

Open Reduction Internal Fixation of Medial Epicondyle Fractures After Ulnar Collateral Ligament Reconstruction in Professional Baseball Pitchers

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Background: Ulnar collateral ligament reconstruction (UCLR) is a common procedure among professional baseball pitchers. An uncommon complication after UCLR is a fracture of the medial epicondyle at the level of the humeral tunnel, which requires open reduction internal fixation (ORIF).

Purpose/Hypothesis: The purpose of this study was to determine the performance upon and rate of return to sport (RTS) in professional baseball pitchers after ORIF of the medial epicondyle and examine whether there is a difference in the RTS rate and performance between players who underwent ORIF and matched controls. It was hypothesized that there would be a high rate of RTS in professional baseball pitchers after ORIF of the medial epicondyle, with no difference between the ORIF and control groups in the rate of RTS or performance, specifically related to the primary performance outcome variables of win-loss percentage, walks plus hits per inning pitched, fielding independent pitching, and wins above replacement.

Methods: All professional baseball pitchers who underwent ORIF of the medial epicondyle between 2010 and 2016 were included in this study. Demographic and performance data (preoperative and postoperative) were recorded for each player. Performance metrics were then compared between the ORIF and control (no history of UCLR or ORIF) groups.

Results: Overall, 15 pitchers (80.0% starters, 73.3% right-handed) underwent ORIF of a medial epicondyle fracture. All had undergone prior UCLR using either the American Sports Medicine Institute (n = 9; 60.0%) or docking (n = 6; 40.0%) technique. ORIF techniques included fixation with 1 screw (n = 13; 86.7%) and fixation with suture anchors (n = 2; 13.3%). Eleven (73.3%) pitchers were able to return to sport (did not differ from controls; $P = .537$); 55% returned to the same level or higher. No significant differences existed in the primary performance outcome variables when comparing preoperative with postoperative performance. No significant differences in the primary performance outcome variables were seen between the ORIF and control groups after surgery, although players in the ORIF group pitched fewer innings than controls after surgery ($P = .003$).

Conclusion: After ORIF of the medial epicondyle in professional pitchers with a history of UCLR, 73.3% were able to return to sport (only 55% of those who returned pitched at the same level or higher) without a significant decline in most performance variables when compared with their preoperative performance or matched controls. The number of innings pitched declined after surgery.

Keywords: Major League Baseball; MLB; ulnar collateral ligament reconstruction; UCLR; medial epicondyle; open reduction internal fixation; ORIF; pitcher; return to sport

Overhead athletes, specifically baseball pitchers, place a significant amount of stress on the medial elbow during the throwing motion.^{12,16,25} Stability of the medial elbow is provided by both osseous and soft tissue stabilizers, each affording approximately 50% of stability to the elbow.¹⁷ The ulnar collateral ligament (UCL) is the primary soft tissue restraint to valgus stress about the elbow. When pitchers sustain a tear of the UCL and fail nonoperative treatment,

the recommended treatment for those pitchers who wish to return to sport at a high level is UCL reconstruction (UCLR).^{4,11} Several surgical techniques for UCLR have been described in the literature. No study to date has found one technique to be significantly superior to all others.⁷ Each of these techniques involves drilling either tunnels or a socket in the medial epicondyle.^{2,3,9,24}

While the results after UCLR have generally been good, there are several known complications that can occur postoperatively.^{4,6,18} These complications include transient or permanent ulnar neurapraxia, graft failure, the formation of heterotopic ossification, stiffness, and fractures through

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the ulnar tunnel or medial epicondyle.^{1,4,5,22,23} Although fractures of the medial epicondyle have been reported after UCLR, the results after open reduction internal fixation (ORIF) of this fracture in professional baseball players are unknown.²³ Furthermore, the best method to treat this complication in these elite-level athletes is unknown.

