

## Displaced Medial Epicondyle Fractures in Children: Comparative Effectiveness of Surgical Treatment Versus Nonsurgical Treatment

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**Purpose:** The purpose of this study was to assess the comparative effectiveness of surgical versus nonsurgical treatment for pediatric patients with acute, displaced medial epicondyle fractures.

**Methods:** This retrospective, comparative study included 56 children (31 female, 25 male) under age 18 years with an acute, displaced medial epicondyle fracture treated between 2000 and 2011 and with at least 1 year clinical follow-up. Medical records were searched for demographic, surgical, and functional data (range of motion, pain, symptoms, and limitations). Displacement was measured on radiographic injury films. Patients were contacted by phone for completion of the validated QuickDASH (an abbreviated version of the Disabilities of the Arm, Shoulder and Hand [DASH] questionnaire. Outcomes of surgical and nonsurgical treatment were compared using Mann-Whitney and Fisher exact tests and linear regressions controlling for age and maximum displacement.

**Results:** Of the 56 patients (mean age, 11 years; range, 4-17) with displaced medial epicondyle fractures, 41 were treated surgically and 15 nonsurgically. The surgically treated patients were older (12.0 vs 9.6 years,  $P = 0.036$ ), had greater maximum displacement (11.0 vs 7.9 mm,  $P = 0.011$ ), and shorter immobilization (3 vs 4 weeks,  $P = 0.014$ ) than the nonsurgically treated patients. The two groups did not differ in range of motion, pain, or patient-reported functional outcomes at most recent follow-up ( $P > 0.05$ ). Fracture dislocations occurred in 41% (17 of 41) of surgically treated and 33% (5 of 15) nonsurgically treated patients. Patients with dislocated fractures were more likely to have long-term functional disability, regardless of age, maximum displacement, or treatment ( $P = 0.040$ ). Complications occurred in 53% of patients (8 of 15) in the nonsurgical group and included arthrofibrosis, two ulnar neuropathies, three refractures, and three nonunions. Seven nonsurgically treated patients advanced to surgical treatment within 3 years, and five had residual functional limitations.

**Conclusion:** Our findings demonstrate a high failure rate (47%) of nonsurgically treated medial epicondyle fractures. Nonsurgical treatment is only recommended for fractures without elbow dislocation that do not contain an intra-articular fragment.

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### **A Prospective Cohort Study of the Adoption of Titanium Elastic Intramedullary Nails for the Treatment of Femur Fractures in Kumasi, Ghana**

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**Background/Purpose:** Elastic intramedullary nails (EIN) have been shown to be effective in the treatment of transverse and short oblique femur fractures in children. No studies have compared outcomes of EIN versus skin traction for pediatric femur fractures. At Komfo Anokye Teaching Hospital (KATH), prior to 2010, all pediatric femur fractures were treated with skin traction until union. This study was designed to compare the early results and cost of EIN versus skin traction and determine health-related quality of life (HRQOL) outcomes of children with femur fractures stabilized with EIN.

**Methods:** This was a prospective observational study of 83 pediatric patients age 3 to 14 years presenting with closed femur fractures at KATH from January to December 2010. Implant costs were borne by the patient's family. Those who did not purchase implants were treated with skin traction until union, and this comprised the control group. Patient and injury demographics, initial radiographs, postoperative radiographic outcomes, length of stay, and total costs were compared between groups. The child's HRQOL at 6 months was assessed using the pediatric quality of life inventory (PedsQL).

**Results:** There was significantly better radiographic alignment in the 45 children treated with elastic nails. Average posttreatment length of stay was 30.8 days in the traction group versus 15.6 days in the EIN group ( $P = 0.001$ ). Cost of hospitalization was significantly lower in the EIN group ( $P = 0.039$ ). The mean HRQOL remained significantly lower in total score (63.4) and in all five subscales (physical health, 64.9; psychosocial health, 63.0; emotional functioning, 68.0; social functioning, 68.3; and school functioning, 51.33) than the general population mean at average 6-month follow-up.

**Conclusions:** In this prospective observational cohort study of pediatric femoral fractures in Kumasi, Ghana, treatment with EIN resulted in superior radiographic outcomes, shorter hospital stay, and decreased hospital cost in comparison to skin traction. At 6 months, HRQOL remained significantly impacted in children who sustained femur fractures stabilized by EIN.

**Refracture Rates Following Clavicle Shaft Fractures in Children:  
Angulation-Only Fractures Versus Completely Displaced Fractures***Michelle Masnovi, MS; Charles T. Mehlman, DO, MPH;**Cincinnati Children's Hospital Medical Center, Cincinnati, Ohio, USA*

**Purpose:** A growing body of literature has focused on completely displaced clavicle fractures, but there has been remarkably little attention focused on angulated fractures. The purpose of this study was to assess refracture rates following angulation only and completely displaced clavicle shaft fractures in children.

