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ORIGINAL ARTICLE

Corticosteroid and Anesthetic Injections for Muscle Strains and Ligament Sprains in the NFL

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Abstract *Background:* Administering local anesthetic or corticosteroid injections in professional athletes to allow return to play is common but has traditionally been viewed as suspect and taboo. The skepticism surrounding therapeutic injections stems predominantly from anecdotal experience as opposed to scientific data. *Questions/Purposes:* The purpose of this paper is to evaluate the current use of corticosteroid injections for muscle strains and ligaments sprains in the National Football League to document player's ability to return to play and possible adverse effects. *Patients and Methods:* Athletes from a single National Football League team who received at least one corticosteroid or anesthetic injection for either a muscle strain or ligament sprain during three consecutive seasons were retrospectively reviewed. Thirty-seven injections were given over the three seasons. Injections were either performed blindly or by using ultrasound guidance. *Results:* Twice as many defensive players were injected than offensive players. The average number of days of conservative treatment before injection was 6.5 days. All players returned to play after injection. There were no complications from any of the injections. Seventeen (55%) players did not miss a single game, and nine (30%) did not miss a single day. Quadriceps strains were associated with the most missed games (four) and the most missed days (36.5). Proximal hamstring strains were second with an average of three missed games and 28 missed days. *Conclusion:* Corticosteroid injections are a safe and effective therapeutic intervention for treating muscle strains and ligament sprains in order to enable athletes to return to competition earlier.

Keywords corticosteroid injection · muscle strain · ligament sprain · national football league · ultrasound guided

Level of Evidence: Retrospective Case Series, Level IV. See the Guidelines for Authors for a complete description of levels of evidence.

Work performed at Hospital for Special Surgery and the New York Giants Medical Services and Training Center.

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Introduction

The use of corticosteroid and anesthetic injections in professional sports has been performed for many years. However, for a variety of reasons, there has been a lack of clinical studies effectively assessing this intervention. Traditionally, the use of these therapeutic injections to treat various soft tissue injuries has been viewed as taboo. Some authors have asserted that sports medicine physicians should report objective data on their results or the sport's governing bodies should officially ban these injections altogether [7]. Without widely published data documenting the therapeutic and adverse effects of corticosteroid and anesthetic injections for treating muscle strains and ligament sprains in athletes, it is difficult to establish effective treatment guidelines and properly advise patients about anticipated risks and benefits.

The purposes of this study are to document the use of therapeutic corticosteroid and anesthetic injections for treating muscle strains and ligament sprains in a professional football team and to evaluate any adverse outcomes and player's ability to return to play. We hypothesize that the selective use of corticosteroid or anesthetic injections for certain specific diagnoses may accelerate some player's return to play without any short-term consequences. Athletes may experience relief of symptoms related to their injury thus enabling them to return to athletic competition without further progression or exacerbation of the injury. By studying and documenting these interventions and outcomes, this study may form the framework by which other studies can be compared and ultimately provide a database so that long-term data can be evaluated.

Patients and Methods

The private medical database of a single National Football League team was retrospectively reviewed over a three-season period from September 2006 to January 2008. Inclusion criteria included corticosteroid or anesthetic containing injection administered to players for either muscle strains or ligament sprains either locally or under ultrasound guidance. This study was approved by the IRB and conforms to accepted ethical standards for research involving human subjects.

Players identified suffered injuries that required treatment by the training staff and entered into the team database. There were 264 total injuries during the period. All patients were treated initially with physical therapy, activity modification, and nonsteroidal anti-inflammatory medications. In some cases, players were also treated with electrical stimulation and massage. Conservative treatment times ranged from 1 to 27 days (mean=6.5 days) before administering an injection. The decision to give an injection was based on the inability of an athlete to practice or play as a result of the injury. Thirty-seven injuries in 31 athletes were treated with therapeutic injections. All corticosteroid injections were administered 1–2 days prior to competition, while all anesthetic injections were administered within one hour of the beginning of the game.

