

# Shoulder Injuries to Quarterbacks in the National Football League

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**Background:** Quarterbacks are at risk for shoulder injury secondary to both the throwing motion as well as from contact injury.

**Objective:** To delineate the incidence and etiology of shoulder injuries to quarterbacks in the National Football League (NFL).

**Methods:** Using the NFL Injury Surveillance System (NFLISS), all reported injuries to quarterbacks between 1980 and 2001 were identified.

**Results:** A total of 1534 quarterback injuries were identified with a mean of 18.8 and a median of 6.0 days of playing time lost. The majority of these injuries occurred during a game (83.8%). Passing plays were responsible for 77.4% of all quarterback-related injuries. Shoulder injuries were the second most common injury reported (233 or 15.2%), following closely behind head injuries (15.4%). Direct trauma was responsible for 82.3% of the injuries, with acromioclavicular joint sprains being the most common injury overall (40%). Overuse injuries were responsible for 14% of the injuries, the most common being rotator cuff tendinitis (6.1%) followed by biceps tendinitis (3.5%).

**Conclusion:** In this review, the vast majority of shoulder injuries in quarterbacks occurred as a result of direct trauma (82.3%), and less than 15% were overuse injuries resulting from the actual throwing motion.

**Keywords:** shoulder injury; quarterback; throwing; AC joint; rotator cuff

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Football throwers are at risk for shoulder injury secondary to both the throwing motion as well as from contact injury either with another player or with the ground.<sup>2,8,9</sup> Although the incidence of shoulder injury in quarterbacks appears to be less frequent than in baseball pitchers, in our clinical experience with both professional and collegiate football athletes, we have encountered a unique spectrum of shoulder injuries including acromioclavicular (AC) and sternoclavicular (SC) joint separations, deltoid and rotator cuff contusions, shoulder dislocations and subluxations, fractures, pectoralis major injury, disorders of the biceps tendon, and overuse rotator cuff pathology.<sup>2,8,9,12-14,21</sup> The risk for shoulder injury may be increased with the level of athlete (elite versus nonelite), the style of throwing (side arm versus overhead), the length of the throw, and with the associated muscle fatigue that occurs throughout a game or practice. These injuries may be secondary to

trauma (AC joint separation, SC joint separation, deltoid contusion, rotator cuff contusion, pectoralis major muscle injury)<sup>2,14,21</sup> or chronic overuse (rotator cuff tendinitis, biceps tendinitis, impingement syndrome).<sup>8,9</sup>

Many authors have investigated the epidemiology of injuries in football players.<sup>1,3,15-17,20</sup> The majority of these studies has focused on injuries in high school or recreational athletes and has provided little information about specific injury mechanisms or patterns seen with different positions. Quarterbacks have unique skill requirements similar, in many respects, to other overhead athletes. In addition, however, they are subjected to high contact loads and are thus at risk for a wide spectrum of injury patterns that are not encountered in other throwing athletes. The purpose of this investigation was to identify all types of shoulder injuries affecting quarterbacks in the National Football League (NFL) and to report on the epidemiology of these injuries.

## METHODS

A retrospective review of all injuries to quarterbacks that have been reported to the NFL between 1980 and 2001 (22 seasons) was performed using the National Football

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TABLE 1  
Injury Patterns to Quarterbacks in the  
National Football League by Body Part

Body part	Total injuries (%)
Head (concussion)	15.4
Shoulder/arm	15.2
Knee	14.2
Hip/thigh/groin	9.8
Hand	9.3
Ankle	6.2
Chest	5.7
Elbow	4.1
Foot	4.0
Back	3.7
Leg/calf	3.0
Face/scalp	2.4
Forearm/wrist	2.0
Other	1.9
Neck	1.7
Abdomen	1.4

League Injury Surveillance System (NFLISS). Attention was directed to the location and mechanism of the injury, the type of play resulting in the injury, the playing conditions (game versus practice, grass versus turf), and the total days lost due to the injury. The injury data collected in the NFLISS are based on the primary clinical diagnosis made by the medical staff involved. The injury data are collected jointly by the athletic trainers and orthopaedic surgeons caring for each team and are then submitted to a central office for data collection. No follow-up examinations were included in this review. The data reflect only those cases reported during the season (training camp to Super Bowl) and require the player to be restricted for at least 2 days.

Shoulder injuries were defined as injuries affecting the rotator cuff, deltoid, proximal biceps, scapular stabilizers, pectoralis major, capsulolabral complex (dislocations and subluxations), glenohumeral joint, AC joint, SC joint, clavicle, humerus, glenoid, and axillary nerve.

