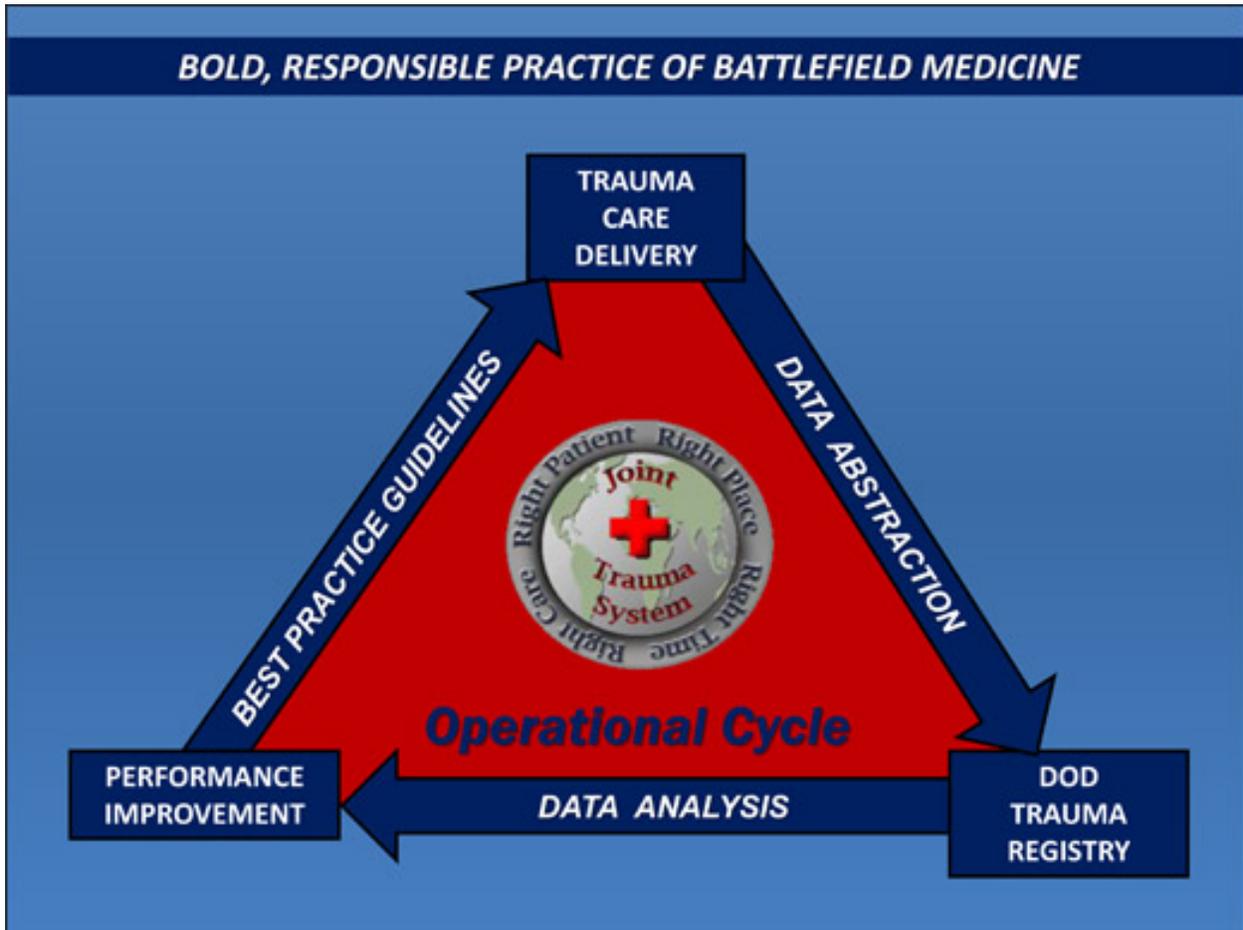


Committee on En Route Combat Casualty Care  
(CoERCCC)



Journal Watch

1st Quarter

2018

## Journal Watch Key Terminology Searched:

Emergency medical services  
Acute coronary syndrome  
Emergency care  
Aeromedical evacuation  
Traumatic brain injury  
Substances for disinfection  
Standardized operating procedures  
Forward MEDEVAC  
Trauma  
Helicopter  
Transportation Vibration  
Spinal cord injury  
Physically demanding occupation  
Casualty Distribution

