

## Outcome Analysis of Fixation with Titanium Kirschner Wire Versus Stainless Steel Kirschner Wire for Supracondylar Fractures in Children

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### Abstract

**Background:** The supracondylar humeral fracture is one of the common elbow fracture in children. The standard method of managing supracondylar humerus fractures is by Closed reduction and percutaneous fixation with kirschner wire (k-wire). A desirable implant must have the following characteristics : durability, strength, stiffness.

**Materials and Methods:**

30 patients with Gartland type III supracondylar humerus fractures were identified and included in study who has been managed with closed reduction and fixation with kirschner wire. Follow up of patients at 3 weeks for k-wire removal and at 6 wks and at 12 wks after surgery. Functional outcome and ROM were recorded as per Flynn's criteria in each visit.

**Results:** 15 patients were operated with stainless steel k-wires and 15 patients were operated with titanium k-wires. During follow up on 3 months, reduction was maintained in all patients.

**Conclusions:** Both materials of k-wires (titanium & stainless steel) provide satisfactory results with stability, when fracture fixation was adequately reduced. With proper aseptic precautions none of the materials were seen with any infection or loosening. With the price of titanium k-wire in consideration, stainless steel k-wires seems to be more cost effective.

## 1. Introduction

Supra-condylar humerus fractures comprise 55% to 75% of all elbow fractures commonly in age group from 5-8 years. Male to female ratio is 3:2. Non dominant side is most frequently injured. Most common type of displacement is extension type of supracondylar humerus fracture. Its gold standard management is closed reduction internal fixation with percutaneous k wires. The purpose of this review, recognizing the limited quantity of available literature, is to summarize study directly comparing both stainless steel and titanium implant. Our study compares clinical parameters such as functional outcome of CRIF with k wire and radiological changes with fixation in Gartland type -III supra-condylar humerus fractures in terms of loss of reduction, late deformity, and functional outcomes.

## 2. Materials and Methods

This was a prospective randomized study conducted between May 2019 and December 2019.

Children between the ages of 2 and 12 years were included with Type- III Gartland supra-condylar fractures. Children presenting up to 7 days of injury were considered as inclusion criteria. The exclusion criteria for study includes children with open fractures, established compartment syndrome at presentation, transphyseal injuries, vascular injuries, blisters. The children were randomized into two different groups one for fixation with titanium k-wires and other with stainless steel k-wires. Before proceeding for operative fixation a written informed consent was obtained from the parents/legal guardians of each patient.

15 patients had their fracture fixed with titanium kirschner wire and other group of 15 patients had their fracture fixed with stainless

steel kirschner wire. Postoperatively immobilization done with an above elbow slab for 3 weeks

The K wires were removed at 3 weeks on first follow up visit.

Patient was advised aggressive physiotherapy of elbow and active and passive stretching to avoid elbow stiffness. Follow up radiological evaluation were done on 6 wks and 3 months by measuring Baumann's angle and reduction of fracture fragments. Assessment done at 3 months follow up and range of motion of fractured limb is compared to contralateral limb and its outcome was compared based on Flynn's criteria.

## 3. Results

In our study consist of 30 cases selected as per inclusion and exclusion criteria mentioned.

The average age was 7.2 yrs (range 2-12 yrs). 21 cases (70%) were male and 9 cases (30%) were female. 16 on left side and 14 on right side. Displacement in posterolateral in 18 patients, whereas 12 patients has posteromedial displacement. 3 cases had radial nerve palsy at presentation, whereas 2 cases had anterior interosseous nerve palsy. 15 (50%) patients were treated with titanium K-wire fixation and remaining 15 (50%) patients were treated with stainless steel K-wire fixation. Post operatively both titanium k wires and SS wires were found stable and did not had loss of reduction at 3 weeks and 3 months follow up. No cases of nonunion or delayed union were identified and All the fractures eventually healed by 3 months.

