Highlights From Literature Review Of Clinical Usage: Ready-Heat Blankets

Note: The “HPMK” indicated below in following reports is the North American Rescue “Hypothermia Prevention and Management Kit”. Ready-Heat blankets are the warming source provided in the “HPMK”.

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Tactical Combat Casualty Care 2007: Evolving Concepts and Battlefield Experience

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….Since the basic principle of TCCC is to provide the best possible trauma management plan consistent with good tactics, the membership of the CoTCCC includes combat medics as well as physicians. Tri-service representation was critical to ensure that differences in doctrine and experience among the Army, Navy, and Air Force medical departments were captured. (Marine Corps combat operations are supported medically by Navy health services personnel.) The combat medics selected in included SEAL corpsmen, Navy corpsmen assigned to Marine units, Ranger medics, Special Forces 18-D medics, Air Force Pararescuemen, and Air Force aviation medics. Physician membership included representatives from the trauma surgery, research, emergency medicine, critical care, and operational medicine communities. Physician assistants and combat medical educators were also represented. A list of the membership of the original CoTCCC Combat Casualty Care (a total of 28) is included in Table I. The committee membership in 2004 to 2005 is shown in Table II. Upon its transition to a permanent body, the Committee’s membership was expanded to include greater representation for the Marine Corps and representation for the Public Health Service, including the Coast Guard.

Metrics
When new medical treatment plans are proposed, an evidence-based approach to documenting the efficacy of these treatments is desirable. This evidence is uniquely hard to gather from the battlefield, however, since studies are difficult to perform in this setting, especially randomized, prospective, controlled ones. Input regarding the outcomes from TCCC practiced on the battlefield can, however, be obtained from published case reports and case series as well as lessons learned reported by first responders describing their experiences with combat trauma care. The sections below will describe how various aspects of the TCCC guidelines have evolved from 1996 to the present and present available evidence for the various aspects of care.

7. Prevention of hypothermia Minimize casualty’s exposure to the elements.
Keep protective gear on or with the casualty if feasible
Replace wet clothing with dry if possible
Apply Ready-Heat blanket to torso
Wrap in Blizzard Rescue Blanket
Hypothermia on the Battlefield

The hypovolemic shock seen in trauma patients, however, both predisposes the casualty to hypothermia and is potentially worsened by the coagulopathy that ensues from hypothermia (Fries et al. 2002; Carr, 2004; Eastridge et al., 2006). Hypothermia-induced coagulopathy is well described and results from decreases in platelet function (Watts et al., 1998; Peng and Bongard, 1999; Wolberg et al., 2004), coagulation cascade enzyme activity slowing (Watts et al., 1998; Peng and Bongard, 1999), and alterations of the fibrinolytic system (Peng and Bongard, 1999). Hypothermia is a problem even in relatively warm climates, because the presence of hypovolemia causes decreased ability to produce heat and to maintain normal body temperature. This problem is exacerbated by aircraft-based CASEVAC, where the casualty is exposed to cooler temperatures and significant wind chill at altitude during a rotary-wing evacuation in an open-cabin airframe. Hypothermia has been found in recent years to be more prevalent than generally realized and was found to independently contribute to overall mortality (Arthurs et al., 2006). The importance of instituting aggressive steps to prevent hypothermia in the field has been emphasized (Peng and Bongard, 1999; Husum et al., 2002), and simple interventions have been demonstrated to be effective in decreasing the incidence of hypothermia in prehospital settings with prolonged evacuation (Husum et al., 2002). A number of specific interventions have been recommended in the 2006 TCCC guidelines to prevent hypothermia in combat casualties (McSwain and Salome, 2006). These interventions reflect the guidance on this topic provided by the Assistant Secretary of Defense for Health Affairs (Winkenwerder, 2006). These measures have only recently been put into place and no metrics are available at this point in time to document their efficacy in the current conflict. The article by Arthurs et al. (2006), however, clearly shows that hypothermia is an independent predictor of mortality in combat casualties in OIF.