Therefore, the purposes of this study were to determine (1) the rate of return to sport (RTS) in professional baseball pitchers after ORIF of the medial epicondyle after UCLR, (2) performance after RTS, and (3) the difference in the RTS rate and performance between pitchers who underwent ORIF of their medial epicondyle after UCLR versus matched controls without a history of UCLR or ORIF of their medial epicondyle. We hypothesized that there would be a high rate of RTS in professional baseball pitchers after ORIF of their medial epicondyle, with no significant difference between the ORIF and control groups in the rate of RTS or performance, specifically related to the primary performance outcome variables of win-loss percentage, walks plus hits per inning pitched (WHIP), fielding independent pitching, and wins above replacement.

METHODS

This study was performed with the approval of the Major League Baseball (MLB) Players Association (MLBPA) and the Office of the Commissioner of MLB. The inclusion criterion was any professional baseball pitcher (after being drafted or playing at least 1 MLB game) who sustained a medial epicondyle fracture that required ORIF between 2010 and 2016. Study data were analyzed from the MLB Health and Injury Tracking System (HITS). The HITS is a centralized database that contains deidentified player information; it was developed as a league-wide surveillance system in 2010 to record player injuries and disability time.²⁰ This database was agreed upon by MLB and the MLBPA as a more efficient way to track injury trends in professional baseball.

One author (B.J.E.) reviewed the operative reports for each player, including the operative report for ORIF and the operative report for UCLR. Surgical data for both procedures were recorded. All players identified were included in this study in regards to RTS rate. A player was deemed to have returned to sport if he played in any professional game after ORIF of the medial epicondyle. Players who

underwent ORIF of their medial epicondyle with a minimum follow-up of 12 months were included in the study.

Pitchers who returned to professional baseball and had played in at least 1 game were included in prefracture and postfracture in-game performance statistical analyses. Pitcher demographic and performance data were collected. In-game performance variables were analyzed as the mean over the preinjury and postinjury courses of players' careers. A control group was selected to compare the data with the ORIF group. Controls were matched 1:1 to pitchers who underwent ORIF based on sex, age, years of experience in professional baseball, level of play (A, AA, AAA, MLB), and performance. Controls had no history of ORIF and no history of UCLR. An "index year" was designated for controls, analogous to the surgical year for pitchers who underwent ORIF. In other words, the controls pitched the same number of years before the index year as the players in the ORIF group pitched before their injury. The same demographic and in-game performance data were collected and analyzed over the course of the controls' careers as a total before and after the index year. RTS rates were also determined for control players after their index year to account for the natural attrition of professional players each year. Therefore, if a control pitched in a game in a season after his "index year," he was deemed to have returned to sport. This RTS rate was then compared between the ORIF and control groups.

Statistical Analysis

Descriptive statistics were calculated. Data were analyzed for normality using the Kolmogorov-Smirnov test, and parametric and nonparametric tests were used as appropriate. Performance measurements were averaged before the injury and postoperatively. Performance data were categorized as either ≥ 1 year before the injury or ≥ 1 year postoperatively. All performance data within the year of surgery were discarded.

Pitching performance data are reported as both raw counts (ie, number of earned runs) and percentages (ie, WHIP). For those performance data available as counts, we determined the number of available years before the injury and postoperatively, then divided the sum of each count by the number of available years to determine the number per year. For those performance data available as percentages, we calculated weighted means based on the number of games played per year for this study.

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Ethical approval for this study was waived by the University of Utah Institutional Review Board.

TABLE 1

Performance of Pitchers Before and After ORIF of the Medial Epicondyle for Primary Performance Variables^a

Variable	Mean Difference (95% CI)	P
WHIP	0.01 (-0.11 to 0.12)	.868
W-L%	-0.03 (-0.15 to 0.08)	.556

^aPositive values indicate improved performance after surgery, while negative values indicate worse performance after surgery. ORIF, open reduction internal fixation; WHIP, walks plus hits per inning pitched; W-L%, win-loss percentage.