**Methods:** We performed computerized medical records searches aimed at identifying children treated for clavicle shaft fractures at our institution. Inclusion criteria were age less than 18 years and a minimum of 1 year radiographic follow-up. Statistical methods included Fisher's exact test with significant probability values being defined as less than 0.05.

**Results:** We identified 121 angulation-only patients and 41 completely displaced patients that met the criteria to be included in our study. All fractures were treated nonsurgically. We identified a significantly higher ( $P = 0.008$ ) refracture rate (18%, 22 of 121) in angulation-only fractures as compared to 0% (0 of 41) for completely displaced fractures. Subgroup analysis of the angulation-only fractures revealed that fractures angulated less than 40° refractured at a 26% rate (18 of 69) versus 8% (4 of 52) of fractures with greater angulation ( $P = 0.009$ ).

**Conclusion:** We found that angulation-only shaft fractures had a significantly higher refracture rate than completely displaced fractures. Subgroup analysis demonstrated that less angulated fractures had a higher refracture rate than the more angulated ones. We feel this somewhat paradoxical finding is analogous to greenstick fractures of the forearm shaft that refracture at a higher rate than complete forearm shaft fractures due to less exuberant callus formation.

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**Predicting Redisplacements of Diaphyseal Forearm Fractures:  
How About the Three-Point Index?**

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**Background/Purpose:** Redisplacement is the most common complication during the cast treatment of forearm diaphyseal fractures in children. It would seem to be worth making an effort to apply the three-point index (TPI) to diaphyseal forearm fractures, as it has previously been found to most accurately predict redisplacement in the distal radius. The index is based on the three-point fixation principle in the cast treatment. The aim of this prospective study was to determine the effect of cast-related indices and other factors that could play a role in redisplacement.

**Methods:** 76 children were included. Age, initial complete displacement, reduction quality, location of the fracture, having fractures at different levels, and quality of the casting (according to TPI, cast index, Canterbury index, padding index) of each patient were analyzed as possible risk factors. Logistic regression analysis was utilized to search for risk factors.

**Results:** A total of 18 of 76 fractures were redisplaced in the cast. A TPI value higher than 0.8 was the only significant risk factor for redisplacement at 239 times more likely to redisplace ( $P < 0.001$ ; odds ratio: 238.5; 95% confidence interval: 7.063-8054.86) than those with lower values. The TPI was far superior to other cast-related indices with a sensitivity of 84% and a specificity of 97%.

**Conclusion:** A cast lacking adequate three-point fixation is the major risk factor for a forthcoming redisplacement of a diaphyseal forearm fracture of the children.

### Factors Associated With Nonunion in 97 Consecutive Type 2 and Type 3 Odontoid Fractures in Elderly Patients

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**Purpose:** Odontoid fractures are the most common cervical spine injury in older adults and have high rates of morbidity and mortality. The purpose of this study was to determine factors that were associated with nonunion in odontoid fractures.

**Methods:** Between 2002 and 2011, 97 consecutive patients, age 65 years and over, with type 2 and type 3 odontoid fractures were treated at a single Level I trauma center, were followed in a single private practice, and retrospectively evaluated. Radiographs were reviewed and fusion was determined by flexion/extension x-rays, CT scan, or both. 23 mortalities occurred prior to 6 months postinjury, and they were excluded from the fusion analysis. One patient was lost to follow-up prior to evaluation for fusion.

**Results:** There were 31 males (42%) and 42 females with a mean age of 80 (range, 65-93) who were evaluated for fusion of their type 2 (55, 75%) or 3 (18, 25%) odontoid fracture. Mean body mass index (BMI) was 26.9 (range, 17.1-37.5). The overall fusion rate in the 73 patients who were living at the time of fusion analysis was 71.2%. Patients treated with nonsurgical management had a lower rate of fusion (31 of 51, 60.8%) compared to patients who were treated with surgery (21 of 22, 95.5%) ( $\chi^2 = 0.003$ ). Males had a lower fusion rate (18 of 31, 58.1%) than females (34 of 42, 81%) ( $\chi^2 = 0.033$ ). Fusion was affected by comorbidities. Those with fusion had a lower Charlson score (1.65) than those who did not fuse (2.67) ( $t = -2.045$ , sig = 0.045). Additionally, congestive heart failure (CHF) was a significant independent medical comorbidity associated with nonunion. Out of the 21 patients who were found to have nonunion, 8 (38.1%) had a diagnosis of CHF at the time of admission. 52 patients were found to have a fusion of their odontoid fracture, and only 4 of those patients had CHF (7.7%) ( $\chi^2 = 0.002$ ). Factors without statistical significance included age, BMI, tobacco use, sagittal fracture displacement, direction of displacement, type of odontoid fracture, odontoid angle, time to surgery, method of nonsurgical management, time to discontinuation of rigid collar, and surgical technique.

**Conclusion:** Factors associated with nonunion in older patients with odontoid fractures include: nonsurgical treatment, males, higher numbers of medical comorbidities, and congestive heart failure.

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