Acromioclavicular joint injuries comprised of grades 1 and 2 sprains were treated with anesthetic and steroid intraarticular injections to decrease inflammation and improve rehabilitation. Ankle sprains and grade 1 medial collateral ligament sprains of the knee and elbow were treated with anesthetic peri-ligamentous injection at game time if the patient's ability to play was hindered. Higher-grade sprains have not been injected, and steroids have not been used in these injuries because of the theoretical risks of ligamentous rupture in the literature [1]. Primary tendon injury was considered a contraindication for initial injection with an anesthetic or corticosteroid. Contraindications for repeat injection included no significant resolution of symptoms, no improvement in function after the initial injection, and progression of the injury after injection. Grade 1 ligamentous injuries to the joints of the midfoot and forefoot, such as the tarsometatarsal joint and the great toe metatarsal-phalangeal joint, have been injected with anesthetic and steroid into the peri-ligamentous tissue to decrease inflammation and to allow for rehabilitation. Muscle or musculotendinous strains of the proximal and distal hamstring, adductor, quadriceps, rectus femoris, biceps brachii, gastrocnemius, and distal peroneal tendons were evaluated by MRI. If a hematoma was present, aspiration was carried out followed by anesthetic and steroid injection into the site of the aspiration under ultrasound guidance to decrease inflammation and promote rehabilitation. Injections consisted of a mixture of triamcinolone, with an anesthetic agent (lidocaine, bupivicaine). All players were counseled about the risks and benefits of corticosteroid injections which include infection, ligament or tendon rupture, and progression of injury secondary to the masking of protective pain to name a few. The players' progress was tracked by the team database for the three seasons, and number of missed days, practices, and games were all recorded.

Statistics

Descriptive statistics for days between injury and injection, practices missed, games missed, and total days missed for all injection sites of local and ultrasound guided injections were reported using means and standard deviations (Table 1). Overall and anatomic-specific differences between games, days until injection, and total days missed were calculated between local and ultrasound-guided injections. All statistical analysis was performed using SPSS version 14.0 (SPSS Inc., Chicago, IL).

Injection Techniques

For the local injection, the area of injury was palpated, and with the guidance of the player, the injection site was designated with a marking pen. The skin was then prepped in a sterile fashion with Betadine and immediately numbed with ethyl chloride spray prior to the injection. After the injection, an occlusive bandage was used for a short period after to protect the site.

For the ultrasound-guided technique, a sonologist or radiologist positioned the transducer, while a radiologist positioned the needle and performed the procedure. Indications for ultrasound-guided administration were based on the anatomic proximity of neurovascular structures near the site of injection and the presence of fluid or hematoma at the site of injury identified clinically or by imaging studies. Using a linear transducer, typically 7.5 MHz, a direct approach was used with either a 22-gauge spinal needle or, in thin patients, a 22-gauge 1.5-in. needle. Tendons are usually scanned in short axis. It is important to keep in mind that tendons display inherent anisotropy. Therefore, it is necessary that the transducer is oriented to maximize tendon echogenicity in order to avoid false interpretation of the tendon as being complex fluid or synovium. When fluid distended the tendon sheath, the tip of the needle was directed into the fluid. Often, a small hematoma can also be detected in the presence of an acute trauma. This hematoma was aspirated when