Preinjury and postoperative performance data were compared using the paired Student *t* test and related-samples Wilcoxon signed-rank test as appropriate based on data normality. For each player, maximum preoperative and postoperative levels of play were calculated. The levels of play were arranged from highest to lowest as MLB, AAA, AA, A+, A, A-, Rookie, Foreign, and Fall. Each player was then categorized as not having returned to play, having returned but to a lower level, or having returned to the same or higher level.

RESULTS

Overall, 15 professional baseball pitchers underwent ORIF of a medial epicondyle fracture after having previously undergone UCLR. There were 12 (80.0%) starting pitchers, while 3 (20.0%) were relievers. Eleven pitchers (73.3%) were right-handed, while 4 (26.7%) were left-handed. The UCLR techniques included the American Sports Medicine Institute (ASMI) technique (n = 9; 60.0%) and a version of the docking technique (n = 6; 40.0%) (modified docking technique [n = 5; 33.3%] and DANE TJ [David Altchek, Neal ElAttrache, Tommy John] technique [n = 1; 6.7%]). The graft choices for UCLR included the palmaris longus tendon (n = 11; 73.3%) and gracilis tendon (n = 4; 26.7%). The mean length of time between UCLR and ORIF of the medial epicondyle was 482 ± 180 days (range, 287-824 days).

Surgical techniques for ORIF of the medial epicondyle included fixation with 1 cannulated screw in 13 patients (86.7%) and fixation with suture anchors in 2 patients (13.3%) (1 patient fixed with 2 anchors and 1 patient with 3 anchors). All procedures were performed open by exposing the medial epicondyle through the old UCL incision. None of these procedures were performed percutaneously. The screws were all cannulated and placed over a guide wire that was initially used to reduce the fracture. The sizes of the drill tunnel created on the medial epicondyle during the initial UCLR were as follows: 7 mm (n = 1), 4.5 mm (n = 2), 4 mm (n = 1), 3.5 mm (n = 1), and not reported (n = 10).

With regard to RTS, 11 pitchers (73.3%) were able to return to sport (55% of these returned to the same level or higher), while 4 (26.7%) did not return to sport. Of those who returned to sport, the mean time to RTS overall was 447 ± 148 days (range, 280-695 days) and to RTS at the same level was 467 ± 168 days (range, 289-718 days). Tables

TABLE 2

Performance of Pitchers Before and After ORIF of the Medial Epicondyle for Secondary Performance Variables^a

Variable	Mean Difference (95% CI)	P
H/9	0.16 (-0.75 to 1.07)	.723
HR/9	-0.25 (-0.50 to 0.00)	.048
BB/9	-0.06 (-0.56 to 0.43)	.789
SO/9	0.36 (-0.62 to 1.33)	.453
SO/W	0.07 (-0.50 to 0.64)	.805
W/y	1.64 (-0.66 to 3.94)	.152
L/y	1.72 (-0.25 to 3.68)	.084
G/y	-4.72 (-11.90 to 2.45)	.184
GS/y	6.50 (0.19 to 12.82)	.044
GF/y	-4.27 (-8.11 to -0.44)	.031
CG/y	0.28 (-0.02 to 0.58)	.067
SHO/y	0.08 (0.02 to 0.15)	.019
SV/y	-1.00 (-2.67 to 0.67)	.226
IP/y	24.45 (-10.48 to 59.38)	.159
H/y	21.73 (-13.80 to 57.25)	.216
R/y	11.35 (-7.13 to 29.82)	.214
ER/y	7.46 (-9.72 to 24.64)	.375
HR/y	0.24 (-4.15 to 4.63)	.909
BB/y	7.55 (-4.32 to 19.43)	.199
IBB/y	-0.19 (-1.04 to 0.65)	.641
SO/y	20.56 (-7.27 to 48.38)	.138
HBP/y	2.47 (0.31 to 4.62)	.027
BK/y	0.49 (0.28 to 0.69)	<.001
WP/y	1.15 (-0.42 to 2.72)	.143
BF/y	102.43 (-46.74 to 251.60)	.167

