[Orthopaedic Surgery]

Preexisting Rotator Cuff Tears as a Predictor of Outcomes in National Football League Athletes

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Background: A preexisting rotator cuff tear may affect the draft status and career performance of National Football League (NFL) players.

Hypothesis: Preexisting rotator cuff tears decrease a player's draft status, performance, and longevity in the NFL.

Study Design: Retrospective cohort study.

Level of Evidence: Level 3.

Methods: Medical reports of prospective NFL players during the NFL Scouting Combine from 2003 to 2011 were evaluated to identify players with a previous rotator cuff tear. Athletes were matched to control draftees without documented shoulder pathology by age, position, year drafted, and round drafted. Career statistics and performance scores were calculated.

Results: Between 2003 and 2011, 2965 consecutive athletes were evaluated. Forty-nine athletes had preexisting rotator cuff tears: 22 athletes underwent surgical intervention for their tear and 27 were treated nonoperatively. Those with a rotator cuff tear were significantly less likely to be drafted than those without a previous injury (55.1% vs 77.5%, $P = 0.002$). The 27 drafted athletes with preexisting rotator cuff tears started significantly fewer games (23.7 vs 43.0, $P = 0.02$) and played significantly fewer years (4.3 vs 5.7, $P = 0.04$) and significantly fewer games (47.1 vs 68.4, $P = 0.04$) than matched control athletes without rotator cuff tears.

Conclusion: Athletes with a preexisting rotator cuff tear were less likely to be drafted and had decreased career longevity.

Keywords: rotator cuff tears; football; athletes; shoulder injuries

Rotator cuff tears in young athletes are rare. However, an increased incidence of rotator cuff tears has been noted in contact athletes.^{1,12} There are very few reports on rotator cuff tears in National Football League (NFL) players, and outcomes in football athletes have not been well studied.^{1,2,7}

The National Football League Combine is an event held annually for college football players likely to be drafted. Injury to the rotator cuff, including tears and contusions, comprised 12% of shoulder injuries in combine athletes, and rotator cuff tears alone made up 1.8% of all shoulder injuries.⁶ Of active NFL players who sustained a rotator cuff tear, 75% had residual

shoulder pain after operative intervention.² Some (9.5%) professional contact athletes are unable to return after surgical repair of a rotator cuff tear.⁸

The purpose of the current study was to determine whether a preexisting rotator cuff tear affects a player's draft status, career longevity, and career performance in the NFL.

METHODS

The written medical evaluations of all prospective professional American football athletes who attended the NFL Combine

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between 2003 and 2011 were reviewed for evidence of a rotator cuff tear and stratified based on whether they underwent surgical intervention. A minimum 2-year follow-up of performance data was available for all players who were drafted. Permission for this study was obtained from the NFL Injury and Safety Panel.

The control group consisted of athletes who were matched for age within 1 year, participated at the same position, and drafted the same year and within the same round but who did not have significant documented shoulder pathology. Athletes at the NFL Combine who were not drafted were excluded from career performance and career longevity analysis.

Outcome Measures

Career and demographic statistics were compiled. These specific data included position played, date of birth, round drafted, height, weight, body mass index (BMI), year of entry into the NFL, total years played, total games played, total games started, and position-specific career statistics. NFL.com, ESPN.com, and pro-football-reference.com, which are public sources for performance data, were utilized in data collection. A previously established and validated Performance Score was calculated for all players excluding offensive linemen, kickers, and punters to compare on-field statistics from 1 athlete to another and from 1 position to another.^{3-5,9-11,13}

Statistical Analysis

Continuous variables of each cohort were compared using a paired 2-sided (2-tailed) Student *t* test for normally distributed data. A chi-squared test was performed to compare and analyze categorical data. Statistical significance was accepted with $P < 0.05$.

RESULTS

Between 2003 and 2011, 2965 consecutive athletes attended the NFL Combine. Forty-nine athletes were identified with a preexisting rotator cuff tear. Of these 49 players, 27 were drafted at the NFL draft after the Combine. Twenty-two of the 49 athletes underwent surgical intervention for their tear, and 27 were treated nonoperatively. Of those drafted, 11 had surgery and 16 were treated nonoperatively (Table 1). The most common position affected was defensive lineman (24.5%) followed by offensive lineman (20.4%) (Table 1). The majority of tears involved the supraspinatus (44.9%) followed by the infraspinatus (8.2%) and subscapularis (8.2%) (Table 1).

Overall, those athletes who attended the NFL Combine with a history of a rotator cuff tear were significantly less likely to be drafted than those without a rotator cuff tear (55.1% vs 77.5%, $P = 0.002$) (Table 2).