Table 1 Mean time to injection and missed time based on site of injection

Site of injection (no. of injections)	Local injections/ US-guided	Days between injury and injection mean (SD)	Practices missed mean (SD)	Games missed mean (SD)	Days missed mean (SD)
Knee (8)	6/4	16.6 (18.2)	4.1 (6.2)	0.7 (1.6)	7.6 (11.5)
MCL (5)	3/2	27.0 (19.8)	5.2 (8.7)	1.2 (2.2)	9.8 (16.1)
Distal Hamstring (3)	2/1	5.7 (4.5)	3.3 (3.5)	0.7 (1.2)	8.0 (8.5)
Ankle (7)	6/1	3.7 (3.3)	1.7 (1.0)	1.3 (3.4)	6.0 (3.2)
Hamstring (3)	0/3	4.0 (5.2)	14.0 (9.6)	3.0 (1.7)	28.0 (20.8)
Groin (3)	1/2	1.7 (0.6)	3.0 (1.7)	0.3 (0.6)	4.3 (1.5)
Biceps (3)	3/0	2.0 (1.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)
AC Joint (3)	3/0	3.0 (3.0)	1.7 (2.9)	0.3 (0.6)	3.7 (6.4)
Quadriceps (2)	0/2	8.0 (5.7)	23.5 (12.0)	4.0 (0.0)	36.5 (7.8)
Great toe and toe (2)	0/2	2.5 (0.7)	1.5 (0.7)	1.0 (0.0)	5.0 (0.0)
Foot (2)	1/1	5.5 (5.0)	3.5 (3.5)	0.0 (0.0)	5.5 (6.4)
Hip flexor (1)	0/1	1.0 (0.0)	10.0 (0.0)	2.0 (0.0)	24.0 (0.0)
Lower leg (1)	1/0	14.0 (0.0)	3.0 (0.0)	0.0 (0.0)	5.0 (0.0)
Elbow (1)	1/0	1.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)
Calf (1)	0/1	2.0 (0.0)	7.0 (0.0)	2.0 (0.0)	12.0 (0.0)

visible. Otherwise, the needle was directed along the superficial margin of the tendon and a test injection with local anesthetic of 1% lidocaine (Abbot Laboratories, North Chicago, IL) was used to confirm local distension of the sheath. Upon confirmation of the anatomic location of the needle, the anesthesia/corticosteroid mixture, typically consisting of 0.5 cm^3 1% lidocaine, 0.5 cm^3 0.5% bupivacaine (Sensorcaine (Astra Pharmaceuticals, Westborough, MA)), and 1 cm^3 (40 mg) triamcinolone (Kenalog (Apothecon, a Bristol Myers Squibb Company, Princeton, NJ)), was administered. The presence of fluid distension of the sheath with superficially located microbubbles helps to confirm a successful injection.

Results

Two hundred sixty-four nonspine injuries were identified in the database. Thirty-seven injuries (14%) ended up receiving injections over the three-season period in 31 players. Thirty of the injuries (81%) occurred during the season, and only seven occurred in the preseason. There were 21 local and 16 ultrasound-guided injections. Fourteen anatomic locations were injected, with the ankle being most common (Fig. 1). Severe injuries with fluid collections or deep musculotendinous strains and ligament sprains were chosen to be addressed with ultrasound guided injections. Approximately twice as many defensive players (26) were injected than offensive players (15). On defense, there were nine defensive backs, eight defensive linemen, and nine linebackers. Offensively, there were seven wide receivers, three running backs, three tight ends, and two offensive linemen (Fig. 2).

All players returned to play with a mean number of 10.4 days missed for all injuries (Fig. 3). There were no major or minor complications from any of the local or ultrasound guided injections over the three seasons. Seventeen (55%) players did not miss a single game, and nine (30%) did not miss a single day. The injuries associated with the most lost time were quadriceps strains and proximal hamstring strains. The number of missed games and missed days for quadriceps strains was four games (Fig. 4) and 36.5 days. For proximal hamstring strains, it was three games and 28 days, respectively. Tarsometatarsal sprains, medial ulnar collateral ligament sprains, distal biceps brachii strains, and distal peroneal strains were all injuries which lead to no missed games in this series. The mean number of days of conservative treatment before injection was 6.5 (Fig. 5).

Discussion

Musculotendinous strains and ligament sprains are a common cause of lost playing time in professional athletes, specifically players in the National Football League. Lost playing time, for this specific population, has significant negative financial consequences for the athlete. Therefore, it is reasonable, in the informed patient, to provide a safe means of treatment; the goal of which is to return the player to sport as quickly as possible. A simple analogy for this would be the treatment of the symptoms of low back pain with the goal of returning someone to work. There are several reports of the use of both corticosteroids and isolated local anesthetic in the treatment of injuries in athletes [12, 8]. Corticosteroid injections have been used successfully to decrease pain and increase function in patients with mild arthritis of the knee [10] and with iliotibialband friction syndrome [5]. Although, reports of cartilage damage in animal studies [2], plantar fascia rupture [1], and Achilles tendon rupture [3] have caused physicians to use corticosteroid injections with caution.

