RESOURCE DOCUMENT

EMS SPINAL PRECAUTIONS AND THE USE OF THE LONG BACKBOARD – RESOURCE DOCUMENT TO THE POSITION STATEMENT OF THE NATIONAL ASSOCIATION OF EMS PHYSICIANS AND THE AMERICAN COLLEGE OF SURGEONS COMMITTEE ON TRAUMA

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ABSTRACT

Field spinal immobilization using a backboard and cervical collar has been standard practice for patients with suspected spine injury since the 1960s. The backboard has been a component of field spinal immobilization despite lack of efficacy evidence. While the backboard is a useful spinal protection tool during extrication, use of backboards is not without risk, as they have been shown to cause respiratory compromise, pain, and pressure sores. Backboards also alter a patient's physical exam, resulting in unnecessary radiographs. Because backboards present known risks, and their value in protecting the spinal cord of an injured patient remains unsubstantiated, they should only be used judiciously. The following provides a discussion of the elements of the National Association of EMS Physicians (NAEMSP) and American College of Surgeons Committee on Trauma (ACS-COT) position statement on EMS spinal precautions and the use of the long backboard. This discussion includes items where there is supporting literature and items where additional science is needed. **Key words:** EMS; spinal injury; backboards

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INTRODUCTION

The National Association of EMS Physicians (NAEMSP) and the American College of Surgeons Committee on Trauma (ACS-COT) have published a new position paper on "EMS Spinal Precautions and the Use of the Long Backboard."[1] This paper is the resource document for the position paper and is designed to guide practitioners in understanding of the new position statement. Each item in the position is quoted and followed by a discussion and a review of the literature.

- *"Long backboards are commonly used to attempt to provide rigid spinal immobilization among EMS trauma patients. However, the benefit of long backboards is largely unproven."*

HISTORY OF THE BACKBOARD

Field spinal immobilization using a cervical collar and a backboard has been standard practice for patients with suspected spine injury since the 1960s. Prior to that time no formal immobilization practice was used and advanced first aid was the highest level of training for ambulance personnel.

A 1966 report by Geisler et al. attributed "delayed onset of paraplegia" in hospitalized patients with spinal fractures to "failure to recognize the injury and protect the patient from the consequences of his unstable spine."[2] This retrospective study of the surgical management of spinal column injury includes a discussion of only two patients, one who incurred a depressed skull fracture from a motor vehicle crash in 1955, but was otherwise "observed to move all four limbs." The authors write that after the patient began to develop paraplegia with a sensory level at T10, an

x-ray identified a thoracic spine fracture and the patient was taken to operative management with a decompressive laminectomy. The patient eventually developed permanent paralysis at the T4 level, leading the authors to write that the patient "would surely have been protected from the paraplegic condition had the spinal instability been recognized and precautions taken." Further, the authors write that "the importance of proper first-aid was deduced from the fact that 29 patients [in their dataset] developed further paralysis through faulty handling."[2]

After the publication of the report by Geisler et al., the medical community subscribed to the belief that patients with blunt-force trauma (primarily from motor vehicle crashes) should be immobilized on rigid devices to minimize the risk of delayed paralysis in the setting of occult spinal column injury. Farrington, in 1968, described the placement of a cervical collar and a long or short backboard as necessary to keep the head and neck from sagging during extrication.[3] The backboard was designed to assist in minimizing spinal movement during complex extrication maneuvers by freeing the hands of rescuers from actively holding spinal precautions. Farrington also described a technique for spinal traction to be used in extrication. Although spinal traction has fallen out of use in favor of spinal precautions using in-line spinal stabilization, the backboard and cervical collar remain.

