Original Article

Strains/Sprains and Fractures Are the Most Common Hand and Wrist Injuries in National Basketball Association Athletes Who Return to Preinjury Player Efficiency and Equal or Greater True Shooting Percentage Within Two Years of Injury

Eugenia Lin, M.D., Sailesh V. Tummala, M.D., Landon Morikawa, M.A., Neeraj Vij, M.D., Skye Buckner Petty, M.P.H., Kade S. McQuivey, M.D., and Anikar Chhabra, M.D.

Purpose: To characterize the prevalence and incidence of in-game hand and wrist injuries in the National Basketball Association (NBA), to determine the factors associated with an equal or greater player efficiency rating (PER), and to determine the factors associated with an equal or greater true shooting percentage (TS%) 2 years after a hand and wrist injury using a large-scale national database of NBA players. **Methods:** Injury data from seasons 2015-2016 to 2020-2021, with exclusion of the 2019-2020 because of abbreviated play due to the coronavirus disease 2019, were extracted from a public online database, Pro Sports Transactions. Injury characteristics and NBA player demographic information were assessed using descriptive statistics. Poisson logistic regression analyses were performed to identify risk factors associated with equal or increased PER and TS% 2years after injury. **Results:** There were 214 reported hand and wrist injuries, and of these injuries, 173 (81%) were classified as structural. The most common injury types were a strain or sprain (0.63 per 1,000 game exposures), followed by fractures (0.37 per 1,000 game exposures). Older age (relative risk [RR] 0.89; 95% confidence interval [CI] 0.84-0.95) and more years played in the NBA were modestly associated with relative risk of having a decreased PER at 2 years after injury. Increased weight (RR 1.02; 95% CI 1-1.05) and increased body mass index (RR 1.14; 95% CI 1.01-1.29) were also modestly associated with having a decreased PER and TS%, respectively at 2 years after injury. **Conclusions:** Strains/sprains and fractures are the most common hand and wrist injuries sustained by NBA players. Regardless of dominant or nondominant hand and wrist injuries, NBA players are likely to return to baseline overall player efficiency based on PER and TS% within 2 years of injury. **Clinical Relevance:** Our study characterizes hand and wrist injuries of NBA players and provides an understanding for these injuries on player performance at 2 years.

Hand and wrist injuries have previously been thought of as uncommon in basketball players. Much of the literature on athletic injuries in professional basketball players centers on the knee,[1,2] foot and ankle,[1,2] and shoulder.[3,4] However, a recent systematic review demonstrated that hand and wrist injuries in professional basketball players may be more common than previously thought.[5] Hand and wrist injuries in basketball players comprise a spectrum of injuries including wrist sprain,[6] scapholunate interosseus ligament injury,[7] thumb ulnar collateral ligament injuries,[8] metacarpal fracture,[9,10] and phalangeal fracture.[11]

The current literature on hand and wrist injuries in professional basketball players is limited, with one study describing the spectrum of athletic injuries in the Women's National Basketball Association of which 20.8% were hand and wrist injuries.[6] The remaining published literature on hand and wrist injuries in

From the Department of Orthopaedic Surgery, Mayo Clinic, Phoenix, Arizona, U.S.A. (E.L., S.V.T., K.S.M., A.C.); John A. Burns School of Medicine, Honolulu, Hawaii, U.S.A. (L.M.); Department of Orthopedic Surgery, University of Kansas — Wichita, Wichita, Kansas, U.S.A. (N.V.); and Department of Biostatistics, Mayo Clinic, Phoenix, Arizona, U.S.A. (S.B.P.).

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Address correspondence to Anikar Chhabra, M.D., Department of Orthopedic Surgery, Mayo Clinic Arizona, 5777 E. Mayo Blvd., Phoenix, Arizona, 85054, U.S.A. E-mail: chhabra.anikar@mayo.edu

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professional basketball players is limited to retrospective studies with small patient sample sizes between 25 and 137.[7,9,11]

The long-term implications of hand and wrist injuries on National Basketball Association (NBA) players are unknown with limited understanding of effect on player performance. The purposes of this study were to characterize the prevalence and incidence of in-game hand and wrist injuries in the NBA, to determine the factors associated with an equal or greater player efficiency rating (PER), and to determine the factors associated with an equal or greater true shooting percentage (TS%) 2 years after a hand and wrist injury using a large-scale national database of NBA players. We hypothesized that there would be no significant factors associated with an equal or greater PER or TS%.