Local anesthetic injections have been used in Australia for professional athletes in rugby and Australian rules football. The study describes the use of local anesthetic injection as an aid to hasten return to play in 268 injuries. No career-limiting complications were reported; however, they did report some minor complications including plantar fascial rupture, superficial peroneal nerve block, prepatellar bursal infection, adductor longus tendinopathy, and partial rupture

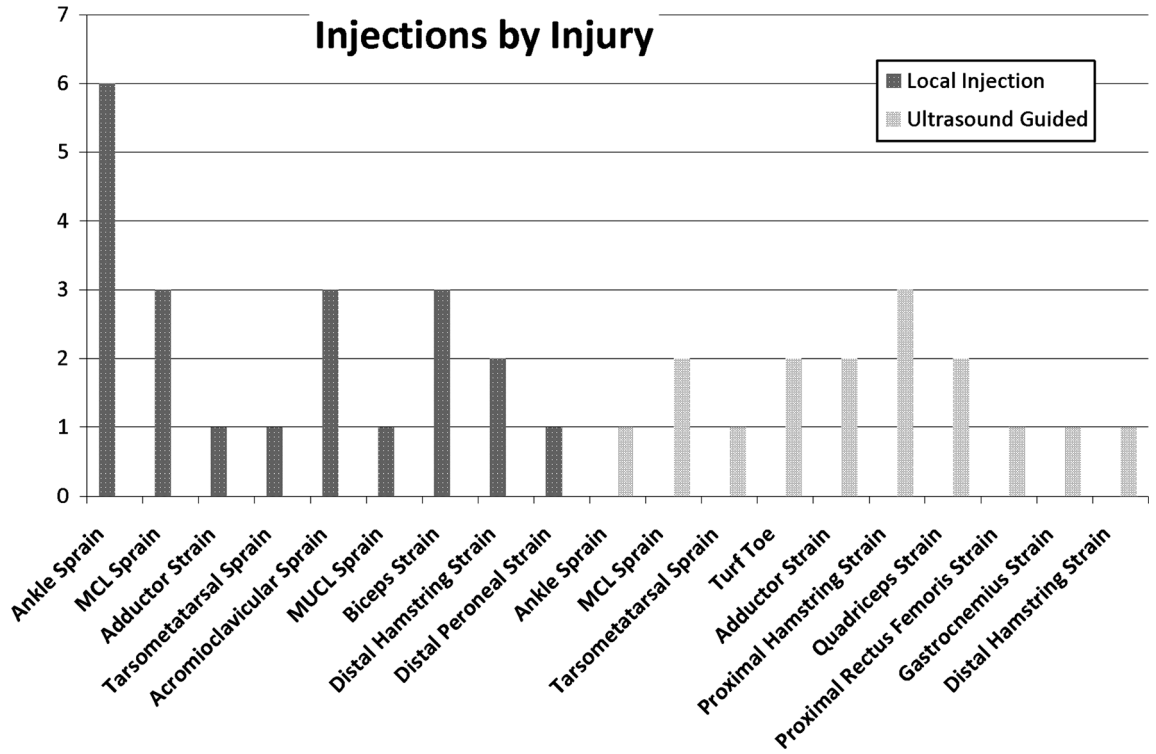

Fig. 1. Injections given by type and anatomic location.

of the Achilles tendon. They believed some of these complications were the result of the athletes being able to play through masked pain and worsen the present injury [8]. There is also a case report of using local anesthetic to inject a distal hamstring rupture in a National Football League athlete. The athlete missed one game after rupture of his

Fig. 2. Injections given by football position.