Resuscitation  
Myocardial infarction  
Telemedicine  
Inflammation  
Air traffic  
Highly infectious diseases  
Combat  
Joint trauma system  
MRAP  
Porcine model  
Airway management  
ST-segment elevation  
Task analysis  
Casualty Evacuation

Treatment efficacy  
Pre-hospital  
Hypobaria  
Neuronal cell death  
Disinfection of aircraft  
Stabilization  
FLYP  
PECC  
SCI  
Shock  
Guideline  
Employment standards  
Vibration

## Air Versus Ground Transportation in Isolated Severe Head Trauma: A National Trauma Data Bank Study.

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### Abstract

**BACKGROUND:** The effect of prehospital helicopter emergency medical services (HEMS) on mortality has been analyzed previously in polytrauma patients with discordant results.

**OBJECTIVE:** Our aim was to compare outcomes in patients with isolated severe blunt traumatic brain injuries (TBIs) transported by HEMS or ground emergency medical services (GEMS).

**METHODS:** We conducted a National Trauma Data Bank study (2007-2014). All adult patients ( $\geq 16$  years old) who sustained an isolated severe blunt TBI and were transported by HEMS or GEMS were included in the study.

**RESULTS:** There were 145,559 patients who met the inclusion criteria. Overall, 116,391 (80%) patients were transported via GEMS and 29,168 (20%) via HEMS. Median transportation time was longer for HEMS patients (41 vs. 25 min;  $p < 0.001$ ). HEMS patients were more likely to have hypotension (2.7% vs. 1.5%;  $p < 0.001$ ), Glasgow Coma Scale (GCS) score  $< 9$  (38.2% vs. 10.9%;  $p < 0.001$ ), and head Abbreviation Injury Scale (AIS) score of 5 (20.1% vs. 9.7%;  $p < 0.001$ ). Stepwise logistic regression analysis identified age  $\geq 65$  years old, male sex, hypotension, GCS score  $< 9$ , prehospital intubation, and head AIS scores 4 and 5 as independent predictors of mortality. Helicopter transportation was independently associated with improved survival (odds ratio [OR] 0.55; 95% confidence interval [CI] 0.47-0.67;  $p < 0.001$ ). Admission to a Level I trauma center was an independent predictor of survival (OR 0.64; 95% CI 0.53-0.82;  $p = 0.001$ ). Regardless of head AIS, helicopter transport was an independent predictor of survival (AIS 3: OR 0.35;  $p < 0.001$ ; AIS 4: OR 0.44;  $p < 0.001$ ; AIS 5: OR 0.76;  $p < 0.001$ ). A prolonged transport time was not an independent predictor of mortality.

**CONCLUSIONS:** Helicopter transport, in adult patients with isolated severe TBI, is associated with improved survival.

PMID: 29258783 DOI:[10.1016/j.jemermed.2017.11.019](https://doi.org/10.1016/j.jemermed.2017.11.019)

## Critical Care Air Transport Team Evacuation of Medical Patients Without Traumatic Injury.

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### Abstract

**BACKGROUND:** Air Force Critical Care Air Transport Teams (CCATTs) provide fixed-wing aeromedical evacuation for combat casualties. Multiple studies have evaluated CCATT trauma patients; however, nearly 50% of patients medically evacuated from combat theaters are for nontraumatic medical illnesses to include stroke, myocardial infarctions, overdose, and pulmonary emboli. Published data are limited regarding illness types, in-flight procedures, and adverse events.

**OBJECTIVE:** The objective of our study was to characterize patients with nontraumatic medical illnesses transferred via CCATT to include a description of in-flight procedures and events.

**STUDY DESIGN:** We performed a retrospective review of CCATT medical records of patients with nontraumatic medical illnesses transported via CCATT from theater of operations to Landstuhl Regional Medical Center between January 2007 and April 2015. We abstracted data from CCATT records to include demographics, description of current illness, vital signs, labs, in-flight procedures and medications, and in-flight adverse events. Following descriptive analysis, comparative tests were performed based on service status of patients and primary diagnoses.

