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SPINAL MOTION RESTRICTION: AN EDUCATIONAL AND IMPLEMENTATION PROGRAM TO REDEFINE PREHOSPITAL SPINAL ASSESSMENT AND CARE

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ABSTRACT

Introduction. Prehospital spine immobilization has long been applied to victims of trauma in the United States and up to 5 million patients per year are immobilized mostly with a cervical collar and a backboard. **Objective.** The training of paramedics and emergency medical technicians on the principals of spine motion restriction (SMR) will decrease the use of backboards. **Methods.** The training for SMR emphasized the need to immobilize those patients with a significant potential for an unstable cervical spine fracture and to use alternative methods of maintaining spine precautions for those with lower risk. The training addressed the potential complications of the use of the unpadded backboard and education was provided about the mechanics of spine injuries. Emergency medical services (EMS) personnel were taught to differentiate between the critical multisystem trauma patients from the more common moderate, low kinetic energy trauma patients. A comprehensive education and outreach program that included all of the EMS providers (fire and private), hospitals, and EMS educational institutions was developed. **Results.** Within 4 months of the policy implementation, prehospital care practitioners reduced the use of the backboard by 58%. This was accomplished by a decrease in the number of patients considered for SMR with low kinetic energy and the use of other methods, such as the cervical collar only. **Conclusion.** The implementation of a SMR training program significantly decreases the use of backboards and allows alternative methods of maintaining spine precautions. **Keywords:** Emergency Medical Services; humans; spinal injuries/therapy; transportation of patients; cervical vertebrae/injuries; emergency medical services/methods; emergency medical technicians; immobilization/methods; spinal motion restriction

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INTRODUCTION

Prehospital spine immobilization has long been applied to victims of blunt or penetrating trauma who

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have experienced a mechanism of injury forceful enough to possibly damage the spinal column. Emergency medical services (EMS) textbooks commonly stress that any significant mechanism of injury requires full body immobilization, which is typically defined as the patient being secured to a backboard and a cervical collar being applied.^{1,2} It is estimated that up to 5 million patients receive spine immobilization each year in the United States, most of who have no evidence of spine injuries.^{3,4}

The rate of cervical spine fractures among severely traumatized patients is 2–5% and the rate of unstable cervical fracture is 1–2%.^{5–7} Among patients with lesser mechanisms, such as a motor vehicle crash without multisystem trauma or a fall from standing and assault, the cervical fracture rate (1.2–3.3%)^{3,8–11} and the cervical spine cord injury rate (0.4–0.7%) are substantially lower.^{12,13}

Recent research among patients with penetrating trauma demonstrated a doubling of mortality among those who received spine immobilization.^{7,14–20} A recent systematic review of this literature pointed out the relatively rare appearance of patients with an unstable spine fracture and no neurologic deficits.²¹ They concluded that there are no data to support routine spine immobilization in patients with penetrating injury to the neck, head, or torso.

There are clinical complications with cervical spine immobilization as it is currently practiced. Pain is almost universal with the use of a backboard.^{22–25} There are other potential problems, such as mild respiratory compromise²⁶, increased intracranial pressure,^{27,28} or the rare cases of distracting an unstable fracture.^{29,30} A recent pediatric study demonstrated that immobilized children with a similar level of trauma had higher rates of pain and were more likely to undergo radiographic evaluation and admission to the hospital.^{31,32} A recent position statement by NAEMSP and the American College of Surgeons on the use of backboards states that they are largely unproven and their use should be judicious, so that the potential benefits outweigh the risks.³³

The Alameda County Emergency Medical Services Agency developed a unique training program to continue to immobilize those patients with a high risk of an unstable cervical spine injury, and to avoid the use of the backboard in our patients with lesser mechanisms of injury. Our hypothesis is that the implementation of this program will result in fewer patients receiving immobilization with backboards.

METHODS

Alameda County is an urban/suburban/rural county in Northern California that is 737 square miles with a population of 1.5 million. Our paramedic-staffed first response engines and paramedic/EMT-staffed transport ambulances respond to 125,000 EMS calls each year and transport 90,000 patients each year. This county was one of the early adopters of the State of Maine and later NEXUS criteria to allow paramedics to omit spine immobilization on selected trauma patients.^{11,12,34–39} The past practice was to place minor and major trauma patients who could not be cleared by the NEXUS criteria on an unpadded hardboard and cervical collar. The UCSF Committee on Human Research decided that approval was not required for this study because the data was extracted from a performance improvement data set with no identifiable personal information.

