

Appropriate Prehospital Care of the Spine-Injured Athlete

Preamble

The best practice recommendations in this report are a revision and update of the recommendations developed following the 1st Inter-Association Task Force on the Prehospital Care of the Spine-Injured Athlete (2001) and is based on the deliberations and discussions at the 2nd Inter-Association Task Force on the Prehospital Care of the Spine-Injured Athlete held in Pensacola, FL, January 16-17, 2015. Representatives from 24 medical organizations with expertise in managing the spine-injured athlete gathered to review current literature for prehospital treatment protocols for the cervical spine-injured athlete.

While consensus agreement exists pertaining to the general recommendations made within this document, the group acknowledges that the science of prehospital spine injury care is not perfect and is evolving. Ultimately, clinical management decisions remain at the discretion of the responsible medical professionals, and are dependent on the specific injury scenarios and availability of qualified personnel and resources at the time of injury.

Introduction

Traumatic spinal cord injury (SCI) is a devastating condition that merits concerted focus due to its high rates of morbidity and mortality. Approximately 12,500 new cases of SCI are reported in the United States each year, not including those who die at the scene (e.g., motor vehicle crashes).¹ Nine percent of these cases are due to participation in sports¹ with American football having the highest number of catastrophic cervical spine injuries among all sports played in the United States.² Additional high risk sports are provided in Table 1. In addition to diagnosed cervical SCI, there are a large number of injuries with suspected cervical SCI requiring spinal precautions prior to clearance by definitive diagnosis.^{3,4}

Athletes with a suspected SCI are unique from the general population in that they tend to be younger, with good bone health and less co-morbidity. While motor vehicle crashes, motorcycle crashes, or violence result in comparably more poly-traumatic outcomes, sport-related cervical SCI may occur in isolation or with concurrent mild traumatic brain injury^{5,6} (i.e., concussion). Additionally, the athletic environment presents challenges for medical providers that are not typical of non-athletic environments. The best example is participants in equipment-intensive sports such as football, ice hockey and lacrosse where the equipment (e.g., helmets, shoulder pads) worn for protective purposes may present a treatment barrier for basic or advanced life support skills to the airway and chest.

Most cervical SCI occurs in the lower cervical spine. The spinal cord occupies less than half of the canal's cross-sectional area at the level of the atlas, but close to 75% at the lower cervical levels.⁷ Injuries to the mid-level cervical spinal cord region (C3-C5) can negatively impact appropriate motor neuron activation of the phrenic nerve; thus, impairing diaphragm muscle contractions and resulting in respiratory compromise.⁸ Secondary and tertiary complications of a SCI can be induced by vascular compromise.^{9,10} Hypermobility of the neck or cord compression from bone fragments or dislocation can compromise blood flow to the spinal cord.^{11,12} A catastrophic cervical SCI infrequently results in sudden death, but the risk of death in the athlete increases in cases when the injury involves the upper cervical spine. Therefore, immediate recognition of those at risk combined with judicious treatment in the pre-hospital setting and appropriate emergency department management focusing on timely injury identification and treatment, are critical.

The goal of the sports medicine team is to safely immobilize the spine-injured athlete for transportation to an appropriate medical facility. An athletic emergency may involve physicians of various specialties, certified athletic trainers, athletic training students, paramedics, emergency medical technicians,

midlevel providers (e.g., physician assistant, nurse practitioner), coaches and game officials; all of whom must work cohesively to accomplish this goal.

Recommendation 1: Athletic programs must have an Emergency Action Plan (EAP) developed in conjunction with local EMS.

Catastrophic injuries are unpredictable and can occur without warning. Proper management of emergencies in athletics is critical. The EAP should be developed in consultation with local emergency medical system (EMS) personnel. Emergencies should be handled by trained medical personnel. Preparation is essential and should include education and training, maintaining emergency equipment and supplies, appropriately using personnel and creating and implementing an EAP.¹³⁻¹⁶ Ideally, an athletic trainer should be on site during all sporting events and at a minimum for high-risk activities (Table 1). If medical personnel are not present, sports administrators should develop procedures for implementing the EAP. The role of the emergency medical team is to:

- Establish and control scene safety and initiate care of the athlete
- Activate the EMS
- Get emergency equipment on to the field
- Direct EMS to the scene

The primary steps of assessment and management of the injured athlete include scene survey, primary survey, stabilization of the head and spine, life preserving procedures, secondary survey and transport to the appropriate medical facility.¹⁷ Appendix A provides further details on these procedures.

It is essential that a transportation plan be developed prior to the start of any athletic practice or competition. EMS response time should be factored in to the EAP when determining on site ambulance coverage. Emphasis should be placed on having an ambulance on site at high risk sporting events (Table 1). If an ambulance is not on site, there should be a designated location with rapid access to the site and a cleared route for entering/exiting the venue. Transportation to the hospital should be based upon the strengths and capabilities of the facility, as well as local EMS protocols.

The EAP and procedures should be reviewed and rehearsed on a regular basis, including scenario-based training (e.g., athlete in prone or supine position, barriers/space restrictions, the combative athlete, limited rescuers on site, equipment issues, etc.) with the medical care team in realistic situations. Appendix B provides an example of an EAP template, an emergency protocol for spine injury management and an example of Crisis Management Guidelines. Athletic emergency responses should be properly documented. Following an emergency response, it is recommended that the medical care team review the response for quality improvement purposes.¹⁸

Recommendation 2: Sports medicine teams should conduct a “Time Out” before each athletic event.