In 1971, the American Academy of Orthopedic Surgeons published one of the first guidelines for EMS treatment. *Emergency Care and Transportation of the Sick and Injured* advocated the use of spinal immobilization using a backboard and cervical collar for trauma patients with signs and symptoms of spinal injury.[4] Concern that rescuers could inadvertently worsen unstable spinal injuries during extrication and transport led to the adoption of field spinal immobilization protocols utilizing cervical collars and backboards, a combination intended to splint the entire spine and protect against additional injury.[5–7]

In 1979, Bohlman linked delayed paralysis in 100 of 300 hospitalized cervical spine fracture patients with concern that the causative injuries were being underappreciated by emergency physicians. Bohlman attributed the resulting spinal cord injuries to spinal cord tissue hypoxia due to cord compression from edema or contusion, or from direct injury to the spinal cord vascular supply. No injuries or deficits were attributed to post-injury spinal manipulation by emergency physicians or prudent rescuers.[8]

EMS providers were suspected of similar underappreciation of spinal injuries. From this concern arose the theory that EMS providers were placing spinal injury patients at risk for delayed paralysis and secondary injury during improper packaging and handling in the field.[9–11] It was because of this concern that EMS providers began applying spinal immobilization, using backboards and cervical collars, based on mechanism of injury alone, even if the patients were asymptomatic, for fear of exacerbating occult spinal injuries.[12] Field providers were instructed to approach the patient, hold cervical spine immobilization manually until a cervical extrication collar was placed, maintain spinal precautions through extrication onto a backboard, and maintain immobilization with a cervical collar and backboard until cleared by a physician.[2,3] Thus, the term "spinal immobilization" came to include both the concept – limiting spinal motion – and the method by which it was achieved – backboard and cervical collar.

With the potential benefits of the backboard seen as prevention of spinal cord injury in a patient with unstable fracture and no cord injury at presentation, low cost of the device and its convenience as a patient transport device with no perceived downside to the backboard and cervical collar, in the United States, spinal immobilization with the backboard and cervical collar became nearly universal standard practice for all trauma patients with a mechanism of injury that could potentially cause spine injury.

The backboard may have its most helpful impact in facilitating safe extrication and movement of unconscious or impaired patients. Like a scoop stretcher, Stokes basket, or similar lifting device, the backboard serves as both a means to reduce patient movement and as a patient conveyance when moving a patient from the site of injury. When the patient is strapped to the backboard, rescuers can more easily maintain a patient's position while moving over uneven terrain.

- *"The long backboard can induce pain, patient agitation, and respiratory compromise. Further, the backboard can decrease tissue perfusion at pressure points, leading to the development of pressure ulcers."*

Side Effects of Backboards

Protecting the patient with a potential spine injury is an important component of EMS trauma care. While the backboard can be an important spinal protection adjunct during extrication, use of the backboard is not without side effects. Some of these have been previously investigated.

Pain

The conditions leading to the creation of pressure sores also inflict considerable pain in patients on backboards. Pain is not limited to areas of contact with the backboard, as backboards can also cause pain in the lower back and cervical spine due to the anatomically incorrect positioning caused by a flat backboard. Existing painful conditions can be exacerbated and new

pain can develop in areas that were not painful prior to the application of the backboard. Pain may improve or resolve for some patients once they are removed from the backboard.[13] Lower back and cervical pain has been reported to persist in previously pain-free, healthy volunteers 24 hours after being subjected to only one hour on a backboard.[14]

Unnecessary Radiological Testing

It can be difficult for the receiving trauma team to distinguish between pain caused by injury and pain that resulted from application and use of the backboard. Clinicians may be forced to perform imaging studies on areas that are painful solely due to the backboard, and not due to the initial injury.[15] Unnecessary radiological studies carry their own risks and have been correlated with increasing risk for the development of cancer[16,17] as well as prolonged lengths of stays in the emergency department and increased cost of evaluation.[18]

Respiratory Compromise

Studies of healthy, nonsmoking males show that straps tightened across the torso have a restrictive effect, lowering a patient's forced vital capacity (FVC), forced expiratory volume over 1 second (FEV1), and forced mid-expiratory flow (FEF 25–75%).[19] For those patients with injury to the chest wall and lungs, backboard straps further interfere with respiratory mechanics; removal of these straps improves ventilation even in the face of such injuries.[20]

