Medial Epicondyle Fractures in Children and Adolescents: Shifting Care from General Hospitals to Children's Hospitals?

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Objectives To determine if there is a shift in the treatment of children with medial epicondyle fractures toward children's hospitals, and to explore potential confounders of any observed effect.

Study design The Healthcare Cost and Utilization Project Kids' Inpatient Database was used to examine the epidemiology of medial epicondyle fractures, particularly with attention to whether they were admitted to a general hospital or a children's hospital (defined as free-standing children's hospitals, specialty children's hospitals, and children's units within general hospitals). Age and insurance payer status were also collected and evaluated as potential confounders.

Results The proportion of medial epicondyle hospital discharges from children's hospitals increased (from 29%-46%; $P < .001$), and the proportion of discharges from general hospitals declined over the study period (from 71%-42%; $P < .001$). Age and insurance payer status both remained consistent throughout the study period and did not contribute to this finding.

Conclusions This study demonstrates an increase in the proportion of discharges for pediatric medial epicondyle fractures from children's hospitals. Although this finding is likely multifactorial, it may represent increasing subspecialization and increasing medical liability when treating children. Children's hospitals should identify those conditions which will continue to increase in number and consider constructing clinical pathways in order to optimize delivery of care and resource utilization. *(J Pediatr 2015;167:1116-20)*.

Medial epicondyle fractures of the distal humerus account for 12% of pediatric elbow fractures, and most commonly occur between the ages of 9 and 14 years.[1,2] Although these injuries are occasionally associated with complicated presentations including intra-articular incarceration of fracture fragments, ulnohumeral dislocation, ulnar nerve injury, and concomitant fractures, good outcomes can be expected with both operative and nonoperative treatment in most children.[3-7] The reported treatment success with both operative and nonoperative treatment and the lack of high-level clinical evidence to create universally accepted operative indications, makes clinical decision making controversial.[8,9]

In light of this, and in the current healthcare setting of decreasing reimbursement and increasing liability with child-related malpractice claims,[10-12] subspecialization and compartmentalization of care is increasing. Care "silos" have started to emerge allowing for optimal resource utilization. It is well-known that surgeons and centers with increased volume of a given surgical procedure tend to have better outcomes.[13-19] This has been shown to be true for pediatric elbow fracture care as well.[20] According to the Agency for Healthcare Research and Quality (AHRQ), there may be significant differences in practice patterns, severity of illness, and available services between children's hospitals and other hospitals.[21] Knowing how referral patterns change over time can help hospital systems and other stakeholders optimize patient referrals, create standardized clinical pathways, and reorganize resources to where they may be best used.

By understanding the complex referral patterns between general and children's hospitals, one can understand what institutional characteristics are important to improve the care for children and adolescents, and anticipate how resources may be optimally used within the healthcare system.[22,23] The purpose of this study was to investigate children's fracture referral patterns using medial epicondyle fractures as a model experienced by skeletally immature patients, adolescents, and young adults alike (which could be treated at both children's hospitals and general hospitals). We hypothesized that there would be an increasing proportion of surgical treatment of these fractures in children's hospitals (defined as free-standing children's hospitals, specialty children's hospitals, and children's units within general hospitals) compared with general hospital admissions. Further, we hypothesized that such a finding would not be explained by changes in age and/or payer demographics.

AHRQ	Agency for Healthcare Research and Quality
KID	Kids' Inpatient Database

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Methods

This study used publically available databases and was, therefore, exempt from institutional review board review. The Healthcare Cost and Utilization Project Kids' Inpatient Database (KID)[24] is a population-weighted nationwide sample of pediatric (<20 years old) inpatient discharges which is sponsored by the AHRQ and allows for tracking of healthcare trends and utilization of diseases of children. Systematic random sampling is used to sample 80% of pediatric nonbirth discharges from nonrehabilitation hospitals in the US; because this represents a large proportion of the entire population, a finite population correction is not used.[21,25] The KID is produced every 3 years starting with 1997 data; in contrast to adult AHRQ datasets, annual updates are not performed for the KID because children are hospitalized less frequently than adults.[21]