Since miscommunication may lead to potentially catastrophic errors, information sharing, team training and collaborative skill development among the emergency medical providers are critical components of emergency medical care. The “Time Out” should include a review of items such as medically qualified personnel on site, equipment available, management protocols for all types of catastrophic injuries, medical professional in charge of the response, signals and communication, transport procedures and local hospital trauma management plans. Additionally, a review of the equipment to be used will prevent the inadvertent use of equipment that may not fit into the transport vehicle. It is incumbent on the host team to coordinate with the visiting team and medical personnel to plan the emergency response which will help to ensure that a coordinated emergency approach is in place for all athletic medical care team members.¹⁹

Recommendation 3: When deemed necessary and appropriate by onsite medical personnel, protective athletic equipment may be removed *prior* to transport to a primary emergency facility by medical personnel familiar with equipment removal.

Historically, recommendations for accessing an airway for a potential catastrophic spine injury in football have suggested that the facemask be removed from the helmet while keeping the helmet and shoulder pads in place for ensuing emergency transport.^{20,21} While removing the facemask does expose the airway with less motion than helmet removal²², recent research demonstrates that the quality of basic life support skills (chest compressions and ventilations) are compromised in the presence of athletic equipment.^{23–26} Shoulder pads are reported to inhibit consistent chest compressions of adequate depth and full pulmonary expiration.²⁶ For ventilations, the helmet is cited as complicating a jaw thrust maneuver and pocket or bag-valve mask placement^{23–26}, while the football helmet chin strap can prevent the mask from creating a seal.²⁶ While one study has reported ventilation success on an equipped simulation mannequin using endotracheal intubation by direct laryngoscopy,²⁷ not all providers responding to athletic emergencies are trained or skilled in advanced airway adjunct techniques. Finally, proper placement of AED pads is complicated with shoulder pads in place. Hence, current evidence^{24,25} supports the option of equipment removal when delivery of basic life support/advanced life support (BLS/ALS) may be required.

Rationale for Allowing Medical Personnel to Remove Equipment Prior to Transport

The rationale for allowing prehospital equipment removal is based on the following concepts:²⁸

- ***Chest access is prioritized.*** Recent research and changes to the International Liaison Committee on Resuscitation (ILCOR) guidelines prioritize compressions and automated external defibrillator (AED) deployment over ventilations.²⁹ Both procedures require access to the chest; thus, necessitating equipment removal. Based on the above reasons, protective equipment may be removed prior to hospital transport.
- ***Equipment removal should be performed by those with the highest level of training.*** In most cases, athletic trainers have been exposed to more equipment removal training than many other members of the emergency medical team. It is often likely that on-site medical professionals (e.g., athletic trainers, emergency medical technicians, physicians) will possess the requisite tools and experience in equipment removal compared to hospital emergency department staff.
- ***Cervical collars cannot be applied correctly while protective equipment is in place.***
- ***Advances in equipment technology.*** Changes in helmet and shoulder pad design, in some cases, have helped to facilitate equipment removal.
- ***Expedited provider care.*** With protective athletic equipment such as helmets and shoulder pads removed in the prehospital setting, evaluation, treatment and diagnostic tests may be expedited while in transport and once accepted by the receiving emergency facility.

In addition to the clinical situation described above, the final decision to remove equipment prior to transport should also be based on several logistical factors including the nature of the injury, type of protective equipment worn (e.g., helmet, shoulder pads, neck roll, rib pads), the number of rescuers on site and the training level of rescuers in equipment removal. Equipment removal should be performed by rescuers trained and experienced with equipment removal. Clinical judgment in each situation may recommend an alternative strategy than this best practices recommendation (i.e. changes in clinical status, equipment failure, space barriers, etc.). The medical team should be able to recognize when it is inappropriate to remove equipment on the field of play and have a plan to best manage the patient.

Recommendation 4: Athletic medical teams must be familiar with a variety of safe sport-specific equipment removal techniques.

A wide variety of facemasks and helmets exist. It is important for rescuers to understand the different types of facemasks and helmets and the concepts of removal. If the helmet is ultimately going to be removed, it may be more efficient to simply leave the facemask on and remove the helmet as a unit. However, in some cases, it may be more prudent to first remove the facemask and then the helmet.²² Rescuers should maintain their skills in isolated facemask removal. Some helmet models may have quick release clips facilitating removal.

In a life-threatening situation, it is important to have access to the chest. Therefore, onsite medical personnel should be familiar with shoulder pad construction, accessories (i.e., use of string ties, coated webbing, or high impact plastic, which impacts cutting; cervical rolls; rib pads, etc.), and removal techniques. When removing the helmet and shoulder pads, specific and orderly steps taken in the process should maximize efficiency for stabilization of the head and access to the chin strap and cheek pads.^{21,30,31} In general, the helmet should be removed first, followed by the shoulder pad. Specific recommendations for facemask, helmet, and shoulder pad removal are provided in Appendix E.

Recommendation 5: A rigid cervical stabilization device should be applied to spine-injured athletes prior to transport with manual in-line stabilization until stabilization on a full-body immobilization device has been accomplished.

If protective equipment is removed, a rigid cervical collar should be applied at the earliest and most appropriate time possible during pre-hospital preparation. With practice, cervical collars can be placed and removed with manual in-line stabilization and minimal risk.^{27,32} The type of rigid cervical collar should be selected in advance and be adjustable or available in various sizes to correctly fit the athlete. Several research studies have demonstrated that rigid cervical collars are not effective in controlling cervical spine motion in all planes of movement.^{33,34} Therefore, manual in-line stabilization by the medical team must be maintained until the athlete has been stabilized on a full body spinal motion restriction device (e.g., long spine board, vacuum mattress) and a head stabilization device has been applied.

