The Incidence of Fever in US Critical Care Air Transport Team Combat Trauma Patients Evacuated From the Theater Between March 2009 and March 2010

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Introduction: Most critically ill injured patients are transported out of the theater by Critical Care Air Transport Teams (CCATTs). Fever after trauma is correlated with surgical complications and infection. The purposes of this study are to identify the incidence of elevated temperature in patients managed in the CCATT environment and to describe the complications reported and the treatments used in these patients.

Methods: We performed a retrospective review of available records of trauma patients from the combat theater between March 1, 2009, and March 31, 2010, who were transported by the US Air Force CCATT and had an incidence of hyperthermia. We then divided the cohort into 2 groups, patients transported with an elevation in temperature greater than 100.4°F and patients with no documented elevation in temperature. We used a standardized, secure electronic data collection form to abstract the outcomes. Descriptive data collected included injury type, temperature, use of a mechanical ventilator, cooling treatment modalities, antipyretics, intravenous fluid administration, and use of blood products. We also evaluated the incidence of complications during the transport in patients who had a recorded elevation in temperature greater than 100.4°F.

Results: A total of 248 trauma patients met the inclusion criteria, and 101 trauma patients (40%) had fever. The mean age was 28 years, and 98% of patients were men. The mechanism of injury was an explosion in 156 patients (63%), blunt injury in 11 (4%), and penetrating injury in 45 (18%), whereas other trauma-related injuries accounted for 36 patients (15%). Of the patients, 209 (84%) had battle-related injuries and 39 (16%) had non–battle-related injuries. Traumatic brain injury was found in 24 patients (24%) with an incidence of elevated temperature. The mean temperature was 101.6°F (range, 100.5°F-103.9°F). After evaluation of therapies and treatments, 80 trauma patients (51%) were intubated on a mechanical ventilator ($P < .001$). Of the trauma patients with documented fever, 22 (22%) received administration of blood products. Nineteen patients received antipyretics during their flight (19%), 9 received intravenous fluids (9%), and 2 received nonpharmacologic cooling interventions, such as cooling blankets or icepacks. We identified 1 trauma patient with

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neurologic changes (1%), 6 with hypotension (6%), 48 with tachycardia (48%), 33 with decreased urinary output (33%), and 1 with an episode of shivering or sweating (1%). We did not detect any transfusion reactions or deaths during flight.

Conclusion: Fever occurred in 41% of critically ill combat-injured patients evacuated out of the combat theater in Iraq and Afghanistan. Fewer than 20% of patients with a documented elevated temperature received treatments to reduce the temperature. Intubation of patients with ventilators in use during the transport was the only factor significantly associated with fever. Serious complications were rare, and there were no deaths during these transports.

Key words: Fever; Flight medicine; Critical care transport; Trauma; Military medicine; Combat

The use of a Critical Care Air Transport Team (CCATT) in the transportation of our critically injured military men and women has played a vital part in the rapid evacuation of patients during Operation Iraqi Freedom and Operation Enduring Freedom. The purposes of this study are to identify the incidence of documented fever in patients managed in the CCATT environment and to describe the coinciding complications reported and the treatments used in these patients. Fever, or elevation in temperature, was defined for the purpose of this study as a temperature higher than 100.4°F (38°C). The elevation in temperature had to be documented on the flight record, and no time restraints were imposed.

Aims included (1) identifying the incidence of fever (temperature > 100.4°F [> 38°C]) in any traumatically injured patient transported by the CCATT within the defined time frames, (2) describing the initial specific mechanism of injuries involved in the traumatic event of the patient, (3) further investigating any interventions with treatment modalities used to address the fever noted by the flight team, and (4) identifying complications coinciding with a documented temperature.

The environment that the CCATT presents is unique and challenging and can impact the clinical outcomes and mortality rates of severely injured patients.[1] The CCATT program was founded in 1994 because of the unmet need for evacuation of traumatically injured and critically ill patients for long-range air transport.[2] The concept of the CCATT program is to manage casualties that require further resuscitation, stabilization, and critical care as necessary until they can reach a higher level of care at another facility.[1] Flights average 2 to 6 hours in length. The CCATT is made up of a physician, registered nurse, and respiratory therapist who have a critical care background.[1]

There are no previous publications on fever and aeromedical evacuation of combat-injured patients. Fever is an identified complication with implications for the progression of a patient's injuries, disease, and death.[3] Past research has been performed by pioneers in immunology and neurophysiology and identified fever as an adaptive physiologic response to some threat.[3] Trauma patients who sustain devastating injuries have a higher incidence of systemic inflammatory response syndrome (SIRS) that occurs as a result of these injuries.[2] SIRS to some degree is beneficial in clearing organisms that would hinder recovery, but overactivation can lead to increased mortality rates and complications, such as vital organ failure that leads to multisystem organ failure and/or death.[2] The incidence of wound infections, blood transfusion requirements, and critical care in trauma patients has also been noted in research, supporting the need for the critical care team to address these threats in a timely and efficient manner.[2] Simply stated, fever (elevated temperature) can often be the first sign of SIRS and sepsis, which needs to be identified, treated, and re-evaluated to prevent the life-threatening complications that accompany it in trauma patients.[4]

Thus, to improve care and outcomes in the previously described patient population, critical evaluation of the incidence of fever needs to be addressed. Our research objectives were to identify the incidence of fever in patients managed in the CCATT environment and to describe the complications reported and the treatments used in the care of these patients. We also investigated the current therapeutic, evidence-based treatment modalities for the management of fever that are used during flight in CCATT transports.

Methods

We performed a retrospective review and analysis of all available flight medical records of all charts from all trauma patients transported by the CCATT from theater base locations to Landstuhl Regional Medical Center (LRMC) between March 1, 2009, and March 31, 2010 (Figures 1-3). Inclusion criteria included all patients who had trauma-related injuries during this period that occurred at bases in Iraq and Afghanistan and who were transferred to LRMC, a tertiary care receiving point in Germany. All patients were adults (aged ≥ 17 years) and included active-duty military personal, coalition forces, civil service employees, government contractors, and residents of Iraq or Afghanistan. We excluded children,