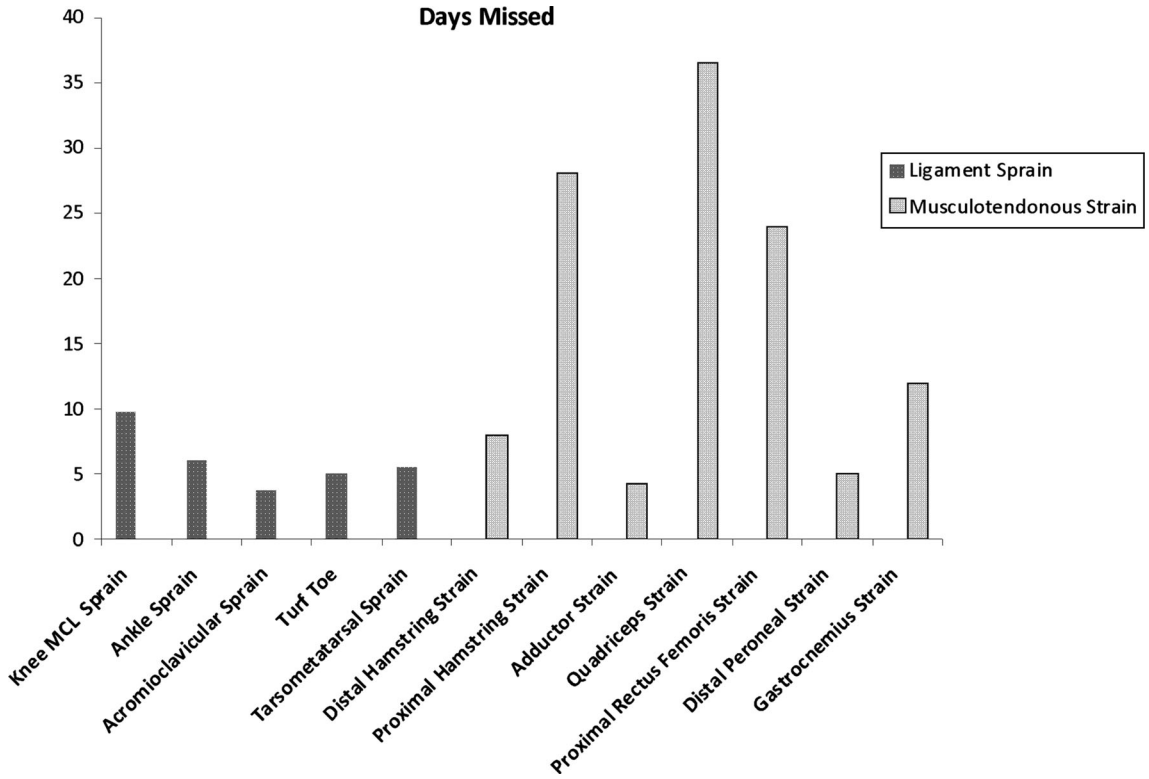

Fig. 3. Number of days missed based on type of injury.

