SCIENTIFIC ARTICLE

Trends in Revision Elbow Ulnar Collateral Ligament Reconstruction in Professional Baseball Pitchers

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Purpose To determine the frequency of revision elbow ulnar collateral ligament (UCL) reconstruction in professional baseball pitchers.

Methods Data were collected on 271 professional baseball pitchers who underwent primary UCL reconstruction. Each player was evaluated retrospectively for occurrence of revision UCL reconstructive surgery to treat failed primary reconstruction. Data on players who underwent revision UCL reconstruction were compiled to determine total surgical revision incidence and revision rate by year. The incidence of early revision was analyzed for trends. Average career length after primary UCL reconstruction was calculated and compared with that of players who underwent revision surgery. Logistic regression analysis was performed to assess risk factors for revision including handedness, pitching role, and age at the time of primary reconstruction.

Results Between 1974 and 2014, the annual incidence of primary UCL reconstructions among professional pitchers increased, while the proportion of cases being revised per year decreased. Of the 271 pitchers included in the study, 40 (15%) required at least 1 revision procedure during their playing career. Three cases required a second UCL revision reconstruction. The average time from primary surgery to revision was 5.2 ± 3.2 years (range, 1–13 years). The average length of career following primary reconstruction for all players was 4.9 ± 4.3 years (range, 0–22 years). The average length of career following revision UCL reconstruction was 2.5 ± 2.4 years (range, 0–8 years). No risk factors for needing revision UCL reconstruction were identified.

Conclusions The incidence of primary UCL reconstructions among professional pitchers is increasing; however, the rate of primary reconstructions requiring revision is decreasing. Explanations for the decreased revision rate may include improved surgical technique and improved rehabilitation protocols. *(J Hand Surg Am. 2015;40(11):2249–2254. Copyright © 2015 by the American Society for Surgery of the Hand. All rights reserved.)*

Type of study/level of evidence Therapeutic IV.

Key words Baseball, revision, Tommy John surgery, ulnar collateral ligament, reconstruction.

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Elbow ulnar collateral ligament (UCL) reconstruction was famously performed in 1974 on major league baseball (MLB) pitcher Tommy John, from whom its eponym is derived. This procedure has since allowed many MLB pitchers to return to elite levels of competition from what was once a career-ending injury. The success of the procedure has led to its increasing utilization in recent years as well as the public perception that it can enhance the performance of athletes not suffering from UCL insufficiency.[1]

Previous studies have assessed risk factors associated with primary reconstruction as well as the effects of the surgery on performance and return to play rate.[2–4] Gibson et al[2] determined that decreased MLB experience, pitching in the starting role, and a lower earned run average were associated with a higher incidence of UCL insufficiency requiring surgical reconstruction. In addition, most MLB pitchers were observed to return to previous levels of performance within 2 seasons following primary UCL reconstruction.[2] Erickson et al[3] also reported a high incidence of return to play among MLB pitchers who had undergone UCL reconstruction and a subsequent rise in performance metrics when compared against demographic-matched controls.

Other studies have addressed reinjury rates in professional baseball by evaluating the incidence of return to the disabled list or revision incidence in a smaller cohort of players.[3–5] Makhni et al[4] reported a significant incidence of return to the disabled list for throwing arm injuries (57%) as well as an immediate decline in performance metrics following primary UCL reconstruction surgery. Despite the potential reinjury incidence suggested by Makhni et al,[4] Erickson et al[3] reported a UCL reconstruction revision incidence of 4%. Additional studies have focused more narrowly on pitchers who underwent revision surgeries. Dines et al[6] reported less reliable outcomes and a higher incidence of complications among pitchers electing to have revision UCL reconstruction compared with primary surgery. Furthermore, Jones et al[5] showed a significant decrease in the ability of pitchers who underwent revision surgery to return to their preinjury workload.

The purpose of this study was to describe the trends in UCL reconstruction and particularly to define the frequency of revision UCL reconstructions in professional baseball pitchers.

MATERIALS AND METHODS

All available records of professional baseball pitchers in the United States who underwent primary UCL reconstruction from 1974 to 2014 were reviewed. A database containing name, height, weight, handedness, date of primary surgery, date of revision surgery (when applicable), pitching role, organization, and retirement date or status was created by accessing available online data (www.mlb.com, www.mlbreports.com, www.baseballreference.com). Inclusion criteria were status as a professional pitcher at the time of surgery (major and minor leagues) and a minimum of 1 day of MLB service at any point in that player's career. The second criterion was included to increase accuracy in determining primary and revision surgery dates as such information is readily and publicly available for all MLB players. According to article XIII section C of the MLB Players Association Collective Bargaining Agreement, "Application by a Club to the Commissioner to place a Player on the Disabled List shall be accompanied by a Standard Form of Diagnosis." The Standard Form of Diagnosis is completed by the team physician and includes fields for UCL injury and surgery. Before a player is placed on the disabled list, the Standard Form of Diagnosis must be signed by the team physician and a club official and submitted to the Commissioner for approval. These standards ensure a high degree of reliability for MLB injury reporting serving as a primary source for determining the target population in this study. Record of surgery was corroborated by disabled list data and team press releases. Similar methods of data acquisition have been used in previous studies.[2,4,7]

Data frequency tables were created to show the total number of primary and revision UCL reconstructions by year. The total revision incidence, as well as revision rates by year, was calculated from these tables to evaluate any historical trends. Revision rates were calculated by reporting revision reconstructions by year of the player's primary reconstruction. These data were compared with the total number of primary reconstructions in that respective year, and trend lines were compared via z test. Average time to revision for players who underwent secondary UCL reconstruction was also calculated. Average length of career for players who only underwent primary reconstruction was calculated and compared (t test) with that of those who underwent both primary and revision reconstruction. Finally, risk factors for revision UCL reconstruction including handedness, age at the time of primary reconstruction, and pitching role following primary surgery were assessed using binary logistic regression.

RESULTS

Beginning in 1974, the number of primary UCL reconstructions among professional pitchers has increased steadily, peaking at 33 in 2012 (Fig. 1). Of the 271 cases included in this study, 40 (15%) required revision at some point during the remainder of the player's career. Three cases required a second UCL revision reconstruction. The number of revision surgeries performed each year on professional pitchers has also increased, although at a significantly ($P < .001$) lower rate compared with that of primary UCL reconstructions (Fig. 1). Furthermore, despite the steady increase of the rate of primary UCL reconstructions among MLB pitchers since 1974, the rate of primary reconstructions requiring revision reconstruction has decreased since the first revision was