The 27 drafted athletes with preexisting rotator cuff tears started significantly fewer games (23.7 vs 43.0, $P = 0.02$) and played fewer years (4.3 vs 5.7, $P = 0.04$) and in fewer games (47.1 vs 68.4, $P = 0.04$) than matched control athletes without rotator cuff tears. There was no difference in mean performance

Table 1. Demographics of players at the NFL Combine with a preexisting rotator cuff tear (RCT)

Draft status of Combine athletes with RCT (N = 49)	
Drafted	27 (55.1%)
Surgery	11
No surgery	16
Undrafted	22 (44.9%)
Surgery	11
No surgery	11
Position	
Quarterback	3 (6.1%)
Wide receiver	2 (4.1%)
Running back	8 (16.3%)
Offensive line	10 (20.4%)
Tight end	2 (4.1%)
Defensive line	12 (24.5%)
Defensive back	7 (14.3%)
Linebacker	5 (10.2%)
Site of tear	
Multiple tendons	2 (4.1%)
Supraspinatus	22 (44.9%)
Infraspinatus	4 (8.2%)
Teres minor	1 (2.0%)
Subscapularis	4 (8.2%)
Unknown	16 (32.7%)

NFL, National Football League.

scores for the 27 drafted athletes compared with controls (0.97 vs 1.33, $P = 0.52$) (Table 3). There was also no difference in BMI (32.4 vs 32.7 kg/m², $P = 0.53$), round drafted (4.18 vs 4.18, $P > 0.999$), or age entering NFL (22.9 vs 22.7, $P = 0.31$) for those with rotator cuff tears compared with controls (Table 4).

Of the 11 drafted athletes who underwent operative repair for rotator cuff tears, there was no difference in years played (4.2 vs 6.0, $P = 0.13$), games played (47.4 vs 68.5, $P = 0.20$), games started (29.5 vs 41.5, $P = 0.33$), or performance score (0.18 vs 2.0, $P = 0.15$) compared with matched controls (Table 5). For the 16 athletes treated nonoperatively, there was no difference

Table 2. Comparison of players drafted with and without preexisting rotator cuff tears (RCT)

	Players Drafted , %	P Value
With previous RCT	55.1	0.002
Without previous RCT	77.5	

Table 3. Comparison of outcomes in players drafted with preexisting rotator cuff tears with controls

	Control (N = 27)	Rotator Cuff Tear (N = 27)	Percent Change	P Value
Years played	5.7 ± 3.0	4.3 ± 2.4	(-) 24.6	0.04
Games played	68.4 ± 46.8	47.1 ± 38.9	(-) 31.1	0.04
Games started	43.0 ± 45.3	23.7 ± 30.2	(-) 44.9	0.02
Performance score	1.3 ± 2.2	0.97 ± 1.8	(-) 25.4	0.52

Table 4. Demographics of players with rotator cuff tear (RCT) compared with controls

	Control (27)	RCT (27)	P Value
Body mass index, kg/m ²	32.7 ± 5.44	32.4 ± 4.74	0.53
Round drafted	4.18 ± 2.00	4.18 ± 2.00	> 0.999
Age entering NFL, y	22.7 ± 0.91	22.9 ± 0.70	0.31

NFL, National Football League.

Table 5. Comparison of outcomes in players drafted with operatively treated rotator cuff tears (RCTs) with controls

	Control (N = 11)	RCT (N = 11)	Percent Change	P Value
Years played	6.0 ± 2.6	4.2 ± 2.6	(-) 30.0	0.13
Games played	68.5 ± 42.0	47.4 ± 37.9	(-) 30.8	0.20
Games started	41.5 ± 42.4	29.5 ± 31.9	(-) 28.1	0.33
Performance score	2.0 ± 3.1	0.18 ± 0.28	(-) 91.0	0.15

in years played (4.3 vs 5.5, $P = 0.17$), games played (47.0 vs 68.4, $P = 0.14$), or performance score (1.4 vs 0.99, $P = 0.51$) compared with matched controls. Athletes with rotator cuff tears treated nonoperatively started significantly fewer games than the control cohort (19.8 vs 44.0, $P = 0.025$) (Table 6).

Finally, subgroup analysis was performed based on player position. When offensive and defensive linemen with rotator

cuff tears (which comprised 44.9% of all athletes affected) were compared with matched controls, they played fewer years (4.0 vs 6.2, $P = 0.01$), played fewer games (39.9 vs 76.6, $P = 0.01$), and started fewer games (23.1 vs 53.4, $P = 0.009$) than controls (Table 7). There was no difference in the same parameters when comparing athletes at other positions with controls (Table 8).

