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THE INCIDENCE OF SPEARING BY BALL CARRIERS AND THEIR TACKLERS DURING A HIGH SCHOOL FOOTBALL SEASON.

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ABSTRACT: This study established the cumulative incidence per season of ball carrier spearing and concurrent defensive spearing by tacklers for a New Jersey high school football season. Spearing (flexing the neck and initiating contact with the top of the helmet) is a significant cause of injury to the head and neck in football. To reduce the risk of head and neck injuries in football all types of spearing must be explored. Nine game films from the 1989 football season were viewed to determine the incidence of ball carrier spearing and concurrent defensive spearing. There were 167 incidents of ball carrier spearing (1 per 5.1 plays) and 72 incidents of concurrent defensive spearing (1 per 2.3 ball carrier spears). Officials can now penalize any player who initiates contact with his head. However, there were no spearing penalties called throughout the 1989 season. This study detected a surprisingly high cumulative incidence of ball carrier spearing and concurrent defensive spearing, along with poor enforcement of the spearing rule. To further reduce the risk of head and neck injuries officials should acknowledge ball carrier spearing as a rule infraction and enforce existing spearing rules during the tackling process. Coaches also should teach and drill correct technique with ball carriers, tacklers, and blockers throughout the season.

KEYWORDS: ball carrier spearing, concurrent defensive spearing, head down, spearing, tackling process.

Catastrophic head and neck injuries are among the most devastating injuries in sports. Because the damage from these injuries is often permanent and limits rehabilitation, prevention of these injuries is the only acceptable management plan. Even the few catastrophic injuries that have occurred each season are too many (1).

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The National Federation of State High School Associations (NFSHA) and the National Collegiate Athletic Association (NCAA) changed their football rules in 1976, making the deliberate use of the helmet to ram or punish (spear) an opponent illegal (2). The NFSHA and the NCAA did this in an effort to reduce the number of head and cervical spine injuries occurring in football. Head and neck injuries in high school and college football have declined since 1976 (3,4,5,6,7). The rule change (3,4,6,8,9) and subsequent changes in the way coaches teach their players to tackle are believed responsible for this reduction (3,4,10).

Injuries to tacklers (defensive backs and linebackers) account for the largest percentage of cervical spine injuries (4,6). The contact techniques of these players have received the majority of attention and corrective coaching. Consequently, it seems that coaches and officials have overlooked ball carrier spearing.

This lack of instructional technique, overlooking ball carrier spearing as a rule infraction, and poor enforcement of the spearing rule during tackling have allowed ball carrier spearing to become an unquestioned aspect of football. Therefore, the purpose of this study was to determine the cumulative incidence per season of ball carrier spearing and concurrent defensive spearing during a high school football season.

METHODS

In this study, spearing was defined as the lowering of the head, either on purpose or as a reflex action, during the tackling process. A ball carrier was defined as any player who runs with the football--running back, kick-returner, receiver, any player who advances a fumble, or any player who returns an interception. Ball carrier spearing was defined as spearing by the ball carrier while being tackled. Concurrent defensive spearing was defined as a head-first technique used by the tackler of a spearing ball carrier.

Incidents of ball carrier spearing were tabulated if the ball carrier lowered his head before contact and initiated or attempted to initiate contact with the tackler using the crown or top of his helmet. Incidents of concurrent defensive spearing were tabulated if the ball carrier speared on the particular play and his tackler lowered his head before contact and initiated contact using the top or crown portion of his helmet.

Offensively, incidents of ball carrier spearing were only tabulated during the tackling process. Incidents of spearing by any offensive player other than the ball carrier were excluded.

Concurrent defensive spearing was counted only if a tackler used a head first technique while tackling a spearing ball carrier. Or concurrent defensive spearing only occurred simultaneously with ball carrier spearing as defined for this study. Therefore, incidents of

concurrent defensive spearing were considered only after ball carrier spearing had been established. This study excluded all other types of defensive spearing.

Data were obtained from the observation of a New Jersey high school varsity football team. Nine regular season game films were reviewed from the 1989 season on a 16mm Kodak projector with standard reverse mode and slow motion capabilities. Each game was graded individually on its own score sheet. The score sheet consisted of: total plays, un-viewable plays, ball carrier spearing, and concurrent defensive spearing --for both teams.

In viewing the game films, total plays only included plays in which a ball was carried. These included: returned kick-offs, returned punts, interceptions, plays with a fumble, running plays, passes, and plays that included a penalty which allowed the play to continue, such as clipping or holding. A play was considered un-viewable when contact by the ball carrier and the tackler(s) could not be seen on the game film.