Pressure Sores

Because the backboard is a rigid appliance that does not conform to a patient's body, patients develop pressure sores as a result of being immobilized on the backboard. In 1987, Linares et al. associated immobilization in the immediate post-injury period with the development of pressure sores, and recommended that "every effort should be made to provide adequate pressure relief for [spine injury] patients in the immediate post-injury period."[21]

Occipital and sacral contact pressures are higher for a patient on a rigid backboard compared to a padded backboard or a vacuum mattress and are significantly above the pressures at which tissue necrosis and pressure ulcers can develop.[22,23] Using near infrared spectroscopy, Berg et al. discovered significant tissue hypoxia in sacral tissue of healthy adults after 30 minutes on a backboard, indicating that early pressure ulcer development begins soon after patients are placed on the backboard and even before their arrival at the hospital.[24]

Although the consequence of the side effects of backboards on patient outcome have not been quantified, these side effects are recognized and must be considered even though they may not impact every patient immobilized on a backboard.

- *"Utilization of backboards for spinal immobilization during transport should be judicious, so that potential benefits outweigh risks."*

JUDICIOUS USE OF BACKBOARDS

Field spinal precautions are intended to prevent spinal cord injury in a patient presenting with an unstable spinal fracture, and to potentially prevent worsening of an unsuspected cord injury in patients presenting without evidence of such an injury. The backboard can be a useful spinal protection adjunct during extrication, when the patient must be moved by multiple rescuers from a position of injury to a position of safety on the ambulance cot. The benefits of the backboard as a spinal protection adjunct once the patient is on the ambulance cot are less clear and are not well described in the literature.

To date, there have been no patient outcome studies focusing on the contribution of the backboard to the maintenance of spinal precautions after extrication is complete. It is difficult to study the contributions of the backboard, positive or negative, to the implementation of spinal precautions. The rarity of spinal injury further hampers efforts to study field treatment methods. Domeier et al. in 2003 reported the cervical spine injury rate in EMS trauma patients at 1% (237/22,333) with 68 of 22,333 (0.3%) having cervical cord injuries.[25]

There have been reports of worse outcomes in patients who received spinal immobilization that included the use of backboards. These studies have raised questions about the use of the backboard as an adjunct to spinal precautions, though none has proven causality. Additionally, the interchangeable use of the terms "spinal immobilization" and "backboard" makes clinical correlation difficult.

Hauswald et al. in 1998 compared neurologic outcomes of spinal injury patients in New Mexico, where all included EMS patients received full, "standard spinal immobilization," including backboard, to those of spinal injury patients in Malaysia, where none of the included patients received spinal precautions. Given comparable age, mechanism of injury, and spinal injury level, the odds ratio for neurologic disability was higher in the New Mexico group, all of whom were placed on backboards (OR 2.03; 95% CI 1.03–3.99; $p = 0.04$).[26] This study did not focus on the backboard as an adjunct to spinal precautions, as the Malaysian group received no formal spinal precautions.

In 2010, Haut et al. reported the results of a query of the National Trauma Data Bank comparing outcomes of penetrating trauma patients immobilized in the field versus those who were not. The odds ratio of

death for spine-immobilized patients was 2.06 (95% CI: 1.35–3.13) compared with nonimmobilized patients. The association between patients treated with spinal immobilization including backboards and greater mortality held across all types of penetrating injuries queried. Only 0.01% of the patients in the sample had incomplete, unstable spinal injuries requiring operative fixation.[27] It is unclear if the patients requiring operative fixation would have benefitted from spinal precautions, and it is unclear if a backboard would have been a useful or harmful adjunct in that process.

Leonard et al. in 2012 reported that in pediatric trauma patients spinal immobilization with a backboard is associated not only with increased pain and radiographic usage but also increased admission to the hospital.[28] The degree of discomfort induced by the backboard itself was not quantified.