Methods

Data Collection

This study was granted exemption by our institutional review board. A retrospective review was performed of a publicly available database, Pro Sports Transactions (prosportstransactions.com), which has previously been cited in the literature in studies of the NBA. Five complete NBA seasons were evaluated from 2015-2016 to 2020-2021; we excluded the 2019-2020 season due to the abbreviated nature of the season from the coronavirus disease 2019 pandemic. Injury data such as injury descriptions, dates of injury, and dates of return to play from October 2015 to July 2021 were documented from the database and independently verified through official team press releases and collateral media reports. Injury data were corroborated through player game logs on Basketball-Reference (basketball-reference.com), which provides data from the official statistics partner of the NBA, Sportradar US (Sportradar AG).

We classified hand and wrist injury by the following key words: soreness, contusion/bruise, sprain/strain, dislocation, fracture, ligament tear, and other (tendinitis, laceration, management) (Table 1). A game absence was classified as management if the player was intentionally held out for injury rest. All nonsoreness injuries were considered structural. Game exposure (GE) was defined as the appearance in any regular season or playoff game, independent of minutes played.

NBA player demographics and basketball statistics were collected from Basketball-Reference (Table 2). Demographic data were retrieved from the season in which the injury occurred. Baseline statistics correspond to the full season before injury, from the season before injury, and 2 seasons after injury (Table 2).

Table 1. Injury Characteristics of Players With Hand and Wrist Injuries

	No. of Injuries	Games Missed, Median, (Q1, Q3)
Overall	214	4.0 (2.0, 12.0)
Dominant-side injury	140 (65.4%)	3.0 (2.0, 12.0)
Injury location		
Finger	33 (15.4%)	3.0 (1.0, 10.0)
Hand	49 (22.9%)	7.0 (1.0, 14.0)
Thumb	46 (21.5%)	4.0 (2.0, 13.0)
Wrist	86 (40.2%)	3.0 (2.0, 11.0)
Injury type		
Contusion	16 (7.5%)	3.0 (1.0, 6.0)
Dislocation	6 (2.8%)	13.0 (10.5, 18.0)
Fracture	51 (23.8%)	2.0 (1.0, 5.0)
Other	5 (2.3%)	2.0 (1.0, 3.0)
Soreness	41 (19.2%)	15.0 (14.0, 30.0)
Sprain/strain	86 (40.2%)	7.5 (2.3, 22.5)
Torn ligament	9 (4.2%)	1.0 (1.0, 2.0)
Season-ending injury	15 (7.0%)	12.0 (10.5, 25.5)
Sprain/strain	5 (33.3%)	25.0 (12.0, 38.0)
Fracture	6 (40.0%)	10.3 (11.5, 18.8)
Soreness	2 (13.3%)	6.5 (5.8, 7.3)
Contusion	1 (6.7%)	12.0 (12.0, 12.0)
Torn ligament	1 (6.7%)	66.0 (66.0, 66.0)

Minutes per game, points scored, and number of games played were calculated from regular season (82 games) and playoff (up to 28 games) statistics. Two advanced basketball statistics were collected, PER (Table 3) and true TS% (Table 4), from regular season statistics only. PER is a numerical representation of a player's per-minute performance including offensive and defensive contributions while accounting for pace developed by ESPN Inc (ESPN.com).[12] The scale is from 0.0 to 35.0+ and is normalized by current NBA league players to 15.0 to allow for player performance comparisons across seasons. TS% measures a player's efficiency at shooting the ball, which uses percentage of 2-point field goals, free throws, and 3-point field goals.

