Examining the Prevalence of Sports-Related Injuries in Collegiate Baseball Players

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Background: Sports-related injuries remain a significant problem for collegiate baseball players. Although some studies reported the epidemiology of sports-related injuries among collegiate baseball players, the latest information on sport-related injuries should be provided.

Purpose: To examine the current trends of sports-related injuries among collegiate baseball players in the Pacific 12 (PAC-12) Conference.

Study Design: Descriptive epidemiology study.

Methods: Demographic and injury data were obtained from a database of the PAC-12 Health Analytics Program between 2016 and 2021. Injury incidence, type, mechanism, and outcome were analyzed. The annual incidence of injuries was defined as the number of injuries per total players for 1 year. Detailed reports of the 20 most common specific diagnoses were generated.

Results: A total of 1434 sports-related injuries occurred in 6 years, with the number increasing from 2016 (n = 75; incidence, 8.5 per 100 player-years) to 2021 (n = 378; incidence, 43 per 100 player-years). Most of the injuries occurred in pitchers (33.6%), were acute (76.6%), resulted in missed time (68.8%), and were new injuries (86.9%). In addition, most injuries were caused by noncontact events (53.2%) and occurred during in-season games (39.9%) and practice (47.4%). Only 1.3% of sports-related injuries did not result in a return to the previous activity level. Rotator cuff tendon injuries were the most common specific diagnoses (n = 98), followed by ulnar collateral ligament (UCL) injuries (n = 63), hamstring muscle strains (n = 60), ankle ligament sprains (n = 46), and hand/wrist fractures (n = 40). UCL injuries had the highest proportion of surgical interventions (41.3% of all UCL injuries) and the longest days to clearance (167 $\pm$ 197 days) among the 20 most common diagnoses.

Conclusion: The number of sports-related injuries among PAC-12 collegiate baseball players has increased by approximately 5 times over the past 6 years. Rotator cuff tendon injuries followed by UCL injuries, hamstring muscle strains, ankle ligament sprains, and hand/wrist fractures are the most common specific diagnoses among this cohort of collegiate baseball players. Of the 20 most common specific diagnoses, UCL injuries most often require surgical interventions and had the longest return to playtime.

Keywords: baseball; epidemiology; medical aspects of sports; National Collegiate Athletic Association; return to sports; rotator cuff tendon injuries; softball; ulnar collateral ligament injuries

Baseball is one of the most popular sports in the world. Sports-related injuries remain a significant problem for baseball players at all levels of play.[8,16,38] Better programs for injury prevention rely on epidemiological research to understand the incidence of types of injuries related to baseball.[36] In Major League Baseball (MLB), injury surveillance is conducted by using data provided by the Health and Injury Tracking System (HITS) database.[28] Using the HITS data, many epidemiologic reports on forearm flexor injuries,[18] hand and wrist injuries,[30] abdominal oblique injuries,[6] hip and groin injuries,[10] hamstring injuries,[2,25] knee injuries,[12] and ankle and lower leg injuries[21] have recently been published. Camp et al[8] analyzed a multitude of injury data (ie, a total of 49,955 injuries) and generated detailed reports of the 50 most common specific diagnoses. Although the incidence and characteristics of the injuries at the level of professional baseball continue to become clearer, there is little information regarding the injuries among collegiate baseball players.

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Some epidemiological research focused on sports-related injuries among National Collegiate Athletic Association (NCAA) baseball players has been published.[4,11,13,14,24,32,37,38,39] McFarland and Wasik[24] first reported sports-related injuries that occurred among the 3 divisions of NCAA baseball between 1991 and 1993. They demonstrated that the shoulder (24%) followed by the elbow (12%) is the most commonly injured body region. Subsequently, other researchers investigated the incidence and characteristics of the injuries during the 1988-2004,[14] 2004-2014,[11,38] and 2014-2019[4] seasons. Although these reports have provided valuable information on sport-related injuries in collegiate baseball players, the information is somewhat limited. These previous studies reported general injuries based on body regions and did not provide detailed information on specific diagnoses such as rotator cuff muscle strains, shoulder instability, ulnar collateral ligament (UCL) injuries, and hamstring muscle strains. A few studies reported the epidemiology of specific diagnoses on the shoulder[11,37] and elbow[11,13,32,39] in NCAA baseball players. However, other specific diagnoses commonly occurring in collegiate baseball players have not yet been examined. Understanding the incidence and characteristics of the specific diagnoses may allow for the development of treatment and preventive measures against each of the specific diagnoses.

