

## Post-Injury Hypothermia in Trauma:

# A CHILLING REALITY

by Robert M. Miller

Hypothermia is widely recognized as a life-threatening complication, particularly in situations involving traumatic injury and hemorrhage. Although results from inducing a therapeutic hypothermic state in specific cases of cardiac arrest, traumatic brain injury and spinal cord insult are promising and deserve special considerations, the scope of this discussion is limited to accidental hypothermia especially when complicated by the hemorrhage and shock which often accompany severe trauma, both penetrating and blunt. Without early preventative measures during patient transport, the survival of the trauma patient could well be at stake, even after arrival to the ED. Increased risk of cardiac instability, respiratory problems, infection and delayed surgical interventions due to re-warming issues are all very real possibilities. As first responders and pre-hospital care providers face the challenges of trauma management in the field, the chilling realities of post-injury hypothermia are well worth warming up to...



the body's internal temperature decreases, the level of severity increases. 93°F to 97°F classifies as mild, 86°F to 93°F as moderate, and less than 86°F as severe. This incremental decrease in temperature dramatically increases the likelihood of systemic damage and even death. Unlike primary hypothermia which has a mortality rate of less than 25%, secondary hypothermia in the trauma patient with a core temperature of less than 88°F is linked to a mortality rate of nearly 100%\*.

### The Mechanics of Hypothermia

These are the cold hard facts: a diminishing body temperature intensifies a destructive chain reaction which eventually affects every system in the body. The following is a snapshot of the chilling sequence as it dramatically unfolds:

**CLASS I:** Body temperature drops by 1-2°F below normal temperature. Mild to moderate shivering occurs. The casualty is unable to perform complex tasks. Blood vessels in the extremities constrict, decreasing heat loss. Respirations are quick and shallow..

**CLASS II:** Body temperature drops by 2-4°F. Extreme shivering occurs. Movements are slow and mental activity is accompanied by mild confusion. Blood vessels further constrict as the body focuses its remaining resources to keeping the vital organs warm.

**CLASS III:** Body temperature drops below 88°F. Shivering is usually absent. Cellular metabolic processes shut down. Below 86°F, the exposed skin becomes blue and puffy. Pulse and respiration rates decrease significantly. Ventricular tachycardia and atrial fibrillation can occur. Major organs fail.

### The Lethal Triad

With this intensifying drop in core temperature, a deadly downward spiral is set into motion as hypothermia is then joined by coagulopathy and acidosis. Collectively known as the "Lethal Triad", this serious combination surely lives up to its name. Blood flow continues to adjust as the body desperately struggles to regain its internal equilibrium. Coagulopathy then develops when vulnerable clotting factors are compromised by being either diluted, depleted or rendered totally inactive. The blood then loses its ability to clot normally. Perfusion decreases and oxygen delivery to tissues becomes impaired. In a third blow, acidosis sets in by attacking cellular metabolism and altering its function from aerobic to anaerobic. The result is the production of lactic acid, which in turn decreases effective cardiac output... and the cycle drives on until the damage is irreversible and death is imminent.

### The Key

Understanding and recognizing the Lethal Triad is key to the prevention of this downward spiral. Unfortunately in many cases, healthcare providers can actually contribute to this vicious cycle by incidental patient exposure and the delivery of cold fluids during resuscitation. Statistics indicate that successful intervention warrants a few simple preventative measures implemented early in the field, such as the removal of wet clothing, the application of self-heating reflective blankets and the warming of IV fluids. By actively addressing post-injury hypothermia, pre-hospital care providers can influence the outcome by more than just a few degrees. ■

**“Secondary hypothermia in the trauma patient with a core temperature of less than 88°F is linked to a mortality rate of nearly 100%\*...”**

\*Larry M. Gentilello, MD  
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Consider how often hypothermia is actually encountered in the prehospital setting. Since statistics indicate a direct link between trauma and hypothermia, the chances of dealing with this complication are inevitable. On the military front, recent data from the Global War on Terrorism reflects a high percentage of casualties sustained on the battlefield present in a mild to moderate hypothermic state. This is consistent even in environments with elevated ambient temperatures. Likewise, as many as 66% of civilian trauma patients arrive at the hospital in a mild hypothermic state, at the very least.

The severity of hypothermia is reciprocal to the body's core temperature. This simply means that as

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