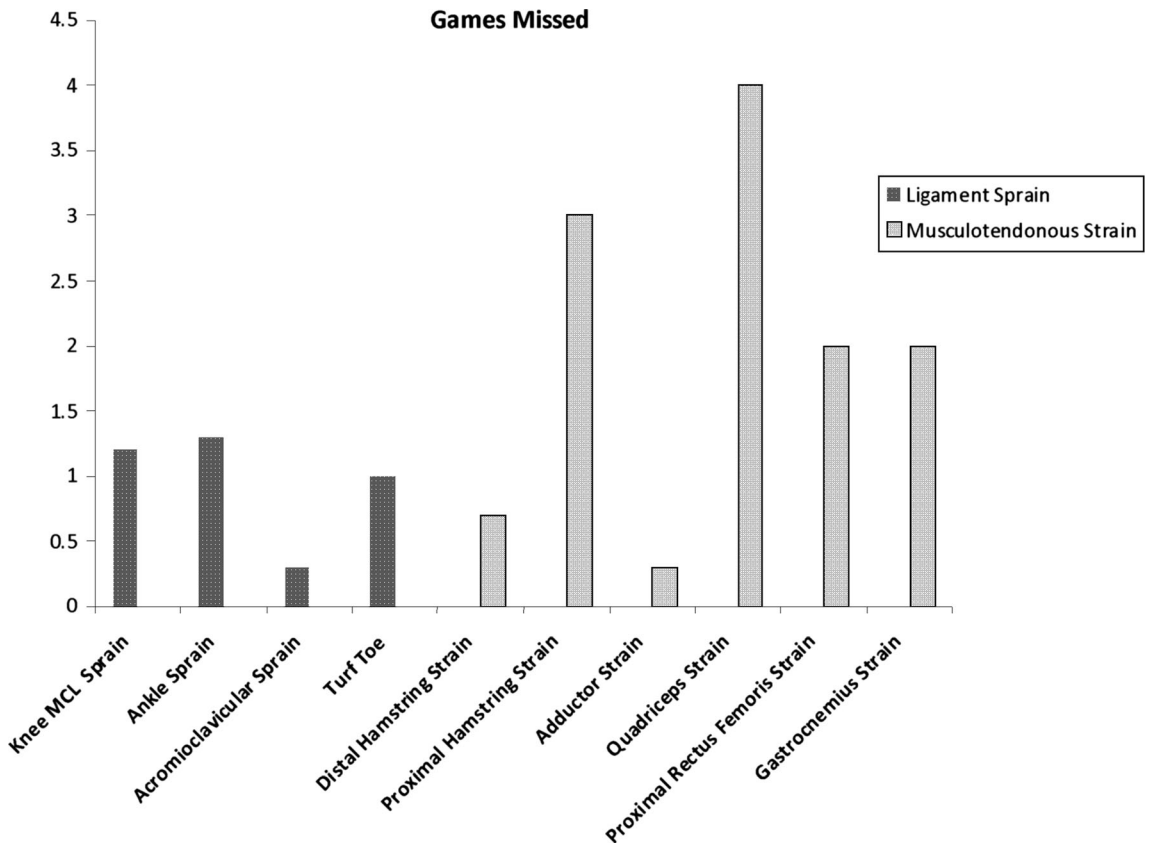

Fig. 4. Number of games missed based on type of injury.

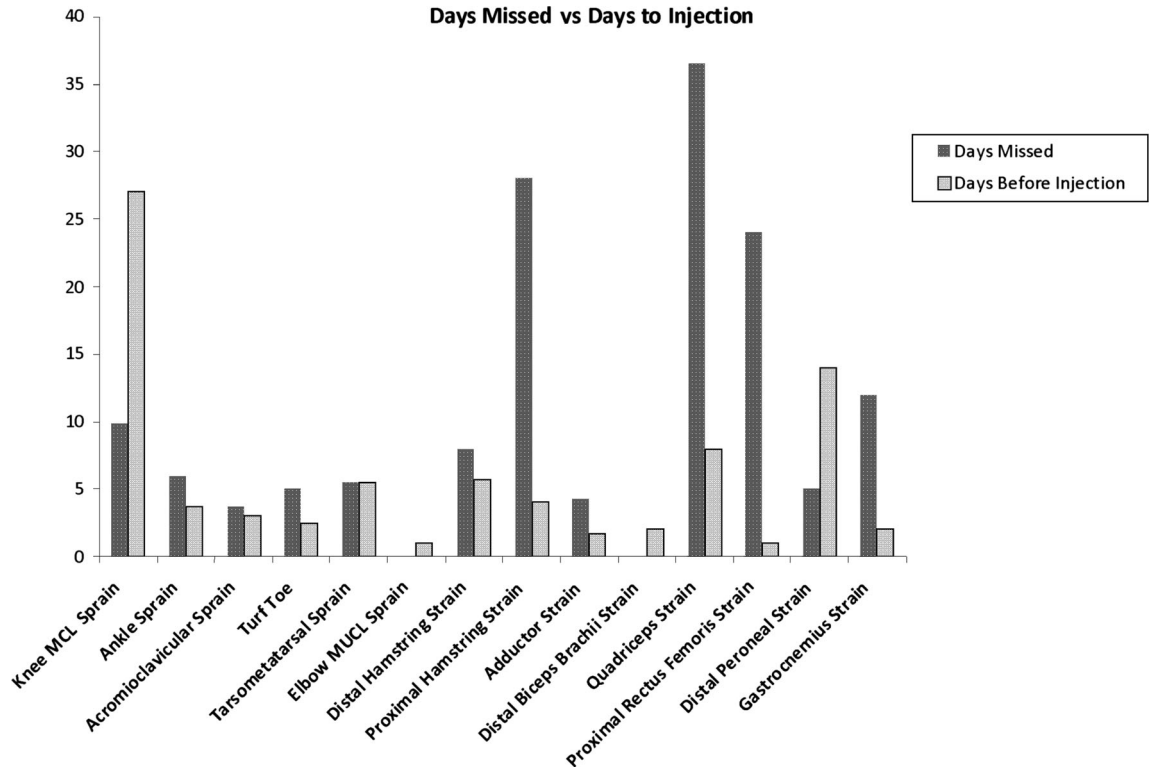

Fig. 5. Number of days missed as compared to number of days of conservative treatment before injection by injury type.

distal semitendinosus and elected to receive anesthetic injections for the following two games and was able to compete without any complications [9].

