The prevalence of medial ulnar collateral ligament (UCL) reconstruction is increasing (p < 0.001). Overuse injuries: less than half (48.4%) believed the benefits, and rehabilitation related to UCL reconstruction. Study design. Cross-sectional survey study, Level 3. Methods. This study utilized an online thirty-question survey designed to assess an individual's perception of UCL reconstruction with regard to risk factors for injury, indications, benefits, surgical details, and rehabilitation. Eligible study participants were members of the media including print, internet, radio and/or television directly involved in the coverage of Major League Baseball (MLB). Results. A total of 516 members of the media with a mean age of 43.6 years completed the survey. In nearly half (47.8%), professional baseball represented 76–100% of their total sports coverage responsibility. Indications: although the majority answered correctly, 45% did not know if an athlete needed an elbow injury as a prerequisite for UCL reconstruction and 25% believed the primary indication was performance enhancement. As percentage of baseball coverage increased, media members were less likely to believe that an elbow injury was not required (p = 0.038). Benefits: eighty percent recognized that pitching speed is typically reduced following surgery, but the remaining 20% felt that velocities actually increased compared with pre-injury velocities. Return to play: fifty-two percent overestimated the ability of pitchers to return to back to professional baseball and 51.2% believed return would occur in 12 or less months. Estimates were higher in those of older age (p = 0.032) and increased percentage of baseball coverage (p < 0.001). Overuse injuries: less than half (48.4%) believed the use of pitch counts to be important in the prevention of UCL injury and 33.2% felt that throwing injuries were not preventable in adolescent baseball. Conclusion. Common misconceptions exist regarding UCL reconstruction within the professional baseball media. Efforts for physicians to educate the media on the risks of overuse throwing injuries with emphasis on accurate indications, outcomes, and recovery of Tommy John Surgery are encouraged.

Introduction

The medial ulnar collateral ligament (UCL) of the elbow is the primary stabilizer to valgus stress and is most commonly injured in the overhead throwing athlete. Ulnar collateral ligament insufficiency is surgically managed with UCL reconstruction or “Tommy John surgery”, named for the first professional pitcher treated by Dr. Frank W. Jobe in 1974 [1]. The prevalence of the operation is estimated at 16% of all professional pitchers (major and minor) and 25% of Major League Baseball (MLB) pitchers [2-4]. This high prevalence has made the surgery a popular headline within the national media. A major concern now exists regarding the increasing number of injuries and surgeries being performed on recreational and professional baseball players, with the phenomenon being described as an “epidemic” of UCL reconstruction [5,6].

Despite its recent acclaim, basic misconceptions within the public may exist regarding the incidence, causation and outcomes of UCL reconstruction. A recent investigation reported on Tommy John surgery perceptions in athletes, coaches, and parents involved in baseball [7]. An alarming 30% of coaches, 37% of parents, 51% of high-school athletes, and 26% of collegiate athletes believed surgery should be performed on players without elbow injury to...
enhance performance. Also, this study identified that 31% of coaches, 28% of players, and 25% of parents did not believe the number of pitches thrown to be a risk factor for injury. Many players (28%) and coaches (20%) felt that performance would be enhanced over the pre-injury level with UCL reconstruction.

Factors that drive public misperceptions of UCL injury and surgery have been speculated. The media, in the form of print, radio, television, and the Internet, is a prominent source of information that inevitably educates youth athletes and their families. Likewise, professional athletes serve as influential role models through their portrayal in the media [8-11]. A national survey reported that children ranked famous athletes among the most admired people in their lives (73%), second only to their parents (92%) [10]. It is possible that the media’s projection of high-profile athletes performing well after surgery may explain the misperceptions of young athletes and their families regarding UCL reconstruction. Such misperceptions may negatively influence patient expectations regarding treatment decisions and even serve as barriers within the patient–physician relationship. In addition, successful UCL reconstruction stories in well-known players may perpetuate the perceived invulnerability to career-ending injury in youth baseball and impede compliance with protective throwing guidelines [4,12].