RESULTS

The totals for the nine observed games are shown in table 1. Ninety seven percent of the plays were viewable. There were an average of 94.9 (+/-8.7) total plays per game. The mean score for incidents of ball carrier spearing was 18.6 (SD 3.0) per game. The mean score for incidents of concurrent defensive spearing per game was 8 (SD 2.3).

TABLE 1-- The Number of Total Plays (TPL), Un-viewable Plays (UPL), Ball Carrier Spears (BCS), Concurrent Defensive Spears (CDS) and the Incidence of Ball Carrier Spearing and Concurrent Defensive Spearing per Game.

	GAME									TOTAL
	1	2	3	4	5	6	7	8	9	
TPL	88	87	102	107	101	105	89	90	85	854
UPL	1	6	1	4	3	2	1	4	5	27
BCS	20	22	18	20	18	22	13	15	19	167
CDS	7	11	5	8	7	10	8	5	11	72
BCS/ PLAY	1/ 4.4	1/ 4.0	1/ 5.7	1/ 5.4	1/ 5.6	1/ 4.8	1/ 6.9	1/ 6.0	1/ 4.5	1/ 5.1
CDS/ BCS	1/ 2.9	1/ 2.0	1/ 3.6	1/ 2.5	1/ 2.6	1/ 2.2	1/ 1.6	1/ 3.0	1/ 1.7	1/ 2.3

There was an incident of ball carrier spearing in 20% of the total plays. In 43% of the plays that involved ball carrier spearing, there was also an incident of concurrent defensive

spearing. The cumulative incidence per season of ball carrier spearing was 1 per 5.1 plays. The cumulative incidence per season of concurrent defensive spearing was 1 per 2.3 ball carrier spears. The incidence of ball carrier spearing and concurrent defensive spearing per game are also shown in table 1.

A total of 239 incidents of spearing were found for the year. The selected team accounted for 92 (55%) of the total ball carrier spearing incidents. The nine opponents accounted for 75 (45%) of the 167 incidents of ball carrier spearing. The opponents were responsible for 39 (54%) of the 72 incidents of concurrent defensive spearing, while the selected team's tacklers were responsible for 33 (46%) of concurrent defensive spears.

DISCUSSION

Ball Carrier Spearing

Only in three games were there less than seven ball carrier spears for a team. Two factors that possibly could have caused a lower number of ball carrier spears were a high number of passing attempts or poor performance by the offense.

When an incomplete pass was thrown, there was no ball carrier as defined in this study. Also, when a receiver caught a pass, he often was tackled immediately and from behind. These situations would have eliminated the possibility for ball carrier spearing. Therefore, a high number of passing attempts could have lowered the incidence of ball carrier spearing.

If the offense was not sustaining "drives" and making first downs (a poor performance) there would be fewer plays involving a ball carrier for that game. This could also result in a lower incidence of ball carrier spearing, because spearing opportunities would have decreased.

Ball carrier spearing is dangerous for two reasons. First spearing and the use of the head as an offensive weapon have an inherent risk of quadriplegia (11). Second, forces generated through running followed by head-first contact are sufficient to cause a concussion (12). Ball carrier spearing has been an overlooked hazard of being a ball carrier.

According to Hodgson and Thomas (1) the rule changes, the rule book warnings, and the helmet warnings have not eliminated head-first hitting in football. The incidence of ball carrier and concurrent defensive spearing found in this study support that opinion.

Concurrent Defensive Spearing

For every two incidents of ball carrier spearing there was one incident of concurrent defensive spearing. The cumulative incidence per game of concurrent defensive spearing also was consistent. A possible explanation for this may be that, generally, the defense reacts to the offense (12), and the tackler reacts to the ball carrier when attempting to make a tackle. Often what the ball carrier does will determine how the tackler brings him down (shirt tackle, arm tackle, etc.) The situation for concurrent defensive spearing arises when a ball carrier decides to break a tackle or to run over a tackler by lowering his head.

When a tackler has a spearing ball carrier running directly toward him, he has three basic options. He can remain upright and attempt to make the tackle with a helmet stuck in his abdomen or chest. He can attempt to get lower than the ball carrier and consequently lower his head into the spearing position. Or, he can choose to take on the ball carrier in a similar position, often initiating helmet-to-helmet or shoulder pad-to-helmet contact. Tacklers chose the latter two options 43% of the time in this study.