This study aimed to examine the current trends of sports-related injuries among collegiate baseball players. More specifically, we sought to determine (1) whether the number of sports-related injuries has increased over time, (2) which specific diagnoses are common and have the most impact on playing time, and (3) the characteristics of the common specific diagnoses. Some authors explored the impact of the coronavirus 2019 (COVID-19) pandemic on sports-related injuries among MLB baseball players and reported a higher rate of injury, particularly UCL injuries, in 2021 (post-COVID-19 pandemic year) as compared with 2019 (pre-COVID-19 pandemic year).[22,27] We hypothesized that (1) the number of sports-related injuries among collegiate baseball players would increase over recent years (ie, 2016-2021) and (2) UCL injuries would be the most common specific diagnosis, would have a higher proportion of surgical intervention, and would have longer days to clearance than other diagnoses. The current trends of sport-related injuries among collegiate baseball players would be similar to those of MLB baseball players.

METHODS

This study was approved by our institutional review board. We received permission to use a database of the Pacific 12 (PAC-12) Health Analytics Program (HAP), which was established in 2014.[3] The PAC-12 Conference is an NCAA Division I athletic conference, comprising 12 universities in the Western United States. The database is derived from clinical documentation in a Health Insurance Portability and Accountability Act (HIPAA)-compliant electronic medical record by a team's sports medicine clinician or athletic trainer. Data are deidentified using the HIPAA Safe Harbor method. The resulting project data includes deidentified records only from student-athletes who provide authorization for secondary research as part of the HAP. The HAP functions under the guidance of the PAC-12 Student-Athlete Health and Well-Being Initiative board of directors. A project manager at the conference level and 2 campus administrator (CA) co-leads, who also serve individually as their school's local CA, provide administrative and clinical oversight to participating institutions to optimize data collection, data quality, and reporting. The CA ensures that clinical staff understand how to complete these forms—including documenting all HAP variables. The CAs offer local leadership and oversight of clinical athletic training staff to ensure accurate data entry and are also responsible for implementing weekly data-quality checks.[31]

This database was queried to identify all injuries that occurred in collegiate baseball players who participated in the PAC-12 Conference between 2016 and 2021. Sport-related injuries—defined as an injury that occurred due to participation in an NCAA-certified event, training, or practice—were included for analysis. This information was ascertained in the injury history portion of an examination or by directly witnessing an injury during an event or training. The sport-related injuries were classified by specific diagnoses and body parts using the Orchard Sports Injury and Illness Classification System, which is one of the commonly used systems for coding injury diagnosis in sports injury surveillance systems.[26] The exclusion criteria were an injury or medical illness (eg, cardiovascular, respiratory, and gastrointestinal diseases) not related to sports activities (ie, nonsports-related injuries). These medical illnesses that occurred during sports activities were included in the sports-related injuries.

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Ethical approval for this study was obtained from the University of Utah (00114221).

Demographic and injury characteristics for sports-related injuries were analyzed. Demographic characteristics included age and position. Injury characteristics included the onset of injury (acute vs chronic/overuse), whether or not the injury resulted in missed time, recurrence of injury (new vs recurrent vs preexisting injury), mechanism of injury (contact vs non-contact), injury season (preseason, in-season, post-season, etc), injury event (practice, competition, conditioning, etc), whether or not the surgical intervention was required, outcome (did not interfere with sport activity, returned to previous activity level, and returned to restricted activity level, etc), days to examination, and days to clearance. Days to examination were defined as the number of elapsed calendar days from the reported incident date and the date of examination by medical staff. Days to clearance were defined as the number of elapsed calendar days from the date of examination and the date of clearance by medical staff.