Statistical Analysis

Player and injury characteristics were summarized via means, standard deviations, medians, interquartile range, frequencies, and percentages. Associations of player and injury characteristics with the likelihood of recovering baseline player efficiency ratings and true shooting percentages after 2 years were assessed with Zou's modified Poisson regression models. Each model was adjusted for baseline performance. Relative risks with 95 percent confidence intervals (CIs) were derived from the models. Relative risks greater than 1 indicate an increased likelihood of recovering baseline performance. *P* values less than .05 were considered statistically significant. All analyses were conducted with R, version 4.2.1 (R Foundation for Statistical Computing, Vienna, Austria).

Table 2. Player Characteristics of NBA Players With Hand and Wrist Injuries (N = 153)

Age, y	
Mean (SD)	26.1 (4.1)
Median (Q1, Q3)	25.0 (23.0, 29.0)
Height, m	
Mean (SD)	2.0 (0.1)
Median (Q1, Q3)	2.0 (2.0, 2.1)
Weight, kg	
Mean (SD)	100.5 (11.2)
Median (Q1, Q3)	100.0 (92.0, 108.0)
BMI	
Mean (SD)	24.9 (1.7)
Median (Q1, Q3)	25.0 (23.8, 26.0)
Year in NBA	
Mean (SD)	5.8 (4.1)
Median (Q1, Q3)	5.0 (2.0, 8.0)
Total minutes per game	
Mean (SD)	23.6 (7.6)
Median (Q1, Q3)	23.5 (17.5, 30.1)
Hand	
Left	12 (7.8%)
Right	141 (92.2%)
On-court position	
Center	35 (22.9%)
Power forward	28 (18.3%)
Point guard	28 (18.3%)
Small forward	28 (18.3%)
Shooting guard	34 (22.2%)
Player efficiency rating (PER)	
Mean (SD)	15.1 (5.0)
Median (Q1, Q3)	14.3 (11.9, 17.6)
Total shooting percentage (TS%)	
Mean (SD)	0.6 (0.1)
Median (Q1, Q3)	0.5 (0.5, 0.6)

NBA, National Basketball Association; SD, standard deviation.

Results

Characterization of Hand and Wrist Injuries

There was a total of 214 reported hand and wrist injuries, and of these injuries 173 (81%) were classified as structural (Table 1). The most common injury type was a strain or sprain, which had an injury incidence of 0.63 per 1,000 GEs. Fractures were the second most common type of injury, which had an injury incidence of 0.37 per 1,000 GEs. Most of the structural hand and wrist injuries were classified as moderate in severity (missing 2-10 games) with an injury incidence of 0.68 per 1,000 GEs. Torn ligaments and fractures were most severe on average, with 15 and 13 games missed, respectively.

Characterization of Players

Players were an average of 26.1 years of age (standard deviation [SD] 4.1), with a mean of 5.8 years (SD 4.1) of experience in the NBA (Table 2). Of all players included in this cohort who had a hand and wrist injury in the seasons assessed, the mean total minutes per game played over the course of all seasons, pre- and postinjury, was 23.6 minutes (SD 7.6). The most common position was center (22.9%), followed by shooting guard (22.2%).

Factors Associated With Having an Equal or Greater PER

In our model, only the factors of age, years in NBA, and weight were associated with having an equal or higher PER at 2 years compared with baseline (Table 3). For every 1-year increase in age, the relative risk of having an equal to greater PER decreased by 11%, with a relative risk of 0.89 ($P < .001$, 95% CI 0.84-0.95). For weight, the relative risk was found to be 1.02 ($P = .032$, 95% CI 1-1.05), indicating that for every one-pound increase in weight, the risk of having an equal to greater PER increased by 2%. Lastly, the relative risk for years in NBA was 0.89 ($P = .002$, 95% CI 0.83-0.96), implying that for every 1-year increase in years in NBA, the risk of having an equal to greater PER decreased by 11%.

Factors Associated With Having an Equal or Higher TS%

The results of the multivariate regression analysis showed that body mass index (BMI) was the only statistically significant predictor of having an equal or greater TS% at 2 years compared with baseline ($P = .036$) (Table 4). The relative risk for BMI was 1.14 (95% CI 1.01-1.29), indicating that for every one-unit increase in BMI, the risk of having an equal or greater TS% increased by 14%. The other variables in the model, such as age, years of experience, and position, were not statistically significant predictors of TS%.

