 yrs. old girl.

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