J Shoulder Elbow Surg (2016) 25, 1005–1012

ELSEVIER

Journal of Shoulder and Elbow Surgery

www.elsevier.com/locate/ymse

ELBOW

Disproportionate trends in ulnar collateral ligament reconstruction: projections through 2025 and a literature review

Siddharth A. Mahure, MD*, Brent Mollon, MD, FRCSC, Steven D. Shamah, BA, Young W. Kwon, MD, PhD, Andrew S. Rokito, MD

Department of Orthopaedic Surgery, NYU Hospital for Joint Diseases, New York, NY, USA

Background: Medial ulnar collateral ligament (UCL) injuries of the elbow that require surgical management are uncommon. There is growing evidence, however, suggesting that the incidence of UCL reconstruction (UCLR) procedures is rapidly increasing. We sought to quantify the incidence of age-related trends for UCLR from 2003 to 2014 and subsequently to project future trends through 2025. We hypothesized that as the total number of UCLRs performed increased, a disproportionate incidence among younger patients would be observed.

Methods: New York State's Statewide Planning and Research Cooperative System database was queried from 2003 to 2014 to identify individuals between 10 and 40 years old undergoing UCLR. Poisson regression was used to develop future projections for UCLR and New York State population through 2025, and incidence estimates per 100,000 people were calculated.

Results: In New York State between 2003 and 2014, there were 890 patients who underwent UCLR, with average annual incidence per 100,000 people equaling 6.3 ± 2.8 for ages 15 to 19 years, significantly greater than for all other age groups ($P < .001$). Projections from 2015 through 2025 suggest that incidence in 15- to 19-year-olds and 20- to 24-year-olds will continue to rapidly increase while rates for other age groups will remain relatively stable.

Conclusions: The number of UCLRs performed between 2003 and 2014 increased by 343%, and a disproportionate trend in average annual incidence for patients between 15 and 19 years old was observed. As our review of the literature questioned outcomes in adolescent athletes after UCLR, continued attempts at preventing these injuries in the young throwing athlete remain paramount.

Level of evidence: Epidemiology Study; Large Database Analysis

Keywords: Ulnar collateral ligament reconstruction; throwing athlete; Tommy John surgery; baseball; pitching; elbow injuries; youth sports injuries

New York University Langone Medical Center Office of Science and Research Institutional Review Board deemed approval not applicable as the study did not contain human subjects research.

Investigation conducted at New York University Hospital for Joint Diseases, New York, NY, USA.

*Reprint requests: Siddharth A. Mahure, MD, Department of Orthopaedic Surgery, NYU Hospital for Joint Diseases, 301 East 17th Street, New York, NY 10003, USA.

E-mail address: Siddharth.mahure@nyumc.org (S.A. Mahure).

1058-2746/$ - see front matter © 2016 Journal of Shoulder and Elbow Surgery Board of Trustees.
http://dx.doi.org/10.1016/j.jse.2016.02.036

The ulnar collateral ligament (UCL) is the most important static stabilizer of the medial elbow and may become attenuated or rupture when resisting excessive or repetitive forces.[2] UCL injuries are most commonly associated with overhead athletics because of the repetitive valgus forces generated during the throwing motion and thus are classically associated with overhead throwing activities, such as pitching in baseball or javelin throw.[18,37] UCL injuries may also be caused through a sudden impact, weight bearing on the upper extremity, similar to the maneuvers associated with gymnastics and wrestling.[20] Once UCL injury occurs, athletes may experience pain or functional deterioration that may not respond to nonoperative treatment.[10,24]

UCL injuries of the elbow that require surgical reconstruction are relatively uncommon but have been reported to be increasing in incidence, particularly in younger patients.[12,15,33] The reasons for this observation are probably multifactorial and are likely related to the increasing rates and intensity of year-round athletic participation in addition to a lack of consensus and adherence to established participation guidelines.[1,16,21,34,39] Furthermore, increased access to cross-sectional imaging as well as growing and potentially misguided public awareness around UCL injuries may be further driving surgical demand.