^aPositive values indicate improved performance after surgery, while negative values indicate worse performance after surgery. Bolded *P* values indicate statistically significant difference (*P* < .05) in performance before and after ORIF. BB/9, walks per 9 innings; BB/y, walks per year; BF/y, batters faced per year; BK/y, balks per year; CG/y, complete games per year; ER/y, earned runs per year; G/y, games per year; GF/y, games finished per year; GS/y, games started per year; H/9, hits per 9 innings; H/y, hits per year; HBP/y, hit by pitch per year; HR/9, home runs per 9 innings; HR/y, home runs per year; IBB/y, intentional walks per year; IP/y, innings pitched per year; L/y, losses per year; ORIF, open reduction internal fixation; R/y, runs per year; SHO/y, shutouts per year; SO/9, strikeouts per 9 innings; SO/W, strikeouts per win; SO/y, strikeouts per year; SV/y, saves per year; W/y, wins per year; WP/y, wild pitches per year.

1 and 2 demonstrate the comparison of performance variables in pitchers before and after ORIF of their medial epicondyle. No significant differences existed in the primary performance outcome variables when comparing preoperative with postoperative performance. However, the pitchers performed worse after ORIF in several secondary performance variables, including the number of home runs per 9 innings, the number of games finished per year, and the number of shutouts per year. Surprisingly, the number of games started per year improved significantly after ORIF compared with before ORIF.

Pitchers who underwent ORIF of their medial epicondyle were compared with matched controls. There were no significant differences in preoperative performance variables between the groups (Tables 3 and 4). No significant

TABLE 3
Baseline Performance Metrics
Between the ORIF and Control Groups
for Primary Performance Variables^a

Variable	ORIF	Control	P
WHIP	1.43 ± 0.2	1.71 ± 1.5	.068
W-L%	0.50 ± 0.1	0.47 ± 0.2	.867
FIP	4.90 ± 1.2	6.88 ± 5.5	.537
WAR	0.33 ± 0.6	0.25 ± 0.6	>.999

^aPositive values indicate improved performance after surgery for the ORIF group, while negative values indicate worse performance after surgery for the ORIF group compared with the control group. FIP, fielding independent pitching; ORIF, open reduction internal fixation; WAR, wins above replacement; WHIP, walks plus hits per inning pitched; W-L%, win-loss percentage.

differences in the primary performance outcome variables were seen between the ORIF and control groups after surgery (Tables 5 and 6). However, players in the ORIF group pitched significantly fewer innings postoperatively ($P = .003$) (Tables 5 and 6). There was no significant difference in RTS rates or the level to which pitchers returned to sport (lower, same, or higher) between the ORIF and control groups ($P = .537$). The normal attrition rate or decrease in performance for this select group of pitchers should be accounted for when determining RTS and return to preinjury performance attributable to the results of the surgical intervention.

DISCUSSION

Elite-level baseball players impart a significant amount of stress on the medial elbow during the throwing motion.^{12,13} This stress is significant enough to cause a fracture of the medial epicondyle after UCLR. Medial epicondyle fractures in a professional baseball pitcher without a history of UCLR have not been reported. In the present study, our hypotheses were mostly confirmed, as the overall RTS rate after ORIF of the medial epicondyle was 73.3%. However, a significant finding was that only 55% of these players returned to the same or higher level of play. For pitchers in the ORIF group, performance upon RTS was not significantly different from their preoperative level or compared with the control group. There were some secondary performance variables that declined after surgery, including innings pitched. This may be because of inherent issues with the pitchers such as decreased stamina, or it could be precautionary and purposeful limits set on these pitchers by their respective teams.