Clearly, if there is a potential benefit to using a backboard as a spinal precautions adjunct after the patient is on the ambulance cot, it needs to be better quantified. Lack of supporting data, in the absence of negative effects, would not itself mandate change in practice or philosophy. During field trauma evaluation and treatment, the risks associated with backboard use must be countered with the risks of an unprotected unstable spine injury and consideration of the best way to protect the spine.

Given the rarity of unstable spinal injuries in EMS trauma patients, the number that might benefit from immobilization to prevent secondary injury is likely extremely small. For each patient who has potential benefit, hundreds to thousands of patients must undergo immobilization with no potential benefit. Given the fact that the normal shape of the human spinal column has curvature, unlike a rigid backboard, there may be better alternatives for protecting the spinal column than a rigid backboard.

Since there are risks of continuing to use a backboard as an adjunct to spinal precautions after a patient is extricated to the ambulance and mattress gurney, rescuers should be judicious in their decision to keep the patient on the backboard. After placing the patient on the ambulance cot, and while maintaining spinal precautions, the risk–benefit analysis may include protocols that allow rescuers to consider removing the patient from the backboard if patient condition permits.

- *"Appropriate patients to be immobilized with a backboard may include those with:*
  - *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:*
    - *Drug or alcohol intoxication;*
    - *Inability to communicate; and/or*
    - *Distracting injury."*
- *"Patients for whom immobilization on a backboard is not necessary include those with all of the following:*
  - *Normal level of consciousness (GCS 15);*
  - *No spine tenderness or anatomic abnormality;*
  - *No neurologic findings or complaints;*
  - *No distracting injury;*
  - *No intoxication."*

Practices Limiting the Use of Spinal Immobilization

These points spell out the current practice of selective immobilization based on a clinical spine injury assessment. Prospective and retrospective studies have shown that EMS providers are able to safely evaluate and identify patients with suspected spinal injuries in the field. In 1997 and 2003, Domeier et al. reported that using selective spinal immobilization criteria, spinal immobilization of trauma patients could be reduced by 37% from the rate based only on mechanism of injury.[29,30] Muhr et al. showed a similar reduction of one-third in 1999.[31] Based in part on these studies, NAEMSP endorsed selective spinal immobilization in 1999.[32]

Subsequent studies have reached similar conclusions, and thus the criteria and definitions for selective application of spinal precautions remains unchanged in the 2013 NAEMSP-ACSCOT consensus position paper. In 2001, Stroh and Braude performed a retrospective chart review of 504 patients transported by EMS under a selective spinal immobilization protocol who were ultimately diagnosed with cervical spine injuries. They found that the selective spinal immobilization protocol was 99% sensitive in identifying patients with cervical injuries for immobilization.[33] In 2005, Domeier et al. reported that, in a prospective study of 13,483 patients with mechanism of injury suspicious for spinal injury, EMS personnel using a selective spinal immobilization algorithm were able to identify and immobilize 92% of patients with spinal injuries. Of those not identified, none had spinal cord injury. Adult patients with mechanism of injury suggestive of possible spinal injury but without altered mental status, intoxication, spinal pain or tenderness, focal neurologic deficits, or significant distracting injuries can be safely transported by EMS without using a backboard.[34] Using easy-to-follow algorithms, many agencies now allow EMS providers to perform selective spinal immobilization in the field, providing spinal immobilization to those more likely to have spinal injury.[35]

If there is a benefit to using a backboard during transport, ideally it should only be applied to patients with high risk for unstable spine injury. Risk stratification strategies for identifying patients at risk for spine injury has an inherently high false-positive rate. As a result, most patients who are maintained on a rigid

backboard during transport are exposed to the side effects without scientifically supported benefit.

- *"Patients with penetrating trauma to the head, neck or torso and no evidence of spinal injury should not be immobilized on a backboard."*

PENETRATING TRAUMA

As previously mentioned, Haut et al. reported the results of a query of the National Trauma Data Bank comparing outcomes of penetrating trauma patients immobilized in the field versus those who were not. He reported higher death for immobilized patients compared with nonimmobilized patients. Only 0.01% of the patients in the sample had incomplete, unstable spinal injuries requiring operative fixation.[27] As a result of this study, the use of a backboard as a spinal precautions adjunct during transport of patients suffering penetrating trauma is no longer recommended.