Ultimately, the media has a powerful influence within baseball culture and potentially public health with respect to UCL injury and surgery. We hypothesized that the media involved in delivering professional baseball news has inaccurate perceptions of the causes of UCL injury and the indications, risks, benefits, and rehabilitation related to UCL reconstruction. The purpose of this study was to examine the media’s perception regarding factors involved in Tommy John surgery.

Materials and methods

Study design

A cross-sectional survey study was conducted with members of Major League Baseball media.

Participants

The study was approved through the research compliance and administration system at Columbia University Medical Center. An online survey (Survey Monkey, Portland, Oregon) was created to assess the media’s perception of various factors involved in UCL reconstruction surgery. A personalized invitation email (see Appendix 1A) was sent to 1100 members of Major League Baseball media asking for their participation in an online survey assessing the “risk factors, indications, benefits, surgical details and recovery of Tommy John surgery.” The public relations department for each team in MLB was contacted to facilitate the distribution of the survey. A hyperlink to the survey was included within the invitation email. Two reminder emails were sent to nonresponders during the 4-week-data collection period at 1 and 3 weeks after the initial invitation. The criteria for study inclusion was a member of the media including print, internet, radio and/or television directly involved in the coverage of MLB where access to email was available. Specific media type included: Local Beat Writer, National Print Media, Internet (Baseball Prospectus, FanGraphs, etc.), National TV/Radio Network (ESPN, FS1, MLB Network, ABC, NBC, CBS, etc.), Regional TV/Radio Network (SportsnetLA, Fox Sports West, Fox Sports North, etc.), Local TV/Radio Network (KTLA, KUSA, KCNC, etc.). A total of 516 individuals completed the online survey representing a response rate of 46.9%. Each participant completed the survey anonymously without influence or assistance from any of the coauthors.

Media perception was defined as the difference between actual truths based in published, peer reviewed medical reports and virtual truths shaped by popular opinion. The best available evidence for UCL injury and reconstruction in the orthopedic literature was used to establish surgical indications, success rates, return to play rates, complication rates, and rehabilitation standards [2,12-15].

Survey detail

The questionnaire used in the study (see Appendix 1B) was developed and modified based on an existing instrument [7]. Additional question content was derived from a literature review of impactful characteristics in UCL reconstruction and modified by consensus of five sports medicine physicians and one sports medicine physical therapist. As it was desirable to correlate the media’s responses to the current literature, questions were created that reflected the reporting methods common to the literature on UCL reconstruction and recently analyzed in a systematic review [13]. The survey consisted of 30 questions addressing the indications, risks, benefits, operative technique, and recovery time of UCL reconstruction. In addition, factors potentially associated with injury such as the number of pitches and types of pitches thrown were included. The intended respondents had an anticipated wide range of educational backgrounds and to facilitate question comprehension, the questionnaire was written to an 8th grade reading level [16]. The questionnaire did not undergo reliability and validity testing since it was designed as an informative survey rather than a precise quantitative instrument.

Questions were constructed into four different formats including “yes, no or I don’t know”; multiple choice; selecting from a list of options; and ranking lists in order of importance. The questionnaire was organized into 10 sections (Table 1). Nine questions addressed demographic and personal information including type of media responsibility, and percentage of baseball coverage. Four questions explored the benefits of Tommy John surgery. Two questions asked about prior experience with Tommy John surgery and if the respondent has previously been a professional baseball player. Two questions inquired about the indications for Tommy John surgery. Two questions asked about postoperative rehabilitation following Tommy John surgery and one question about how the procedure is performed. Five questions asked the respondents to characterize the surgical risks of UCL reconstruction. Four questions dealt with throwing injuries as
a whole, assessing baseline knowledge. Two questions inquired about revision Tommy John surgery. Of the 30 questions in the survey, 20 were considered factual, having a single correct answer based on the current orthopedic literature (e.g. “Are pitch counts important for prevention of Tommy John surgery?”). The remaining 10 questions did not have a single correct answer and focused on individual personal information.

