Heat Loss Through the Head and Hypothermia

By wildernessmedicinenewsletter

The rate of heat loss, at rest, with exercise, and with hypothermia

Since there has been a fair amount of interest regarding Myth #2 in the Wilderness Medicine Newsletter – Frozen Mythbusters, Nov/Dec 2004 – the topic deserves more discussion.

MYTH #2 states. *"If your feet are cold, cover your head because you can lose up to 75% of your body heat through your head alone.*

The problem is that the head is only about 10% of the body surface area. Thus, the head would have to lose about 40 times as much heat per square inch or centimeter compared to the rest of the body.

Gordon had heard this statement one too many times and finally decided to see if this was indeed true. So he took several test subjects, all volunteers, of course, (you have to wonder what problem they caused at the university), wired them to monitor their core temperatures, and discovered that we do indeed lose heat through any exposed part of the body and the amount of heat we lose depends on the amount of exposed surface area. The rate of heat loss is relatively the same for any exposed part of the body not simply the head. You do not lose heat significantly faster through the scalp than any other portion of the body with the same surface area.

It is still a good idea to put on a hat (a hood really – what insulation does a baseball hat have?) if your feet are cold. But what is BUSTED is that there is nothing peculiar or unique about the head. The idea that we lose heat faster through out scalp, because of the constant blood supply to the brain, is simply a myth. (One that I personally have believed for many years.)"

UPDATE & DISCUSSION

#1 Heat loss via the head at rest, during exercise, and with hypothermia:

I did have the opportunity to speak with Dr. Murray Hamlet about this topic, and we hope this additional information will help to clarify heat loss in the hypothermia patient.

The cerebral blood flow is supplied via the carotid and vertebral arteries (4 in total) and is constant. The blood flow to the brain does not change as the demand for oxygen is constant. As a result, when you look at total heat loss, the head accounts for about 7% of the heat lost.

The cerebral blood flow does, however, vary based on cardiac output – the harder your heart beats, the greater the blood flow to the brain. And as you increase the blood flow to the brain, you also increase the percentage of heat loss. As it turns out, when you begin to exercise, there is increased cerebral blood flow. This increases the percentage of heat lost through the head to about 50% of total body heat loss. But as the person continues to exercise, the muscles demand more oxygen which increases blood flow. To ensure thermoregulation and maintain normal core

temperature (exercises increases body heat), the skin vasodilates which increases blood flow to the skin to cool the blood. The net result is a decrease in the total blood flow to the brain and a decrease in percentage of total body heat lost through the head to about 10%. Once sweating begins, the percent lost through the scalp returns to 7%.

In Gordon's research his test subjects were at rest in cool water, and the researchers were comparing the rate of heat lost by monitoring core temperature through different body parts and quantities of skin exposed. At rest, they found that the rate of heat loss only depended upon the amount of skin surface area exposed, and the percentage of heat lost through the head was the same as the rest of the body.

Research at the Army Research in Environmental Medicine labs showed that there was a temporary increase in heat loss through the scalp that returned to the baseline of 7% as the subjects continued to exercise.

Now, what about hypothermia and heat loss through the head?
If the hypothermia victim is not shivering, they are at rest, and the heat loss through the head remains about 7%. But, this is important, if they are shivering, the percent of heat loss via the scalp can increase to upwards of 55%, so protecting the head well is a very important part of treating the hypothermia patient. And as you can imagine, the primary defense against the cold and hypothermia is vasoconstriction of the peripheral circulation, this shunts blood to the core, reduces circulation to the skin, and increases the percent of heat loss through the scalp.

The difference is that the shivering hypothermia patient is indeed exercising, but they do not vasodilate the peripheral circulation; the shivering muscles increase metabolic demand and cardiac demand so the patients do increase their cardiac output; therefore, they do increase cerebral circulation; therefore, they do increase the percent of blood loss through their head.

Treatment of the hypothermia victim:
Remove from the cold.
Get them dry and keep them dry.
Insulate from the ground.
Hypothermia wrap:
Re-insulate with dry insulation.
Cover and protect the head from further heat loss.
Cover and protect the hands and feet from frostbite.
Surround with a windproof and waterproof layer.
If conscious, feed warm, sweet liquids.
If unconscious, evacuate and handle very gently to prevent ventricular fibrillation.

#2 How does being in water change the equation?

Life-preserver, personal flotation device (PFD), research has shown that when in the water, if your head and neck are wet, you cool faster. This is why modern PFD's hold the person in the water with their head and neck out of the water; even if unconscious, to decrease the rate of heat loss into the water.

#3 What difference does hair on your head or facial hair make?

None.
In order for hair or fur to provide a protective thermal barrier, it has to be much denser than what we humans grow and it has to be in layers of different types of fur to provide a thermal barrier. Beards are great, but they do not keep you any warmer. And bald is beautiful.

We at the Wilderness Medicine Newsletter appreciate the comments and discussion.