**RESULTS:** We reviewed 672 records of critically ill medical patients transported via CCATT, most of whom were male (90%, n = 606). Approximately 56% of the patients were U.S. active duty members; the remainder included U.S. contractors and civilians, and foreign citizens or unknown. The three categories (active duty, contractor/civilian, foreign/unknown) significantly differed from one another in age. Over half of the patients received a primary or secondary cardiac diagnosis. The most common in-flight procedures and medications included supplementary oxygenation, anticoagulant/antiplatelet medications, analgesics, and ventilation. Up to 20% of patients required continuous medication infusions other than analgesics. Patients most frequently experienced in-flight complications related to their primary diagnoses.

**CONCLUSIONS:** Fifty-six percent (672) of 1,209 CCATT records that were queried were of patients with medical conditions. The most common primary diagnoses of CCATT medical patients were cardiac, pulmonary, and neurological in etiology. Mechanical ventilation and continuous medication infusions were required in approximately 20% of patients. The data provided by this study may assist in guiding future CCATT training requirements and resource allocation, as well as clinical practice guideline development.

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PMID: 29087856 DOI: [10.7205/MILMED-D-17-00091](#)

## Measuring US Army medical evacuation: Metrics for performance improvement.

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### Abstract

**BACKGROUND:** The US Army medical evacuation (MEDEVAC) community has maintained a reputation for high levels of success in transporting casualties from the point of injury to definitive care. This work served as a demonstration project to advance a model of quality assurance surveillance and medical direction for prehospital MEDEVAC providers within the Joint Trauma System.

**METHODS:** A retrospective interrupted time series analysis using prospectively collected data was performed as a process improvement project. Records were reviewed during two distinct periods: 2009 and 2014 to 2015. MEDEVAC records were matched to outcomes data available in the Department of Defense Trauma Registry. Abstracted deidentified data were reviewed for specific outcomes, procedures, and processes of care. Descriptive statistics were applied as appropriate.

**RESULTS:** A total of 1,008 patients were included in this study. Nine quality assurance metrics were assessed. These metrics were: airway management, management of hypoxemia, compliance with a blood transfusion protocol, interventions for hypotensive patients, quality of battlefield analgesia, temperature measurement and interventions, proportion of traumatic brain injury (TBI) patients with hypoxemia and/or hypotension, proportion of traumatic brain injury patients with an appropriate assessment, and proportion of missing data. Overall survival in the subset of patients with outcomes data available in the Department of Defense Trauma Registry was 97.5%.

**CONCLUSION:** The data analyzed for this study suggest overall high compliance with established tactical combat casualty care guidelines. In the present study, nearly 7% of patients had at least one documented oxygen saturation of less than 90%, and 13% of these patients had no documentation of any intervention for hypoxemia, indicating a need for training focus on airway management for hypoxemia. Advances in battlefield analgesia continued to evolve over the period when data for this study was collected. Given the inherent high-risk, high-acuity nature of prehospital advanced life support and emphasis on the use of nonphysician practitioners in an out-of-hospital setting, the need for ongoing medical oversight and quality improvement assessment is crucial.

**LEVEL OF EVIDENCE:** Care management, level IV. PMID: 29267184  
DOI: [10.1097/TA.0000000000001715](#)

## Evaluating the Military Medical Evacuation Chain: Need for Expeditious Evacuation Out of Theater?

[van Dongen TTCF](#)<sup>1</sup>, [de Graaf J](#)<sup>2</sup>, [Plat MJ](#)<sup>3</sup>, [Huizinga EP](#)<sup>4</sup>, [Janse J](#)<sup>2</sup>, [van der Krans AC](#)<sup>5</sup>, [Leenen LPH](#)<sup>6</sup>, [Hoencamp R](#)<sup>1</sup>.

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### **Abstract**

**BACKGROUND:** An important factor within the military medical logistical chain is the capability of expeditious evacuation from point of injury, through a Medical Treatment Facility, to the country of residence where highest level of care can be provided. Although many factors can relate to patient outcome, the evaluation of the medical evacuation chain related to long-term patient outcome can be important for investigating possibilities for performance improvement in this domain. This article aims to provide a means to evaluate the quality of care of the medical evacuation chain.