It must be realized that cervical collars have some disadvantages. Cervical collars do not completely reduce motion in all planes in an unstable cervical spine cadaver model.³³⁻³⁷ In rare cases, the use of the cervical collar may increase the risk of medical complications such as increased intracranial pressure, abnormal distraction within the upper cervical spine in the presence of a severe injury and creation of pivot points that shift the center of rotation lateral to the spine, increasing intervertebral motion.³⁸⁻⁴⁰ In addition, cervical collars may be over utilized in many cases. Ideally, only patients with unstable spines would have a cervical collar applied, but these patients cannot be easily identified in prehospital emergency situations. Although cervical injuries are seen in 14% of severely injured trauma patients,⁴¹ only approximately 7% are considered to be unstable injuries.⁴¹ Despite these disadvantages, the benefits of cervical collars to reduce cervical motion in patients deemed to have a potentially unstable spine still may outweigh the disadvantages of their use.

Recommendation 6: Spine-injured athletes should be transferred to and transported on a rigid immobilization device.

An athlete with a suspected SCI should be transferred to a rigid spinal motion restriction device and remain on the device for transport to a medical facility. The transport of the spine-injured athlete requires special considerations that may include, but are not limited to: the mechanism of injury, size of the athlete, equipment worn by the athlete and the number and skill level of the sports medical team members. Sports medicine teams must appreciate the concepts of spinal motion restriction (SMR) as compared to spinal immobilization. SMR is considered a more appropriate term and does not imply that complete spinal immobilization is obtained when the patient securely strapped to a spine board.¹⁷ Like spinal immobilization,

the premise of SMR is to reduce spinal motion and prevent further harm to the spinal cord.¹⁷ Criteria for the use of SMR are provided in Table 2.

Many jurisdictions have followed a paradigm shift relative to the use of long spine boards for maintaining spinal precautions. Recent changes in some EMS protocols have impacted spine injury management in the field and during preparation for and transportation to hospital emergency departments.⁴²⁻⁴⁶ The changes are based in large part on epidemiological studies that include all SCI patients and are non-specific to the athletic population. The spine-injured athlete should be transferred to the rigid immobilization device using a technique that limits spinal motion (Table 3).⁴⁷⁻⁵⁰ Although the exact number of people needed to move a potentially spine injured athlete cannot be definitively determined, the medical professional in charge at the scene must apply best judgement to determine the best transfer technique. In the case of a supine athlete, the multi-rescuer lift-and-slide technique (previously described as the six-plus lift)⁴⁷ is now preferred over the log roll technique. The scoop stretcher⁵¹ may also be employed to lift the supine athlete from the field.⁴⁸ In the case of a prone positioned athlete, the medical team should position the rigid immobilization device and use the appropriate number of people to safely complete a log roll push technique to place the athlete on to the rigid immobilization device⁵² (Appendix D).

Securing an athlete to a rigid immobilization device in preparation for transportation involves strapping the torso first, incorporating an x-strap technique⁵³ (shoulder/axilla) to minimize cephalo-caudal movement on the immobilization device. Use of the spider strapping technique is also acceptable.

If rigid immobilization is not required (i.e., not meeting criteria that establishes need for SMR; Table 2), the athlete should be transported in the most stable manner and based upon local protocols, which may include the use of a rigid cervical collar.

Recent publications have reported potential harmful effects with prolonged immobilization on a spine board.^{42,54-56} Therefore, every effort should be made to reduce the amount of time on the spine board.⁴⁴ The ED medical team is encouraged to assess the athlete on arrival to the ED with transfer to an appropriate hospital bed as soon as safely possible.⁵⁷⁻⁶⁰

Recommendation 7: Spine-injured athletes should be transported to the most appropriate medical facility that can deliver immediate and preferably definitive care for SCIs.

Immediate care for the spine-injured athlete should *ideally* include:

- Emergency department staffed with board certified/eligible emergency physicians.
- Readily available, advanced imaging services including interpretation by a radiologist.
- Spine surgeon consultation.
- Readily available operating room staff.
- Rehabilitation services or a pre-existing referral system.

In most cases, potentially spine-injured athletes should be transported to a trauma center for definitive care or a large community hospital with the capability to deliver definitive care. If definitive care is not readily available, spine-injured athletes should be transported to the closest appropriate hospital for stabilization and possible air medical evacuation to the nearest trauma center. Attempts should be made to avoid this extra delay in definitive care as the patient in this scenario might have improved outcomes with expeditious definitive management.⁵⁶ The chance for further harm to the injured athlete increases when permitted to remain on the spine board for extended periods of time following arrival to the emergency department. Increased tissue-interface pressures at the occiput, sacrum, and left heel have been reported.^{61,62} Additionally, if spine-injured, the chance for further neurological compromise increases every time the patient is moved.⁴⁷ For this reason, transfers within the ED should also be kept to a minimum and appropriate transfer devices used.^{58-60,63,64} Radiographic tests should be ordered based upon a thorough physical examination, local protocol, and use of nationally accepted decision making tools such as NEXUS or Canadian C-spine Rule.⁶⁵ ED staff should avail themselves of training modules in the event an athlete arrives

with equipment in place. In the likelihood that an athletic trainer is involved in the transport of a spine-injured athlete, he or she should offer his or her services to assist the ED staff with the athlete's care.