The initial training of over 800 paramedics (approximately 90% of practicing paramedics) for modifying our spine injury assessment and treatment procedures was delivered to EMS providers as a component of the County's mandatory annual policy update training (see Table 1). This training consisted of

- 1) Video lecture – 11 minutes of the 41-minute policy update video was devoted to spine injury assessment and treatment.
- 2) "Train the trainer" session to the leaders of the County's various agencies' clinical education departments. Discussion period of varied duration for providers to address questions and concerns regarding pathophysiology, assessment, spine motion restriction (SMR) techniques, and liability.

TABLE 1. Spinal motion restriction (SMR) teaching points

- No longer use mechanism of injury as the sole criteria for spinal immobilization
- Education about the mechanics of spinal injuries and stable versus unstable cervical column injuries
- Differentiated the critical multisystem, multitrauma victim from more common moderate, low kinetic energy trauma
- Emphasized the full and complete assessment of the patient before making a decision regarding immobilization
- Omit SMR altogether for those that meet "clearance" criteria
- Victims of penetrating trauma should not be immobilized unless neurological deficits are present
- Lack of evidence and potential harm in unpadded backboard immobilization and avoiding its use
- Stable spine injuries need very little in terms of field stabilization (cervical collar and gurney)
- Alternative methods of SMR, including the vacuum mattress
- Stressed that any SMR method should conform to the patient, not the other way around
- Allow patients to be comfortably secured in a myriad of positions such as sitting, reclined, or on their side

- 3) Hands-on practice of spine injury assessment and SMR (including vacuum mattress use and alternative methods maintaining spine precautions).
- 4) Post-test and evaluation.

A similar mandatory training was also delivered to new accreditation candidates at our orientation. Reference articles and research papers, as well as spine injury and SMR policies from other areas are made available electronically (www.acphd.org/emtpara/edutrain/spineinjuryresources.aspx). More condensed versions of training (brief lecture with demonstration of techniques and no practicum) were presented to various stakeholders, including receiving hospitals, trauma audit committee, and local EMS educational institutions. The lesson plan emphasized physically assessing patients prior to performing procedures, avoiding placing patients with suspected spine injury directly on a backboard and supporting alternative methods of maintaining spine precautions with other methods that are more comfortable and with fewer complications.

The curriculum differentiated the critical multisystem, multitrauma victim from more common moderate, low kinetic energy trauma correlating that information to stable vs. potentially unstable spinal column injuries. The concept that stable spine injuries need very little in terms of field stabilization was emphasized. Many patients require only a cervical collar and to be secured just like any other nontrauma patient. We also demonstrated alternative methods of maintaining spine precautions, including the vacuum mattress that allows patients to be comfortably secured in a myriad of positions such as sitting, reclined, or on their side. We stressed that any SMR method should conform to the patient, not the other way around.

Our electronic patient care records were queried for the number of patients who received cervical spine immobilization from April 2012 through April 2013. During the period of April 1 through November 31, 2012, the only option was no immobilization or full immobilization with a hard collar and a backboard. Specific data elements on cervical spine management in the electronic patient care record were expanded to include cervical spine immobilization with backboard and collar, cervical collar only, Kendrick Extrication Device (KED), self-limited, or other.

RESULTS

The training on spine motion restriction began in September and was completed by December 2012. In the pretraining period of April through September 2012, an average of 604 (SD, 39; range 564–643) patients each month were considered for spine immobilization and placed in a cervical collar and backboard. In the post-training period, 241 (SD 9.5; range 232–250)