**METHODS:** Repatriated service members from the Afghan theater between 2004 and 2014 were invited to participate in a survey concerning functional outcome and quality of life using Lower Extremity Functional Scale, Short Form health survey 36, and EuroQol-6D questionnaires. Possible associations between these outcomes were analyzed in respect to duration of medical evacuation from point of injury to arrival in the Dutch military hospital. The duration was dichotomized into within and after 72 hours. Ordinal regression was used to analyze a possible association with duration as a continuous variable.

**FINDINGS:** Sixty percent (28/47) of battle casualties arrived in The Netherlands within 72 hours. For the nonbattle injury cohort this was 30% (7/23). Of those who became ill, 18% (5/28) was evacuated in 72 hours. No significant independent associations between interval duration and measured outcomes were found.

**CONCLUSION:** Repatriated battle casualties had lower outcome scores compared to the disease nonbattle injured service members. Significant differences in functional outcome and quality of life with respect to evacuation duration were not found. Specialized tactical evacuation and en route care capability during strategic evacuation contributed to relative high standards of care. Combined with our results, this could implicate that delivery of the right care to the right patient at the right time is a justifiable paradigm. The main focus of the medical support organization is to offer the highest level of care per echelon as soon as possible in conjunction with facilitating maximum social support through expeditious evacuation out of theater. Further research using semistructured interviews among the direct circle around battle casualties, including caregivers, is needed to provide insight into these complex matters.

## Reexamination of a Battlefield Trauma Golden Hour Policy.

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### Abstract

**BACKGROUND:** Most combat casualties who die, do so in the prehospital setting. Efforts directed toward alleviating prehospital combat trauma death, known as killed in action (KIA) mortality, have the greatest opportunity for eliminating preventable death.

**METHODS:** Four thousand five hundred forty-two military casualties injured in Afghanistan from September 11, 2001, to March 31, 2014, were included in this retrospective analysis to evaluate proposed explanations for observed KIA reduction after a mandate by Secretary of Defense Robert M. Gates that transport of injured service members occur within 60 minutes. Using inverse probability weighting to account for selection bias, data were analyzed using multivariable logistic regression and simulation analysis to estimate the effects of (1) gradual improvement, (2) damage control resuscitation, (3) harm from inadequate resources, (4) change in wound pattern, and (5) transport time on KIA mortality.

**RESULTS:** The effect of gradual improvement measured as a time trend was not significant (adjusted odds ratio [AOR], 0.99; 95% confidence interval [CI], 0.94-1.03;  $p = 0.58$ ). For casualties with military Injury Severity Score of 25 or higher, the odds of KIA mortality were 83% lower for casualties who needed and received prehospital blood transfusion (AOR, 0.17; 95% CI, 0.06-0.51;  $p = 0.002$ ); 33% lower for casualties receiving initial treatment by forward surgical teams (AOR, 0.67; 95% CI, 0.58-0.78;  $p < 0.001$ ); 70%, 74%, and 87% lower for casualties with dominant injuries to head (AOR, 0.30; 95% CI, 0.23-0.38;  $p < 0.001$ ), abdomen (AOR, 0.26, 95% CI, 0.19-0.36;  $p < 0.001$ ) and extremities (AOR, 0.13; 95% CI, 0.09-0.17;  $p < 0.001$ ); 35% lower for casualties categorized with blunt injuries (AOR, 0.65; 95% CI, 0.46-0.92;  $p = 0.01$ ); and 39% lower for casualties transported within one hour (AOR, 0.61; 95% CI, 0.51-0.74;  $p < 0.001$ ). Results of simulations in which transport times had not changed after the mandate indicate that KIA mortality would have been 1.4% higher than observed, equating to 135 more KIA deaths (95% CI, 105-164).

**CONCLUSION:** Reduction in KIA mortality is associated with early treatment capabilities, blunt mechanism, select body locations of injury, and rapid transport.