Recommendation 8: Preventing spine injuries should be a priority in athletics.

Regular equipment checks are needed to ensure equipment is in good form and will function as intended. Failure to complete equipment checks prior to the start of the season and throughout the season may result in equipment that either malfunctions and results in an injury or potentially hampers the removal of equipment (e.g., rusting screws in helmets) in emergency situations.^{21,66,67} Also, the coaching staff and medical team must emphasize to all athletes the proper sizing, wearing and use of all protective equipment. Modifications should not be made to protective equipment for any reason as this will likely void the manufacturer warranty and potentially complicate emergency medical care procedures.

Athletes should be taught the rules of the sport at the start of the season. Special emphasis should be placed on rules that have been implemented to prevent injury. Specifically, education and appropriate training to stop the use of head-first tackling is essential in the prevention of cervical spine injuries.^{57,65,68} Several published research investigations have suggested the use of muscle strengthening exercises for the cervical spine region to reduce the chance of injury.⁶⁹ Additionally, the medical team and more importantly the coaching staff needs to have an understanding of proper training progressions of skills for training athletes to perform higher level skills.

Recommendation 9: Sports medicine professionals should continue to investigate the role of equipment, airway devices, and SMR in caring for spine-injured athletes.

The sports medical team should keep abreast of innovative and novel treatment options for the spine-injured athlete. As is outlined in this document, it is essential that the medical teams be knowledgeable of changes and procedures regarding spinal immobilization versus SMR.¹⁷ Allowing an athlete to remain on the long spine board for extended periods of time may have a detrimental effect on the spine-injured athlete. Complications such as pressure sores, skin breakdown, aspiration, respiratory compromise, pain and discomfort have been noted when patients are left on long spine boards for extended time. Research should address a means for rapid and accurate spine check or clearance followed by definitive care to prevent these negative consequences.

In conclusion, the nine recommendations included in this document are intended as guidance to all members of the sports medicine team. The most important factors in providing optimal care to the spine-injured athlete include: communication and collaboration of various agencies involved in providing care, the preparation of an EAP, review of the EAP at a Time Out prior to the start of a competition, review of procedures regarding equipment removal for sports with equipment laden athletes and procedures to provide SMR as deemed appropriate by the medical team.

DISCLAIMER

National Athletic Trainers' Association (NATA) and the Inter-Association Task Force for Appropriate Prehospital Care of the Spine-Injured Athlete advise individuals, schools, athletic training facilities, and institutions to carefully and independently consider each of the recommendations. The information contained in the statement is neither exhaustive nor exclusive to all circumstances or individuals. Variables such as institutional human resource guidelines, state or federal statutes, rules, or regulations, as well as regional environmental conditions, may impact the relevance and implementation of these recommendations. NATA and the Inter-Association Task Force advise their members and others to carefully and independently consider each of the recommendations (including the applicability of same to any particular circumstance or individual). The foregoing statement should not be relied upon as an independent

basis for care but rather as a resource available to NATA members or others. Moreover, no opinion is expressed herein regarding the quality of care that adheres to or differs from any of NATA's other statements. NATA and the Inter-Association Task Force reserve the right to rescind or modify their statements at any time.

Tables for task force documents

Table 1. High risk sports that may render an athlete more likely to sustain a cervical spine injury.

Football
Lacrosse
Ice Hockey
Gymnastics
Equestrian
Rodeo
Diving
Pole vaulting

Table 2. Criteria for the use of SMR.⁴³

- Blunt trauma and altered level of consciousness
- Spinal pain or tenderness
- Neurologic complaint (e.g., numbness or motor weakness)
- Anatomic deformity of the spine
- High-energy mechanism of injury and any of the following:
 - Drug or alcohol intoxication
 - Inability to communicate
 - Distracting injury

Table 3. Recommended spinal motion restriction devices.

- Long spine board
- Scoop stretcher
- Vacuum mattress
- Kendrick extrication device (KED)
- Gurney

Appendix A – Initial Recommended Procedures for the Spine-Injured Athlete

- Scene survey and mechanism of injury
 - Close observation of the playing field during an event will allow the provider to see the mechanism of injury.
 - Upon approaching the injured athlete, ensure the scene is safe to enter, note the number of injured players and if there are mitigating circumstances that may hinder delivery of patient care.
 - Determine if additional resources are needed and activate the emergency action plan (EAP) if indicated.
- Consider stabilization of the head and spine
 - If a cervical spine injury is suspected, one rescuer should assume control of the head and ensure it remains in line with the torso (Figure 1).
 - If the airway is compromised, the head should be moved into a position that allows adequate airway access.
- Primary Survey (Figure 2)
 - Circulation
 - Assess radial or carotid pulse for rate, rhythm, and character. Weak or radial absent pulses indicate poor perfusion.
 - Identify and control hemorrhage with direct pressure and tourniquets if necessary.
 - Airway
 - Make certain the airway is open and clear of foreign bodies such as a mouthpiece or chewing gum. A noisy airway is often an obstructed airway.
 - Clear the airway by removing foreign bodies or suctioning.
 - An airway adjunct such as an oral or nasal airway should be placed in the event the patient cannot maintain his or her own airway.
 - Breathing
 - Determine that respiratory rate, quality and work of breathing are adequate. Normal rate is 12-20 breaths per minute.
 - Observe chest expansion for adequate excursion and symmetry. Rocking of the sternum indicates inadequate respiratory effort.
 - Disability and Defibrillation
 - Perform a neurological assessment including level of consciousness and possible loss of sensory or motor function. Use the mnemonic AVPU:
 - Alert and oriented to date, time, place, name, and surroundings.
 - Responds to verbal stimuli.
 - Responds to painful stimuli.
 - Unresponsive.
 - Perform defibrillation as soon as possible if indicated. This necessitates removal of equipment.
 - Exposure
 - Remove equipment and clothing in order to examine the injured area and facilitate treatment and transport.
- After completion of the Primary Survey, determine if the athlete is unstable and must be transported immediately or is stable and can be assessed further. Obtain baseline vital signs including blood pressure, pulse, respiratory rate and pulse oximetry (Figure 3). If EMS is already on