- *"Spinal precautions can be maintained by application of a rigid cervical collar and securing the patient firmly to the EMS stretcher, and may be most appropriate for:*
  - *Patients who are found to be ambulatory at the scene;*
  - *Patients who must be transported for a protracted time, particularly prior to interfacility transfer; or*
  - *Patients for whom a backboard is not otherwise indicated."*

- *"Whether or not a backboard is used, attention to spinal precautions among at-risk patients is paramount. These include application of a cervical collar, adequate security to a stretcher, minimal movement/transfers, and maintenance of in-line stabilization during any necessary movement/transfers."*

SPINAL PRECAUTIONS DURING TRANSPORT

The ambulance stretcher is in effect a padded backboard and, in combination with a cervical collar and straps to secure the patient in a supine position, provides appropriate spinal protection for patients with spinal injury. Once the patient is secured to the ambulance cot, the backboard becomes redundant, as the standard transport cot provides a flat surface to which the patient can be secured. Like the hospital bed, the ambulance cot can provide spinal protection, and the straps can reduce spinal flexion, rotation, and lateral motion. In addition, the cot mattress can conform to the anatomic shape of the spine and the nonslick surface minimizes patient movement on the cot. Other types of mattresses, such as vacuum splints, may also be used to provide spinal precautions during transport. Transport on a mattress is largely without the downside risks of the backboard.[36,37]

Those at low risk are clearly safe to be transported using this form of spinal precautions. In circumstances where the risk of unstable injury is low, the risks of rigid backboard may outweigh its benefit, thus warranting transport using a cervical collar and the mattress gurney alone as spinal precautions. Patients who are ambulatory at the scene are clearly low risk. Patients with anticipated protracted transport time and those undergoing interfacility transport are more likely to suffer adverse effects from the backboard.[38] Patients for whom the backboard is likely to cause injury or significant discomfort are also best transported without the device (e.g., elderly kyphotic patient).

- *"Education of field emergency medical services personnel should include evaluation of risk of spinal injury in the context of options to provide spinal precautions."*
- *"Protocols or plans to promote judicious use of long backboards during prehospital care should engage as many stakeholders in the trauma/EMS system as possible."*

FROM SCIENCE TO PRACTICE – EMS PROTOCOL AND CULTURAL CHANGES

Imbedded within every medical decision is the balance between the risks and benefits of the available choices. In the analysis of the literature on the use of backboards it is evident that while backboards may have utility as an adjunct for spinal precautions during extrication, there is no demonstrated evidence that backboards prevent injury deterioration during transport. There are numerous studies that indicate that backboard use may result in harm to patients. The number of patients impacted by the adverse effects of the backboard is unclear.

The change from "spinal immobilization" to "spinal precautions" is both subtle and significant. Protecting the spine of the patient with a potential spinal injury is still an important EMS skill. Spinal precautions involve the same care and attention to spinal protection as spinal immobilization, with the only exception being the judicious use of the backboard or similarly rigid devices during transport. Because "spinal immobilization" and "backboarding" have become synonyms, changes in EMS protocols to adopt "spinal precautions" by decreasing or eliminating the backboard as a spinal protection device during transport represent a significant change in EMS practice and culture within the United States. Other modern EMS systems have already made significant change in practice. In much of Australia, the backboard is used only as an

extrication device with use during transport being discouraged or prohibited.[39,40]

With any EMS system clinical or procedural evolutionary change, there are generally numerous invested stakeholders who function within the system or interface closely with it. The EMS medical director should be aware of these stakeholders and their attitudes with regard to spinal precautions procedures. Stakeholders might include, for example, EMS providers, other public safety agency personnel, emergency department personnel, emergency physicians, trauma surgeons, neurosurgeons, orthopedic surgeons, and athletic trainers. Ideally, they would be engaged to help evaluate available scientific information and authoritative guidance, within the context of the specific EMS system, to advance a culture that values backboards as tools to be used with discretion. Ultimately, backboard utilization would then decrease appropriately.