Functional outcome was assessed using Flynn's criteria at 6 weeks and 3 months from the day of surgery. Out of all the 30 patients, 26 had excellent, 4 had good functional outcome

**Figure 1: Intraoperative image.**



**(a)**



**(b)**



**(c)**

**Figure 2: (a) Preoperative x ray (b) Immediate postoperative x ray. (c) 3 months follow up X-ray**



**Figure 3: (a) Preoperative x ray (b) Immediate postoperative x ray. (c) 3 months follow up X-ray**

As per Flynn's criteria is mentioned in Table- 2.

In our study, 26 cases had excellent result and 4 had good result, and outcome of SS k wire and titanium k wire were found similar. In our result we observed carrying angle of contralateral upperlimb was comparable in both the groups.(SS and titanium k wire).

With follow up on 3 and 6 weeks k wire found in situ. There was no signs of infection, loosening or migration of k wire. There was no evidence of distal neuro vascular injuries in both the groups.(SS and titanium k wire).

**Table 1: Clinical details of patient**

Sr. no.	Age	Gender	Material (K-wire)	Baumann's angle post-operative	Baumann's angle on final follow-up	Carrying angle at 3 months post-op	Extension at 3 months post-op	Flexion at 3 months post-op	Grading based on Flynn's criteria
1	8	Male	Titanium	72	72	12	0	140	Excellent
2	3	Male	Titanium	75	76	11	3	138	Excellent
3	6	Male	Titanium	71	71	13	4	140	Excellent
4	9	Female	Titanium	68	64	10	0	138	Good
5	9	Male	Titanium	74	74	9	3	142	Excellent
6	8	Male	Titanium	70	71	9	0	140	Excellent
7	10	Female	Titanium	75	75	11	0	135	Excellent
8	9	Male	Titanium	73	74	8	0	140	Excellent
9	10	Male	Titanium	74	75	9	0	140	Excellent
10	9	Female	Titanium	72	74	12	0	136	Excellent
11	10	Male	Titanium	74	75	10	0	138	Excellent
12	11	Male	Titanium	75	75	9	0	140	Excellent
13	10	Male	Titanium	78	78	10	0	144	Excellent
14	8	Male	Titanium	76	76	10	0	140	Excellent
15	9	Female	Titanium	75	75	12	0	132	Good

16	7	Male	SS	79	81	10	0	135	Excellent
17	6	Female	SS	75	77	8	0	140	Excellent
18	7	Male	SS	77	78	9	0	138	Excellent
19	5	Female	SS	80	80	10	0	142	Excellent
20	2	Male	SS	74	74	11	10	140	Excellent
21	5	Male	SS	75	76	9	10	130	Good
22	7	Male	SS	76	76	10	0	140	Excellent
23	7	Female	SS	72	74	8	4	142	Excellent
24	6	Male	SS	72	72	9	0	140	Excellent
25	5	Male	SS	75	75	8	0	138	Excellent
26	8	Female	SS	74	75	8	0	140	Excellent
27	4	Male	SS	72	74	9	-4	136	Excellent
28	7	Male	SS	74	75	10	0	135	Excellent
29	5	Female	SS	72	70	9	0	130	Good
30	6	Male	SS	75	75	9	0	140	Excellent

**Table 2: K-wire material and grading by Flynn’s criteria**

K-wire material	Flynn’s criteria based grading			
	Excellent	Good	Fair	Poor
Titanium	13	2	0	0
Stainless steel	13	2	0	0
Total	26	4	0	0

#### 4. Discussion

Our study was conducted on 30 patients fulfilling inclusion and exclusion criteria of fracture supracondylar humerus. As per global literature closed reduction and internal fixation with percutaneous k wire is gold standard for supra condylar humerus fracture. Stainless steel k-wires seems to be more cost effective in consideration with the price of titanium k-wire.

In our study results of both k wire material showed excellent clinical and radiological parameter and functional outcome was similar.

#### 5. Conclusions

Closed reduction internal fixation with k-wires gives excellent results in supracondylar humerus fracture in paediatric patients with minimal functional loss.

Both stainless steel and titanium k wires gives optimal results with no significant difference in stability and infection.

In our study stainless steel k wires were found to be more cost effective and easily accessible as compared to titanium k wires.

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