Within the orthopedic community, concern exists that elbow injuries are occurring at disproportionally higher rates in younger athletes despite increased awareness and injury prevention programs, such as pitch count restrictions and mandatory days off between competitions. Several high-volume centers have reported an increase in the number of adolescent athletes referred for UCL injuries, with subsequently higher numbers of those undergoing reconstructive surgery.[4,20] Given the growing concern for these age-related trends, we sought to use a large sample of long-term data to develop a projection for future patterns. We hypothesized that in addition to observing an exponential growth in procedural volume from 2003 to 2014, we would also observe disproportionate age-related trends of greater UCL reconstruction (UCLR) incidence in younger patients that will persist during the next decade.

Methods

We used the Statewide Planning and Research Cooperative System (SPARCS) database to examine incidence and trends in UCLR in New York State. The SPARCS database was established by the New York State Department of Health in 1979. The passage of the New York State Public Health Law in 1986 mandated all nonfederal, licensed hospitals to report patient discharges from their facilities. Subsequent regulations expanded reporting requirements to include freestanding, licensed ambulatory surgery facilities and emergency departments. The database collects and reports data on age, gender, race/ethnicity, type of insurance, diagnoses, and procedures performed. The SPARCS database has been used to collect epidemiologic information in a number of orthopedic peer-reviewed publications.[9,11,23,30,36,38]

For this study, diagnoses and procedures were classified by *Current Procedural Terminology* (CPT) and *International Classification of Diseases, Ninth Revision, Clinical Modification* codes. CPT code 24346 (reconstruction of ulnar collateral ligament with tendon graft) was used to identify patients undergoing UCLR. Although primary UCL repair has been described, we limited our search to UCLR with a tendon graft to reflect the standard of care for these injuries in overhead throwing athletes. Patients between 10 and 40 years old were included in our cohort as we thought that this age range would be most representative of individuals undergoing UCLR for an activity-related injury. Patients with associated diagnoses of elbow dislocations, fractures, malunion or nonunion, inflammatory arthritis, or tumors were excluded as they were unlikely to be representative of our desired overhead throwing athlete cohort. Data regarding age, gender, and year of UCLR were extracted.

To facilitate age-related trend analysis, patients were stratified into 6 age brackets: 10 to 14 years, 15 to 19 years, 20 to 24 years, 25 to 29 years, 30 to 34 years, and 35 to 40 years. New York State Census data were used to determine "population at risk" within each age bracket, and these values were subsequently used to calculate incidence per 100,000 people for each specific age group. Similar to previous methodology, Poisson regression was used to calculate annual trends in UCLR and population changes to forecast projections through the year 2025.[15,25,32] Cochran-Armitage analysis and χ^2 tests were used to evaluate for significant trends and differences in categorical variables over time; *t*-tests were used for continuous variables. All statistical analyses were performed using SAS 9.3 (SAS Institute, Cary, NC, USA).

Results

Between 2003 and 2014, 890 patients underwent UCLR in New York State. The majority of patients were male (95.0%), and mean age of the patients was 19.7 ± 4.3 years, with no age-related differences observed between genders (male: 19.8 ± 4.2 years; female: 18.8 ± 5.4 years; $P = .130$). Minimum age of the patients was 12 years, whereas maximum was 40 years (Table I).

Patients aged 15 to 19 years (56.6%) comprised the majority of UCLR procedures ($P < .001$), whereas 20- to 24-year-olds comprised 31.9% of the sample. Remaining age bracket distributions were as follows: 10 to 14 years, 2.25%; 25 to 29 years, 5.1%; 30 to 34 years, 1.9%; and 35 to 40 years, 2.3%.

Incidence and trends of UCLR for 2003 to 2014 with projections to 2025

The total number of UCLR procedures performed during the period increased by 343%, from 21 in 2003 to 93 in 2014,