Skin Temperature Measurement in Acute Neurotrauma: The Unknown Tool

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Human body temperature has physiological and deleterious implications. The reflection of temperature is from dysfunction at the metabolic level to dysfunction of organs. Body temperature is one of the key vital signs for homeostasis. The brain is one of the key locations where temperature fluctuation can lead to a major clinical impact on the body. As a matter of fact, the brain controls body temperature through the central controller in the hypothalamus. The brain is susceptible to injury even with small systemic changes in temperature. The development of fever due to systemic causes has been considered a factor associated with the core approach for critically ill patients.

The measurement of body temperature can offer us some information about brain temperature. On the other hand, an acute neurological injury generates an increase in brain temperature like hemorrhagic/ischemic stroke, acute cerebral edema, subarachnoid hemorrhage, or traumatic brain injury. The same brain conditions can lead to hypothalamus injury and central fever.

Brain and spinal cord relationship with body temperature is not straightforward. Roth et al looked at the brain injured patients and temperature distribution. There was normal gradient in normal subjects from head to toes with lower temperature in the toes. Higher basal metabolic rate will blur this gradient. With brain injury, this gradient is deranged due to reduced vasoconstriction.[1] These patients probably should not have their temperature checked in the lower part of the body. The temperature-sensing neurons are present in the anterior hypothalamus. These neurons send the signal for vasodilation of the skin and sweating when the brain temperature increases to reduce the central temperature of the body. The afferent signals from the skin go to the posterior hypothalamus to inhibit these neurons, leading to vasoconstriction.[2] Hence, the higher temperature of the brain is more of an active process, while a systemic drop in the temperature is a negative active process. The relationship of skin temperature to the brain response was shown in the trial where the subjects' face was immersed in cold water when in a hyperthermic state leading to bradycardia followed by tachycardia. The direct relationship was noted due to the cooling effect of ophthalmic venous inflow to the hypothalamus area.[3] The interrelationship of skin and brain was shown in the experiment where scalp cerebral evoked potential was recorded with the application of temperature-changing stimuli to the palms. The location of temperature response was the same as the sensory perception on the cerebral cortex.[4] While the use of skin temperature can be very useful, the pitfall is the temperature differential between this parameter and the core temperature especially brain temperature. Epidural temperature is noted to be approximately 1°C higher as compared with rectal temperature.[5] Bladder temperature was found to be 0.5°C lower compared with brain.[6]

We believe that in places where resources are scarce, the application of body temperature measurement can offer us an additional marker to establish potential neurological damage and make more intensive management of the measures applied in patients with neurotrauma. A general concept of adding 0.5 to 1°C to surface temperature can help with an overall clinical picture in neurotrauma and closer control of brain temperature.

Conflict of Interest
None declared.

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