**LEVEL OF EVIDENCE:** Therapy, level III. PMID:29266051 DOI: [10.1097/TA.0000000000001727](#)

## The dynamics of prehospital/hospital care and modes of transport during civil conflict and terrorist incidents.

[Celik S](#)<sup>1</sup>, [Dursun R](#)<sup>2</sup>, [Aycan A](#)<sup>3</sup>, [Gönüllü H](#)<sup>4</sup>, [Adanaş C](#)<sup>5</sup>, [Eryılmaz M](#)<sup>6</sup>, [Gönüllü E](#)<sup>7</sup>, [Akyol ME](#)<sup>3</sup>, [Keskin S](#)<sup>8</sup>, [Güloğlu C](#)<sup>2</sup>.

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### **Abstract**

**OBJECTIVE:** Prehospital and hospital care during incidents of mass violence and civil conflict involve a number of aspects that distinguish it from care during times of peace. We aimed to analyze the dynamics and outcomes of prehospital and hospital care during ongoing conflicts.

**STUDY DESIGN:** Multicentric prospective observational study.

**METHOD:** Patients enrolled in the study, which was conducted in Turkey, were all injured in armed conflict and taken to level 1 trauma centers. On admittance, patients were requested to complete a semistructured questionnaire containing questions on patient demographics, transport type, weapons used, injury severity score (ISS), and other incident-related factors. We analyzed patient outcomes (mortality, morbidity, complications, and length of hospital stay) and transfers of patients between hospitals. The present study evaluated the cases of 390 victims enrolled over a 9-month period and followed up for 6 months.

**RESULTS:** The majority of patients were transported by ambulances (n = 334, 85.6%); other transport modes were helicopters (n = 32, 8.2%) and private vehicles (n = 24, 6.2%). Nearly half of patients (48.7%) did not benefit by changing hospitals. During transport to hospitals, 4.1% of the vehicles in the study were involved in accidents. Using multiple regression analysis, only ISS (odds ratio [OR]: 1.098, 95% confidence interval [CI]: 1.044-1.156) and the Glasgow Coma Scale (OR: 0.744, 95% CI: 0.639-0.866) were found to affect mortality. In Receiver-operator characteristic analysis, a cutoff value of 22.5 for ISS had a sensitivity of 100% and a specificity of 89.6% for mortality.

**CONCLUSIONS:** Despite lower ISS values, patient outcomes were worse in terror incidents/civil conflicts. Transport modes did not significantly affect outcomes, whereas hospital transport was found to be inefficiently used.

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PMID: 28886492 DOI: [10.1016/j.puhe.2017.07.029](https://doi.org/10.1016/j.puhe.2017.07.029)

## In by helicopter out by cab: the financial cost of aeromedical overtriage of trauma patients.

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### Abstract

**BACKGROUND:** Helicopter transport of injured patients is controversial and costly. This study aims to show that a complex trauma algorithm leads to significant aeromedical overtriage at substantial cost. Our secondary outcomes were to compare adjusted mortality and outcomes between air and ground transport and determine predictors of overtriage.

**MATERIALS AND METHODS:** A 6-y retrospective analysis was conducted of all trauma activations at a Level I center. Patients were dichotomized by transportation method as well as trauma activation criteria. Overtriage was defined as those who were discharged from the emergency department, medically admitted without injuries, or admitted to observation status only. Overtriage and associated charges were calculated for each patient cohort, and multivariate regression models were created to derive adjusted mortality rates and predictors of overtriage.

**RESULTS:** A total of 4218 patients were treated with 28% arriving by helicopter. Overtriage increased significantly from 51% to 77% with lower tier activation criteria ( $P < 0.001$ ). Median charges for air-evacuated patients was \$10,478 (versus \$1008 ground). Eliminating overtriage of air patients would result in a cost savings of \$1,316,036 annually. Adjusted mortality between air and ground transport was not significantly different (8.5% versus 10.9%,  $P = 0.548$ ). Predictors of overtriage included decreasing age, Injury Severity Score, Head Abbreviated Injury Score, nonoperative treatment, and lower tier activation criteria.

**CONCLUSIONS:** Significant overtriage (52%) and unnecessary air evacuation of minimally injured patients occurs at great financial cost. Revision of trauma activation protocols may result in more judicious air transport use and significant reductions in health care costs.