Preventing Hypothermia: Comparison of Current Devices Used by the US Army in an In Vitro Warmed Fluid Model

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Background: The purpose of this study was to develop an in vitro torso model constructed with fluid bags and to determine whether this model could be used to differentiate between the heat prevention performance of devices with active chemical or radiant forced-air heating systems compared with passive heat loss prevention devices.

Methods: We tested three active (Hypothermia Prevention Management Kit [HPMK], Ready-Heat, and Bair Hugger) and five passive (wool, space blankets, Blizzard blankets, human remains pouch, and Hot Pocket) hypothermia prevention products. Active warming devices included products with chemically or electrically heated systems. Both groups were tested on a fluid model warmed to 37°C versus a control with no warming device. Core temperatures were recorded every 5 minutes for 120 minutes in total.

Results: Products that prevent heat loss with an actively heated element performed better than most passive prevention methods. The original HPMK achieved and maintained significantly higher temperatures than all other methods and the controls at 120 minutes ($p _{\leq} 0.05$). None of the devices with an actively heated element achieved the sustained 44°C that could damage human tissue if left in place for 6 hours.

Conclusions: Our in vitro fluid bag “torso” model seemed sensitive to detect heat loss in the evaluation of several active or passive warming devices. All active and most passive devices were better than wool blankets. Under conditions near room temperature, passive warming methods (Blizzard blanket or the Hot Pocket) were as effective as active warming devices other than the original HPMK.” [which includes Ready-Heat – note added]

CONCLUSIONS
From this testing, we cannot definitively conclude that all active methods are better than passive methods nor can we rank their performance as originally intended. Given the poor performance of the wool blanket when used alone during the course of this study, one must wonder about its utility given the advanced
technologies available today. Traditional single coverage passive products like the wool blanket and the space blanket may be adequate for 30 minutes; but if evacuation times exceed 30 minutes, the HPMK, RH, or Bair Hugger 505 may be a better choice. The observations that chemically heated devices performed as well or better than the Bair Hugger that requires electrical power, and that some passive prevention products (Blizzard, Hot Pocket) performed as well as the Bair Hugger system and the RH, is useful information for first responders who may need to keep casualties warm in the field or during evacuation; situations where power is unavailable. Also, we did not detect surface temperatures produced by the active warming devices that would indicate they would burn human skin.

The original HPMK maintained the highest temperatures to the starting 37°C compared with the other methods tested in preventing heat loss from this fluid model. This exact product is no longer available. However, the newer HPMK performed similarly to the original, and the slight difference may be an issue only in evacuation times exceeding several hours. It should be noted that a further refinement in the HPMK has been made to improve the product, which should continue to make it a valuable option for reducing heat loss.

### TABLE 1. Mean Core Temperatures of the Model at Times After Wrapping in Hypothermia Prevention Products

<table>
<thead>
<tr>
<th>Hypothermia Prevention Product Active (A) or Passive (P)</th>
<th>Mean Core Temperature, °C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>At 30 Minutes</td>
</tr>
<tr>
<td>Name</td>
<td>NSN*</td>
</tr>
<tr>
<td>Original HPMK(A)</td>
<td>6515-01-532-8056</td>
</tr>
<tr>
<td>New HPMK (A)</td>
<td>6515-01-532-8056</td>
</tr>
<tr>
<td>New RH (A)</td>
<td>6532-01-525-4062</td>
</tr>
<tr>
<td>Bair Hugger (A)</td>
<td>6530-01-463-6823</td>
</tr>
<tr>
<td>Blizzard blanket (P)</td>
<td>6532-01-524-6932</td>
</tr>
<tr>
<td>HRS (P)</td>
<td>Pending</td>
</tr>
<tr>
<td>Hot pocket (P)</td>
<td>----</td>
</tr>
<tr>
<td>HRP (P)</td>
<td>9930-01-331-6244</td>
</tr>
<tr>
<td>Space blanket (P)</td>
<td>7210-00-935-6666</td>
</tr>
<tr>
<td>Wool blanket (P)</td>
<td>7210-00-282-7950</td>
</tr>
<tr>
<td>Control</td>
<td></td>
</tr>
</tbody>
</table>
Figure 1. Temperature maintenance of active heating products (HPMKs, Bair Hugger, and RHs) during the 2-hour period compared with untreated controls. The original HPMK maintained the highest temperatures compared with the others at 120 minutes ($p < 0.05$). All products maintained significantly higher temperatures than controls and wool blankets from 60 minutes to 120 minutes. The HPMK was significantly better than the controls and wool blankets from 20 minutes to 120 minutes. Both RHs were better than the controls and wool blankets from 35 minutes to 120 minutes. Data represent the mean ± SD of five separate determinations for each product.

