Midfoot Sprains in the National Football League

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Abstract

Midfoot sprains in the National Football League (NFL) are uncommon. There are few studies on midfoot sprains in professional athletes, as most studies focus on severe traumatic injuries resulting in Lisfranc fracture-dislocations.

We conducted a study to evaluate midfoot sprains in NFL players to allow for better identification and management of these injuries. All midfoot sprains from a single NFL team database were reviewed over a 15-year period, and 32 NFL team physicians completed a questionnaire detailing their management approach. A comparative analysis was performed analyzing several variables, including diagnosis, treatment methods, and time lost from participation.

Fifteen NFL players sustained midfoot sprains. Most injuries occurred during games as opposed to practice, and the injury typically resulted from direct impact rather than torsion. Twelve players had nonoperative treatment, and 3 had operative treatment. Nonoperative management resulted in a mean of 11.7 days of time lost from participation. However, there was a significant ($P = .047$) difference in mean (SD) time lost between the grade 1 sprain group, 3.1 (1.9) days, and the grade 2 sprain group, 36 (26.1) days. Of the 3 operative grade 3 patients, 1 returned in 73 days, and 2 were injured late in the season and returned the next season.

Eleven (92%) of the 12 players who had nonoperative treatment had a successful return to play, and 10 (83%) of the 12 played more games and seasons after their midfoot injury. Depending on the diastasis category, NFL team physicians vary treatment: no diastasis (84% cam walker), latent diastasis (47% surgery, 34% cam walker), and frank diastasis (94% surgery).

In the NFL, midfoot sprains can be a source of significant disability. Successful return to play can be achieved with nonoperative management for grade 1 injuries within 1 week and grade 2 injuries within 5 weeks. However, severe injuries with frank diastasis that require operative management will necessitate a more significant delay in return to play. Either way, most NFL athletes will have a successful NFL career after their midfoot sprain injury.

Midfoot (Lisfranc) joint injuries are uncommon in the general population, with a reported incidence ranging from 1 per 50,000 to 1 per 60,000 per year.[1,2] The majority of these midfoot injuries result from high-velocity direct trauma involving severe disruption of the tarsometatarsal joint.[1-6] Most of the literature on Lisfranc injuries are based on cohorts that include trauma patients. On the other hand, low-velocity indirect injuries of the tarsometatarsal joint have also been associated with midfoot or Lisfranc sprains.[7] These injuries are even less extensively studied in athletes, who may sustain them from torsion or the shoe–surface interface.[8]

Foot and ankle injuries are among the most common injuries in athletes and represent 16% to 22% of all sports injuries.[9] Although midfoot sprains are not common in the general population, sporting activities appear to result in a higher rate of midfoot injury, especially in elite athletes. In fact, midfoot sprains comprise the second most common athlete injury to the foot, after metatarsophalangeal joint injuries.[10] Football players are especially prone to midfoot sprains; incidence is 4% per year, with offensive linemen sustaining 29.2% of midfoot sprains.[10] The most common mechanism of injury is an axial longitudinal force while the foot is plantarflexed and slightly rotated.[11,12]

There is a paucity of literature detailing the impact of midfoot injuries on football players.[8,10,13] A study of 23 collegiate football players found that they may have initially underwent a long period of acute disability but had very minor long-term complaints resulting in residual functional disability.[10] However, there are no case series detailing the impact of midfoot sprains on professional football players for whom delayed return to sport can potentially have a devastating impact on a career in terms of both acute- and long-term disability.

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We conducted a study to further define the mechanism of injury, diagnosis, treatment, and outcomes among National Football League (NFL) players with midfoot sprains. In addition, we aimed to provide a qualitative analysis of diagnostic and treatment algorithms being used by NFL team physicians in their management of midfoot sprains in these high-level contact athletes.

Materials and Methods

We evaluated midfoot sprains in NFL players in 2 specific phases. In phase 1, we retrospectively reviewed prospectively collected data involving midfoot sprains in professional players from a single NFL team over a 15-year period. In phase 2, we collated diagnostic and treatment algorithms for midfoot sprains among all 32 NFL team physicians by means of a structured questionnaire. Institutional review board approval was obtained for this study at the investigators' institution.