Descriptive statistics—such as numbers, percentages, and means ± standard deviations—were used to report summarized data. The annual incidence of injuries was defined as the number of injuries per total players registered in the PAC-12 HAP for the 2022 season, as data from other years were not available. The number of players for the 2022 season was 879 players. The 20 most common specific diagnoses were identified and ranked based on the number of injury events for that diagnosis over the 6 years. A linear regression model was used to assess trends of the number of injuries over the 6 years, with statistical significance determined at the $P = .05$ level. In addition, the linear regression analysis was performed over the 5 years excluding 2020, which is the COVID-19 pandemic year, as its effect on sport participation is well documented.[33] Statistical analyses were performed using the statistics software SPSS Version 25 (IBM).

RESULTS

A total of 2188 injuries (age, 19.9 ± 1.3 years; all men) were recorded in the PAC-12 HAP database between 2016 and 2021. Of these, 66% (n = 1434) were sports-related injuries, and 34% (n = 754) were nonsports-related injuries. The number of sports-related injuries significantly increased from 2016 (n = 75; annual incidence, 8.5 per 100 player-years) to 2021 (n = 378; annual incidence, 43 per 100 player-years) ($R^2 = 0.735$; $P = .029$ for all years; $R^2 = 0.980$, $P = .001$ for excluding 2020) (Figure 1).

Of the sports-related injuries, the most commonly injured body parts were the shoulder (n = 279; 19.5%), followed by the arm/elbow (n = 231; 16.1%), the hip/thigh/upper leg (n = 203; 14.2%), the trunk (n = 180; 12.6%), and the hand/wrist (n = 173; 12.1%) (Figure 2). The most common age for sports-related injuries was 19 years (28.5%), followed by 20 years (22.4%) and 21 years (21.4%) (Figure 3). Pitchers (33.6%) were the most common position for sports-related injuries, followed by infielders (22.4%), outfielders (19.9%), and catchers (11.5%) (Figure 4).

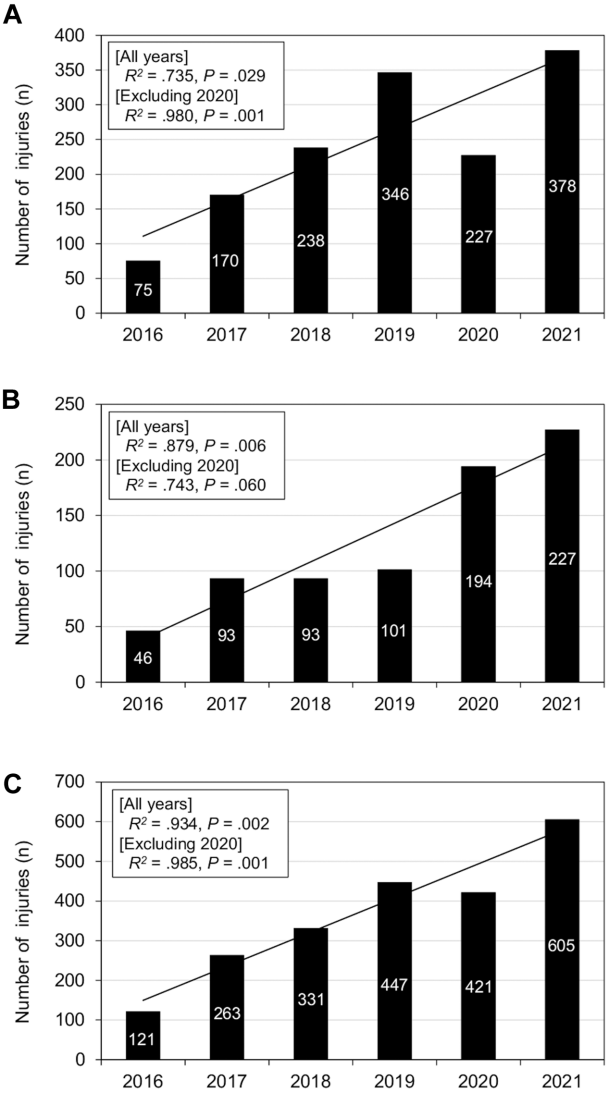

Figure 1. The number of injuries between 2016 and 2021 for (A) sports-related injuries, (B) nonsports-related injuries, and (C) total injuries. The number of sports-related injuries significantly increased between 2016 (n = 75) and 2021 (n = 378) ($R^2 = 0.735$; $P = .029$).

