

Clinical Study

Reoperation after in-theater combat spine surgery

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Abstract

BACKGROUND CONTEXT: The ideal timing of surgical decompression or stabilization following combat-related spine injury remains unclear.

PURPOSE: The study aims to determine the etiology and factors related to reoperation following evacuation to the United States after undergoing in-theater spine surgery.

STUDY DESIGN: This is a retrospective analysis.

PATIENT SAMPLE: The sample includes 13 patients with combat-related spine injuries undergoing revision spine surgery.

OUTCOME MEASURES: The outcome measures were time to arrival in the United States, time to reoperation, indications for revision, operative details, further revision surgery, infection rate, complications after reoperation, and most recent clinical follow-up information.

METHODS: This is a retrospective analysis of patients undergoing spine surgery designated as injured during the Global War on Terrorism between July 2003 and July 2013. Inpatient and outpatient medical records, operative reports, and imaging studies were reviewed.

RESULTS: The mean time to index surgery was 1.6 days. The mechanisms of injury included five gunshot wounds, three improvised explosive devices (IED), two helicopter crashes, one motor vehicle accident, and two other mechanisms (fall and crush injury). The mean injury severity score (ISS) was 22.7 (range: 13–45). There were six cervical, seven thoracic, eight lumbar, and two sacral injuries, with a mean of 1.8±1.0 spinal regions injured per patient. Twelve patients had a spinal cord injury, four of which were AIS (American Spinal Association Impairment Scale). Three patients underwent spinal stabilization on the date of injury, and one patient had three separate spine surgeries while downrange before arrival. Four patients underwent fixation in theater. There was a mean of 5.5 days from injury to arrival in the United States, and the mean time to revision fixation was 11.2 days post-index surgery (range: 4–14 days). Revision indications included instability or progressive kyphosis (N=6), and two of these patients had decompression without instrumentation downrange. Other indications included inadequate decompression (N=4), infection, persistent drainage, and epidural hematoma. At a mean of 5.5-year follow-up, all patients were medically retired from service, with minimal neurologic improvement.

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

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CONCLUSIONS: Our study found that instability or progressive kyphosis and incomplete decompression were the most common indications for reoperation after evacuation to the United States. Our data provide additional understanding of the potential etiologies of failure and reoperation following in-theater combat spine surgery, and may help avoid such complications. Published by Elsevier Inc.

Keywords: Combat spine injury; Combat spine surgery; Combat spine trauma; In-theater spine surgery; Reoperation spine surgery; Spinal cord injury; Spine reoperations

Introduction

The rate of spinal trauma encountered in the conflicts in Iraq and Afghanistan is the highest reported in modern US warfare history, accounting for 5.5%–7.4% of all surviving US combat casualties [1,2] and present in 39% of deceased service members [3]. There has also been an increased incidence of atypical fracture patterns, including low lumbar burst fractures [4,5] and lumbosacral dissociations [6], likely related to the use of improvised explosive devices and high-velocity gunshot wounds as the primary mechanisms of injury [7,8]. In this regard, combat spinal trauma presents a unique clinical challenge to forward-deployed surgeons, as the austere in-theater surgical environment is relatively inadequate to support surgical stabilization of the spine [9]. The algorithm for treatment of these injuries is nebulous at best, and despite the increased incidence of spine injuries that have been encountered in the current conflicts, there is no explicit time frame for surgical stabilization of the injured spine before medical evacuation.

Currently, there are 44 clinical practice guidelines (CPG) established by the Department of Defense's (DOD) Joint Theater Trauma System [10], with two CPGs specifically pertaining to the evaluation and care of the spine. In the CPG detailing treatment of the combat-injured thoracolumbar spine, the decision to operate in theater is generally left to the clinical judgment of the deployed surgical team, although the CPG notes that variations in surgical expertise, inappropriate or incomplete surgical instrumentation, and more poorly controlled operative environments may limit the ability of the team to effectively manage spine trauma. Considerations for intervention in theater include cases of progressive neurologic deficits, open cerebrospinal fluid leaks, expected delay in transport (>5 days), or concern for neurologic deterioration with transfer [9,11].

In the present case series, we sought to evaluate the rates of complications and surgical revision, as well as the overall clinical outcomes, of service members with combat spine trauma initially stabilized in theater before requiring reoperation in the United States. To our knowledge, this work represents the only study to evaluate reoperations for combat-related spine trauma treated surgically before evacuation to the United States.

Materials and methods

An institutional review board approval was obtained before initiation of the present study. A retrospective review of the

surgical scheduling system for three institutions (National Naval Medical Center, Walter Reed Army Medical Center, and Walter Reed National Military Medical Center) was performed. Patients undergoing spinal surgery between July 2003 and July 2013 and who were identified as active in support of Operation Enduring Freedom, Operation Iraqi Freedom, or Operation New Dawn were included. The DOD inpatient and outpatient medical records, as well as radiographs, were reviewed. A preliminary list of patients was generated from this search, and only those patients whose index spinal stabilization procedure occurred in theater or in Germany at the main Echelon IV facility (Landstuhl Regional Medical Center [LRMC]) were included in the final analysis.

Data collected on each patient included age, sex, rank and mission or service, date of injury, mechanism of injury, nature and location of spine injuries, location of index spine surgery, associated injuries or spinal cord injury, and time from injury to index surgery. Time from injury to arrival in the United States, time to reoperation, as well as indications for surgical revision were documented. Other data collected include operative details, any further revision surgery, infection rate, or any other acute complications after reoperation. The most recent clinical follow-up information was included when available.

Results

Before arrival in the United States

We identified 13 patients undergoing revision spine surgery after evacuation to the United States, comprising 6.8% of all surgical combat spine trauma at our institution over a 10-year period. All patients were male, with a mean age of 26 years. The mean time from injury to index surgery was 1.6 ± 1.4 days. Six patients were injured in Iraq and seven patients were injured in Afghanistan. Four patients had their index spine surgery in theater, whereas nine patients had their initial spine treatment at LRMC. Three patients underwent surgery on the date of injury, whereas five patients underwent surgery 1 day following injury. The mechanisms of injury included gunshot wounds in five patients, improvised explosive devices in three, helicopter crashes in two, motor vehicle accident in one, fall in one, and crush injury in one. The injury distribution was cervical injury in six patients, thoracic injury in seven, lumbar injury in eight, and sacral injury in two, with six patients having more than one vertebral region injured. There was a mean 1.8 ± 1.0 spinal regions injured and a mean 3.6 ± 2.1 vertebrae

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