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In phase 1, a NFL team injury database was reviewed for midfoot sprains that had been prospectively entered by a team-certified athletic trainer after consultation with the head orthopedic team physician. All injury and diagnostic modalities and treatments were then analyzed. These included player position, foot and ankle protective gear (none, tape, brace, or unknown), playing surface (grass, AstroTurf, FieldTurf, or unknown), field condition (normal, wet, hard, or unknown), onset of injury (acute, chronic, or unknown), place of injury (game or practice), time of injury in game or practice (first quarter, second quarter, third quarter, fourth quarter, or unknown), type of play (collision, tackled, tackling, blocked, blocking, running/cutting, kicking, or unknown), and mechanism of injury (direct, torsion, shearing, or unknown).

Once the diagnosis was confirmed by physical examination and radiographic findings, midfoot sprain treatment was initiated based on the following algorithm protocols. Nondisplaced sprains were treated with a period of immobilization in a cam walker with progression to weight-bearing as tolerated (grade 1). Once asymptomatic, rehabilitation was initiated, including range of motion, strengthening, and proprioception, and gradual return to play as tolerated. Injuries with subtle diastasis (2-5 mm) were typically treated with nonoperative management in the same manner as the nondisplaced sprain protocol (grade 2); however, signs of gross instability indicated the potential requirement for surgical management. Some of these injuries underwent stress-testing to determine if there was gross instability. If the injury had subtle diastasis with instability or frank (>5 mm) displacement (grade 3), then surgical management was performed with closed versus open reduction and internal fixation (ORIF). The postoperative course included no weight-bearing for 4 to 6 weeks followed by partial weight-bearing for an additional 4 to 6 weeks. After approximately 8 to 12 postoperative weeks, screw removal was performed followed by progression to full weight-bearing and a comprehensive rehabilitation program, including range of motion, strengthening, proprioception, and gradual return to play. Return to play was allowed when the athlete was asymptomatic and had normal range of motion and strength. Time lost from participation was then recorded based on the dates of injury and return to play.

To further elucidate long-term postinjury playing status, we then gathered information from the www.NFL.com historical and current player databases as previously described by Shah and colleagues.[14] From this website, we documented the number of regular-season and postseason games as well as the number of seasons before and after the injury. To be included in the series, the athlete had to have been on the active roster for an NFL franchise at the time of injury. Successful return to play was defined as actual return to play in regular season or postseason NFL games after the midfoot sprain.

In phase 2, a structured electronic questionnaire was sent to all 32 NFL team physicians. The questionnaire was compiled to gather information relating to current diagnostic, treatment, and outcome algorithms in the management of midfoot sprains involving professional football players. Each questionnaire was sent by e-mail to all survey participants and included an embedded link to a secure online survey resource (REDCap Survey Software Version 1.3.9; Vanderbilt University, Nashville, Tennessee). Once the electronic questionnaire was completed by each NFL team physician, results were exported in spreadsheet format for descriptive data analysis.

The retrospective case series and NFL team physician survey data were then analyzed. A descriptive analysis was performed for all variables, including means and minimum–maximum range for quantitative variables as well as frequencies and percentages for qualitative variables. Depending on injury severity, an independent-sample t test with corresponding *P* values was also calculated for time lost from participation.

Results

The retrospective review of the prospectively collected NFL injury database revealed there were 15 midfoot sprains during the study period. A statistical and descriptive analysis was performed for all study parameters, including player, field, injury, and outcome-specific data. For player, field, and injury-specific data, the results are summarized in the **Table**.

All grade 1 midfoot sprains (7 nondisplaced) and grade 2 midfoot sprains (5 with subtle diastasis and no instability) were treated with nonoperative management. The 12 players were allowed to return to play without the need for subsequent

surgery within the same season. In the evaluation of return to play, based on the severity of the midfoot sprain, there was a statistically significant ($P = .047$) difference in mean (SD) time lost from participation between the grade 1 sprain group, 3.1 (1.9) days, and the grade 2 sprain group, 36 (26.1) days. Overall, nonoperative treatment of either grade 1 or grade 2 midfoot sprains resulted in a mean of 11.7 days of time lost from participation. In 1 patient with a grade 2 midfoot sprain, the injury occurred toward the end of the season, and the patient was not able to return to play during the remaining 42 days of the season. However, this patient returned to play the next season and had no residual problems.