the scene, the first blood pressure may be obtained in the ambulance. At all times the medical team must continue to reassess the athlete and modify the treatment plan as indicated. Vital signs should be obtained every five minutes until stable or arrival at the hospital. The medical team should always refer to the newest CPR guidelines and follow local protocols as necessary (Figure 4).

- A Secondary Survey, involving assessment of the athlete from head to toe should be conducted if all components of the Primary Survey are stable.
 - Palpate the posterior cervical spine for pain, deformity and posterior step off.
 - If spinal injury is suspected, ensure respiratory effort is adequate since high cervical spinal cord injuries will impact the phrenic nerve and may necessitate positive pressure ventilation.
 - Airway management deserves special consideration when caring for the cervical spine-injured athlete.
 - Basic interventions such as airway adjuncts, pocket mask, and/or bag valve mask ventilation with supplemental oxygen are *essential* and the minimal level of interventions that should be available.
 - Advanced airway management such as endotracheal intubation should only be performed by individuals that perform these tasks on a frequent basis as a normal part of their job. The use of supraglottic airways (e.g., King LT, Combitude, LMA) may be considered an *essential* skill in some areas of the country and should be used when appropriate (Figure 5).
 - The use of positive pressure ventilation is complicated by the presence of a helmet, facemask, shoulder pads and chinstrap. Removal of the equipment eliminates this problem. A patient should never be transported with a face mask in place. If a cervical collar is in place and endotracheal intubation is required, the collar should be loosened in the front. A second provider must stabilize the head and neck from a caudal position during intubation. Remember that insertion of a supraglottic airway should not cause movement of the cervical spine.

Appendix B – Emergency Action Plan Template

It is essential that the EAP be reviewed and practiced annually. Additional practice sessions are desirable. Each venue should have an EAP specific to that site and the personnel available at the site. The information provided below includes basic EAP information, as well as more specific EAP procedures for the spine-injured athlete. Many portions of Appendix B have been copied directly from EAPs of the University of Georgia (*modified with permission, R.Courson, 2015*).

Address: Insert address of practice/game site.

Venue Directions: Provide accurate and concise directions for access to the facility. When possible provide additional access directions in the event the primary access is obstructed.

GPS Coordinates (in event of the need for a medical helicopter transport): GPS coordinates will provide quicker and easier access for air transport.

Map of facilities: Provide a clear map of the facilities.

Emergency Personnel: List each site for all (practices/games) separately and identify those in charge. For example, list all available staff available to assist in the case of an emergency: certified athletic trainers, student athletic trainers, and physician (when available).

Emergency Communication: For each facility identify available phones and location of the phones: It is essential to list the phone numbers of key personnel in this section.

Emergency Equipment: For each facility list all available emergency equipment and location of the equipment: For example: AED, trauma kit, splint kit, spine board, vital signs monitor, 12 Lead EKG/defibrillator are located in athletic training room. **If equipment is to be moved for a practice or game specific information must be provided:** Example: the AED, trauma kit, splint kit, spine board will be maintained on motorized medical cart parked adjacent to practice shed during practice. Additional supplies will be maintained under the practice shed.

Roles of First Responders (clearly identify the role of each responder):

1. Immediate care of the injured or ill athlete
2. Activate emergency medical system (EMS)
 - a. 911 call (provide name, address, telephone number, number of individuals injured, condition of injured, first aid treatment, specific directions, other information as requested)
 - b. Complete secondary calls after assessing the athlete and calling 911. An example of a secondary call may be the Campus Police.
3. Emergency equipment retrieval
4. Direct EMS to scene
 - a. Be sure any access routes are open (e.g., open access gates)
 - b. Designate individual to “flag down” EMS and direct to scene
 - c. Scene control: limit scene to the medical team and move bystanders away from area

Spine Injury Management Protocol

General Guidelines

- Any athlete suspected of having a spinal injury should initially not be moved and should be managed as though a spinal injury exists. Cervical spine in-line stabilization should be maintained.
- The primary acute treatment goals are to ensure that the cervical spine is immobilized in neutral and vital life functions are accessible. The athlete’s airway, breathing, circulation, level of consciousness and neurological status should be assessed. If the airway is impaired, maintain cervical spine in-line stabilization while simultaneously using a modified jaw thrust maneuver. If the athlete’s breathing is inadequate, assist ventilations with bag-valve-mask, airway adjuncts as appropriate, and supplemental oxygen.
- During initial assessment, the presence of any of the following, alone or in combination, requires the initiation of the spine injury management protocol: unconsciousness or altered level of consciousness, bilateral neurological findings or complaints, significant midline spine pain with or without palpation/’ve or obvious spinal column deformity.
- EMS should be activated.
- The athlete should not be moved until SMR procedures have been employed unless absolutely essential to maintain airway, breathing and circulation. If the athlete must be moved, the athlete should be placed in a supine position while maintaining SMR.
- In a situation where it may not be appropriate for on-site medical personnel to transfer the athlete to a long spine board prior to EMS arrival (e.g., lack of enough qualified help or other factors), the

rescuer(s) should maintain in-line stabilization, place a rigid cervical collar on (if possible), support ABCs, and continue to monitor baseline vital signs and complete secondary evaluation while awaiting EMS.