There is one report describing the use of intramuscular corticosteroid injections for high-grade hamstring strains in professional football players. In the study, 58 players with hamstring strains with palpable defects were injected locally with corticosteroid and anesthetic. They found that only nine players missed any games, and on average the athletes returned to play in 7.6 days. There were no complications reported from any of the injections [6]. Unfortunately, there are few no other published reports about the current practice patterns of the use of anesthetic and corticosteroid injections in the National Football League.

This study demonstrates that injections may be given safely and effectively to players to enhance return to play. There have been anecdotal reports of tibial and femoral nerve paresthesias and paralyses from injections to the quad and hamstrings [8]. For this reason, we addressed these specific injuries and other deep injuries with direct ultrasound visualization based on some literature which suggests that ultrasound guidance increases the accuracy of corticosteroid delivery [4]. This practice also provides the advantage of decompressing a hematoma when applicable.

Of note, musculotendinous injuries, specifically proximal hamstring strain, quadriceps strain, and rectus femoris strain, demonstrated the longest period of recovery and "days missed." We believe this to be secondary to the nature of the injury to these muscles. All of these injuries necessitated injection with ultrasound guidance because of the close anatomic proximity of major neurovascular structures and hematoma formation around the injury. Radiographic studies have shown that muscle tissue remote from the site of the injury at the musculotendinous junction demonstrates MRI signal changes associated with edema and inflammation explaining the deleterious nature of the swelling on surrounding structures [11]. The large area of these muscle groups also requires the therapeutic injection to disperse over a larger surface area.

In our series, we had no infections, tendon ruptures, or progression of the injury in severity. Progression in severity of the original injury after therapeutic injection was of major concern. Previous studies have demonstrated the efficacy and safety of using anesthetic and corticosteroid injections. Players were closely monitored for further progression of the injury after injection and competition. Injury progression was considered a contraindication for repeat injection or continued competition.

We recognize that our study is not without limitations. One is that we do not have a control group, although these players did return to play football at the professional level after their injections without incident. We also recognize that a relatively small proportion of injuries necessitated treatment with anesthetic and corticosteroid injection. We understand that not segregating injections into two categories is a limitation of this study, but we wanted to report on data for all therapeutic injections administered in this athletic population. We hope to further delineate the efficacy of anesthetic versus corticosteroid injections in further studies as more reports of the use of therapeutic injections

in football players in the National Football League continue to be published. This study does not advocate the judicious use of injections on a weekly basis in the same player for the same injury, especially if there is no significant resolution of symptoms or improvement in function with the first injection. However, we contest that when properly indicated after a period of conservative treatment, these injections can safely hasten an athlete's return to play. In our study, corticosteroid was safely used to treat sprains of the ankle, acromioclavicular joint, forefoot, midfoot, and medial collateral ligament of the knee and elbow. It was also safely used to treat muscle strains of the hamstring, adductor longus, quadriceps, biceps brachii, rectus femoris, gastrocnemius, and peroneus longus.

Disclosures

Conflict of Interest: Mark Drakos MD, Patrick Birmingham, MD, Demetris Delos, MD, Ronnie Barnes, ATC, Conor Murphy, BA, and Leigh Weiss, ATC, PT have declared that they have no conflict of interest. Russell Warren, MD receives royalties from Biomet and stock options from Ivy Sports and Cayenne, outside the work.

Human/Animal Rights: All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2000 (5).

Informed Consent: Informed consent was waived from all patients for being included in the study.

Required Author Forms Disclosure forms provided by the authors are available with the online version of this article.

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