Epidemiology of Tommy John Surgery

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COMMENTARY
Tommy John surgery 'epidemic'?  
More than a dozen big league pitchers have already had the surgery this year 

By Jayson Stark | ESPN.com  
Updated: May 4, 2014, 10:32 AM ET
Definition of “Epidemic”

• An epidemic occurs when a disease affects a greater number people than is usual for that population.
• This is measured by epidemiological studies
• In UCL Reconstruction, these POPULATIONS are age or competitive levels.
  • Youth, HS, College, Professional
• Analyzing not only the incidence but the increases from year to year.

What Published Epidemiological Studies are Available?

• Petty, Cain, et al. AJSM 2004 - Ulnar Collateral Ligament Reconstruction in High School Baseball Players
  • 50% increase at ASMI from 1988-94 to 1995-2003.
• Cain, et al. AJSM, 2010. Outcome of Ulnar Collateral Ligament Reconstruction of the Elbow in 1281 Athletes: Results in 743 Athletes With Minimum 2-Year Follow-up
  • “Many people involved in organized baseball have reported a rise in the incidence of serious arm injuries in recent years, although exact statistical numbers are not available”
**Trends in Medial Ulnar Collateral Ligament Reconstruction in the United States: A Retrospective Review of Large Private-Payer Database From 2007-2011**
Erickson, Romeo, et al. AJSM. 2015

**Figure 1.** Overall average incidence of ulnar collateral ligament reconstruction by age of patients in the PearlDiver database in 2007-2011.

**Figure 3.** Annual incidence of ulnar collateral ligament reconstruction in patients aged 15-19 in the PearlDiver database in the years 2007-2011.

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**Epidemiology of Medial Collateral Ligament Reconstruction: A 10-Year Study of NY State**
Hodges, Ahmad, et al. AJSM: 2016

**Figure 1.** The number of medial ulnar collateral ligament (MUCL) reconstructions performed in New York State by year. There is a significant trend for a greater number of reconstructions performed over time ($P < .001$).

**Figure 4.** The number of medial ulnar collateral ligament (MUCL) reconstructions performed in New York State by age cohort. There is a significant trend for greater number of reconstructions performed in the 17- to 18-year and 19- to 20-year age groups ($P < .001$).
UCLr MLB Players Only 1974-2016
Source: baseballheatmaps.com

MLB TJ Surgeries
Pitchers and Position Players

2000-2011 AVG TJS = 17
2012-2016 AVG TJS = 27

TJ Surgeries MLB Players
baseballheatmaps.com

No. of Tommy Johns
2000-2016
TJ Surgeries MLB Players
baseballheatmaps.com

No. of Tommy Johns
2000-2016

UCLr (2010-16) 40 Man Roster Only
HITS Data-John D’Angelo (MLB)

40 Man TJ Surgeries

p = .67
R² = .04
**UCLr (2010-16) Non-40 Man Roster Only**
HITS Data-John D’Angelo (MLB)

**UCLr (2010-16) All Levels Combined**

Baseballheatmaps.com = 386 TJS
MLB HITS Data = 786

*P = .002
R² = .88

*P = .006
P = .03 without 2010, 2011*
The annual rate of primary and revision UCL reconstructions rose significantly for all levels of play from 1974 to 2015 and from (p<0.001).

The overall mean time to return to play (RTP) was 436 days (14.5 months). RTP = any level.

The rate of RTP to any level was 93.9% for MLB pitchers vs. 76.3% for MiLB pitchers. Both groups RTP at 83.6%

MLB pitchers RTP at the MLB level in 73.1% of cases

The time to RTP was longer (by 54 days) for revisions (p=0.025) compared to primaries.

The revision rate was 10.7%
Prevalence of Ulnar Collateral Ligament Surgery in Professional Baseball Players
Conte, et al, AJSM Vol. 43, No. 7 (2015)

- Over 5,000 Pro Baseball Players surveyed in 2012 season
- Overall Rate of 10% had TJ Surgery
- 16% of All Pitchers
- 1 in 4 (25%) Major League Pitchers
  - 86% had surgery in pros
- 1 in 7 (15%) Minor League Pitchers
  - 61% had surgery in HS or College

Revisions

- Cain, et, al. (Am J Sports Med 2010 38: 2426) reports out of their study of 743 athletes who underwent UCL reconstruction only 9 or 1% had to undergo revisions.
- Erikson, et al (Am J Sports Med 2014 42: 536) reported out of 177 Major League pitchers, the revision rate was 3.9%.
Outcomes in Revision Tommy John Surgery in Major League Baseball Pitchers
Joseph Liu, M.D.; Grant H Garcia, MD; Stan Conte, PT, DPT, ATC; Neal ElAttrache, MD; David W Altchek, MD; Joshua S Dines, MD