Three grade 3 injuries (midfoot sprains with frank displacement) required surgical management with ORIF. One patient returned to play the same season, in 73 days; however, the other 2 patients had injuries toward the end of the season (29 and 77 days remaining) and were not able to return to play the same season. However, both these patients returned to play the next season and had no persistent problems. In terms of complications within the same season, there were no recurrent injuries reported after successful return to play.

When evaluating long-term postinjury playing status, we found that 11 (92%) of the 12 NFL players who had nonoperative treatment successfully returned to play. The only player who did not return to an NFL regular season or postseason game was an active-roster NFL player who never actually played in an NFL game before or after his midfoot sprain injury. Our series of NFL players played on average 1.9 years (range, 0-7 years) before the midfoot injury and 5.5 years (range, 0-14 years) after the midfoot injury. In terms of NFL regular-season and postseason games played, our cohort of NFL players played on average 24.0 games (range, 0-80 games) before the midfoot injury and 77.7 games (range, 0-226 games) after the midfoot injury. In fact, 10 of the 12 NFL players (83%) who had nonoperative treatment played more games and seasons after their midfoot injury.

The surveys from phase 2 were completed by all 32 NFL team physicians. When evaluating the severity of midfoot sprains, 63% of the NFL team physicians perform stress-view radiographs. To ascertain NFL team physicians' management decisions, we evaluated midfoot sprain results according to injury severity, including amount of diastasis.

When managing midfoot sprains with no diastasis, 94% of the team physicians use immobilization, including 27 with a cam walker and 2 with a cast; however, 2 physicians (6%) use only ankle taping or an Ace bandage. Initial weight-bearing status varies among the NFL team physicians, but most (78%) choose to protect the player, including 17 non-weight-bearing, 8 partial weight-bearing, and 7 weight-bearing as tolerated. Most physicians ideally progress players to full weight-bearing by 3 weeks (12% immediately, 12% by week 1, 41% by week 2, 16% by week 3, and 19% from 4-6 weeks).

In the management of midfoot sprains with subtle diastasis, there is variation in treatment modes among the NFL team physicians, with 53% using nonoperative management (34% cam walker, 19% cast) and 47% suggesting operative management. Regardless of treatment, most physicians (97%) maintain initial non-weight-bearing restrictions. In fact, only 1 physician first recommended partial weight-bearing, which corresponded to initial treatment in a cam walker.

In terms of midfoot sprains with frank diastasis, 94% of the NFL team physicians indicated surgical management is warranted, with only 2 physicians (6%) recommending initial nonoperative management with a cam walker. Regardless of treatment, all the physicians (100%) implemented initial non-weight-bearing restrictions. Once surgical treatment was recommended, the preferred fixation method was ORIF using screws (94%) as opposed to closed reduction and internal fixation with percutaneous Kirschner wires (6%). Most of the physicians (59%) do not allow return to play until midfoot

Table. **Midfoot Sprains by Player, Field, and Injury-Specific Data**

Variable	Category	Midfoot Sprains (N= 15)
Position	Running back	0
	Quarterback	2
	Wide receiver	3
	Tight end	1
	Offensive lineman	1
	Defensive lineman	4
	Linebacker	1
	Defensive back	3
	Special team	0
Foot and ankle protection	Nothing	9
	Tape	3
	Brace	0
	Unknown	3
Playing surface	Grass	7
	FieldTurf	4
	AstroTurf	1
	Unknown	3
Field condition	Normal	9
	Wet	1
	Hard	2
	Unknown	3
Place of injury	Game	8
	Practice	4
	Unknown	3
Time of injury	1st quarter	1
	2nd quarter	4
	3rd quarter	2
	4th quarter	5
	Unknown	3
Mechanism of injury	Direct impact	9
	Torsion	3
	Shearing	0
	Unknown	3
Type of play	Tackling	2
	Tackled	2
	Blocking	1
	Blocked	1
	Collision	5
	Running/cutting	1
	Kicking	0
	Unknown	3

hardware is removed; however, 38% allow full participation with contact, and 3% allow partial participation with no contact. Removal of midfoot fixation is an important factor for most of the physicians before considering return to play, and 69% recommend hardware removal after 11 weeks. However, the specific timeline for hardware removal varied among these physicians, with 28% opting for removal at 11 to 12 weeks, 16% at 13 to 14 weeks, 12.5% at 7 to 8 weeks, 12.5% at 15 to 16 weeks, 12.5% at more than 16 weeks, 12.5% never, and 6% at 9 to 10 weeks.