## RESULTS

Over the past 22 seasons, a total of 1534 quarterback injuries were reported to the NFLISS involving all body parts. There was a mean of 18.8 and a median of 6.0 days of playing time lost for all injuries. A total of 6501 NFL games were played with 13,002 quarterback-game exposures during the study period. Of the total games played, 49.9% were played on artificial turf (all types) and 50.1% were played on grass. Of all offensive plays involving a quarterback, 54.3% were passing plays (including quarterback sacks) and 45.7% were rushing plays. Of all quarterback injuries, 1285 (83.8%) occurred during a game and 249 (16.2%) occurred in practice. Slightly more than half of the injuries occurred on grass (55.7%); the remainder occurred on artificial turf (44.3%). Passing plays were

TABLE 2  
Injuries to the Glenohumeral Joint and Upper Arm  
in Professional Quarterbacks Reported to the  
NFL Injury Surveillance System  
From 1980 to the Present (in percentages)

Injury type	Contact	Throwing	Overall
Rotator cuff contusion/ sprain/tendinitis	8.4	6.1	14.5
Deltoid contusion	11.3	0	11.3
Anterior shoulder dis- location/subluxation/ capsulo-labral injury	8.0	0.4	8.4
Biceps tendinitis	0.4	3.9	4.3
Impingement/bursitis	1.7	1.2	2.9
Posterior shoulder dislocation/ subluxation/capsulo-labral injury	2.5	0.4	2.9
Scapular/trapezius contusion	1.7	0	1.7
Synovitis/capsulitis	0	1.6	1.6
Fracture (humerus or scapula)	1.2	0	1.2
Pectoralis major tear/sprain	1.2	0	1.2
Nerve injury	0.4	0	0.4
Total shoulder/upper arm	36.8	13.6	50.4

responsible for 77.4% of all quarterback-related injuries, and rushing plays were responsible for 11.3% of reported injuries; the remainder was not specified. For all injuries, the vast majority occurred with contact (82.3%); 14.4% occurred with no contact, and 3.3% were not specified.

The most common injury sustained by quarterbacks involved the head (15.4%). Shoulder injuries were the second most common injury seen (15.2%). The complete breakdown of quarterback injuries by body category is summarized in Table 1. The 233 injuries to the shoulder involved the glenohumeral joint, proximal humerus, scapula, clavicle, AC joint, SC joint, long head of the biceps tendon, rotator cuff, scapular stabilizers, deltoid, and pectoralis major muscles (Tables 2 and 3). The most common mechanism of shoulder injury was related to direct trauma either from contact with another player or with the ground (82.3%). Nearly 70% of shoulder injuries occurred while the quarterback was being tackled; 47.3% occurred while being tackled as the passer, 12.6% occurred while being tackled as the ball carrier, and 9.6% occurred while being tackled after the pass. Only 14% of injuries were reported as being secondary to the actual throwing motion (Table 4).

Overall, the most common single shoulder injury identified was an AC joint sprain incurred while being tackled or during a collision with another player or the ground (40%). Of all AC joint sprains, 44% were type I (sprain of the AC ligament with intact AC and coracoclavicular [CC] ligaments), 24% were type II (disruption of the AC ligaments but leaving the CC ligaments intact), 20% were type III (disruption of both the AC and CC ligaments), and 12% were not specified.<sup>19</sup> There was a mean of 22.1 and a median of 12.5 days of playing time lost for AC joint injuries. The second most common group of injuries was shoulder

TABLE 3  
Injuries to the Clavicle, Acromioclavicular (AC) Joint,  
and Sternoclavicular (SC) Joint in Professional  
Quarterbacks Reported to the NFL Injury  
Surveillance System From 1980 to Present

Injury type	Contact	Throwing	Overall
AC joint sprain	40.0	0	40.0
SC joint sprain	3.0	0.4	3.4
Clavicle fracture	2.5	0	2.5
Total clavicle	45.5	0.4	45.9

contusions from collisions or tackling and involved the deltoid (11.3%), rotator cuff (8.4%), and scapular stabilizers (1.7%). There was a mean of 14.1 and a median of 5.0 days of playing time lost for shoulder contusions. Other injuries reported as a result of direct trauma included anterior shoulder dislocations (8.0%); fractures of the proximal humerus, scapula, and clavicle (3.7%); posterior shoulder dislocations (2.5%); SC joint sprains (3.0%); impingement/bursitis (1.7%); pectoralis major injuries (1.2%); biceps tendinitis (0.4%); and axillary nerve injury (0.4%) (Tables 2 and 3). Shoulder dislocations resulted in a mean of 42.9 and median of 19.0 days of playing time lost.

The most common injury identified as a result of the throwing motion itself was rotator cuff tendinitis (6.1%) followed by biceps tendinitis (3.9%). Rotator cuff tendinitis resulted in a mean of 15.3 and a median of 11.0 days of playing time lost; biceps tendinitis resulted in a mean of 19.3 and a median of 9.5 days of playing time lost. Other injuries reported as being associated with the throwing motion itself included synovitis/capsulitis (1.6%), anterior labral tear (0.4%), posterior capsular strain (0.4%), impingement (1.2%), and SC joint strain (0.4%) (Tables 2 and 3).