Discussion

The most important findings of this study were NBA players with hand and wrist injuries of increased age and years in the NBA are modestly less likely to maintain or improve their PER compared with younger, less-experienced players, and players with greater weight or BMI may be more marginally likely to maintain or improve their PER and TS% at 2 years after injury. These findings were modest in relative risk, suggesting that hand and wrist injuries did not have much of an effect on changes in performance. Previous studies have found that age has not been associated with return to play after hand and wrist injuries.[11,13,14] However, our results are likely not unique to the hand and wrist injuries themselves, rather, our results may mirror changes in PER and TS% across the league, that is, performance generally decreases with age, despite more experience in the NBA.[15]

In addition, we did not find significant differences in PER or TS% for players who sustained hand and wrist injuries, regardless of whether this injury was dominant or nondominant. This is in contrast to a study

Table 3. Associations With Having an Equal or Greater Player Efficiency Rating (PER) at 2 Years

	Per at 2 Years less than Baseline (n = 50)	Per at 2 Years Greater than or Equal to Baseline (n = 40)	Relative Risk	*P* Value
On-court position				
Center	10 (20.0%)	9 (22.5%)	Reference	Reference
Power forward	11 (22.0%)	4 (10.0%)	0.5 (0.19-1.28)	.146
Point guard	11 (22.0%)	4 (10.0%)	0.46 (0.19-1.14)	.094
Small forward	7 (14.0%)	13 (32.5%)	1.01 (0.52-1.97)	.969
Shooting guard	11 (22.0%)	10 (25.0%)	0.72 (0.33-1.56)	.402
Age, y	28.0 (25.0, 31.0)	25.0 (23.0, 28.0)	0.89 (0.84-0.95)	<.001
Height, m	2.0 (1.9, 2.1)	2.0 (2.0, 2.1)	9.7 (0.46-203.03)	.143
Weight, kg	99.5 (88.0, 108.0)	101.0 (96.0, 108.2)	1.02 (1-1.05)	.032
BMI	25.0 (23.8, 26.1)	25.3 (24.7, 26.0)	1.15 (0.99-1.32)	.065
Years in NBA	7.0 (5.0, 11.0)	4.0 (3.0, 7.2)	0.89 (0.83-0.96)	.002
Total minutes per game	27.2 (21.1, 31.9)	26.6 (20.2, 31.7)	1.01 (0.98-1.05)	.49
Dominant-sided injury	28 (56.0%)	26 (65.0%)	1.11 (0.68-1.8)	.673
Injury location				
Finger	7 (14.0%)	6 (15.0%)	Reference	Reference
Hand	13 (26.0%)	13 (32.5%)	1.33 (0.69-2.58)	.392
Thumb	9 (18.0%)	8 (20.0%)	0.95 (0.43-2.09)	.901
Wrist	21 (42.0%)	13 (32.5%)	0.79 (0.39-1.61)	.519

NOTE. Relative risks are from Zou's modified Poisson regression models adjusted for baseline PER. Values are shown as n (%) and median (IQR). Center and Finger were used as reference values to calculate relative risk in their subcategories.

BMI, body mass index; IQR, interquartile range; NBA, National Basketball Association.

examining PER and TS% after shoulder injuries in which the authors found that players who sustained dominant sided shoulder injuries were not able to return to baseline PER within 2 seasons after injury. As most hand and wrist injuries are treated conservatively, management of the injury, time off from play, and success in treatment may confound the differences in player efficiency when comparing hand and wrist injuries to shoulder injuries.[16] Our findings add longitudinal understanding of overall player efficiency after sustaining hand and wrist injuries and demonstrate that factors such as increased age or decreased weight may

Table 4. Associations With Having an Equal or Greater True Shooting Percentage (TS%) at 2 Years

