K-Wire vs. Screw Fixation in Pediatric Lateral Condyle Fractures: A Multicenter Study of 762 Fractures

Maria Schwabe, Jason L Cummings[1], Kevin M Neal[2], Asdrubal Enrique Rivera, Jaime Rice Denning, Julia S Sanders[3], Rachel Y Goldstein[4], Laura Bellaire[5], Pooya Hosseinzadeh

[1]Washington University in St. Louis School of Medicine, [2]Nemours Children's Specialty Care, [3]Children's Hospital Colorado, [4]ChildrenS Hospital Los Angeles, [5]University of Wisconsin Orthopaedics

INTRODUCTION: Lateral condyle fractures are the second most common elbow fracture in the pediatric population. Although minimally displaced lateral condyle fractures can often be managed nonsurgically, operative intervention is indicated when greater than 2 mm of displacement is noted. Two commonly used fixation methods when managing these fractures surgically are K-wires and screws. Each of these methods has been associated with unique advantages and disadvantages but larger studies directly comparing the outcomes of these two techniques in this patient population are lacking.

METHODS: This retrospective study was performed across 6 different institutions. Using a universal data collection sheet, each institution retrospectively collected the same data points regarding demographics, radiographic outcomes, and complications. Data was collected preoperatively as well as 6 weeks, 3 months, 6 months, and 12 months postoperatively. Patients were divided into two cohorts based on the type of initial treatment: K-wire fixation and screw fixation. Statistical comparisons between these two cohorts were performed with an alpha of 0.05.

RESULTS: A total of 762 patients across the six different institutions met all inclusion criteria and were included in the final analysis, 72.6% (n=553) of which were treated with K-wire fixation (table 1). The majority of fractures in both cohorts were classified as Milch Type 2 (table 2) and treated with open reduction (n=553, 72.6%). The average duration of immobilization was 5 weeks in both cohorts and most patients in this study demonstrated radiographic healing by 11 weeks postsurgically regardless of treatment method (tables 3 and 4). Both those treated with K-wires and those treated with screws demonstrated similar reoperation rates (5.6% vs. 4.3%, p=0.473) and there were no significant differences in any of the reasons for additional operative intervention between the 2 groups (table 5). Elbow stiffness necessitating further intervention with physical therapy was significantly more common in those treated with K-wires than those treated with screws (21.2% vs. 13.9%, p=0.023) as was superficial skin infection (3.8% vs. 0%, p=0.002), but there was no significant difference in nonunion rates between the two groups (2.4% vs. 1.3%, p=1.000) (table 6).

DISCUSSION AND CONCLUSION: This multicenter study of children with lateral humeral condyle fractures has demonstrated similar success rates between K-wire and screw fixation. Contrary to previous studies, we did not find evidence that treatment with screw fixation decreases the likelihood experiencing nonunion. However, given the unique complications associated with K-wire fixation such as elbow stiffness and superficial skin infection, treatment with screw fixation remains a reasonable alternative to K-wire fixation in these patients. Future prospective studies are warranted to confirm these findings.

TABLE 1. Patient demographics

	K-wires	Screws	P-value
Age in years [mean, (SD)]	8.78, (2.83)	7.81, (3.62)	**<0.001**
Sex, n (%)			
Male [n/N (%)]	390/684 (%)	126/181 (0%)	0.515
Weight in one [mean, (SD)]	113.80, (18.40)	118.05, (27.86)	**0.012**
Weight in kg [mean, (SD)]	24.85, (10.66)	25.84, (13.39)	0.901
Weight <50 kg [n/N (%)]	541 (94.9%)	139/181 (0%)	0.092
Height in cm [mean, (SD)]	127.70, (17.62)	128.07 (7.56)	0.147

SD = standard deviation, n = frequency, N (%) = valid percentage.
Bold: Statistically significant

TABLE 2. Fracture classification

	K-wires	Screws	P-value
	n, (N%)		
Song classification			
Stages 1 – 3	111, (28.1%)	57, (28.1%)	**0.020**
Stages 4 – 5	440, (79.9%)	146, (71.9%)	
Jakob classification			
Type I	98, (17.5%)	22, (10.8%)	**0.036**
Type II	461, (82.5%)	182, (89.0%)	**<0.001**
Type 3	250, (45.0%)	58, (28.4%)	**0.003**
Milch classification			
Type I	79 (12.8%)	32, (15.8%)	0.381
Type 2	475, (87.2%)	171, (84.2%)	

n = frequency, N (%) = valid percentage. **Bold**: Statistically significant

TABLE 3. Intervention data

	K-wires	Screws	P-value
Tourniquet time* [mean, (SD)]	30.96, (20.80)	22.28, (32.78)	**<0.001**
Duration of immobilization* [mean, (SD)]	5.12, (1.16)	5.01, (5.19)	0.557
Time to hardware removal* [mean, (SD)]	8.97, (4.28)	26.04, (16.11)	**<0.001**

* Time in minutes. † Time in weeks. **Bold**: Statistically significant.

TABLE 4. Radiographic findings

	K-wires		Screws	
	n, (N%)	Cumulative %†	n, (N%)	Cumulative %†
Radiographic healing*				
6 weeks	128, (42.5%)	54.9%	72, (34.4%)	94.4%
11 weeks	122, (52.1%)	97.1%	66, (28.7%)	97.7%
6 months	72, (13.0%)	97.5%	42, (20.1%)	97.7%
12 months	2, (0.4%)	97.9%	1, (0.5%)	98.3%

* Described as patients that achieved complete healing by that time.
† Out of 455 reported. *Out of 178 reported. n = frequency. N% = out of total sample.

TABLE 5. Additional operative intervention

	K-wires (n = 553)	Screws (n = 209)	OR (95% CI)	P-value
Surgical irrigation and debridement	2	1	2.20 (0.27 – 18.07)	0.488
Osteotomy	2	1	0.73 (0.07 – 8.37)	1.000
Surgery to treat non-union	13	3	1.65 (0.47 – 5.86)	0.577
Contracture release	2	2	0.38 (0.05 – 2.68)	0.303
Unplanned Hardware removal	7	1	0.88 (0.25 – 3.44)	1.000

TABLE 6. Complications

	K-wires (n = 553)	Screws (n = 209)	OR (95% CI)	P-value
Stiffness	117	29	**1.66 (1.07 – 2.59)**	**0.023**
Superficial infection	21	0		**0.002**
Deep infection	7	1	2.67 (0.33 – 23.81)	0.457
Non-union	13	4	1.25 (0.40 – 3.83)	1.000
Hardware problems*	5	4	0.47 (0.12 – 1.78)	0.268
Bone deformity†	11	3	0.98 (0.35 – 2.75)	1.000

Bold: Statistically significant. * Buried, migration, loosening. † Bone spur, lateral prominence, carrying angle.