Table 6. Comparison of outcomes in players drafted with nonoperatively treated rotator cuff tears (RCTs) with controls

	Control (N = 16)	RCT (N = 16)	Percent Change	P Value
Years played	5.5 ± 3.2	4.3 ± 2.3	(-) 21.8	0.17
Games played	68.4 ± 51.2	47.0 ± 40.8	(-) 31.3	0.14
Games started	44.0 ± 47.5	19.8 ± 29.4	(-) 55.0	0.025
Performance score	0.99 ± 1.7	1.4 ± 2.1	(+) 70.7	0.51

Table 7. Comparison of outcomes in offensive and defensive linemen players with preexisting rotator cuff tears (RCTs) with controls

	Control (N = 14)	RCT (N = 14)	Percent Change	P Value
Years played	6.2 ± 2.9	4.0 ± 2.0	(-) 35.5	0.01
Games played	76.6 ± 46.9	39.9 ± 29.1	(-) 47.1	0.01
Games started	53.4 ± 44.4	23.1 ± 28.2	(-) 56.7	0.009
Performance score	0.25 ± 0.23	0.11 ± 0.10	(-) 56.0	0.13

Table 8. Comparison of outcomes in non-linemen players with preexisting rotator cuff tears (RCTs) with controls

	Control (N = 13)	RCT (N = 13)	Percent Change	P Value
Years played	5.2 ± 3.1	4.5 ± 2.8	(-) 13.5	0.57
Games played	59.6 ± 46.9	55.0 ± 47.3	(-) 7.7	0.77
Games started	31.8 ± 45.3	24.3 ± 33.4	(-) 23.6	0.50
Performance score	2.0 ± 2.6	1.5 ± 2.2	(-) 25.0	0.59

DISCUSSION

Rotator cuff tears in young contact athletes can lead to persistent pain and limited function, which may lead to less productivity and playing time. The current study attempted to evaluate the effect of a preexisting rotator cuff tear on draft status, career length, and career performance in NFL Combine athletes.

At the time of our review, there were 2 studies that reported on professional football players with rotator cuff tears. Team physicians reported 51 full-thickness rotator cuff tears in 49 players. Ninety percent were treated operatively, with 93% returning to play. Seventy-five percent reported ongoing shoulder pain after surgery.² In a cohort of 10 contact athletes, including 9 professional football athletes with rotator cuff repair and/or debridement, 3 did not return to their preinjury level of play.¹

Previous studies have focused on return-to-play statistics while the current study evaluated other career statistics related to career performance and longevity. We found that Combine athletes with a history of rotator cuff tear had a 29.1% decrease in their likelihood of being drafted compared with those without a rotator cuff tear. Those players with a preexisting rotator cuff tear who were drafted had a 24.6% shorter career, played 31.1% fewer games, and started 44.9% fewer games than matched controls without rotator cuff tears (see Table 3).

Athletes with a preexisting rotator cuff tear may be less likely to be drafted because of the negative perception that medical staff have regarding the effect of a rotator cuff tear on a prospective athletes' career.

In this study, the incidence of rotator cuff tears in offensive and defensive linemen (44.9% of all athletes) was greater than

any other position, similar to previous reports.^{1,6} Offensive and defensive linemen with previous rotator cuff tears had a 35.5% shorter career, played 47.1% fewer games, and started 56.7% fewer games than well-matched controls (see Table 5).

The findings of this study should be interpreted in light of certain limitations. Although imaging reports and clinical documentation from the NFL Combine were available, our ability to obtain information about the nature and extent of the rotator cuff tear was limited and we were not able to review any actual imaging studies, operative reports, or previous imaging reports. The inability to differentiate between partial- and full-thickness rotator cuff tears is certainly a limitation of this study. Although athletes were matched with controls, there is the possibility of confounding variables affecting the results. Because of the contact nature of the sport, many athletes sustain multiple injuries during their career, each of which may affect the player's effectiveness and longevity. The matching process in this study was very strict and is consistent with previously published studies.^{10,11} However, it does not account for other preexisting injuries. Furthermore, variables such as the coaching scheme and the presence of more skilled players on a team's roster may significantly alter a player's playing time. Last, many comparisons in this study found no differences between groups. This could very well be due to the small number of athletes included in each subgroup analysis.

CONCLUSION

Prospective NFL athletes who have a previously diagnosed rotator cuff tear are significantly less likely to be drafted in the NFL draft and have a significantly shorter career, both in terms of total years played, games played, and games started than matched controls. The effect of a previous rotator cuff tear on career statistics is more pronounced in linemen than in athletes of other positions.

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