### Statistical analysis

Data was analyzed using SAS 9.3 (SAS Institute, Cary, North Carolina, USA) [17]; *p* values less than 0.05 were considered significant. The frequency of selection for each answer option was measured. Univariate analyses were performed using the *χ*² test for categorical variables and the two-tailed Student’s *t*-test for continuous variables. For continuous variables, a multiple linear regression to model the variation of the outcome was used and 95% confidence intervals were calculated.

### Results

#### Demographic characteristics of respondents

A total of 516 members of the media (mean age ± standard deviation, 43.6 ± 12.1) completed the questionnaire (Table 2). The respondents were predominantly male (93.4%) and Caucasian (83.7%) with the remaining ethnicities Asian (6.6%), Hispanic (5.4%), and African American (2.0%). The primary media responsibility included local beat writers (19.8%), internet blogs (19.0%), local (13.4%), regional (9.3%), and national (13.2%) TV/radio networks, and national print media (9.9%). When analyzed according to the geographic region, media coverage consisted of National (29.6%), West (22.6%), Midwest (12.8%), Northeast (11.4%), and Southwest (9.4%). There was local media representation from 29 of the 30 teams in MLB and in almost half of all respondents (47.8%), coverage of professional baseball represented 76–100% of their sports coverage responsibility.

Sixteen members of the media (3.2%) had previously played professional baseball, seven of which were pitchers and nine position players. No participants had ever personally undergone Tommy John surgery; however a large proportion had indirect experience knowing either a professional athlete (63.1%), teammate (4.3%), or relative (2.2%) that had the surgery.

#### Indications for Tommy John surgery

Questioning revealed that 25% of the media believed that UCL reconstruction should be performed on players without elbow injury to enhance performance and an additional 20.5% did not know if an athlete needed an elbow injury to have the procedure. As the percentage of baseball coverage increased, media members were less likely to believe that an elbow injury was not required for the operation (*p* = 0.038).

#### Benefits of Tommy John surgery

Over half of the respondents (52.6%) overestimated the ability of pitchers to return back to professional baseball after UCL reconstruction. These estimates were significantly lower for females compared to males (*p* = 0.03), and significantly higher for those of older age (*p* = 0.032) and increased percentage of baseball coverage (*p* < 0.001). A proportion of the media believed that both pitching speed and performance were improved over pre-injury levels with UCL reconstruction. Nearly 20% (19.6%) believed pitching speed increased following surgery compared with pre-injury velocities and an additional 16.6% reported that they did not know how speed was affected. Nearly half of the media members either did not believe (22.3%) or did not know (24.9%) that UCL reconstruction was performed to decrease elbow pain with throwing and this finding was significantly more common in younger study participants (*p* = 0.042).

### Table 1. Categories of questions.

| Question type | No. of questions |
|---------------|-----------------|
| Demographics  | 9               |
| Prior experience with TJ surgery | 1 |
| Indications for TJ surgery | 2 |
| Benefits of TJ surgery | 4 |
| Details of surgery | 1 |
| Risks of TJ surgery | 5 |
| Recovery from TJ surgery | 2 |
| Overuse throwing injuries | 4 |
| Revision TJ surgery | 2 |

Abbreviation: TJ = Tommy John.

### Table 2. Subject demographics* (n = 516).

| Variable | No. |
|----------|-----|
| Ageb yr (516 respondents) | 43.6 ± 12.1 |
| Sex       |     |
| male      | 482 (93.4) |
| Female    | 34 (6.6) |
| Media responsibility |     |
| Local beat writer | 102 (19.8) |
| National print media | 51 (9.9) |
| Internet   | 98 (19.0) |
| National TV/radio network | 68 (13.2) |
| Regional TV/radio network | 48 (9.3) |
| Local TV/radio network | 69 (13.4) |
| Other      | 80 (15.5) |
| Percentage of baseball coverage |     |
| 0–25%      | 108 (21.4) |
| 26–50%     | 104 (20.6) |
| 51–75%     | 51 (10.1) |
| 76–100%    | 241 (47.8) |
| Geographical region of coverage |     |
| National   | 148 (29.6) |
| West       | 113 (22.6) |
| Midwest    | 64 (12.8) |
| Northeast  | 57 (11.4) |
| Southwest  | 47 (9.4) |
| Other      | 71 (14.2) |
| Experience with TJ Surgery |     |
| Self       | 0 (0.0) |
| Relative   | 10 (2.2) |
| Teammate   | 20 (4.3) |
| Professional | 291 (63.1) |
| No, does not know anyone | 160 (34.7) |

*Data are expressed as n (%).

bThe value is given as the mean and standard deviation.