• Since 1999, 235 MLB pitchers underwent TJS.
• 31 pitchers (13.2%) underwent revision surgery
• 37% underwent revision within 3 years of their index procedure
• 26 revisions had more than 2-year follow up
• 17 (65.4%) pitched at least MLB game
• Only 11 (42.3%) pitched more than 10 games
• Average return MLB = 20.76 months
• Revision Rate = 13.2%

Revisions Update- MLB Players 1996-2016

Return to Play (1996-2014) = 65% (26/40)
Revision Surgeries Per Year-John D’Angelo

# of UCL Revisions per Year, 2010-2016

<table>
<thead>
<tr>
<th>Year</th>
<th>MLB</th>
<th>Minor</th>
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<tbody>
<tr>
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<td>2016</td>
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</table>

Studies that have Predicted UCL Surgery

- **Fastball Pitch Velocity Helps Predict Ulnar Collateral Ligament Reconstruction in Major League Baseball Pitchers.** Chalmers, et, al

- **Major League Baseball pitch velocity and pitch type associated with risk of ulnar collateral ligament injury.** Keller, et al.

- **Predictors of Ulnar Collateral Ligament Reconstruction in Major League Baseball Pitchers.** Whiteside et al.
Fastball Pitch Velocity Helps Predict Ulnar Collateral Ligament Reconstruction in Major League Baseball Pitchers  
Peter N. Chalmers,*y MD, Brandon J. Erickson,y MD, Brian Ball,z ATC, Anthony A. Romeo,y MD, and Nikhil N. Verma,y MD

- **Methods:** MLB Pitchers 2007-2015. Pitch Velo, number, type (PitchFx), demographics. Examined all UCLr prior to 2007 and after 2012. Put in 3 categories, “control”, ”pre-injury”, “postoperative”. 1327 Pitchers included with 309 (26.8%) underwent UCLr. 145 had pre-injury data.

- **Multivariant Regression showed:**
  - Peak pitch velocity was the primary independent predictor of whether a pitcher underwent UCLR ($P < .001$)
  - Mean velocity ($P = .013$), body mass index ($P = .010$), and age ($P = .006$) being secondary predictors.
  - However, a model constructed with these variables only explained 7% of the variance in UCLR rates.
  - Pitch counts were not significant predictors

Major League Baseball pitch velocity and pitch type associated with risk of ulnar collateral ligament injury  
Robert A. Keller, MD*, Nathan E. Marshall, MD, John-Michael Guest, BA, Kelechi R. Okoroha, MD, Edward K. Jung, MD, Vasilios Moutzouros, MD

- **Methods:** 83 MLB pitchers who underwent primary UCL reconstruction were evaluated. Average Pitching velocity and percent of pitch type thrown (fastball, curve ball, slider, and change-up) were evaluated 2 years before and after surgery. Data were compared with 83 control pitchers matched for age, position, size, innings pitched, and experience

- **Conclusion:**
  - MLB pitchers who pitch a high percentage of fastballs may be at increased risk for UCL injury because pitching a higher percent of fastballs appears to be a risk factor for UCL reconstruction.
  - Pitching more than 48% fastballs was a significant predictor of UCL injury, because pitchers over this threshold required reconstruction ($P = .006$).
  - MLB pitchers requiring UCL reconstruction do not pitch at higher velocities than matched controls, and pitch velocity does not appear to be a risk factor for UCL reconstruction.
Predictors of Ulnar Collateral Ligament Reconstruction in Major League Baseball Pitchers

David Whiteside,* PhD, Douglas N. Martini, PhD, Adam S. Lepley, PhD, ATC, Ronald F. Zernicke, PhD, and Grant C. Goulet, PhD

• Methods: 104 MLB UCLr pitchers compared to 104 age-position matched control group. Used binary logistic regression and machine learning computer

• Results: 6 Performance Metrics that were statistically significant risk factors
  1. Fewer days between consecutive games (fatigue)
  2. Smaller repertoire of types of pitches
  3. Less pronounced horizontal release points
  4. Smaller stature (height)
  5. Greater mean pitch velocity
  6. Greater mean pitch counts per game

Risk Factors and Prevention

<table>
<thead>
<tr>
<th>More Preventable</th>
<th>Less Preventable</th>
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<tbody>
<tr>
<td>1. Pitch Types- Fastballs</td>
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<td>2. Number of Pitch Types</td>
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<tr>
<td>1. Whiteside, et al, supports</td>
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<td>3. More Rest between Outings</td>
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<td>4. Pitch Counts</td>
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<td>1. Whiteside, et al, supports</td>
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<td>6. Weight</td>
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<tr>
<td>1. Chalmers, et al, support</td>
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<td>1. Peak Velocity</td>
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Thank You

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