Medial epicondyle avulsion fractures are a known cause of disability in the adolescent overhead athlete, occasionally necessitating a surgical intervention when there is displacement of the bone fragment, with associated shortening of the UCL.²¹ In adolescents, this injury occurs at the physis. The UCL is stronger than the medial epicondyle in adolescents, and thus, in adolescents when the medial epicondyle fracture displaces, the UCL length is changed, which can be

TABLE 4
Baseline Performance Metrics
Between the ORIF and Control Groups
for Secondary Performance Variables^a

Variable	ORIF	Control	P
H/9	9.19 ± 1.1	10.90 ± 9.3	.185
HR/9	0.59 ± 0.3	0.99 ± 1.3	.583
BB/9	3.74 ± 1.8	4.40 ± 5.0	.519
SO/9	7.84 ± 1.6	8.69 ± 1.5	.239
SO/W	2.41 ± 0.5	3.05 ± 1.2	.061
W/y	5.55 ± 4.0	4.57 ± 4.7	.35
L/y	5.43 ± 4.2	4.50 ± 4.5	.375
G/y	28.99 ± 13.5	23.50 ± 14.9	.259
GS/y	13.64 ± 14.3	11.50 ± 13.7	.65
GF/y	5.38 ± 4.4	4.63 ± 6.7	.185
CG/y	0.30 ± 0.4	0.22 ± 0.5	.519
SHO/y	0.10 ± 0.1	0.05 ± 0.1	.325
SV/y	1.01 ± 1.3	1.03 ± 2.0	.458
IP/y	94.70 ± 74.4	78.40 ± 78.1	.519
H/y	97.50 ± 77.2	76.00 ± 76.1	.402
R/y	51.60 ± 37.8	39.70 ± 39.7	.302
ER/y	44.10 ± 33.6	34.10 ± 36.6	.28
HR/y	7.45 ± 7.5	6.73 ± 8.8	.583
BB/y	34.00 ± 24.5	26.70 ± 27.9	.22
IBB/y	1.19 ± 1.1	0.62 ± 1.1	.185
SO/y	76.20 ± 55.7	70.00 ± 60.5	.83
HBP/y	5.21 ± 3.3	4.87 ± 4.8	.402
BK/y	0.76 ± 0.7	0.45 ± 0.4	.325
WP/y	5.83 ± 2.8	4.14 ± 3.9	.054
BF/y	411.90 ± 319.5	336.80 ± 333.1	.458

^aPositive values indicate improved performance after surgery for the ORIF group, while negative values indicate worse performance after surgery for the ORIF group compared with the control group. BB/9, walks per 9 innings; BB/y, walks per year; BF/y, batters faced per year; BK/y, balks per year; CG/y, complete games per year; ER/y, earned runs per year; G/y, games per year; GF/y, games finished per year; GS/y, games started per year; H/9, hits per 9 innings; H/y, hits per year; HBP/y, hit by pitch per year; HR/9, home runs per 9 innings; HR/y, home runs per year; IBB/y, intentional walks per year; IP/y, innings pitched per year; L/y, losses per year; ORIF, open reduction internal fixation; R/y, runs per year; SHO/y, shutouts per year; SO/9, strikeouts per 9 innings; SO/W, strikeouts per win; SO/y, strikeouts per year; SV/y, saves per year; W/y, wins per year; WP/y, wild pitches per year.

functionally equivalent to UCL tears in older pitchers.¹⁹ However, medial epicondyle fractures are rare in skeletally mature athletes, as the UCL commonly tears before the bone breaks.^{14,21} Unfortunately, the number of UCLRs performed in professional as well as youth baseball players has been increasing over the past 10 years.^{8,10,15} While the results after UCLR have been encouraging, the procedure is not without complications.²⁴ Fortunately, the majority of complications after UCLR are transient and often involve the ulnar nerve.^{7,24} Some of the more rare, devastating complications are those that require a second surgical procedure such as graft failure, fractures of the ulnar tunnel, or fractures of the medial epicondyle.^{5,22,23}

The only report of medial epicondyle fractures after UCLR in the literature to date is from Schwartz et al²³ in 2008. The

TABLE 5
Postoperative Performance Metrics
Between the ORIF and Control Groups
for Primary Performance Variables^a