## DISCUSSION

The kinematics and biomechanics of the baseball pitch have been thoroughly investigated, and relatively consistent definitions have been previously established.<sup>4,5,10</sup> In contrast, there has been only limited research looking at the kinematics and muscle firing patterns during the football throw.<sup>6,11,18,23</sup> Although the football throw is similar in some respects to other overhead throwing motions, the increased weight of the football (0.42 kg versus 0.14 kg for the baseball) appears to affect shoulder position and stresses throughout the throwing motion, and several kinematic and biomechanical distinctions are apparent.<sup>6,11,23</sup> Most notably, during arm deceleration, pitchers produce greater forces and torques in the shoulder and elbow, as well as higher angular velocities throughout the entire pitching motion. Shoulder internal rotation velocities are between 3 and 4.5 times faster during the baseball throw, and elbow extension velocities are between 2 and 3 times faster during the baseball throw.<sup>6,23</sup> In addition, muscle activation patterns, especially activation of the

TABLE 4  
Injury Patterns to Quarterbacks in the  
National Football League by Play Type<sup>a</sup>

Play	Shoulder	Clavicle/AC/SC	Total
Tackled as passer	24.7	22.6	47.3
Tackled after the pass	3.9	5.7	9.6
Tackled as carrier	5.7	7.0	12.6
Throwing	13.6	0.4	14.0
Other	6.2	10.2	16.4

<sup>a</sup> AC, acromioclavicular; SC, sternoclavicular.

accelerator muscles (subscapularis, latissimus dorsi, and pectoralis major), appear to be considerably higher during the baseball throw compared to the football throw.<sup>7,11</sup>

The clinical spectrum of shoulder injuries to quarterbacks that was observed in our analysis of the NFLISS is consistent with the kinematic and electromyographic findings reported previously.<sup>6,11,23</sup> Compared to the baseball throw, the football throw is associated with significantly slower rotational velocities, decreased extremes of range of motion, and decreased electrical activity from the rotator cuff and surrounding shoulder musculature.<sup>6,7,11,23</sup> Based on this biomechanical data, one would expect fewer problems with chronic overuse types of injury such as those experienced much more commonly in baseball pitchers. This is, in fact, what was observed, with the vast majority of shoulder injuries occurring as a result of trauma (82.3%) and less than 15% resulting from the actual throwing motion. However, it is important to realize that the injury patterns observed in younger, less advanced quarterbacks may differ from those observed in NFL professionals. The inferior muscle strength and poor throwing mechanics of younger quarterbacks combined with the decreased contact forces they encounter may predispose them to a different spectrum of injuries. Further epidemiological investigations specific to younger quarterback populations may be warranted.

Treatment of shoulder injuries in quarterbacks varies depending on the specific type and degree of injury and is beyond the scope of this discussion. However, AC joint injuries are the most common shoulder injuries observed, and several management points can be made based on the senior author's NFL experience. Grade I and II injuries have been successfully treated nonoperatively with a progressive rehabilitation program. Similarly, after initial protection with a sling, most grade III injuries in athletes can be placed in a rehabilitation program and observed. In our experience, surgery has rarely been necessary; there is little in the literature to support early repair even in a quarterback. Taft et al.<sup>22</sup> previously reported that only 10% of nonoperative AC joint injuries will go on to need surgical care. In addition, most strength studies have failed to show significant deficits with nonoperative treatment in throwers. We have treated several NFL quarterbacks nonoperatively with a grade III separation who returned to play at 5 or 6 weeks. In contrast, grade IV, V, and VI injuries will need surgical treatment. Nonoperative management has been successful for many of the other

common shoulder injuries encountered including anterior SC joint separations, deltoid contusions (with or without axillary nerve injury), rotator cuff contusions, biceps tendinitis, and partial tears of the pectoralis major. Operative intervention may be more appropriate for other injuries, including nonreducible posterior SC joint separations, recurrent traumatic dislocations, labral pathology, rotator cuff tears, complete pectoralis major ruptures, and displaced fractures.

## CONCLUSION

Like other throwing athletes, quarterbacks are at risk for shoulder injury. However, the spectrum of injury is unique and more commonly related to trauma than to chronic overuse. Shoulder injuries are the second most common type of injury suffered by quarterbacks next to head injuries. The most common injury to the shoulder is an AC joint separation, which results in a mean of 22.1 and a median of 12.5 days of playing time lost. Other traumatic shoulder injuries encountered include shoulder contusions to the deltoid and the rotator cuff, traumatic dislocations, fractures, SC joint separations, and pectoralis major injuries. Chronic overuse-type injuries represent less than 15% of the reported injuries and include rotator cuff tendinitis, cuff tears, impingement, and biceps tendinitis.

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