Additional Guidelines for Care of Spine-injured Football Athlete

- In an emergency situation with equipment intensive sports, the ***protective equipment may be removed prior to transport to the hospital (Appendix E).***

Spinal Motion Restriction

- If the spine is not in a neutral position, medical team members should realign the cervical spine to minimize secondary injury to the spinal cord and to allow for optimal airway management. However, the presence or development of any of the following, alone or in combination, represents a contraindication for moving the cervical-spine to a neutral position:
 - Movement causes increased pain, neurological symptoms, muscle spasm or airway compromise;
 - Resistance is encountered during the attempt at realignment; or
 - The athlete expresses apprehension.
- If possible, a correctly sized rigid cervical collar should be placed on the athlete prior to moving (Figure 6 A and B).
- When moving a suspected spine-injured athlete, the head and trunk should be moved as a unit by securing the athlete to a rigid immobilization device (i.e. long spine board, scoop stretcher, KED, or full body vacuum mattress; Figure 7). Either the multi-rescuer lift-and-slide or scoop stretcher should be used to place the athlete on the rigid spinal motion restriction device. When necessary, one of the various log roll maneuvers may be employed to place the athlete on the rigid spinal motion restriction device. Often an exact number of rescuers are prescribed to complete specific transfer techniques. However, the sports medicine team should assess the number of trained staff during the pre-event "Time Out" and use the appropriate transfer procedure based on the number of available rescuers and status of the athlete. Thus, a general recommendation for the number of needed rescuers may include a minimum of four rescuers, but preferably five to six to perform a log roll procedure and a minimum of eight rescuers to perform the multi-rescuer lift-and-slide.
- The rescuer controlling cervical spine motion restriction will be in command of the multi-rescuer lift-and-slide or log roll maneuvers and transfer to the rigid immobilization device.
- Once positioned onto the long spine board, the athlete's torso and legs should be secured first, using spider straps or speed clips (if speed clips are used, ideally 7 straps should be applied: 2 crossing chest from shoulder to opposite axilla, one across chest under axilla, 1 across the abdomen, 1 across the pelvis, 1 across the mid thighs and 1 across the mid tibias). The athlete's arms should be left free from the long spine board straps to facilitate vital sign monitoring and IV access. The athlete's wrists may be secured together in front of the body with a velcro strap or tape once secured to the rigid immobilization device.
- Once the torso and legs are secured, the head should be secured last. If necessary, padding should be applied under the athlete's head to fill any voids and maintain a neutral in-line position. The head should be secured with lateral restraint pads and then secured to the spine board with tape over forehead and at chin.
- Following securing the athlete to the spine board, neurological status should be reassessed.
- The secondary survey should be completed with baseline vital signs (reassessed at a minimum every five minutes), head-to-toe survey, and SAMPLE (Symptoms, Allergies, Medications, Past medical history, Last oral intake, Event leading to present injury).

- The athlete should be transported to the most appropriate emergency medical facility and the head team physician and appropriate subspecialist(s) notified.
- When possible a member of the medical staff should accompany the athlete in the ambulance.

General Principles of Helmet and Shoulder Pad Removal

For purposes of this document information regarding equipment removal is provided in Appendix E. Standard EAPs would have specific information regarding equipment removal in this section of the EAP.

Procedures for Training in Spine Immobilization

On at least an annual basis, personnel should review signs and symptoms of spine injury and complete a training session each year with in-line stabilization, rigid cervical collar application, log roll maneuver (supine and prone), multi-rescuer lift-and-slide, equipment removal techniques and spinal motion restriction device packaging. Additionally, personnel providing medical coverage for equipment intensive sports should review facemask removal with appropriate tools, helmet removal and shoulder pad removal.

Approved by: _____ **Medical Director** **Date:** _____

Approved by: _____ **Neurosurgeon** **Date:** _____

Approved by: _____ **Dir. Sports Med.** **Date:** _____

Approved by: _____ **Paramedic** **Date:** _____

Appendix C – Checklist for Equipment Removal and Additional Supplies

The items listed below are deemed *essential* to render appropriate care to the spine-injured athlete.

- Cell phone
- Heavy-duty trauma shears
- At least two methods to remove the facemask, such as:
 - Cordless screwdriver with appropriate straight or Phillips head, and extra battery
 - Standard size #8 Phillips head screwdriver or appropriate straight screwdriver
 - Facemask loop strap/clip cutter
 - FM extractor
 - Anvil pruners
- If helmets have quick release clips, appropriate tool for that model readily available and in a location known to all providers
- Pocket mask
- Oropharyngeal airways (complete set)
- Nasopharyngeal airways (complete set)

- Automated External Defibrillator (AED)
- Cervical immobilization device: complete set or adjustable
- Scoop stretcher
- Rigid immobilization device, such as:
 - Long spine board (appropriately sized for athlete)
 - Vacuum mattress
 - Ambulance stretcher/gurney
- Method to appropriately secure patient to long spine board:
 - Spider type straps
 - Seat belt style straps
- Stethoscope
- Aneroid Sphygmomanometer (Blood Pressure Cuff)
- Watch or stopwatch

The items listed below are *desirable* and may enhance appropriate care of the spine-injured athlete.