For injury type, most of the sports-related injuries were acute (76.6%), missed time injuries (68.8%), and new injuries (86.9%) (Table 1). For injury mechanism, most sports-related injuries were caused by non-contact events (53.2%), particularly throwing (34.4%) (Table 2). In addition, sports-related injuries frequently occurred during in-season (39.9%) and practice (47.4%) (Table 2). For injury outcome, surgery was required for 7.3% of sport-related injuries, only 1.3% of those with sport-related injuries did not return to the previous activity level, and the mean days to clearance after sport-related injuries was 35 days (2016, 1 day; 2017, 9 days; 2018, 22 days; 2019, 52 days; 2020, 53 days; 2021, 34 days) (Table 3).

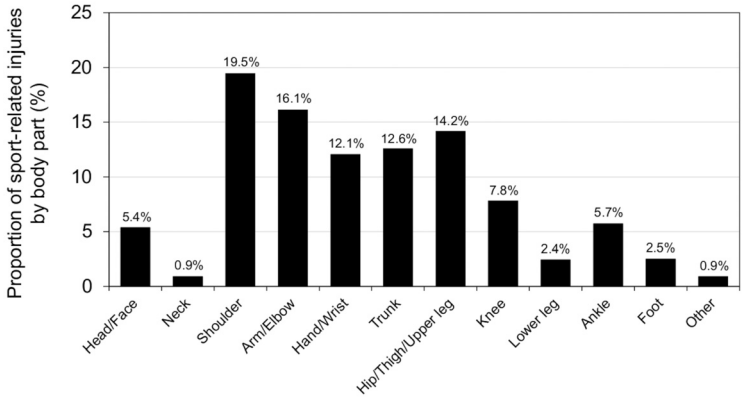

Figure 2. The proportion of sports-related injuries by body part.

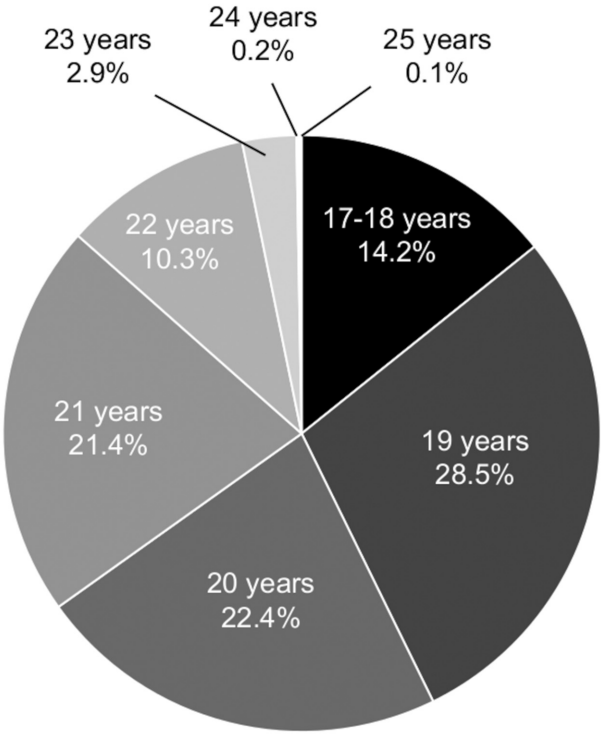

Figure 3. The proportion of sports-related injuries by age.

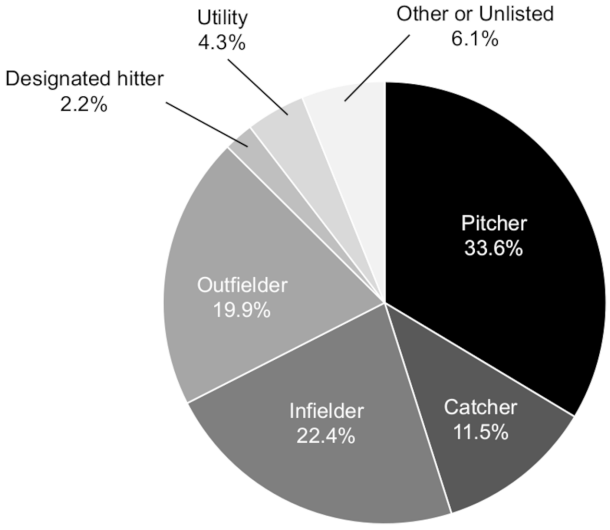

Figure 4. The proportion of sports-related injuries by position.