Perhaps the most important group that the EMS medical director will need to address is the system EMS providers. EMS medical directors and educators will need to spend significant time educating providers on the background and importance of this change in practice as well as how to manage patients with suspected spinal injuries in the future. In places where the backboard is used as an extrication device but not as a tool for maintaining spinal precautions, techniques to facilitate a safe transfer from the backboard to the ambulance cot need to be taught and practiced.

- *"Patients should be removed from backboards as soon as practical in an emergency department."*

Hospital Practice

In most EMS systems, patients with positive selective immobilization criteria travel to the hospital, fully immobilized, on a backboard. Until recently, these patients would remain on backboards in the emergency department until their spines could be radiographically cleared. In 2001, Vickery asserted that, given the risks of prolonged backboard use, patients should be removed from the backboard during the log roll procedure following the primary survey.[41] Movement of the patient from the bed before spinal injury is ruled out is accomplished with a slide board or the temporary reapplication of a backboard until the move is complete. As a result, patients do not experience the side effects of backboard usage while waiting for radiographic clearance on a more comfortable and conforming hospital stretcher. Additionally, by removing the backboard prior to radiographic imaging, images are clearer and free from artifact induced by the backboard itself.[41]

Many hospitals have adopted this recommendation and are now removing patients from backboards soon after arrival in the emergency department, even those with suspected spinal injury, in favor of cervical collar and log-roll movement restrictions.[42,43] In 2007, Hauswald and Braude surveyed 36 hospitals in New Mexico, and found that 42% of emergency departments surveyed had a standardized protocol to remove trauma patients from backboards immediately on arrival, prior to clearance by either a clinical or radiological exam.[44] Ahn et al., in their 2011 review article published in the *Journal of Neurosurgery*, concurred with this practice and stated that patients should be moved off of the backboard as soon as possible once in hospital to reduce patient exposure to the risks posed by the backboard.[45]

Unanswered Questions and Additional Considerations

Effectiveness of the Backboard as a Spinal Precautions Adjunct

To completely immobilize the spine of a trauma patient, the patient must be prevented from flexion, extension, lateral bending, and rotational movement at all spinal levels.[46] Mazolewski performed studies of several strapping techniques demonstrating that healthy, cooperative volunteers are often still able to move when strapped to a backboard.[47] In practice, during transport, even once on a backboard, patients are subject to significant head-to-toe and side-to-side forces.[48]

Though it is assumed that a backboard can provide spinal immobilization as described, this is not being seen in practice. A recent prospective observational study by Peery et al. showed 70% of study patients had at least one backboard strap with 4 or more cm of slack, and 12% of study patients had 4 or more backboard straps with 4 or more cm of slack.[49] The clinical significance of strap tightness and patient movement while "immobilized" has not been established, but such movement cannot qualify as immobilization, the very purpose for which backboards are used during transport. If, as these studies report, patients are still able to move despite being strapped to a backboard, spinal immobilization is more a function of their cooperation than the ability of the backboard and straps to assure spinal immobilization.

Studies on the effectiveness of backboards as a true immobilization device have only included cooperative patients and cadaver models; no mention has been made of patient resistance to immobilization. While difficult to study, the agitated trauma patient may have significant movement against the backboard straps when fighting with the rescue team. Tightening

the straps may restrict movement but not the forces generated by the patient on the spine in resistance to restraining efforts. Attempting to enforce immobilization of the uncooperative patient may result in more force transmission to the spine than before the struggle commenced.[12]

Pediatrics

The pediatric population is one that is neither directly included nor excluded in the position statement. The incidence of cervical spine injuries in pediatrics is lower than in adults and the consequences of injury tend toward the extremes of lethal or no injury.[50] Spinal cord injury without radiographic abnormality (SCIWORA), originally described in children is much more common in adults.[51]

