SCIENTIFIC ARTICLE

Obesity and Failure of Nonsurgical Management of Pediatric Both-Bone Forearm Fractures

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Purpose In pediatric extremity fractures treated nonsurgically, maintaining reduction can be difficult in obese children owing to the larger soft tissue envelope. The purpose of this study was to investigate the relationship between obesity and failure of nonsurgical management of pediatric both-bone forearm fractures.

Methods We conducted a retrospective review of 129 skeletally immature patients older than 2 years who received nonsurgical treatment for closed radius and ulna shaft fractures at a level I pediatric trauma center between 2011 and 2014. The patients were divided into 2 groups: (1) normal-weight children and (2) overweight and obese children. The primary outcome measure was failure of nonsurgical management, defined as the indication for repeat closed reduction under anesthesia or surgical intervention owing to unacceptable angulation after initial closed treatment.

Results Of the 129 patients included in the study, 34 patients (26%) were female and 95 patients (74%) were male. Seventy-six patients (59%) were normal weight, 27 patients (22%) were obese, and 26 patients (20%) were overweight. Eighteen percent (14 of 76) of normal-weight children failed nonsurgical management compared with 34% (18 of 53) of overweight and obese children. Twenty-nine percent (4 of 14) of normal-weight children who failed nonsurgical management required surgery compared with 56% (10 of 18) of overweight and obese children.

Conclusions Overweight and obese children have a significantly higher rate of failure of nonsurgical management of both-bone forearm fractures compared with normal-weight children. These patients may benefit from closer clinical follow-up and a lower threshold for surgical intervention. *(J Hand Surg Am. 2017;■(■):1.e1-e5. Copyright © 2017 by the American Society for Surgery of the Hand. All rights reserved.)*

Type of study/level of evidence Prognosis II.

Key words Pediatrics, obesity, upper extremity, forearm fracture.

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OBESITY IS A SERIOUS HEALTH PROBLEM among children in the United States. Approximately 17% of children and adolescents aged 2 to 19 years are obese.[1,2] In addition to being associated with numerous medical comorbidities, obesity in children has been associated with orthopedic conditions such as Blount disease, tibia vara, slipped capital femoral epiphysis, and genu valgum.[3]

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Obesity has also been associated with a higher prevalence and increased risk and severity of extremity fractures.[4–11] Obese children are theoretically at a higher risk for sustaining extremity fractures owing to factors such altered balance and gait and relatively lower bone mineral density for their weight compared with normal weight children.[12,13] In pediatric fractures treated nonsurgically, particularly both-bone forearm fractures, maintaining proper alignment can be difficult in obese children owing to the larger soft tissue envelope. In this way, obesity can lead to loss of fracture reduction and increase the likelihood of needing subsequent surgical management.[12,14]

It is important to maintain adequate reduction because malunions of pediatric forearm fractures can potentially result in functional limitations.[15] The gold standard for the initial management of closed both-bone forearm fractures is closed reduction and immobilization.[14,16] The purpose of this study was to investigate the relationship between obesity and failure of nonsurgical management of pediatric both-bone forearm fractures.

MATERIALS AND METHODS

We conducted a retrospective review of skeletally immature patients older than 2 years who received initial orthopedic evaluation and treatment for closed radius and ulna shaft fractures at a level I pediatric trauma center between January 2011 and July 2014. Institutional review board approval was obtained. Patients were identified utilizing *International Classification of Diseases,* Ninth Revision, codes. Patients with radius and ulna shaft fractures initially treated nonsurgically with an orthosis or cast were included in the study. A comprehensive review of medical records and radiographic studies was conducted. Radiographic parameters based on previous studies were used to assess the adequacy of the initial reduction.[7,16,17] Reduction was considered adequate if it met the criteria shown in Table 1. Exclusion criteria were as follows: failure to meet acceptable parameters for initial reduction, initial surgical treatment, lack of clinical follow-up to healing, multiple traumatic injuries, comminuted fractures, open fractures, absence of data needed to calculate body mass index, or metabolic disorders affecting bone. Patients were divided into weight status categories, based on the criteria established by the Centers for Disease Control and Prevention as seen in Table 2. The overweight and obese groups were combined for data analysis. The underweight group was not included.

The protocol for management of forearm fractures at our institution, which applied to all cases in this study, is initial closed reduction and stabilization with an orthosis or a cast in the emergency room by the orthopedic surgery resident on call. The first follow-up visit occurs at 1 week, and subsequently patients return for routine follow-up visits at 2-week intervals. The initial orthosis or cast is changed to a long-arm cast typically after 3 weeks, when the fracture has demonstrated adequate callus formation. The patients are followed every 2 weeks after that until the fracture is healed, as demonstrated radiographically by evidence of bridging bone formation at 3 out of 4 cortices. At this time, cast immobilization is discontinued. The patients are placed into a removable forearm fracture brace for 2 to 3 weeks and subsequently allowed to return to activities as tolerated.

The primary outcome measure in this study was failure of nonsurgical management, defined as the indication for repeat closed reduction under sedation or surgical intervention owing to unacceptable angulation after initially adequate closed treatment. All patients who failed nonsurgical management initially underwent attempted repeat closed reduction, and surgical intervention was pursued if attempted repeat closed reduction failed to maintain the fracture within acceptable radiographic parameters.

Statistics

Descriptive statistics were utilized to characterize the patient groups. Bivariate preliminary analyses were conducted and subsequently modeled using multivariable logistic regression analysis to assess the relationship between obesity and failure of nonsurgical management taking into account age, fracture location, and fracture type. Statistical significance was defined as a P value less than .05.

RESULTS

Demographics

We identified 138 patients for inclusion in the study group. Nine patients were lost to follow-up, leaving 129 patients in the final study group. Demographic data are summarized in Table 3.

Of the 129 patients included in the study, 34 patients (26%) were female and 95 patients (74%) were male. Seventy-six patients (59%) were normal weight, 27 patients (22%) were obese, and 26 patients (20%) were overweight.

Fracture characteristics and mechanism of injury

The most common fracture location in both groups was distal third diaphyseal, and the most common fracture pattern in both groups was complete.