Of the 1434 sport-related injuries, rotator cuff tendon injuries were the most common specific diagnoses (n = 98; 6.8%), followed by UCL injuries (n = 63; 4.4%), hamstring muscle strains (n = 60; 4.2%), ankle ligament sprains (n = 46; 3.2%), and hand/wrist fractures (n = 40; 2.8%) (Table 4). The detailed data for the 20 most common specific diagnoses are listed in Supplemental Table S1-S5 (available in the online version of this article). Of the 20 most common specific diagnoses, surgical interventions were most frequently performed on UCL injuries (41.3% of all UCL injuries), followed by hand/wrist fractures (35%), shoulder instability (30.4%), knee ligament injuries (15%), and superior labral anterior to posterior (SLAP) and biceps tendon-related injuries (10.5%) (Supplemental Table S5, available online). The days to clearance for UCL injuries was the longest (167 ± 197 days), followed by rotator cuff muscle strains (107 ± 177 days), shoulder instability (101 ± 121 days), SLAP and biceps tendon-related injuries (83 ± 202 days), and knee ligament injuries (80 ± 110 days) (Supplemental Table S5, available online).

DISCUSSION

This study aimed to examine the current trends of sports-related injuries among collegiate baseball players using the PAC-12 HAP database. As we hypothesized, the number of sports-related injuries increased between 2016 and 2021. Most of the injuries occurred in pitchers, which was consistent with the previous findings in high school,[34,35] collegiate,[4,14] and professional baseball

TABLE 1
Characteristics of Sports-Related Injuries (Type)[a]

Variable	Data
Onset of injury	
Acute	76.6 (1098/1434)
Chronic/overuse	22.7 (311/1434)
Other or unlisted	1.7 (25/1434)
Missed time injury	
Yes	68.8 (986/1434)
No	26.2 (376/1434)
Other or unlisted	5 (72/1434)
Recurrence of injury	
New injury	86.9 (1246/1434)
First recurrence of past injury	7.6 (109/1434)
Multiple recurrences of past injury	2 (29/1434)
Preexisting injury	1.7 (24/1434)
Other or unlisted	1.8 (26/1434)

[a]Data are presented as percentages (n/total).

TABLE 2
Characteristics of Sports-Related Injuries (Mechanism)[a]

Variable	Data
Mechanism of injury	
Contact	26.1 (374/1434)
With person	3.3 (47/1434)
With apparatus/playing device	17.3 (248/1434)
With ground	5.5 (79/1434)
Non-contact	53.2 (763/1434)
Throwing	34.4 (494/1434)
Running	8.2 (117/1434)
Cutting	2.2 (31/1434)
Jumping	1.4 (20/1434)
Repetitive trauma	7 (101/1434)
Other or unlisted	20.7 (297/1434)
Injury season	
Pre-season	28.2 (405/1434)
In-season	39.9 (572/1434)
Post-season	1.2 (17/1434)
Off-season	24.1 (345/1434)
Other or unlisted	6.6 (95/1434)
Injury event	
Practice	47.4 (680/1434)
Competition	26.3 (377/1434)
Conditioning	2.5 (36/1434)
Voluntary workout	7.1 (102/1434)
Strength training, weight room	6.2 (89/1434)
Other or unlisted	10.5 (150/1434)

[a]Data are presented as percentages (n/total).

players.[8,29] Most sports-related injuries were acute, missed time, and new injuries. Moreover, most sports-related injuries were caused by noncontact events—particularly throwing—and occurred during in-season and practice, and only 1.3% of those with sports-related injuries did not return to the previous activity level. The mean days

TABLE 3
Characteristics of Sports-Related Injuries (Outcome)[a]

Variable	Data
Surgical intervention	
Yes	7.3 (105/1434)
No	92.7 (1329/1434)
Outcomes	
Did not interfere with sports activity	26.2 (376/1434)
Returned to previous activity level	66.7 (957/1434)
Returned to restricted activity level	0.7 (10/1434)
Did not return to previous activity level	1.3 (19/1434)
Other or unlisted	5 (72/1434)
Days to examination	5 ± 26[b]
Days to clearance	35 ± 98[b]
	0 (0-20)[c]

[a]Data are presented as percentages (n/total) unless otherwise indicated.
[b]Data are presented as mean ± SD.
[c]Data are presented as median (interquartile range).

