

## Original Contributions

### PEDIATRIC CLAVICULAR FRACTURES: ASSESSMENT OF FRACTURE PATTERNS AND PREDICTORS OF COMPLICATED OUTCOME

Benjamin Jacob Strauss, BSc,\* Timothy P. Carey, MD, FRCSC,\*† Jamie A. Seabrook, MA,†§  
and Rodrick Lim, MD, FRCPC, FAAP\*†§

\*Schulich School of Medicine, †Department of Surgery, ‡Department of Paediatrics, the University of Western Ontario, London, Ontario, Canada, and §Children's Health Research Institute, the Children's Hospital at London Health Sciences Centre, London, Ontario, Canada  
Reprint Address: Rodrick Lim, MD, FRCPC, FAAP, Department of Paediatrics, Children's Hospital at London Health Sciences Centre, 800 Commissioners Road East, London, ON N6C 2V5, Canada

**Abstract—Background:** Clavicular fractures are the most common pediatric long-bone fracture, and although the vast majority heal with supportive treatment, complications do occur and can lead to pain and disability. Although many studies have characterized adult complication rates and risk factors, to our knowledge no comparable studies to date have looked at clavicular fractures in the pediatric population. **Study Objectives:** The study aim was to identify the radiological and clinical variables that increase the complication rate of clavicular fractures. **Identification of these variables would help emergency physicians identify patients who require more thorough follow-up or surgical intervention. Methods:** We analyzed radiographs of 537 clavicular fractures on initial presentation to the Pediatric Emergency Department at the Children's Hospital at London Health Sciences Center over a 4-year period, collecting data on variables such as displacement, angulation, and comminution, as well as demographic data such as age and gender. We then determined the outcome of each fracture by reviewing each patient's chart, and through a logistic regression analysis, determined the variables associated with complications. **Results:** Of all the fractures treated supportively (i.e., non-operatively), only 2.5% resulted in a complication. Our analysis determined that patient age was an independent predictor of complications, with each year past zero conferring an 18.1% increase in risk of complication. Furthermore, completely displaced fractures were shown to increase the odds of complication by a factor of 3.2. **Conclusion:** These findings help the emergency physician

identify a group of high-risk pediatric patients with clavicular fractures for which more thorough follow-up should be considered. © 2012 Elsevier Inc.

**Keywords—**pediatric; clavicle fracture; treatment; risk factors; nonunion; malunion

#### INTRODUCTION

Fractures of the clavicle are frequently seen in the pediatric emergency department (ED); they comprise 10–15% of all pediatric fractures, and the clavicle is the most common of the long bones to sustain a fracture in children (age < 18 years) (1). Furthermore, clavicular fractures occur significantly more often in children than in adults (2). The majority of fractures of the clavicle heal without complication and have a positive outcome; nevertheless, serious complications can occur, and include nonunion, malunion, and refracture, causing symptoms such as chronic pain, decreased range of motion, weakness, or cosmetic deformity (3–5).

Both prospective and retrospective studies have been conducted in adults to determine the rate of these complications, particularly the rate of nonunion. Early studies conducted in the 1960s determined the occurrence of nonunion to be extremely rare in adults: 4 nonunions were seen in 566 patients in one study and 3 nonunions

in 2235 in another (3–6). However, more recent analyses have determined the adult rate to be higher, between 5% and 6% of all clavicular fractures (7–9). Pediatric complication rates are also felt to be rare; a recent study looked at 793 children aged 14 years and under and found no patients with nonunions or refractures (10,11). This suggests that there may not be a need to follow these fractures until healing.

Several adult studies have been conducted that attempt to determine the risk factors that contribute to increased nonunion rates. These factors fall into two categories: patient-related factors (such as age, gender, medical comorbidity, tobacco or alcohol consumption) and fracture-related factors (such as displacement, location of fracture, angulation, and comminution) (8). Higher rates of nonunion are observed (up to 15%) in patients with complete displacement (8,12,13). Other risk factors identified include increasing age, female gender, and the presence of comminution (8). Patients presenting with these factors are now considered more likely to benefit from operative treatment, as shown in various studies, including a randomized, controlled trial (14–16). None of these studies, however, have looked at risk factors in the pediatric population, despite children representing a significant fraction of total clavicular fractures.

The aim of our study was to examine the effect of various patient-related and fracture-related factors on the clavicular fracture complication rate in the pediatric population. We accomplished this through a retrospective chart audit of all pediatric patients presenting to the Pediatric Emergency Department at the Children's Hospital at London Health Sciences Center over the past 4 years with a fractured clavicle. We hoped to determine whether the risk factors identified in the adult population extend to the pediatric population, or if a new set of risk factors for complications exist in pediatric clavicle fractures. This may be useful in identifying a high-risk group at initial presentation, to ensure proper treatment and follow-up.

## METHODS

Our retrospective study aimed to include all patients presenting to the Pediatric Emergency Department at the Children's Hospital at London Health Sciences Center with a clavicle fracture between April 2006 and March 2010. The department serves children between the ages of 0 and 17 years. Our search produced 537 cases of clavicle fracture (394 boys and 143 girls with a median age of 10 years, interquartile range, 5–14 years).

Plain film radiographs taken at the initial ED visit were analyzed to characterize the fractured clavicle. Although we do not know the time between injury and the initial visit, none of the radiographs showed any signs of healing (such as callus formation). Location of the fracture was

assigned to one of three locations: medial, diaphyseal, and lateral. Medial was defined as fractures located medial to a vertical line drawn upward from the center of the first rib; lateral was defined as fractures located lateral to a vertical line drawn upward from the base of the coracoid process. Diaphyseal fractures referred to fractures located in between these two landmarks. Fractures were also categorized as displaced or non-displaced. Of the displaced fractures, displacement length in millimeters was recorded, as well as whether or not the bone ends were completely displaced. Displaced fractures were further categorized into either a translational displacement, lengthening, or shortening (due to overlap of the bone segments). Because the pediatric population represents a large range of clavicle lengths (35.2–192.7 mm in our study), we decided that displacement length as a percentage of total clavicle length would be a better indicator of severity than absolute displacement alone. Therefore, we decided to include this parameter in our study. Angulation of the fracture was recorded in degrees, and comminution was recorded as either present or absent.

Electronic records of orthopedic clinic appointments, documents, and imaging for each fracture were retrieved using our center's electronic medical records, which are linked electronically to the vast majority of peripheral hospitals within our geographic catchment area. This information was used to determine the fracture outcome. Due to the unique geographic location of our institution, as the only pediatric orthopedic referral center in the region, patients with clavicular fracture who were never seen in clinic were assumed to have an uncomplicated outcome. Similarly, we assumed that if no evidence of any complication was found in the electronic record, then there was no complication in reality.

We defined delayed union as lack of bone fusion at 3 months, and nonunion as lack of fusion at 6 months. In order for a complication to be labeled as a refracture, two conditions had to be met: the refracture occurred within 6 months of the original fracture, and the refracture intersected the fracture line of the original fracture or, at the minimum, went through the forming callus.

## Statistics

Data were analyzed using Predictive Analytics Software, version 18.0 (IBM, Armonk, New York). Continuous variables are reported as median and interquartile range. Categorical variables are reported as percentages with 95% confidence intervals (CI). Mann-Whitney test was used to assess differences in continuous outcomes between categorical independent variables. The chi-squared test was used to compare differences in complications between categorical independent variables. Pearson's correlation coefficient was used to assess

Download English Version:

<https://daneshyari.com/en/article/3249720>

Download Persian Version:

<https://daneshyari.com/article/3249720>

[Daneshyari.com](https://daneshyari.com)