Just Two May Do:
Comparing Two-Pin to Three-Pin Lateral Constructs as Treatment for Type III Supracondylar Humerus Fractures

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Introduction: Type III supracondylar humerus (SCH) fractures are common, highly displaced pediatric elbow injuries typically managed with closed reduction percutaneous pinning (CRPP). While 3-pin lateral constructs are widely accepted as the optimal management, some literature questions the necessity of a third pin which presents opportunity for complications. This study sought to compare the outcomes of 2-pin and 3-pin lateral constructs for Type III SCH fractures, hypothesizing no difference in post-operative outcomes.

Methods: A retrospective, single institution, comparative study of patients <16 years treated for a Type III SCH fracture was conducted between November 2007 and October 2017. Patients were identified using elbow fracture CPT codes and only included if treated with CRPP using 2- or 3- pin lateral constructs. Demographics, pre-operative injury characteristics, pin-construct, surgical duration, and post-operative complications were analyzed between pin construct groups using independent t-tests and Fisher exact tests.

Results: Of 369 patients (5.9±2.6 years, 55% female), 253 (68.6%) received 2-pin constructs. The 3-pin group had significantly higher rates of pre-operative neurovascular injury, tenting, and open fractures ($p<0.05$). No differences in the rates of adverse post-operative outcomes (loss of mechanical stability, infection, reoperation, etc.) were observed ($p>0.10$). However, there was a longer surgical duration noted in the 3-pin group ($p=0.002$).

Discussions: This analysis demonstrates that select Type III SCH fractures can be appropriately treated with 2-pin lateral constructs with low rates of fixation loss and post-operative complications. Further, compared to 2-pin lateral constructs, a 3-pin construct may be indicated for more unstable or severe fractures based on pre-operative injury characteristics without significant increases in post-operative complications such as neurovascular injury or infection that might be expected with an additional pin. Surgeons should use their best judgment intraoperatively when determining pin constructs. Selective placement of a third pin based on intraoperative stability testing may substantially reduce unnecessary hardware use in the treatment of Type III supracondylar humerus fractures, challenging the conventional "three pins for Type III" paradigm. This study is not without limitations. The groups were not randomized, as the decision to use a 2- or 3-pin construct was determined by the operating surgeon, introducing the potential for selection bias. Additionally the study may have been underpowered to detect small differences between the cohorts. However, this study was relatively large compared to other relevant studies, and the surgeon's ability to choose the number of pins might further strengthen the conclusion that the 3rd pin may not be necessary when determined by an experienced surgeon.

Significance/Clinical Relevance: From these results, orthopedic surgeons can feel more confident in using their clinical judgment and challenge simplified paradigms when operating on Type III SCH. They should take into account pre-operative injury characteristics, intraoperative stability testing, and clinical experience to determine which patients may not need the additional 3rd lateral pin.

Table I. Demographics by Group (Pin Number)

	2 Pins (n=253)	3 Pins (n=116)	P-value
Sex (Female)	135 (53.36%)	48 (41.38%)	0.0339*
Age (Years)	5.513 ± 2.42	6.599 ± 2.77	0.0002*
Weight (kg)	21.62 ± 11.02	25.79 ± 8.41	0.0001*

Table II. Pre-Operative Fracture Characteristics by Group (Pin Number)

	2 Pins (n=253)	3 Pins (n=116)	P-value
Neurovascular Injury	38 (15.02%)	34 (29.31%)	0.0018*
Tenting	3 (1.19%)	8 (6.90%)	0.0053*
Open Fracture	1 (0.40%)	4 (3.45%)	0.0355*
Polytrauma	11 (4.35%)	4 (3.45%)	0.7839
Floating Elbow	15 (5.93%)	7 (6.03%)	>0.9999

Table III. Surgical Duration and Post-Operative Complications by Group (Pin Number)

	2 Pins (n=253)	3 Pins (n =116)	P-value
Surgical Duration (min)	29.72 ± 15.24	35.59 ± 19.72	0.002*
Loss of Mechanical Stability	3 (1.19%)	1 (0.86%)	>0.9999
Avascular Necrosis	1 (0.40%)	0 (0.00%)	>0.9999
Pin Tract Infection (PTI)	4 (1.58%)	1 (0.86%)	>0.9999
All Infections (PTI + Deep)	6 (2.37%)	3 (2.59%)	>0.9999
Reoperation	2 (0.79%)	3 (2.59%)	0.1812