Abbreviation: TJ = Tommy John.
Details and risks of Tommy John surgery

In general, the accuracy of surgical details was low among respondents. Almost 70% (68.8%) believed that a new ligament was used in the reconstruction. The surgical risks of UCL reconstruction were also consistently overestimated. Fifty percent of respondents believed that postoperative ulnar neuropathia and 20% that persistent elbow instability occurs in one of every two UCL reconstructions.

Surgical rehabilitation

Media members estimated the postoperative rehabilitation program to be shorter allowing prompter return to competitive throwing. Over 50% (51.2%) believed that pitchers could return back to throwing at a professional level within 12 months or less. The predicted time for postoperative recovery lengthened with increasing age of the media respondent ($p = 0.01$).

Overuse throwing injuries

The majority of individuals correctly estimated that the number of pitches (72.7% of participants) and type of pitch (75.7% of participants) to be important in the causation of throwing injuries. However, less than half of members of the media (48.4%) believed the use of pitch counts to be important in the prevention of UCL surgery with 33.2% answering that throwing injuries are not preventable and an additional 28.3% responding that they were unsure if these injuries are preventable or not. Throwing with elbow pain was the most consistently identified risk factor as predictive of future injury (Table 3).

Discussion

This study examined perceptions of the media regarding factors involved in UCL reconstruction. The results demonstrated a variety of misconceptions including the indications, outcomes, and expectant recovery from UCL surgery as well as the prevention of overuse throwing injuries that are different from current medical reports.

In regards to the benefits of UCL reconstruction, despite the majority of respondents answering correctly, a substantial percentage of the media (45%) did not know if an athlete needed an elbow injury as a prerequisite for UCL reconstruction and 25% believed that the procedure’s primary indication was performance enhancement. It should be noted that those members of the media with an increased percentage of baseball coverage per occupation were less likely have these misconceptions. Although 80% recognized that pitching speeds are typically reduced following surgery, 20% believed that pitching velocities actually increase with the operation compared to pre-injury speeds. In addition, over half of the respondents (52.6%) overestimated the ability of pitchers to return back to professional baseball after surgery. These findings are consistent with a similar investigation that reported on Tommy John surgery perceptions in athletes, coaches, and parents involved in youth baseball [7].

Despite these perceptions, no study demonstrates that players have improved performance above pre-injury levels with UCL reconstruction. Instead, players have the ability to return to their pre-injury level of performance successfully in 80–85% of cases and with an estimated complication burden of 4–20% [13]. Most often, return to play (RTP) is defined as returning to the MLB and pitching in a single game and when this definition is expanded to include pitching in at least 10 games post surgery, the success rate may be as low as 67% [15]. New evidence further suggests that UCL reconstruction may be associated with performance declines such as earned run average, batting average against, walks plus hits per inning pitched, percentage of pitches thrown in the strike zone, and innings pitched [15]. In regards to pitching speed, studies have failed to demonstrate any improvements following surgery and actually have shown significant reductions in the percentage of fastballs thrown, and average fastball velocity [18].

In addition to RTP, media members consistently underestimated the post-operative rehabilitation time required to return to competitive throwing. Over 50% (51.2%) believed that pitchers could return back to throwing at a professional level within 12 months or less. In contrast, recent reporting on time for RTP following UCL reconstruction in professional players have projections far in excess of 12 months with mean length of time of 16.8 and 20.5 months for RTP in two recent studies [14,15].

When surveying media members to the risks of the UCL reconstruction, the incidence of serious complication such as ulnar nerve injury was consistently overestimated. For example, the rates of postoperative ulnar nerve neuropathia have been reported as low as 6 – 13% in the literature [13,19]. In our investigation, ~50% of members of the media believed an ulnar nerve injury to occur in one of every two UCL reconstructions.