TABLE 4
Twenty Most Common Specific Diagnoses in Collegiate Baseball Players[a]

Rank	Diagnosis	Proportion
1	Rotator cuff tendon injuries	6.8 (98/1434)
2	UCL injuries	4.4 (63/1434)
3	Hamstring muscle strains	4.2 (60/1434)
4	Ankle ligament sprains	3.2 (46/1434)
5	Hand/wrist fractures	2.8 (40/1434)
6	SLAP and biceps tendon-related injuries	2.6 (38/1434)
6	Low back muscle strains	2.6 (38/1434)
6	Head concussion	2.6 (38/1434)
9	Hip adductor muscle strains	2.2 (31/1434)
10	Forearm flexor muscle strains	2 (29/1434)
10	Hand/wrist contusions	2 (29/1434)
12	Rotator cuff muscle strains	1.7 (24/1434)
13	Shoulder instability	1.6 (23/1434)
13	Hip flexor muscle strains	1.6 (23/1434)
15	Oblique muscle strains	1.5 (22/1434)
15	Hand/wrist ligament sprains	1.5 (22/1434)
17	Knee ligament injuries	1.4 (20/1434)
18	Patellar tendinopathy	1.1 (16/1434)
19	Quadriceps muscle strains	1 (15/1434)
20	Knee contusions	0.8 (11/1434)

[a]Data are presented as percentages (n/total). SLAP, superior labral anterior to posterior; UCL, ulnar collateral ligament.

to clearance after injuries was 35 days. The present study also sought to determine which specific diagnoses are common and have the most impact on playing time. Our hypotheses were partially confirmed, as UCL injuries were the second most common specific diagnoses after rotator cuff tendon injuries, and UCL injuries had the greatest proportion of surgical interventions (41.3%) and the longest days to clearance (167 ± 197 days) among the 20 most common specific diagnoses (Supplemental Table S5,

available online). This study provides a useful direction for research on preventive measures for each specific diagnosis in collegiate baseball players.

The incidence of sports-related injuries among collegiate baseball players has been reported in the previous research.[14,38] Dick et al[14] showed that injury rates among collegiate baseball players remained stable between 1988-1989 and 2003-2004. Wasserman et al[38] examined injury rates among collegiate baseball players between 2004 and 2014. The authors found that whereas the rates of practice injury remained stable, the rates of competition injury were relatively high during 2004-2005 and 2006-2007 and then the injury rates were on a decreasing trend between 2006-2007 and 2013-2014. Boltz et al[4] showed that injury rates increased between 2014-2015 and 2016-2017 and then slightly decreased during 2017-2018 and 2018-2019. In the present study, recent trends between 2016 and 2021 have shown rising rates of injuries among collegiate baseball players. These trends suggest that additional injury prevention programs should be considered to decrease injury rates. An interesting finding in the present study is the greatest number of injuries in 2021 after the COVID-19 pandemic year. Platt et al[27] investigated the impact of the COVID-19 pandemic on sports-related injuries among MLB baseball players. This result showed that the injury rate in 2021 was significantly greater than in pre-COVID-19 seasons (2018-2019). Similarly, there was a greater rate of injury in 2021 compared with 2019 among collegiate baseball players, although the difference was not significant.[20] In the PAC-12 Conference, all competitions and practices were canceled from March 2020 until November 2020. The long periods of detraining could cause loss of an athlete's physical strength, endurance, and sports-specific skills, leading to increased rates of injury in the post-COVID-19 seasons.

