

***Turn the Heat Up: A Focused Effort to Improve and Maintain Normothermia in Pediatric Burn Patients***

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**Purpose:** Our American College of Surgeons verified Level I Pediatric Trauma center manages nearly 200 inpatient burns a year, though it is not a verified burn center. Large (>20%) and more complex burns are frequently transferred to an ABA-verified burn center approximately 6-7%. In 2016, the pediatric transport team transferred 6 patients to a verified burn center. Half of these patients arrived with core body temperatures below 36.8. The total body surface area (TBSA) of these burns ranged between 15%-40%. The receiving burn hospitals were concerned about these major burn patients arriving to the facility with suboptimal temperatures. The burn task force met with the pediatric transport team to devise a strategy to warm these patients during transport to the burn center. In review of traditional warming measures used during transport, the Bair hugger, warmed blankets and warm fluid therapy was considered challenging to maintain in the fixed wing environment with space limitation and the controlling of aircraft temperature. The performance improvement project focused on achieving normothermia in major burn patients (TBSA>20%) during transport.

**Resources:** Trauma Services worked in conjunction with our transport team, Pedi-Flite, and the emergency department to begin using the Criticool blanket, a non-invasive solution for body temperature management, to achieve normothermia in burn patients. The Criticool blanket (MTRE Advanced Technologies, Yavne, Isreal) was currently being used to induce hypothermia in neonatal patients with hypoxic ischemic encephalopathy (REF). Criticool units are housed in the Transport Team area and are transported with the team when eligible patients are alerted. The criticool blankets come in 3 sizes from neonatal to pediatrics and a teen/adult size blanket. The Pedi-flite team members setup and monitor the criticool blankets when used. Training of ER and PICU staff will be offered through an online module as well as scheduled training session during staff meetings.

**Description:** A Normothermia guideline for patients with large burns (>20% TBSA). The Lund Browder chart must be used for calculations. The criticool machine will be packaged for transport with the Pedi-flite team when the patient has a report of >20% TBSA burns. On arrival to the facility, the Pedi-flite team will dress the patient with dry gauze, if not already done, apply the criticool blanket, set the desired temperature for the patient and transport the patient to the hospital. If the patient is transported to the hospital by any other EMS agency or transport provider, the Pedi-flite team will be called to the Emergency department with the criticool machine and supplies to apply the blanket once burns have been examined and treated. The blanket is wrapped around all 4 extremities and the patient's torso. Core body temperature is monitored with a Foley, which is connected to the criticool machine. The criticool machine circulates tap water through the blanket to warm the patient. The machine is set in the normothermia mode to the desired temperature. The heart rate, blood pressure, respiratory rate, core, and skin temperature are documented prior to initiation and every 15 minutes for the first hour. After the first hour, vitals are assessed hourly or per written orders. The criticool blanket should be discontinued after 48 hours.

**Effectiveness:** Four patients were transported to a verified burn center in 2017-2018 with the transport team using the Criticool blanket during transport. The burn size ranged from 17.5%-37% TBSA. The initial temperatures on arrival to our facility ranged from 36.8C-38.6C. The routes of temperatures varied from temporal artery, axillary, rectal and bladder. The patient's core body temperature on discharge from our hospital ranged from 37.5C-38.6C (rectal/bladder). The patients' temperature on arrival to the burn center ranged from 36.1C-39.1C, though these were not all core body temperatures (axillary and rectal). Inconsistency in mode for measuring temperatures led to variability in assessing normothermia on arrival to the accepting burn center. The ED, transport team and receiving burn facilities were educated on the importance of obtaining core body temperatures to ensure normothermia in burn patients.

**Lessons Learned:** The route of obtaining a temperature measurement varied between centers and providers. Communication between centers and education of our staff was necessary to ensure the core body temperatures were being recorded. To truly determine the effectiveness of the warming blanket, core body temperatures needed to be documented. Though the Pedi-flite team was trained and could maintain the blankets, PICU and ED staff needed training for patients with prolonged needs for warming. This education was set up as an online module and through staff meetings.

**Conclusions:** This pilot project reviewed 25 burn patient transfers from January 2016-June 2018. The project shows that after implementation and use of the criticool blanket on burn patients, it can be used safely to warm pediatric burn patients during transport. Further use will be monitored to examine the need for the criticool blanket while measuring

core body temperatures. Traditional methods for warming may be adequate for transport if core body temperature is maintained.

**Benefit to Others:** This project can improve temperature regulations for major burn patients and assist in preventing coagulopathy issues in patients which lead to other devastating outcomes for the patient.

**Implementation by Others:** The criticool blanket can be used to achieve normothermia in burn or trauma patients who present with ongoing hypothermia after failed attempts with other devices or mechanisms such as warm blankets, bair huggers and warmed fluids. The criticool blanket can be purchased from the manufacturer and our protocol can be used as a template for other trauma centers.