Delayed Next-Day Fixation of Pediatric Supracondylar Humerus Fractures Does Not Influence Postoperative Complications Regardless of Fracture Severity

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INTRODUCTION:

Supracondylar humerus (SCH) fractures are among the most common fractures about the pediatric elbow, occurring with an incidence of 180 per 100,000. Approximately 23% of pediatric SCH fractures undergo surgery. Appropriate management of SCHFs is important not only to prevent physical deformity or poor functional outcomes in the short and long term.

Operative and non-operative management of SCHFs has been guided for decades by the Gartland Classification, which describes SCH fractures with increasing levels of displacement and severity. Traditionally, the presence of nerve palsy and/or the concern for vascular compromise influence surgical fixation and timing of intervention, often necessitating emergent intervention. Operative SCH fractures are commonly treated with closed reduction and percutaneous pinning, although some occasionally require open reduction to be performed. Historically, markedly displaced fractures, open fractures, those presenting with a nerve palsy, and those with concern for vascular compromise have been taken to the operating room in emergent or urgent fashion. Even routine, non-complicated SCH fractures have been commonly taken to the operating room in the middle of the night for fear of developing one of these complications. Over the last few years, however, the common doctrine pertaining to timing of treatment for SCHFs has come into question, and large variability of preoperative outcome predictive factors and surgical timing exists. At our institution upon arrival, SCHF's have traditionally undergone assessment and closed reduction in splinting in the emergency department, regardless of neurovascular status. Upon reduction and splinting, neurovascular status has been reassessed, and only patients with concern for a non-perfused hand or grossly contaminated open fractures have been emergently taken to the operating room for emergent intervention. All other fractures, including those with nerve palsies and lack of pulses with a pink and well-perfused hand are reduced, splinted, and observed overnight with surgery occurring the following day.

The purpose of this study was to investigate the outcomes of our conservative approach to initial management of SCHFs that require surgical fixation. Our primary hypothesis is that the current treatment protocol does not lead to worse postoperative outcomes of nerve palsy, infection, malunion/nonunion, or postop stiffness. Secondarily, we hypothesized that the fracture classification type and nerve palsy at presentation will not influence the aforementioned postoperative complications. Additionally, we investigated the relationships between a multitude of patient demographics, injury characteristics, and intraoperative factors with respect to their influence on postoperative outcomes.

METHODS:

This study was granted IRB exempt status by our institutional review board due to its patient de-identified, retrospective nature. Inclusion criteria were established to all patients aged 1-18 undergoing at minimum, closed reduction and percutaneous pinning (searched via CPT coded) for supracondylar humerus fractures, open or closed, at a single Level 1 pediatric children's trauma center over an 8-year period from 2015 through 2023. Patients were required to have been evaluated in our emergency department and to have undergone surgical intervention during the same admission. Preoperative arrival information, injury and fracture characteristics, and physical examination characteristics were collected. Operative and hospital stay related information, as well as follow-up information such as time to pin removal, physical therapy referrals and/or patient stiffness, resolution of nerve palsy, and length of follow up were collected. Descriptives, Chi square, t tests, ANOVA, and non-parametric Mann-Whitney and Kruskal Wallis statistical tests were used to analyze the data. Data analysis was done in SPSS 29.0 (IBM, New York).

RESULTS:

Our study included 505 patient charts for review. The majority were male (55%) at an average age of 6.3 years. 70% of our patients were transferred from outside facilities, and falls were the most common injury mechanism (88%). There were 81 Gartland Type 2 fractures, 378 Type 3, 40 Type 4, and 5 Type 5 (other) injuries. 34% of operative cases occurred on weekends. 7.9% occurred after-hours. Nerve palsies were identified in 50 patients, 11 of which were considered to have iatrogenically developed. There was 1 documented vascular injury requiring repair, and zero incidences of compartment syndrome. There was one neurological deficit that had not resolved at last follow-up. One patient developed a postoperative infection requiring irrigation and debridement.

Iatrogenic median nerve palsies were more likely to occur during daytime operations ($p<0.05$), however the presence of any palsy and multiple palsies simultaneously were more likely to undergo surgical intervention at night ($p<0.05$). Development of all-cause iatrogenic palsy, pin tract infections/surgical site infections, nonunion, and range of motion deficits requiring physical therapy were not related to day or timing of surgical intervention, fracture classification level, open fracture, presence of palsy, or number of pins used ($p<0.05$). Open fractures and delayed pin removal did not influence the development of pin tract infections or surgical site wound complications.

DISCUSSION AND CONCLUSION:

Our data demonstrate complication rates that fall within or below the range of previously reported literature, despite our institution's protocol of closed reduction and delaying surgery until the following day when appropriate. Our findings suggest that, unlike previously suspected, delaying surgical care and avoiding overnight operations does not lead to inferior outcomes. Our data is limited by the retrospective nature of the study. We were unable to analyze certain outcome characteristics and their relationship with preoperative and intraoperative factors because the nature complication rate was so low. A larger study may be needed to further investigate such rare complications.