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Clinical Study

Effect of vacuum spine board immobilization on incidence of pressure ulcers during evacuation of military casualties from theater

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Abstract

BACKGROUND CONTEXT: In the summer of 2009, the vacuum spine board (VSB) was designated by the US Air Force as the preferred method of external spinal immobilization during aeromedical transport of patients with suspected unstable thoracolumbar spine fractures. One purported advantage of the VSB is that, by distributing weight over a larger surface area, it decreases the risk of skin pressure ulceration.

PURPOSE: To examine whether the rate of pressure ulcers has changed since the introduction of the VSB.

STUDY DESIGN: Retrospective cohorts.

PATIENT SAMPLE: Injured US service members undergoing spinal immobilization during evacuation from the Iraq and Afghanistan theaters to Landstuhl, Germany.

OUTCOME MEASURES: Presence and stage of pressure ulceration, and deterioration in neurologic status.

METHODS: Records of the initial 60 patients medically evacuated on the VSB to Landstuhl Regional Medical Center were retrospectively analyzed for patient demographics, injury characteristics, and incidence of pressure injury. The incidence of pressure ulcers after the use of VSB was compared with that in a historical control consisting of 30 patients with unstable spinal injuries evacuated before the introduction of the VSB. No sources of external funding were used for this investigation.

RESULTS: The combined cohort had a mean age of 28.8 years and mean Injury Severity Score (ISS) of 20.63 and comprised 96% men. Most injury mechanisms were blunt (58%). The rate of neurological injury was 19%. There were no cases of progressive neurological deficit or deformity in either cohort. In the VSB group, using a broad definition of pressure ulcer, incidence was 13 of 60 patients (22%). Using a strict definition, incidence was eight of 60 (13%): five Stage I and three Stage II. In the non-VSB group, incidence of pressure ulcers was three of 30 (10%), using either definition, all Stage II. Difference in incidence between the groups was not statistically significant. Intubated patients had a significantly higher incidence of pressure ulcers.

CONCLUSION: Both the VSB and historic means (non-VSB) of spinal immobilization appear to be safe and produce only transient morbidity despite an average of 9 to 10 hours of transport.

FDA device/drug status: Not applicable.

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The disclosure key can be found on the Table of Contents and at www.TheSpineJournalOnline.com.

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Intubated status was identified as the most important risk factor for the development of a pressure ulcer. Published by Elsevier Inc.

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Introduction

In the modern combat theater, individuals sustaining traumatic injuries benefit from unprecedentedly rapid access to highly capable, deployed medical facilities for initial life-saving treatments and subsequent rapid aeromedical evacuation out of theater for definitive care [1]. Casualties are treated by a military health continuum that consists of five levels of care that possess progressively greater medical capabilities and resources [2]. In the Iraq and Afghanistan theaters, casualties generally reach Forward Surgical Teams (Level 2) or Combat Support Hospitals (Level 3) within 30 to 60 minutes of injury, Landstuhl Regional Medical Center (LRMC) in Germany (Level 4) within 24 to 72 hours, and military treatment facilities in the United States (Level 5) in 4 to 7 days.

Evaluation of the casualty in theater includes assessment for spinal injury by clinical examination and computed tomography scan of the entire neural axis at a Level 3 facility. Patients diagnosed with potentially unstable spinal injuries are transported by a US Air Force Critical Care Air Transport Team (CCATT) to a Level 4 facility, where resources are maintained to provide definitive care. Unlike the civilian setting, these patients require spinal immobilization measures for intercontinental evacuation sufficient to withstand multiple transfers and transport times of more than 10 hours.

In the summer of 2009, the vacuum spine board (VSB; Med Tech Sweden Inc., Geneseo, IL, USA) was designated by the US Air Force as the preferred method of external spinal immobilization during aeromedical transport between levels of care in patients with potentially unstable thoracolumbar fractures [3]. Previously, these individuals were flown on standard North Atlantic Treaty Organization (NATO) litters with a variety of external spinal immobilization reinforcement methods. The VSB is a custom-moldable splint that conforms around the patient's body. One purported advantage of the VSB over the backboard is that it decreases the risk of skin pressure ulceration by distributing weight over a larger surface area.

The purpose of this process improvement project was to examine whether the rate of pressure ulcers has changed since the introduction of the VSB. The incidence of pressure ulcers after the use of VSB was compared with that in a group of patients evacuated before the introduction of the VSB.

Methods

The Joint Combat Casualty Research Team approved this performance improvement project. This retrospective cohort analysis compared the initial 60 patients transported by the VSB (the VSB group) with 30 patients with unstable spinal fractures transported before adoption of the VSB (the non-VSB group). No sources of external funding were used to conduct this investigation.

Description of external spinal immobilization techniques for transport then and now

Air Force Instruction 41-307 *Aeromedical Evacuation Patient Considerations and Standards of Care* defines mandatory US Air Force requirements for patient transportation. Per the regulation, ''The goal is to maintain spine stability and prevent further deterioration of the patient's neurological condition during transport with a c-collar, backboard, head blocks, or other non-shifting medium, Stryker Frame with Collins traction or halo fixation'' [4].

Historically, the Stryker Wedge Turning Frame 965 Military Option was the preferred method for aeromedical transport of potentially unstable spinal injuries. However, the device is no longer commercially supported, and remaining systems were maintained by scavenging from incomplete systems or custom manufacture of replacement parts. This process was not logistically sustainable and did not support increased patient flow. By 2008, the Stryker Frame was obsolete for patient movements.

Immediately before the VSB introduction, patients with potentially unstable spinal injuries were transported from the combat zone on a standard NATO litter with a 5-cm foam mattress (black Allen memory foam mattress) placed on it (Fig. 1). The NATO litter is a lightweight, foldable patient stretcher constructed with two fiberglass poles connected by nylon fabric netting and two horizontal stabilizers. To dampen vertical spinal movements and reinforce the base immobilization effect of the standard NATO litter with foam mattress, when it was present and requested, a 1-inch plywood board was placed longitudinally under the foam mattress or patients were transported wearing off-the-shelf rigid thoracolumbar orthoses.

In July 2009, the Joint Theater Trauma System Clinical Practice Guideline designated the VSB as the preferred method of transport (Fig. 2). During the VSB transport, the guideline also recommends deflation during stable cruising altitude flight and logrolling be considered and