Another notable study finding was the media’s perception of overuse throwing injuries in youth baseball. Less than half of members of the media (48.4%) believed the use of pitch counts to be important in the prevention of UCL injury. Over 65% correctly identified the relationship between throwing volumes and the risk of elbow injuries, but the remaining 33.2% believed throwing injuries were not preventable. Recent studies in adolescent baseball have demonstrated overuse as the main cause of player injury, with a 500% increase in risk for surgery for those pitching more than 8 months per year and a 400% increase risk for those

Table 3. Factors predictive of future throwing injury*.

| Specific variable              | Average rating |
|-------------------------------|----------------|
| Throwing with elbow pain      | 1.77           |
| Number of pitches             | 2.81           |
| Previous elbow injury         | 2.85           |
| Number of innings             | 3.85           |
| Type of pitch                 | 3.96           |
| Playing pitch and catch       | 5.76           |

*Participants rated the options from 1 to 6, with 1 being the most important factor.
throwing >80 pitches per game [18,20]. The media reporting of UCL injuries and surgical outcomes is important in shaping public perception of Tommy John surgery and undoubtedly influences baseball culture. Professional players who have undergone UCL reconstruction may become role models to younger players and help perpetuate the invulnerability to career-ending injury in youth baseball and impede compliance with protective throwing guidelines [4,12]. When combined with overestimates for the success of the procedure, the time required for rehabilitation and perceived performance enhancements, powerful misconceptions may exist within the public.

To combat the rising occurrence of UCL surgery and increase public awareness, preventive campaigns have been instituted to help curb injuries and study risks factors [21-23]. We support these programs and others that advocate further efforts to correct misperceptions and encourage public education on UCL injury and surgery. The responsibility to spearhead these campaigns and correct misconceptions falls to the sports medicine community and those physicians working in close association with the media.

The present study has limitations. The questionnaire did not undergo a formal validation process; instead, it was modified from a previous investigation and revised to avoid bias consistent with other works examining perception of orthopaedic surgical procedures [7,24,25]. There was a large proportion of “I don’t know” responses, which may represent limitations of the participant’s knowledge, or may reflect a weakness in the inherent study methodology. The relatively low response rate of 46.9% is a possible source of selection bias in those that decided to participate and the responses of the survey may not actually reflect the opinions of the collective baseball media.

Conclusion

There is wide variation in the knowledge of UCL injury and common misperceptions exist regarding UCL reconstruction within the professional baseball media. Efforts for physicians to educate the media on the risks of overuse throwing injuries with emphasis on the indications, outcomes, and recovery of Tommy John surgery are encouraged.

Declaration of interest

NS ElAttrache is an American Orthopedic Society for Sports Medicine board-committee member; he has also received research support from Arthrex Inc. and has a patent agreement with Arthrex Inc. CS Ahmad has been a paid consultant for and received research support from Arthrex, Inc.; he has also received research support from Major League Baseball and Stryker. The authors have no other relevant affiliations or financial involvement with any organization or entity with a financial interest in or financial conflict with the subject matter or materials discussed in the manuscript apart from those disclosed.