The present study identified a higher proportion of upper extremity injuries (47.7%) than injuries in any other body region. The shoulder (19.5%) followed by the arm/elbow (16.1%) was the most injured body region. Similar findings were confirmed in the previous reports on collegiate baseball players.[4,14,24,38] In addition, 4 of the 20 most specific common diagnoses were involved in the shoulder injuries: rotator cuff tendon injuries (No. 1), SLAP and biceps tendon-related injuries (No. 6), rotator cuff muscle strains (No. 12), and shoulder instability (No. 13). Cross et al[11] reviewed collegiate baseball players with shoulder injuries between 2004 and 2014. The authors found that the most common positions sustaining shoulder injuries were pitchers (45.9%) and 72.8% of the shoulder injuries were caused by noncontact events. Our study demonstrated that the injury characteristics are different for each shoulder injury. Of the 4 shoulder injuries, shoulder instability commonly occurred in position players (82.6%) and was caused by contact with apparatus/playing device or ground (60.8%), whereas the other shoulder injuries commonly occurred in pitchers and were caused by noncontact events (Supplemental Table S2 and S4, available online). These findings represent an appropriate target for the prevention of each shoulder injury. For instance, we should focus on contact events (eg, sliding head first into a base or diving headwhile playing defense) among position players for future prevention of shoulder instability.

Surgery was required for 10.5% of SLAP and biceps tendon-related injuries and 30.4% of shoulder instability, and the proportion was greater than that for the other shoulder injuries (rotator cuff tendon injuries, 5.1%; rotator cuff muscle strains, 4.2%) (Supplemental Table S5, available online). In addition, the mean days to clearance after SLAP and biceps tendon-related injuries and shoulder instability were relatively longer (83 $\pm$ 202 days and 101 $\pm$ 121 days, respectively) (Supplemental Table S5, available online). These findings indicate that players who have SLAP and biceps tendon-related injuries and shoulder instability, which mainly involve the labrum, frequently require surgery, resulting in a greater impact on playing time. Similar findings have been demonstrated in MLB baseball players. Chalmers et al[9] reported that most shoulder procedures addressed the labrum, whereas the rotator cuff was involved much less frequently among MLB baseball players who underwent shoulder surgery. Interestingly, the mean days to clearance after rotator cuff muscle strains was longer (107 $\pm$ 177 days) despite a lower proportion of surgical intervention (Supplemental Table S5, available online). This result provides valuable information to players/staff on prognostic prediction after rotator cuff muscle strains.

One significant finding from the present study is that 41.3% of players with UCL injuries required surgery, and the proportion was the highest among the 20 most common specific diagnoses (Supplemental Table S5, available online). DeFroda et al[13] found that 15% of collegiate baseball players with UCL injuries required surgery between 2009 and 2014. Taken together, the incidence of UCL injuries requiring surgery among collegiate baseball players may be on the increase over recent years. Fleisig and Andrews[17] reported a significant increase in the proportion of youth and high school baseball players who underwent UCL reconstruction between 1994 and 2010. In concert, these findings demonstrate that surgical indications for UCL surgery are broadening with time.

The present study found that only 6.3% of collegiate baseball players with UCL injuries were not able to return to sports (Supplemental Table S5, available online). Cain et al[5] reported that only 26 (8%) of 346 collegiate players who underwent UCL reconstruction did not return to sports for a minimum 2-year follow-up. Erickson et al[15] reviewed a total of 179 MLB pitchers who underwent UCL reconstruction and reported that only 5 pitchers (2.8%) were never able to return to sports in either the MLB or Minor League Baseball. These findings indicate that players with UCL injuries achieve a successful outcome. However, the injuries remain a serious concern, as they derail a limited baseball career of 4 years in college (mean days to clearance, 167 days). They also do not provide information about the pitcher's subsequent performance.