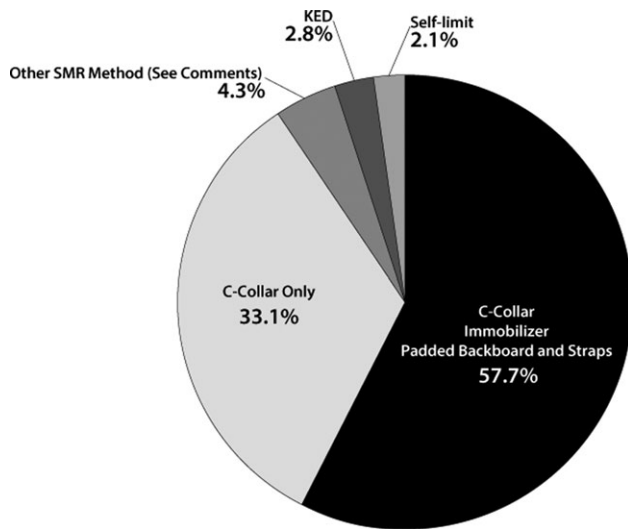


FIGURE 1. Method of immobilization used after the implementation of Spine Motion Restriction.

patients were immobilized with a cervical collar and backboard.

The number of patients considered for spine motion restriction under the new policy decreased to approximately 400 per month. Among these patients considered for SMR, 63% received immobilization with the traditional cervical collar, immobilizer, and backboard (see Figure 1). The remaining 37% were immobilized with either a cervical collar only, car seat, KED, self-limiting of motion by the patient, or some other method of restriction. Between the decrease in consideration and the use of SMR, our community has decreased the use of the backboard by 58% (see Figure 2).

DISCUSSION

The Spine Motion Restriction training program has decreased the use of backboards in our system. The existing ambiguity about the mechanism of injury coupled

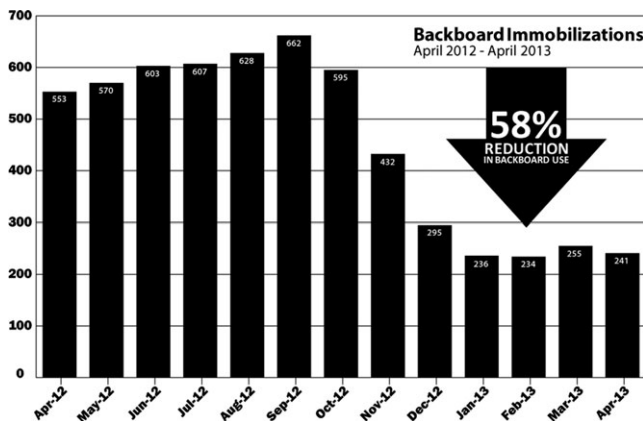


FIGURE 2. Monthly utilization of backboards.

with the concern about potential missed injuries and the fear of reprisals and litigation led to a relatively high rate of spine immobilization even among those patients with lesser mechanisms. Our overarching goal is to continue to appropriately immobilize those patients with a significant potential for an unstable cervical spine fracture and to use alternative spine immobilization for those with lower risk.

This educational module demonstrated the significant and mounting body of evidence showing the detrimental effects of standard spine immobilization (see Table 1). This curriculum included a more thorough understanding of spinal anatomy and pathophysiology as well as concepts of essential traumatic spine mechanisms, injury patterns, and definitive care for spinal cord injuries.^{40,41} This curriculum educated EMS practitioners on the concept of stable versus unstable column injuries and the mechanics of spine injuries secondary to kinetics, edema, and compromised spinal cord perfusion. It helped EMS personnel to differentiate between critical multisystem trauma patients from the more common moderate, low kinetic energy trauma patients.

The lesson plan emphasized physically assessing patients prior to performing procedures, avoiding placing patients with suspected spine injury directly on a backboard, and supporting methods of protecting patients' spines with other methods that are more comfortable.

Our training emphasized the concept that stable spine injuries need minimal field stabilization and can commonly be accomplished with only a cervical collar. Alternative methods such as the vacuum splint or the use of other more comfortable positions were also taught. Our goal was to have the SMR method conform to the patient and not the other way around.

LIMITATIONS

A major limitation of our Spine Motion Restriction training program is the lack of outcomes among our patients. There is no consistent or objective measure of the rate of stable or unstable cervical spine fractures or the rate of spinal cord injuries found in the emergency department. We currently get clinical feedback from our community hospitals through our usual performance improvement process. Our agency has been notified of two stable cervical spine fractures without full immobilization in the first year of our implementation. These two patients both under the age of 50 had cervical spinous fractures, one from a pedestrian struck by a vehicle and the other from a motor vehicle accident.

CONCLUSION

Our unique spine motion restriction training program incorporated recent clinical research. The

implementation of this program resulted in a 58% reduction in the use of unpadded backboards.

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