I believe that there is a relationship between incidents of ball carrier spearing and concurrent defensive spearing, although this study cannot substantiate that opinion. Further research needs to be done comparing the incidence of general defensive spearing to the incidence of concurrent defensive spearing.

Reducing The Risk Of Head And Neck Injuries

Spearing greatly increases the risk of head and neck injuries to defensive players while tackling (3,4,8,9,11,12,13,14). But, for some reason, this has not been applied to spearing by ball carriers. The literature mentions the danger of spearing in relation to tacklers and blockers, but neglects ball carriers. Each time a ball carrier lowers his head at contact, he increases the risk of head and neck injury. Head and neck injuries are far more common to defensive players, but ball carriers are not exempt from these injuries.

Mueller and Blyth (3) found that being tackled was one of the leading activities responsible for head and neck fatalities. Also between 1977 and 1987, being tackled was the activity associated with seven cases of quadriplegia (4). The exact mechanisms for these injuries were not reported in these studies. Although we cannot conclude that spearing caused the above injuries, this study does demonstrate that possibility. One study reported being tackled with the head down was the activity associated with a paralyzed ball carrier in 1982 (1).

The head-first technique has been shown to cause cervical spine injuries in tacklers (5,6,10,14). It seems that it would be potentially dangerous to all players who spear. Albright et al (8)

partially attributed the decrease in non-fatal head and neck injuries in his 8-year study to the teaching of blocking and tackling techniques that avoid the use of the head as a major weapon. Buckley (12) found that wide receivers and quarterbacks had a greater risk of receiving a concussion when being tackled than when blocking. Being tackled and blocking were found to be equal risk activities for running backs. Head-to-head and head-to-knee contact with tacklers was postulated as a cause of concussions for running backs.

The number of paralyzed players does not come close to exposing the risk of hitting with the head down. There is also far more energy generated in a football collision than is required to break the neck of a player hitting with his head down (1). The prevention of these injuries starts with decreasing the use of the head as a weapon (11). This information is also applicable to ball carriers.

No Spearing Penalties Called

Officials are now able to penalize any player who uses his head as a primary point of contact (15). However, these officials did not exercise that power because there were no spearing penalties called throughout the 1989 season. In the limited spearing scope of this study there were 239 incidents of spearing identified. This demonstrates both an extremely poor enforcement level of the spearing rule and the officials of these games were not using the spearing flag as a deterrent to players.

The spearing rule is the single most important rule in football in terms of consequences (paralysis) and yet may be the least enforced. This may be because the spearing rule is the only rule in football that penalizes a player's action for his own protection. The majority of football infractions protect one player from the actions of another (clip, face mask, hold, etc.). The NFSA and the NCAA adopted the spearing rule to deter and therefore protect the player who spears. Its primary function is not to protect the player getting speared. It is the only action penalty in football that protects a player from himself.

It is my observation that the spearing flag is thrown exclusively in the pile-on-situation--that is, a defender coming late and head-first into a pile of players who are already down. It would appear in this situation the officials are trying to protect the player getting speared. I believe this is a misinterpretation of the spearing rule. Officials should deter and thereby protect the player who is spearing. Officials need to begin to acknowledge spearing during the tackling process, when most injuries occur (3,4,5,6,10,13,14,16), to further reduce the risk of head and neck injuries.

The spearing rule is stated in a way that includes all players (tacklers, ball carriers, blockers) and needs to be interpreted as

such. Officials need to enforce existing spearing rules, and they should be educated about the mechanisms of serious head and neck injuries that occur to football players (9). According to Dr. Robert C. Cantu (17), Chief of Neurosurgery at Emerson Hospital in Concord, Mass., "Referees and umpires of games who are not calling the rules as they are written should be held responsible for injuries and deaths."

Safest Position At Contact

Making contact with the head up greatly reduces the risk of serious head and neck injury (1,3). When the neck is extended (and in neutral) the force is absorbed by the neck musculature, the intervertebral discs, and the cervical facet joints. With the head up, the tackler or ball carrier can see when and how impact is about to occur and can prepare the neck musculature for impact. Both are important factors in reducing the risk of head and neck injury. Leibold (18) emphasized the importance of ball carriers and tacklers keeping their necks in extension at contact.

This does not indicate contact should be initiated with the head even if the neck is extended. Contact should be initiated with the shoulder while keeping the neck extended. This places the head and cervical spine in the least amount of danger by focusing the impact force on the shoulder. But this technique must be practiced until a player overcomes the powerful instinct to protect his eyes and face by lowering his head at contact.