- Portable two-way radio
- Pulse Oximeter
- Bag valve mask
- Supplemental Oxygen
- Supraglottic airways
- Endotracheal intubation kit
- Portable suction device

Appendix D - Spinal Motion Restriction and Transfer Techniques (*need insert pictures/figures*)

Multi-Rescuer Lift-and-Slide. The multi-rescuer lift-and-slide (previously called the six-plus lift-and-slide) is used to move a spine-injured athlete from the injury scene to a rigid spinal motion restriction device (often the long spine board) which can then be lifted onto a gurney and placed into the transport vehicle. The multi-rescuer lift-and-slide technique requires one rescuer to provide manual inline stabilization of the head and neck and 6 or more rescuers (i.e., three on each side positioned at the chest, pelvis, and legs) to assist with the lift (Figure 8). The rescuer providing stabilization to the head gives the commands to direct the others to lift the athlete approximately four to six inches off the ground in unison. The eighth rescuer slides the spine board into place from the foot end of the athlete. Once the spinal motion restriction device is in position the athlete is lowered carefully following the commands of the rescuer providing stabilization to the head.^{21,37,47,49,50,71}

Straddle Lift-and-Slide. To perform the straddle lift-and-slide (straddle LS), one rescuer of the medical team provides manual, in-line stabilization of the head and neck. Two rescuers lift the upper torso by placing one hand under the shoulders and the other hand under the torso. The next two rescuers straddle the patient at the hips and pelvis and the knees and lower extremities (figure 9A).^{71,72} The rescuer at the head directs all the other rescuers to lift the athlete off the ground. The sixth rescuer carefully slides the rigid spinal motion restriction device under the athlete from foot to head and the command to lower the athlete is then given. A modification to this procedure is to have one rescuer provide manual in-line stabilization and all other rescuers straddle the athlete to complete the lift (Figure 9B).

Log Roll. The log roll (LR) is performed by having one rescuer provide manual, in-line stabilization to the spine-injured athlete. Two rescuers assist in rolling the torso and upper extremities. One to two additional rescuers control the lower extremities during the LR procedure. On command from the first rescuer, the athlete is rolled 90° to the side-lying position. Once the patient is in this position the sixth rescuer wedges the spine board under the athlete at an angle of 45° to the ground.^{71,72} Then on command the athlete is carefully rolled back to the supine position onto the rigid spinal motion restriction device (Figure 10). If the athlete is not centered on the spine board additional adjustments may be needed to shift the patient to the center. In some instances, the log roll may be completed with fewer rescuers.¹⁷

Prone Log Roll Push. The first rescuer provides in-line stabilization of the head and cervical spine using a crossed-hand position. Three rescuers are positioned along the athlete's body on the same side the athlete's head is facing. The positions of these rescuers are at the athlete's shoulders and chest, the hips, and the legs. The fifth rescuer prepares the spine board. On command from the first rescuer, the athlete is slowly rolled away from the rescuers (i.e., pushing) toward the rigid spinal motion restriction device which is positioned under the athlete by at an angle of 30° to 45° from the ground (Figure 11). Once the rigid spinal motion restriction device is in place the athlete is slowly lowered to the rigid spinal motion restriction device on command of the first rescuer.^{21,52}

Prone Log Roll Pull. The first rescuer provides in-line stabilization of the head and cervical spine using a crossed-hand position. Three rescuers are positioned along the athlete's body opposite from the direction in which the athlete's head is facing. The positions of these rescuers are at the athlete's shoulders and chest, the hips, and the legs. The fifth rescuer prepares the spine board. On command from the first rescuer, the patient is slowly pulled toward the rescuers two through four and the spine board is positioned against the thighs of the rescuers by rescuer five (Figure 12). Once the spine board is in place the athlete is slowly lowered to the rigid spinal motion restriction device following the commands of the first rescuer.²¹ The log roll pull should be practiced by the sports medicine team; however, when possible the log roll push should be used rather than the log roll pull.⁵²

Scoop Stretcher. The adjustable scoop stretcher can be separated into two parts at the hinged interlocking device at each end of the scoop stretcher. Each of the halves is then wedged under the athlete without using LR or LS procedures to get the athlete onto the scoop stretcher (Figure 13). The primary purpose of a standard scoop stretcher is to lift an athlete from the ground to transfer them to a more stable immobilization device such as the long spine board. Krell et al⁵¹ reported that head and neck motion in healthy subjects was less in all three planes of movement when using the scoop stretcher as compared to the LR. To lift the athlete from the ground the first rescuer provides manual in-line stabilization of the head. The two long halves of the scoop stretcher must be separated and then positioned on either side of the athlete. The first rescuer provides the command for three rescuers (two at the shoulders and one at the feet) to push the scoop stretcher halves under the athlete until the hinges are latched and in the locked position.⁴⁸

Cervical Collars. There are many different types of cervical motion restriction devices available on the market. Numerous studies have published results related to the efficacy of these devices.^{33,34,74-77} The amount of cervical spine motion created by the application and removal of properly fitted cervical motion restriction devices does not appear to be significantly impacted by the type of device.³² Due to the differences of each device (e.g., one-piece versus two-piece) it is recommended that manual in-line stabilization be maintained while the cervical motion restriction device is applied according to

manufacturer's directions. In-line stabilization should be maintained even after application of the device until the athlete is secured properly to a spinal motion restriction device.¹⁷

Appendix E – Sport Specific Equipment Removal

General Principles of Helmet and Shoulder Pad Removal

The helmet should be removed first, followed by the shoulder pads. Once the shoulder pads are removed, rescuers should properly fit and apply a cervical collar. The athlete should then be secured to a rigid immobilization device (i.e., spine board, scoop stretcher, KED, or full body vacuum mattress).