Variable	ORIF	Control	P
WHIP	1.27 ± 0.2	1.38 ± 0.1	.235
W-L%	0.49 ± 0.2	0.56 ± 0.1	.418
FIP	3.94 ± 1.0	3.95 ± 0.3	.629
WAR	0.27 ± 0.3	0.95 ± 0.9	.229

^aPositive values indicate improved performance after surgery for the ORIF group, while negative values indicate worse performance after surgery for the ORIF group compared with the control group. FIP, fielding independent pitching; ORIF, open reduction internal fixation; WAR, wins above replacement; WHIP, walks plus hits per inning pitched; W-L%, win-loss percentage.

authors reported on 7 collegiate and professional baseball players who sustained a fracture of the medial epicondyle after UCLR. None of the patients in that study overlapped with the current study, as the patients in the current study were from 2010 to 2016. Schwartz et al²³ treated 6 of the 7 with ORIF, while 1 patient chose nonoperative treatment. The authors performed radiography and magnetic resonance imaging on all patients to characterize the fracture and evaluate the UCL. One of the concerns with a medial epicondyle fracture in a patient with prior UCLR is the competency of the reconstructed UCL. Schwartz et al²³ found that the UCL was intact in 100% of the patients in their study, verified both by magnetic resonance imaging and at surgery (in the 6 players who underwent surgery), and therefore, none of the patients required revision UCLR; instead, all were treated with ORIF of the fracture. This finding is similar to that in the current study, as none of the pitchers necessitated revision UCLR but rather underwent ORIF of the medial epicondyle. The number of pitchers in our study was not high enough to compare the success of the various surgical techniques.

One interesting finding in this study was the prior surgical technique used for UCLR. The majority of players underwent UCLR with the ASMI technique (n = 9; 60.0%), while fewer players underwent UCLR with the modified docking technique (n = 5; 33.3%), and only 1 underwent UCLR using the DANE TJ technique (n = 1; 6.7%). Because the exact number of UCLRs performed in professional players by 1 specific technique is unknown, it is not possible to statistically determine whether this complication was seen more frequently than would be expected with the ASMI, docking, or DANE TJ technique. In our opinion, the most important factor related to the complication of a medial epicondyle fracture in any of the surgical techniques is the size and placement of either the socket or tunnels in the medial epicondyle. As the bone tunnels or socket progress in size from a typical starting diameter of 3.5 mm to ≥5.0 mm, more bone is removed, and therefore, the strength of the medial epicondyle is reduced. Furthermore, if the tunnels or socket are established closer to the cortex of the medial epicondyle instead

TABLE 6
Postoperative Performance Metrics
Between the ORIF and Control Groups
for Secondary Performance Variables^a

Variable	ORIF	Control	P
H/9	8.30 ± 1.7	9.06 ± 1.5	.118
HR/9	0.90 ± 0.7	0.79 ± 0.3	.976
BB/9	3.21 ± 1.5	3.39 ± 1.1	.786
SO/9	7.73 ± 2.7	7.52 ± 1.2	.235
SO/W	3.08 ± 1.4	2.47 ± 0.7	.418
W/y	2.09 ± 1.4	5.78 ± 5.5	.011
L/y	2.16 ± 1.7	5.28 ± 5.4	.104
G/y	25.60 ± 14.1	38.20 ± 14.4	.079
GS/y	2.78 ± 4.2	12.10 ± 17.9	.449
GF/y	8.59 ± 7.4	9.23 ± 6.7	.833
CG/y	0.00 ± 0.0	0.08 ± 0.3	.740
SHO/y	0.00 ± 0.0	0.00 ± 0.0	>.999
SV/y	1.87 ± 3.8	1.97 ± 2.4	.379
IP/y	40.40 ± 22.3	99.80 ± 84.8	.003
H/y	37.60 ± 24.6	106.00 ± 93.0	.004
R/y	19.90 ± 13.1	54.60 ± 49.3	.009
ER/y	18.40 ± 11.9	49.50 ± 46.6	.019
HR/y	3.99 ± 2.3	10.60 ± 13.3	.151
BB/y	15.60 ± 9.9	34.10 ± 23.7	.013
IBB/y	0.37 ± 0.4	1.72 ± 1.9	.044
SO/y	37.20 ± 19.1	80.30 ± 73.3	.016
HBP/y	1.21 ± 1.1	4.27 ± 3.7	.001
BK/y	0.22 ± 0.3	0.27 ± 0.5	>.999
WP/y	0.22 ± 0.3	5.17 ± 4.0	.151
BF/y	2.87 ± 2.0	434.50 ± 366.8	.004