Recommendations

The athletes should be educated about the mechanisms of head and cervical spine injuries. The athletic trainer is in the ideal position to accomplish this task. In a classroom, the athletic trainer should instruct the players on spearing's relationship to head and/or neck injuries and how they can reduce the risks of these injuries. The athletic trainer should do this before contact begins, repeat it halfway through the season, and have the athletes sign attendance sheets at each meeting.

The coaching staff must teach, demonstrate, and practice proper tackling, blocking, and ball carrier contact techniques throughout the season. They should put specific emphasis on each of these techniques at least four times a season: before contact begins, at game 2, at game 5, and at game 7. The coaching staff or the athletic trainer also should document each time this topic is covered. Virgin (19) believed that proper coaching techniques are imperative for the prevention of injury. Teaching contact skills that protect the neck will do far more to prevent injuries than exercises will (18).

Coaches and athletic trainers should design drills for ball carriers, tacklers, and blockers. The coaches should focus each drill or session solely on keeping the head up and initiating contact

with the shoulder. The progression should be from slow walk through skills to full-speed contact. The technique has to be drilled in game like situations. They should also include the types of collisions Torg (7) identified with quadriplegia. These include two athletes colliding while moving in opposite directions and athletes meeting at an oblique angle.

It is also extremely important for the coaching staff to have a strict enforcement policy for dealing with spearing during practice. Spearing at any time should not elude the coach's or athletic trainer's attention without their attempting to correct the player's technique.

CONCLUSION

The incidence of ball carrier spearing and concurrent defensive spearing were surprisingly high. Spearing increases the risk of head and neck injury to all players including ball carriers. This study also revealed the spearing penalty was not enforced during this season. To further reduce the risk of injury, officials should recognize all types of spearing and enforce the spearing penalty during the tackling process. They should also use the spearing flag as a deterrent to protect the player who spears, including ball carriers, tacklers, and blockers. The athletes should be educated to the mechanisms of head and neck injuries. The coaching staff should increase practice time on correct contact techniques throughout the season in game like situations.

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How to Make Professional Boxing Safer—The American Medical Association Controversy

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ABSTRACT: Cerebral concussions occur frequently in contact sports; more than 250 000 concussions occur annually in football alone. Definitions and classifications of severity of concussions vary, which makes evaluation of data extremely difficult. By combining elements of various definitions, the author has developed a practical, on-the-field grading scheme for identifying concussions in contact sports (grade 1: mild, with no loss of consciousness; grade 2: moderate, with less than five minutes of unconsciousness or more than 30 minutes of post-traumatic amnesia; grade 3: severe, with five or more minutes of unconsciousness or 24 or more hours of post-traumatic amnesia.) Also discussed are management of concussions and guidelines for determining when an athlete may safely return to play.

Boxing has been criticized as a brutal sport, and many have called for its abolition. The author reviewed the literature on the health hazards of boxing and found that it has a lower fatality rate than several other sports, including horseracing and parachuting. The most serious health effect of boxing is chronic encephalopathy that affects the pyramidal, extrapyramidal, and cerebellar systems. Often called punchdrunk syndrome, it appears to be directly related to skill level and frequency of participation. Symptoms usually do not appear until after the boxer has retired. The boxing council and a medical surveillance program are necessary to enforce uniform licensing and medical standards and to generate data for research.

KEYWORDS: boxing, injuries, safety, American Medical Association (AMA)

Through the 1962 statement of the AMA Committee on the Medical Aspects of Sports "Statement on Boxing," the AMA had long ago addressed the issue of the medical risks of boxing [1]. It was the January 14, 1983 issue of JAMA that sparked a debate that resulted in extensive major network television coverage, newspaper articles and editorials, magazine stories, an AMA sponsored conference on the medical aspects of boxing, a Congressional hearing on boxing, and the embarrassing position of the AMA appearing to support both sides of the debate simultaneously.

In that issue of JAMA, two major articles on boxing were published [2,3], neither calling for its abolition, and two impassioned editorials each calling for the abolition of boxing based on moral, ethical, and medical grounds [4,5]. It is ironic that the AMA's council on scientific affairs study on the safety issue of boxing, a study and recommendations already approved by the house of delegates at the 1982 annual meeting and thus the official policy of the AMA, appears in the same issue as the conflicting editorial opinion. The council, after deliberation of the medical evidence, concluded that "boxing is a dangerous sport and can