We used the KID database to examine the epidemiology of medial epicondyle fractures from 1997-2009, a time period which maintained a uniform definition of children's hospitals and general hospitals. This database was queried for admissions to hospitals in the US with a principal diagnosis of medial epicondyle fracture (*International Classification of Diseases, Ninth Revision*, 812.43). Year was analyzed as an independent variable, and number and proportion of admissions to a children's hospital were collected as dependent variables. Potential confounders included age (1-4 years old, 5-9 years old, 10-14 years old, and 15-17 years old) and insurance payer status (Medicaid, private, and uninsured). Proportions were calculated based on KID-listed total procedures, which may not be the sum of the stratified parts because of independent sampling of total annual discharges, rounding, and estimates based on sampling weights.[25]

The Healthcare Cost and Utilization Project defines children's hospitals based on information from the National Association of Children's Hospitals and Related Institutions and the American Hospital Association Annual Survey of Hospitals, and includes free-standing children's hospitals, specialty children's hospitals, and children's units within general hospitals.[21,24] Starting in 2012, the definition of a children's hospital was limited to free-standing children's hospitals, newly excluding "children's hospitals within hospitals" and "children's units in general hospitals."[24] As a result, we excluded the 2012 data to eliminate noncomparability for hospital discharges in that year.

Payer definitions were defined as follows: Medicaid includes fee-for-service and managed care Medicaid patients; private insurance includes Blue Cross, commercial carriers, and private health maintenance organizations and preferred provider organizations; and uninsured includes an insurance status of "self-pay" and "no charge." When more than 1 payer is listed for a hospital discharge, KID recognizes the primary payer. Patients covered by the State Children's Health Insurance Program may be included under Medicaid, private insurance, or other insurance, depending on the structure of the state program. Because most state data do not identify State Children's Health Insurance Program patients specifically, this information is not gathered separately in the KID.[21,24]

Statistical Analyses

Members of the research team with advanced training in biostatistics performed data extraction, aggregation, and statistical analyses using Microsoft Excel (Microsoft Corporation, Redmond, Washington) and SAS Software v 9.3 (SAS Institute, Inc, Cary, North Carolina). Descriptive statistics were used to report continuous data elements. Two-tailed *z*-tests were used to compare the number and proportion of surgical admissions for medial epicondyle fractures to children's and general hospitals for each year of study (unpaired *z*-tests), as well as proportion differences at the beginning and end of the study period (paired sample *z*-tests). The presence or absence of changes in proportions of age groups and/or insurance payer status longitudinally over the study period was evaluated using mixed-models repeated measures analyses in order to account for both between-group and within-group variation rather than falsely assuming independence of measurements over the study period. All comparative analyses that generated P values were 2-tailed and used $P = .05$ as the threshold for statistical significance. An a priori power calculation would have been inappropriate because this study used national discharge sampling data of all hospital admissions in the US, and, therefore, was not performed.

Results

Total annual inpatient discharges from US hospitals for medial epicondyle fractures declined from 617 to 407 over the study period, which was largely driven by decreases in discharges from general hospitals. Differences in the number of hospital discharges from each hospital type was significantly different ($P < .001$) until 2003, at which point there were no noted differences in discharges between hospital types ($P > .1$ for all) through the end of the study period (**Figure 1**, A). The proportion of medial epicondyle fracture hospital discharges from children's hospitals increased (from 29% to 46%; paired sample *z*-test; $P < .001$), and the proportion of discharges from general hospitals declined over the study period (from 71% to 42%; paired sample *z*-test; $P < .001$) (**Figure 1**, B).

Age and insurance payer status both remained consistent throughout the study period (mixed-models repeated measures analyses; $P = .98$ and $P = .96$, respectively) and did not contribute to changes in number of discharges from each hospital type (**Figures 2** and **3**).

Discussion

These fractures are unique to children, teens, and adolescents who all may be treated at both children's and general hospitals. Given a recent trend in increasing medicolegal concerns[10-12] and lack of access for pediatric fracture care in