References

[1] Jobe FW, Stark H, Lombardo SJ. Reconstruction of the ulnar collateral ligament in athletes. J Bone Joint Surg Am 1986;68:1158–63.
[2] Cain EL Jr, Andrews JR, Dugas JR, et al. Outcome of ulnar collateral ligament reconstruction of the elbow in 1281 athletes: results in 743 athletes with minimum 2-year follow-up. Am J Sports Med 2010;38:2426–34.
[3] Conte SA, Fleisig GS, Dines JS, Wilk KE, Acue KT, Nancy Patterson N, ElAttrache N. Prevalence of ulnar collateral ligament surgery in professional baseball players. Am J Sports Med 2015; In press.
[4] Petty DH, Andrews JR, Fleisig GS, Cain EL. Ulnar collateral ligament reconstruction in high school baseball players: clinical results and injury risk factors. Am J Sports Med 2004;32:1158–64.
[5] ESPN MLB. Tommy John surgery ‘epidemic’? Available from http://espnc.com/mlb/story/_/id/10831700/is-mlb-midst-tommy-john-epidemic. Last accessed 21 March 2015.
[6] USA Today. Tommy John surgery now ‘an epidemic’. Available from http://www.usatoday.com/story/sports/mlb/2014/04/11/tommy-john-epidemic/mlb/37583413/. Last accessed 21 March 2015.
[7] Ahmad CS, Grantham WJ, Greiwe RM. Public perceptions of Tommy John surgery. Phys Sportsmed 2012;40:64–72.
[8] Biskup C, Pfister G. I Would Like to be Like Her/Him: Are Athletes Role-Models for Boys and Girls? Euro Phys Ed Rev 1999;5:199–218.
[9] Brown WJ, de Matviuk MA. Sports celebrities and public health: Diego Maradona’s influence on drug use prevention. J Health Commun 2010;15:358–73.
[10] Kaiser Family Foundation. A National Survey of Kids (and Their Parents) About Famous Athletes as Role Models. Available from http://www.kff.org/kaiserpolls/3070-index.cfm. Last accessed 21 March 2015.
[11] Kurek M. Believe it, athletes are role models. Available from http://findarticles.com/p/articles/mi_m1208/is_n2_v221/ai_1903417/. Last accessed 21 March 2015.
[12] Bruce JR, Andrews JR. Ulnar collateral ligament injuries in the throwing athlete. J Am Acad Orthop Surg 2014;22:315–25.
[13] Vitale MA, Ahmad CS. The outcome of elbow ulnar collateral ligament reconstruction in overhead athletes: a systematic review. Am J Sports Med 2008;36:1193–205.
[14] Erickson BJ, Gupta AK, Harris JD, Bush-Joseph C, Bach BR, Abrams GD, et al. Rate of return to pitching and performance after Tommy John surgery in Major League Baseball pitchers. Am J Sports Med 2014;42:536–43.
[15] Makhni EC, Lee RW, Morrow ZS, Gualtieri AP, Gorroochurn P, Ahmad CS. Performance, Return to Competition, and Reinjury After Tommy John Surgery in Major League Baseball Pitchers: A Review of 147 Cases. Am J Sports Med 2014;42:1323–32.
[16] Safeer RS, Keenan J. Health literacy: the gap between physicians and patients. Am Fam Physician 2005;72:463–8.
[17] SAS [computer program]. Version 9.3. SAS Institute, Cary, NC; 2010.
[18] Olsen SJ II, Fleisig GS, Dun S, Loftice J, Andrews JR. Risk factors for shoulder and elbow injuries in adolescent baseball pitchers. Am J Sports Med 2006;34:905–12.
[19] Kerut ED, Kerut DG, Fleisig GS, Andrews JR. Prevention of arm injury in youth baseball pitchers. J La State Med Soc 2008;160:95–8.
[20] Watson JN, McQueen P, Hutchinson MR. A systematic review of ulnar collateral ligament reconstruction techniques. Am J Sports Med 2014;42:2510–16.
[21] American Sports Medicine Institute (ASMI). Position Statement for Tommy John Injuries in Baseball Pitchers. Available from http://www.asmi.org/research.php?page=research&section=TJpositionstatement. Last accessed 10 April 2015.
[22] American Orthopaedics Society of Sports Medicine (AOSSM). Stop Sports Injuries. Available from http://www.stopsport uninjuries.org/. Last accessed 10 April 2015.

[23] Pitch smart. Major League Baseball, USA Baseball. Available from http://m.mlb.com/pitchsmart/. Last accessed 26 April 2015.

[24] Matava MJ, Howard DR, Polakof L, Brophy RH. Public perception regarding anterior cruciate ligament reconstruction. J Bone Joint Surg Am 2014;96:e85.

[25] Sperling JW, Smith AM, Cofield RH, Barnes S. Patient perceptions of open and arthroscopic shoulder surgery. Arthroscopy 2007;23:361–6.

**Supplementary material available online**
Appendix 1A and 1B