When extenuating circumstances prevent removal of all equipment, at a minimum, the facemask should be removed prior to transportation, regardless of current respiratory status. Tools for facemask removal (e.g., power screwdriver, FM Extractor, Anvil Pruners, or ratcheting PVC pipe cutter) should be readily accessible (Figure 14). If possible, consideration should be given to the use of quick release facemask clips to facilitate facemask removal.

Helmet removal technique:

- Rescuer 1 stabilizes cervical spine
- Rescuer 2 cuts jersey and shoulder pads in front to maximize space for head stabilization and access to chin strap and cheek pads (if necessary) (Figure 15)
- Rescuer 2 assumes cervical spine control from front, allowing Rescuer 1 to release: "I have cervical spine control; you can release" (Figure 16)
- Rescuer 1 removes helmet; then again assumes cervical spine control, allowing Rescuer 2 to release: "I have cervical spine control; you can release" (Figure 17)

Shoulder pad removal techniques:

Several techniques exist to remove shoulder pads (***following helmet removal***). Rescuers should select the techniques which best fits the individual circumstances associated with each athlete.

- **Supine athlete:**
 - Multi-Rescuer Lift (formerly referred to as lift and slide or levitation technique): Rescuer 1 stabilizes cervical spine; jersey and shoulder pads cut in front; Rescuers 2-7 (3 on each side) lift athlete 12" on command (to allow shoulder pad clearance during removal); Rescuer 8 slides board under athlete; Rescuer 9 carefully removes shoulder pads without interfering with Rescuer 1's c-spine control (Figure 18). Once Rescuer 9 verbalizes "shoulder pads are clear", the athlete is lowered to board on command.
 - Tilt Technique (also known as elevated torso): Rescuer 1 stabilizes c-spine from the front. Rescuers 2-3 tilt athlete to 50 degrees at waist, similar to motion of a "sit-up". An alternate method uses one rescuer straddling the athlete to tilt the torso for shoulder pad removal (Figure 19 A and B). Rescuer 4 removes shoulder pads from over top of head. Rescuer 4 then grasps both sides of head and assists Rescuer 1 with c-spine stabilization as the athlete is lowered down. Note that the tilt should not be utilized as a shoulder pad removal technique with suspected concomitant thoracic and/or lumbar injury.
 - Straddle technique (also known as the straddle lift): may be utilized with small athletes. Rescuer 1 stabilizes c-spine; jersey and shoulder pads cut in front; Rescuers 2-4 standing over straddling the athlete lift athlete 12" on command (to allow shoulder pad clearance for removal); Rescuer 5 slides board in; Rescuer 6 carefully removes shoulder pads

without interfering with Rescuer 1's c-spine control. Once Rescuer 6 communicates "shoulder pads are clear", the athlete is lowered to board on command (Figure 20)

- Flat Torso Technique: Jersey and shoulder pads are cut in front. Rescuer 1 reaches inside shoulder pads and stabilizes c-spine from front. Rescuers 2-3 grasp shoulder pads from either side of athlete and slide pads out in an axial direction. (Figure 21)
 - Log Roll Technique: A standard log roll technique is utilized. Rescuer 1 stabilizes c-spine. Rescuers 2-4 perform supine log roll, pausing at the top of the roll. Rescuer 5 cuts the jersey and shoulder pads in back (Figure 22), then positions spine board and athlete is lowered down onto board. The jersey and shoulder pads are then cut in the front and the bi-valved shoulder pads are then removed from each side by Rescuers 2 and 3 while Rescuer 1 continues to stabilize c-spine.
 - Quick Release Shoulder Pads: Rescuer 1 stabilizes c-spine. Rescuer 2 cuts the jersey and shoulder pads in front. Rescuer 2 cuts the emergency quick release tab and pulls a cable releasing the shoulder pads in back. The bi-valved shoulder pads are then removed from each side by Rescuers 2 and 3 while Rescuer 1 continues to stabilize c-spine (Figure 23).
 - Over the Head: This technique must be used when it is not possible to cut open the shoulder pads in the front to use any of the above techniques. Following helmet removal. Rescuer two must reach up under the shoulder pads and take control of c-spine stabilization. Then the shoulder pads are carefully manipulated over the athlete's head (Figure 24).
- **Prone athlete**: The prone athlete must be log rolled as the multi-rescuer lift-and-slide and scoop stretcher techniques may only be utilized on supine athletes.^{50,52} Rescuers should select either the log roll-push or log roll-pull technique based upon the individual circumstances associated with each athlete.
- Rescuer 1 stabilizes c-spine. Prior to initiating the log roll, Rescuer 2 cuts the jersey and shoulder pads in back (Figure 25 A and B), then positions spine board and athlete is lowered down onto board by Rescuers 3-5. The jersey and shoulder pads cut in front by Rescuer 2 and the bi-valved shoulder pads are then removed from each side by Rescuers 2 and 3.

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