^aPositive values indicate improved performance after surgery for the ORIF group, while negative values indicate worse performance after surgery for the ORIF group compared with the control group. Bolded P values indicate statistically significant difference (P < .05) between the ORIF and control groups. BB/9, walks per 9 innings; BB/y, walks per year; BF/y, batters faced per year; BK/y, balks per year; CG/y, complete games per year; ER/y, earned runs per year; G/y, games per year; GF/y, games finished per year; GS/y, games started per year; H/9, hits per 9 innings; H/y, hits per year; HBP/y, hit by pitch per year; HR/9, home runs per 9 innings; HR/y, home runs per year; IBB/y, intentional walks per year; IP/y, innings pitched per year; L/y, losses per year; ORIF, open reduction internal fixation; R/y, runs per year; SHO/y, shutouts per year; SO/9, strikeouts per 9 innings; SO/W, strikeouts per win; SO/y, strikeouts per year; SV/y, saves per year; W/y, wins per year; WP/y, wild pitches per year.

of the midpoint of the UCL attachment footprint, the strength of the medial epicondyle to resist tension forces is reduced, and a fracture is more likely to occur. There was not enough information regarding tunnel size from the initial UCLR operative reports obtained in this study to draw any conclusion about the maximum tunnel size that should be used on the medial epicondyle. To summarize, the amount of bone removed because of the size of the tunnels or socket, and the placement of the tunnels and socket in the medial epicondyle, are the most important determinants of an increased risk of postoperative medial epicondyle fractures, which vary even when the surgeon uses 1 of the 3 techniques associated with this complication in our study. Medial epicondyle fractures after UCLR

are a difficult problem to treat, so avoidance of this complication with meticulous attention to detail during the index UCLR is paramount.

Limitations

This study did not use public data but rather used the MLB HITS to ensure the accuracy of these patients. Furthermore, all operative reports were reviewed to remove any possibility of including a player who did not undergo ORIF of the medial epicondyle. While the MLB HITS was used, there is the possibility that some players who underwent ORIF of the medial epicondyle were not entered into the database and were therefore missed. The pitchers who underwent ORIF were matched to the best extent possible to a group of controls, but differences between the groups could still exist. We were unable to compare the number of medial epicondyle fractures based on the prior UCLR technique, as the overall number of UCLRs performed in professional baseball players with each specific technique is not known. The control group was purposefully chosen not to have a history of UCLR because once a player sustains a medial epicondyle fracture, this puts him into a completely different category; no longer are they patients undergoing UCLR but are rather patients with an elbow fracture. Hence, it seemed best to compare these pitchers with healthy MLB pitchers because the goal was to evaluate the effectiveness of ORIF, not UCLR. Part of the time between UCLR and the medial epicondyle fracture was spent in rehabilitation, but no rehabilitation data were recorded, so this could not be commented on. Finally, the level of play for some players changed from before the injury to after the injury (to either a higher or lower level league), and this may have had an effect on their relative performance.

CONCLUSION

We found that after ORIF of the medial epicondyle in professional pitchers with a history of UCLR, 73.3% were able to return to sport (only 55% at the same level or higher) without a significant decline in most performance variables when compared with their preoperative performance or when compared with matched controls. The number of innings pitched declined after surgery.

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