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**KEYWORDS:** Aeromedical transportation; Healthcare costs; Trauma; Triage

PMID:28985859 DOI: [10.1016/j.jss.2017.05.102](https://doi.org/10.1016/j.jss.2017.05.102)

## Speed isn't everything: Identifying patients who may benefit from helicopter transport despite faster ground transport.

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### Abstract

**BACKGROUND:** Helicopter emergency medical services (HEMS) have demonstrated survival benefits over ground emergency medical services (GEMS) for trauma patient transport. While HEMS speed is often-cited, factors such as provider experience and level of care may also play a role. Our objective was to identify patient groups that may benefit from HEMS even when prehospital time for helicopter utilization is longer than GEMS transport.

**METHODS:** Adult patients transported by HEMS or GEMS from the scene of injury in the Pennsylvania State Trauma Registry were included. Propensity score matching was used to match HEMS and GEMS patients for likelihood of HEMS, keeping only pairs in which the HEMS patient had longer total prehospital time than the matched GEMS patient. Mixed-effects logistic regression evaluated the effect of transport mode on survival while controlling for demographics, admission physiology, transfusions, and procedures. Interaction testing between transport mode and existing trauma triage criteria was conducted and models stratified across significant interactions to determine which criteria identify patients with a significant survival benefit when transported by HEMS even when slower than GEMS.

**RESULTS:** From 153,729 eligible patients, 8,307 pairs were matched. HEMS total prehospital time was a median of 13minutes (IQR 6, 22) longer than GEMS. Patients with abnormal respiratory rate (OR 2.39; 95%CI 1.26-4.55,  $p=0.01$ ), GCS $\leq$ 8 (OR 1.61; 95%CI 1.16-2.22,  $p<0.01$ ), and hemo/pneumothorax (OR 2.25; 95%CI 1.06-4.78,  $p=0.03$ ) had a significant survival advantage when transported by HEMS even with longer prehospital time than GEMS. Conversely, there was no association between transport mode and survival in patients without these factors ( $p>0.05$ ).

**CONCLUSIONS:** Patients with abnormal respiratory rate, GCS $\leq$ 8, and hemo/pneumothorax benefit from HEMS transport even when GEMS transport was faster. This may indicate these patients benefit primarily from HEMS care, such as advanced airway and chest trauma management, rather than simply faster transport to a trauma center.

**LEVEL OF EVIDENCE:** III, Therapeutic.

PMID: 29251708 DOI: [10.1097/TA.0000000000001769](#)

## Critical Care Air Transport Team severe traumatic brain injury short-term outcomes during flight for Operation Iraqi Freedom/Operation Enduring Freedom.

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### Abstract

**INTRODUCTION:** Our understanding of the expertise and equipment required to air transport injured soldiers with severe traumatic brain injuries (TBIs) continue to evolve.

**METHODS:** We conducted a retrospective chart review of characteristics, interventions required and short-term outcomes of patients with severe TBI managed by the US Air Force Critical Care Air Transport Teams (CCATTs) deployed in support of Operation Iraqi Freedom and Operation Enduring Freedom between 1 June 2007 and 31 August 2010. Patients were cared for based on guidelines given by the Brain Trauma Foundation and the Joint Theater Trauma System by non-neurosurgeon physicians with dedicated neurocritical care training. We report basic characteristics, injuries, interventions required and complications during transport.

**RESULTS:** Intracranial haemorrhage was the most common diagnosis in this cohort. Most injuries were weapon related. During this study, there were no reported in-flight deaths. The majority of patients were mechanically ventilated. There were 45 patients who required at least one vasopressor to maintain adequate tissue perfusion, including four patients who required three or more. Some patients required intracranial pressure (ICP) management, treatment of diabetes insipidus and/or seizure prophylaxis medications.

**CONCLUSIONS:** Air transport personnel must be prepared to provide standard critical care but also care specific to TBIs, including ICP control and management of diabetes insipidus. Although these patients and their potential complications are traditionally managed by neurosurgeons, those providers without neurosurgical backgrounds can be provided this training to help fill a wartime need. This study provides data for the future development of air transport guidelines for validating and clearing flight surgeons.

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PMID: 28385926 DOI: [10.1136/jramc-2016-000743](https://doi.org/10.1136/jramc-2016-000743)