Lower extremity injuries were responsible for 32.6% of sports-related injuries among collegiate baseball players, which is similar to the previous reports in MLB baseball players[8,12] (32.2%-35%). Particularly, hamstring muscle

strains (No. 3) and ankle ligament sprains (No. 4) were the common specific diagnoses. The greater incidence of these injuries has been reported in the literature in professional baseball players.[2,8,21,25] In a 6-year study of MLB players, Camp et al[8] found that hamstring muscle strains were the most common injury among the top 50 specific injuries (6.7% of all injuries). Lucasti et al[21] examined the incidence of lower leg injuries in MLB baseball players during the 2011-2016 seasons. The authors found that the rate of lower leg injuries during the regular season was 1.75 per 1000 athlete exposures, and ankle ligament sprains were the most common lower leg injury subtype. Of the lower extremity injuries, hamstring muscle strains and ankle ligament sprains may be appropriate targets for the development of preventive measures in players at the levels of professional and collegiate baseball.

We identified differences in the injury characteristics between hamstring muscle strains and ankle ligament sprains. The present study demonstrated that 88.3% of hamstring muscle strains occurred through a non-contact mechanism involving running, with 71.6% occurring in position players (Supplemental Tables S2 and S4, available online). Previous studies[2,25] evaluating hamstring injuries in MLB baseball players found that most of the injuries occurred during base running to first base (57% to 78%) rather than fielding (9% to 20%). On the other hand, our study found that ankle ligament sprains more commonly occurred due to contact with apparatus/playing device or ground compared with hamstring muscle strains (41.3% vs 0.0%) (Supplemental Table S4, available online). Interestingly, the proportion of pitchers with ankle ligament sprains (34.8%) was about 2 times greater than that with hamstring muscle strains (16.7%) (Supplemental Table S2, available online). In NCAA baseball, pitchers are not required to bat and run bases as the league has adopted a designated hitter rule, and thus ankle ligament sprains are more likely to occur during fielding. Pitchers frequently cover first base on ground balls to the right side, which may be an area for future prevention programs of ankle ligament sprains.

Trunk injuries were responsible for 12.6% of sports-related injuries among collegiate baseball players. Of the trunk injuries, low back muscle strains (No. 6) and oblique muscle strains (No. 15) were included in the 20 most common specific diagnoses. A detailed report on the epidemiology of oblique injuries in MLB players has been published[6]; however, very little is known about low back muscle strains in baseball players.[7] The present study found that about half of low back muscle strains occurred in pitchers (44.7%) and during strength training (52.6%) and off-season (47.4%). Off-season strength programs are crucial for baseball players.[19] Pitchers frequently strengthen trunk muscles through exercises (eg, squat and deadlift), as trunk rotation power has the largest influence on throwing velocity.[1] Improper posture (ie, flexed lumbar posture) is known to increase back extensor moments, which can lead to injuries.[23] These data suggest that programs to improve load and form during off-season strength training will be necessary to prevent the development of low back muscle strains.

Limitations

This study has several limitations. First, we utilized the PAC-12 HAP database for injury surveillance. In the PAC-12 HAP database, data are input by athletic department staff. The accuracy of these data is dependent on those responsible for input; thus, there may be the possibility for errors in data entry. In addition, increased reporting compliance might contribute to the increase in reported injuries over the study period because nonsports-related injuries had a similar increase to sports-related injuries. Second, our data only represent the epidemiology of injuries in the PAC-12 Conference, and its findings may not apply to other leagues or levels of play. Third, the number of players was approximated from the total number of players registered in the PAC-12 HAP for 1 season, and annual incidence was calculated using the number of players (denominator). The calculation for this study may not accurately reflect annual incidence, as the number of players could be slightly different from year to year. In addition, information on the number of players by position was not available; thus, incidence by position could not be calculated. The present study identified a higher proportion of injuries occurred in pitchers compared with position players. Typically, teams carry more pitchers than position players on their roster; thus, our findings might be due to the larger number of pitchers as well as the difference in stress caused by pitching. Last, specific surgical techniques were unclear in the present study. In addition, our study did not evaluate the rehabilitation protocol for each player. Differences in these clinical features may affect outcomes and return to play.

CONCLUSION

The number of sports-related injuries among collegiate baseball players has increased over the past 6 years. Rotator cuff tendon injuries, followed by UCL injuries, hamstring muscle strains, ankle ligament sprains, and hand/wrist fractures are the most common specific diagnoses among this cohort of collegiate baseball players. Of the 20 most common specific diagnoses, UCL injuries often require surgical interventions and have the most impact on playing time.

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