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Predictors of Orthopaedic Surgery in NCAA Athletes

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Objectives: Orthopaedic injury and surgery is relatively common in National Collegiate Athletic Association (NCAA) athletes and can have devastating career consequences. However, there is a paucity of data regarding predictors of orthopaedic surgery in collegiate athletes. The purpose of this study was to analyze player-related predictors of orthopaedic surgery, including that of the shoulder, hip, and knee, in NCAA athletes.

Methods: All NCAA Division I collegiate athletes at a single institution who began participation from the 2003-2004 through 2008-2009 seasons were retrospectively identified. Player-related factors, including gender, sport, and any pre-college upper or lower extremity orthopaedic surgery, were elicited through pre-participation evaluations (PPEs). Athletes who underwent an orthopaedic surgery in college were identified through the Sports Injury Monitoring System and medical records. All patient-related independent variables were included in a multiple Cox regression model. Exposure time was calculated from the date of PPE to the date of surgery (event) or to the end of the collegiate athletic career (censored). Hazard ratios (HRs) with 95% confidence intervals (CIs) were calculated. Significance was set at $P < 0.05$.

Results: In total, 1,142 athletes in 12 sports (baseball/softball, basketball, football, golf, gymnastics, rowing, swimming & diving, soccer, tennis, track & field/cross country, volleyball, water polo) were identified. There were 262 documented orthopaedic surgeries, including those involving the shoulder (n = 34), hip (n = 25), and knee (n = 72), in 182 athletes. Using the multiple Cox regression model, pre-college lower extremity surgery was an independent predictor of orthopaedic ($P = 0.004$, HR = 1.88) and knee ($P < 0.001$, HR = 3.91) surgery, and type of sport was an independent predictor of orthopaedic ($P < 0.001$), shoulder ($P = 0.002$), and knee surgery ($P < 0.001$) (Table 1). Participation in gymnastics, basketball, and volleyball were the strongest predictors of orthopaedic surgery. Similarly, participation in volleyball, gymnastics, and baseball/softball were the strongest predictors of shoulder surgery, and participation in basketball, football, and volleyball were the strongest predictors of knee surgery. Lastly, athletes with a history of a pre-college orthopaedic surgery were more susceptible to another surgery in the same extremity during college ($P = 0.046$, HR = 2.18). Gender was not a significant predictor of any surgery. No independent predictors of hip surgery were identified.

Conclusion: NCAA athletes who underwent a pre-college lower extremity surgery were more likely to undergo orthopaedic and knee surgery during their collegiate careers. Those in overhead sports (e.g., volleyball, baseball/softball) were more likely to undergo shoulder surgery, and those in cutting and jumping sports (e.g., basketball, football) were more likely to undergo knee surgery. Furthermore, athletes with a history of a pre-college orthopaedic surgery were more likely to undergo another surgery in the same extremity during college, suggesting inadequate rehabilitation or less than full return of function after surgery. The time lost from athletic participation due to an orthopaedic surgery and its potential career impact underscores the need for injury prevention and improved surgical outcomes in the amateur athlete.

Table 1. Multiple Cox Regression Analysis of Player-Related Predictors of Orthopaedic Surgery in NCAA Athletes

Variable	HR	95% CI	P value
Gender (males/females)	0.95	0.65-1.40	0.807
Pre-college upper extremity surgery[1]	1.15	0.65-1.88	0.608
Pre-college lower extremity surgery[2]	1.88	1.24-2.78	0.004
Sport			
Baseball / Softball	3.82	0.74-69.89	0.123
Basketball	14.84	3.05-267.38	<0.001
Football	10.33	2.23-183.56	0.001
Golf[3]	1.00		
Gymnastics	15.38	3.03-280.58	<0.001
Rowing	3.37	0.59-63.45	0.184
Swimming & Diving	1.90	0.24-38.63	0.560
Soccer	8.29	1.75-148.30	0.003
Tennis	3.21	0.47-62.91	0.239
Track & Field / Cross Country	3.58	0.75-64.25	0.125
Volleyball	10.69	2.23-191.75	0.001
Water Polo	3.79	0.72-69.69	0.130
Surgery on previously operated extremity[4]	2.18	1.01-4.79	0.046

HR, hazard ratio; CI, confidence interval.

[1]Reference group = no pre-college upper extremity surgery

[2]Reference group = no pre-college lower extremity surgery

[3]Reference group in analysis

[4]Reference group = surgery on other extremities

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