The NFL team physicians surveyed in our study suggested that midfoot sprains with no or subtle displacement may be treated with nonoperative measures while yielding satisfactory clinical outcomes.

The midfoot sprain treatment protocol (nonoperative vs operative management) based on injury severity was an important factor in considering return-to-play guidelines. When evaluating time lost from participation because of midfoot sprains, most of the NFL team physicians anticipated a period of 5 to 8 weeks when considering nonoperative management (56%) and more than 17 weeks after operative management (53%). In evaluating nonoperative management protocols, return-to-play guidelines were relatively expeditious, with 56% of the physicians estimating from 5 to 8 weeks, 22% from 1 to 4 weeks, 13% from 9 to 12 weeks, 6% from 13 to 16 weeks, and 3% longer than 20 weeks. In comparison to nonoperative management, return-to-play guidelines for operative management were prolonged, with 53% of the physicians estimating more than 20 weeks, 25% from 17 to 20 weeks, 13% from 13 to 16 weeks, and 9% from 9 to 12 weeks.

Discussion

Lisfranc and midfoot injuries remain a controversial topic in sports medicine. Several authors have argued that anatomical reduction of the tarsometatarsal joint in the setting of a Lisfranc injury yields optimal outcomes.[15,16] Some studies have also suggested that purely ligamentous Lisfranc injuries may be more of a problem than bony injuries, which may have the benefit of osseous healing.[15,17] Anatomical reduction can minimize the potential for arch collapse by maintaining the normal tarsometatarsal relationship. However, there are no long-term data to determine how midfoot arthrosis is affected by ORIF, which typically involves hardware traversing joints. Some have even argued that primary tarsometatarsal arthrodesis should be the treatment of choice, as the midfoot has limited native motion, and successful arthrodesis eliminates the potential for midfoot arthrosis.[17,18] However, we are unaware of any studies that have routinely performed arthrodesis in an athletic population.

The majority of studies on midfoot injuries have evaluated individuals involved in traumatic accidents, most commonly motor vehicle collisions. The present study suggests there may be a subset of injuries in athletes that have yet to be adequately studied. Anecdotally, the NFL team physicians surveyed in our study suggested that midfoot sprains with no or subtle displacement may be treated with nonoperative measures while yielding satisfactory clinical outcomes. These results have been quantified in return-to-play status. Our subset of athletes from an NFL team corroborates these findings, even though the series was small (15 patients). Our survey results also suggest there is considerable variation in the "optimal" management plan among the physicians treating these elite athletes. Most would agree that the nondisplaced injuries can be managed conservatively and that the severely displaced injuries should be managed operatively, but the natural history of those injuries with subtle diastasis remains unclear. When operative intervention is implemented, hardware removal versus retention must also be considered when allowing for return to play. Although one would assume that motion-related hardware failure would be possible at the tarsometatarsal joints, this concept has yet to be clearly defined in the literature.

The present study also demonstrates that most athletes with these midfoot injuries can return to play at the elite NFL level, as evidenced by their short- and long-term return to play. However, it was not possible to differentiate the specific return-to-play level related to preinjury performance level. Furthermore, this relatively short-term NFL career follow-up study was not able to elucidate the long-term consequences of these injuries. In fact, arch collapse and acquired flatfoot deformity could eventually result from this injury, and long-term outcomes would be of particular interest in patients who have subtle diastasis and who are treated nonoperatively.

Although previous studies have supported operative management for Lisfranc injuries involving subtle diastasis, more than half of the NFL team physicians surveyed in this study use nonoperative treatment for these injuries.[19] Future studies should evaluate stress-imaging to define the effect of stability or latent diastasis on long-term outcomes. Nonetheless, the present study demonstrates that a large cohort of NFL team physicians supports nonoperative management for these Lisfranc injuries with subtle diastasis, even in elite athletes. Additional prospective studies are needed to provide a more rigorous injury evaluation and closer follow-up, including subjective and objective outcomes, to further define the indications for management options for midfoot sprains in this population of contact athletes.

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