JTTS CLINICAL PRACTICE GUIDELINES FOR HYPOOTHERMIA PREVENTION, MONITORING AND MANAGEMENT
GUIDELINE ONLY—NOT A SUBSTITUTE FOR CLINICAL JUDGEMENT
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1. REFERENCES:
   b. DoD Instruction 6430.2, “DoD Medical Standardization Board”, 17 Mar 97
   d. Marine Corps Center for Lessons Learned, “Hypothermia Incidence in Trauma Patients and Prevention/Mitigation Measures: Analysis of data and information from Operation Iraqi Freedom, September 2003 to November 2005”, 5 Jan 06

2. PURPOSE. The purpose of this clinical practice guideline is to establish guidance for prevention and management of hypothermia. These recommendations are guidelines only and are not a substitute for clinical judgment.

4. BACKGROUND.
   a. Hypothermia is increasingly prevalent in our casualties during winter and is deadly
b. In order to best prevent hypothermia, situational awareness must be raised regarding the problem as well as proven preventive and treatment strategies.

BLUF:
- The following measures must be immediately implemented across the theater of operations until further notice:
  - temp dots on all immediate/urgent litter casualties (forehead) at Level II and during CASEVAC to Level III
  - keep EMT/OR temp 78-90 degrees F during casualty resuscitation
  - use warmed IV fluids and warm blanket and where available, forced air warming devices (Bair Hugger) as applicable (see details below)
  - implement mandatory documentation of patient temperature on arrival to and discharge from all Level II and III facilities (if non-core temp [axilla, tympanic] is high or low, use core temp [rectal, esophageal] measurement for best accuracy)
  - mandatory use of Hypothermia Prevention/Management Kits (HPMK – [includes Ready-Heat]) for all rotary wing evac/ground evac for Urgent Litter or intubated or Immediate triage category casualties (Level I to II and Level II to III)

The following outlines some general recommendations and how to use specific products at the different Levels of care found on the battlefield.

At Level 1 utilize
2. Blizzard Rescue Blanket NSN: 6532-01-524-6932 and
3. TechTrade ‘Ready-Heat’ Blanket NSN: 6532-01-525-4063 and
4. Thermo-Lite Hypothermia Prevention System Cap, manufactured by Encompass Techstyles (item # 5110-100)
5. Tactical Combat Casualty Care principles should be followed while preventing hypothermia:

**Tactical Field Care:**

a. In this phase of care of the patient, all attention should be directed towards preventing heat loss.

b. Stop bleeding and resuscitate appropriately. If available warm fluids should be used. This will start generating internal heat, facilitating rewarming.

c. Place the Thermo-Lite Hypothermia Prevention System Cap on the casualties head, decreasing heat loss from this exposed site

d. Place the patient on the Blizzard Rescue Blanket.

e. Remove any wet clothing and replace with dry clothes, if possible.

f. Place the Ready-Heat Blanket on the torso and back of the casualty with a layer of clothing or a sheet between the casualty’s skin and the Ready-Heat Blanket: This is a self heating blanket that requires no special activation. Once the ingredients are exposed to the air they instantly start to heat up to a max temperature of 104°F (40°C) for 8 hours.

g. Wrap the Rescue blanket around the casualty, effectively retaining the heat generated by the warming blanket next to the casualty.

On any evacuation platform utilize the:
2. Blizzard Rescue Blanket NSN: 6532-01-524-6932 and

a. During CASEVAC, the patient should remain wrapped in the Ready-Heat Blanket, Blizzard Rescue Blanket and hypothermia cap.