	TS% at 2 years less than Baseline (n = 40)	TS% at 2 Years Greater than or Equal to Baseline (n = 49)	Relative Risk	*P* Value
On-court position				
Center	9 (22.5%)	10 (20.4%)	Reference	Reference
Power forward	7 (17.5%)	7 (14.3%)	0.88 (0.45-1.72)	.714
Point guard	6 (15.0%)	9 (18.4%)	0.85 (0.49-1.48)	.569
Small forward	9 (22.5%)	11 (22.4%)	0.88 (0.51-1.51)	.642
Shooting guard	9 (22.5%)	12 (24.5%)	0.85 (0.51-1.44)	.554
Age, y	27.0 (25.0, 30.2)	27.0 (23.0, 29.0)	0.96 (0.92-1.01)	.138
Height, m	2.0 (2.0, 2.1)	2.0 (1.9, 2.1)	1.39 (0.15-13.13)	.775
Weight, kg	99.0 (91.0, 108.0)	100.0 (95.0, 111.0)	1.01 (0.99-1.03)	.194
BMI	24.9 (23.8, 25.7)	25.6 (24.5, 26.2)	1.14 (1.01-1.29)	.036
Years in NBA	6.0 (5.0, 10.2)	5.0 (3.0, 8.0)	0.95 (0.9-1)	.064
Total minutes per game	27.2 (21.2, 32.0)	27.0 (20.3, 31.6)	1 (0.97-1.03)	.935
Dominant-sided injury	23 (57.5%)	31 (63.3%)	1 (0.68-1.47)	.988
Injury location				
Finger	6 (15.0%)	7 (14.3%)	Reference	Reference
Hand	12 (30.0%)	13 (26.5%)	1.04 (0.56-1.93)	.913
Thumb	9 (22.5%)	8 (16.3%)	0.79 (0.38-1.62)	.513
Wrist	13 (32.5%)	21 (42.9%)	1.05 (0.58-1.91)	.875

NOTE. Relative risks are from Zou's modified Poisson regression models adjusted for baseline TS%. Values are shown as n (%) and median (IQR). Center and Finger were used as reference values to calculate relative risk in their subcategories.

BMI, body mass index; IQR, interquartile range; NBA, National Basketball Association.

contribute more than hand and wrist injuries, suggesting that most NBA players with such injuries should expect to recover baseline statistical performance.

We also further characterized the most common injury types in modern-day NBA, which was most commonly a strain or sprain, and secondly a fracture. Dy et al.[17] explored the heterogenous management of hand and wrist injuries within the NBA, National Football League, and Major League Baseball regarding the 10 most common hand and wrist injuries and found wide variability return to play and management, including less likely return to play recommended by basketball surgeons. Our study certainly supports these findings, given the difference in management between the 2 most common injuries characterized by our data.

Future studies should seek to understand the effects of various treatments, both operative and nonoperative, on various injury patterns to better understand a player's trajectory after sustaining a hand and wrist injury. Characterizing the incidence of hand and wrist injuries per athlete exposures can also better inform trainers, therapists, and physicians to better identify these injuries and provide the appropriate treatment.

Limitations

Our study is not without limitations, including the retrospective nature and use of publicly maintained databases. We queried injury data from a public database and used media briefs and other public records to corroborate data, which may differ from official health records including under-reporting minor injuries or nonreporting of injuries that occurred outside of regular season play. Furthermore, we also use PER and TS% as metrics, which are statistics that attempt to account for an amalgamation of player contributions in a game. Although well-documented and publicly used to track player efficiency, both statistics favor offensive performance and do not directly measure a player's value or ability, acting only as a surrogate measure. We also acknowledge there may be confounding variables including the recovery from a hand or wrist injury including concomitant injuries. Finally, our study is limited in further stratifying injury characteristics and management, as treatment whether operative or nonoperative are not delineated and directly evaluated.

Conclusions

Strains/sprains and fractures are the 2 most common hand and wrist injuries sustained by NBA players. Regardless of dominant or nondominant hand and wrist injuries, NBA players are likely to return to baseline overall player efficiency based on PER and TS % within 2 years of injury. Further research should discern type of injury patterns on NBA player statistics as well as overall career longevity.

Disclosure

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