Although not separately analyzed, pediatric patients were included in the largest selective immobilization validation study and the selective immobilization criteria performed without missed injury in pediatric patients.[52] In a pediatric subanalysis of emergency department NEXUS patients, the NEXUS decision instrument performed well in patients above 8 years old.[46] In patients under 8, despite cervical injuries being extremely rare, maintaining spinal precautions when sufficient mechanism exists is prudent practice. Head size in younger patients makes neutral positioning difficult with a standard backboard unless the body is appropriately elevated in relationship to the head.[53]

Biometrics

A recent publication discussing the biometrics of spinal injury questions the theory that additional deleterious effects result from inadvertent manipulation of an already injured spine by careful rescuers. Hauswald, in 2012, explained that the spine is a complex structure of interlocking parts, held together by reinforcing ligaments and muscles.[12] The spine, as a unit, requires very little energy to move within its normal range of motion, and offers little resistance to motion within this range. The major components each fail at similar levels of force, resulting in a strong but lightweight assembly.

Since the spinal components fail at similar force, spinal injuries are either minor, with no threat to the spinal cord, or catastrophic, with multiple, irreversible failures that may irreparably damage the spinal cord so severely that they will be unaffected by prehospital emergency spinal care. If the force experienced to create the unstable fracture was not enough to injure the cord at that time, then forces experienced during patient movement by EMS are unlikely to injure the cord.[12]

The spinal column itself is very strong, requiring up to 2,000–8,000 newtons to fracture the cervical spine.[12,54] Spinal motion during extrication by careful rescuers creates forces at most on the order of magnitude created by gravity, and are spread throughout the spinal column unless the column itself, cord included, has lost all structural integrity at that level. This theoretical presentation raises important points regarding the forces imparted during injury vs. those resulting from patient handling.[12]

There are several significant unanswered questions that are integral to an informed risk–benefit analysis of the available EMS treatments for spine trauma patients. First, the number of unstable injuries that are at risk to worsen with minimal movement is unknown. Although worsening may occur, such occurrence is likely much rarer than previously postulated. Because of this, it is very difficult to determine how many of these injuries can be positively impacted by maintaining spinal precautions. Second, it is unclear whether spinal precautions, including a backboard and cervical collar, adequately protect those unstable injuries at risk to worsen with minimal movement. Third, while it is not clear that a backboard and cervical collar provides adequate spinal protection, the optimal method of such protection, if it is even necessary, is similarly unclear.

Future Direction

There seem to be a growing number of EMS systems that forego utilization of backboards during transport even when potential spinal column injury is a consideration. The Xenia Fire Department in Ohio recently adopted a protocol that instructs EMS providers to transport patients with concern for spinal injury with only a cervical collar on the ambulance stretcher.[55] Alameda County, California, states that "hard backboards should only have limited utilization" during movement of patients needing spinal motion restriction; less invasive methods to achieve spinal motion restriction are preferred.[56] Rio Rancho Fire Department in New Mexico implemented a similar protocol in early 2013.[57] The State of Maryland recently changed its statewide protocols, and will be eliminating the use of backboards as a spinal protection device for penetrating trauma patients.[58]

The protocols referenced above continue to allow the use of the backboard as a spinal precautions adjunct during extrication. However, separate studies by Engsberg et al. and Dixon et al., both published in 2013, suggest that for the cooperative patient, self-extrication without rescuer assistance may invoke the least amount of spinal movement.[59,60] Though interesting, more study is needed in the area of spinal protection and extrication techniques.

Conclusion

All trauma patients should receive spinal assessment from EMS providers in the field. At a minimum, patients with potential for spine injury should be transported to the hospital using spinal precautions that include cervical collar and log roll procedures. Patients who are ambulatory or able to self-extricate without causing undue pain should be encouraged to move themselves to a supine position on the EMS cot, after application of a cervical collar. Backboards remain a valuable adjunct to spinal immobilization during patient extrication. Careful patient handling and transport of the patient with suspected spinal injury using spinal precautions remains prudent.

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