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2019-10

Pesonen , E , Silvasti-Lundell , M , Niemi , T T , Kivisaari , R , Hernesniemi , J & Makinen , M-T 2019 , ' In response to : "Temperature monitoring with zero-heat-flux technology in neurosurgical patients" ' , Journal of Clinical Monitoring and Computing , vol. 33 , no. 5 , pp. 931-932 . https://doi.org/10.1007/s10877-019-00275-2

http://hdl.handle.net/10138/319381
https://doi.org/10.1007/s10877-019-00275-2

unspecified
publishedVersion

Journal of Clinical Monitoring and Computing (2019) 33:931–932
https://doi.org/10.1007/s10877-019-00275-2

LETTER TO THE EDITOR

In response to: "Temperature monitoring with zero-heat-flux technology in neurosurgical patients"

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Received: 16 January 2019 / Accepted: 4 February 2019 / Published online: 15 February 2019

To the Editor,

We appreciate the interest and comments by Menzel and Bräuer [1] on our study "The focus of temperature monitoring with zero-heat-flux technology (3M Bair-Hugger): a clinical study with patients undergoing craniotomy [2]."

Menzel and Bräuer focus on an intriguing and important question: what is the brain temperature? All clinically used temperature measurement sites (nasopharynx, esophagus, tympanum, pulmonary artery, jugular bulb, bladder, rectum) are extracranial, remote to the brain. It is known that the direct brain tissue temperature, obtained invasively under diverse circumstances (e.g. neurosurgery, intensive care and deliberate hypothermia), may be higher than the systemic core temperature [3, 4]. On the other hand, inconsistent and unpredictable individual brain-body temperature differences and reversal of the temperature gradient of brain injury and neurosurgical intensive care patients have been reported [5, 6].

Menzel and Bräuer [1] report unique data on six neurosurgical intensive care patients, in whom the zero-heat-flux thermometry could be compared with concomitant temperature measurements obtained by implanted brain tissue temperature probes. The brain tissue temperature was 0.49 °C higher than the zero-heat-flux or bladder temperatures. The zero-heat-flux or bladder temperatures, on the other hand, were equal. This indicates that in neurological patients at risk of brain damage, deeper brain temperature monitoring may offer valuable additional information.

However, even the concept of "the brain temperature" is not unequivocal. Different temperatures at different sites of the brain parenchyma have been reported [7]. Even in a condition of an intact skull, non-invasively with magnetic resonance spectroscopy measured brain temperature in the frontal lobe was 0.5 °C lower than the temperature in the thalamus [8]. Cooling effect of craniotomy may further confound interpretation of local brain temperature measurements. There is a cortical temperature gradient at the site of craniotomy [9, 10].

The zero-heat-flux thermometry on the forehead seems to reach the core temperature compartment of the body. Thus, the zero-heat-flux system placed on the forehead estimates accurately enough core temperature of elective neurosurgical [2], as well as gynecological [11], vascular [12], cardiac [12, 13], and abdominal [14] surgical patients. In the craniotomy patients of our study [2], invasive brain temperature monitoring was neither necessary nor ethically acceptable. According to the data by Menzel and Bräuer, the temperature measured invasively deeper in the brain was higher than the zero-heat-flux temperature on the forehead. We agree with Menzel and Bräuer that the zero-heat-flux temperature on the forehead should not be regarded as "the brain temperature". We further agree that in case of severe brain injury or pathology, conventional core or zero-heat-flux thermometry should be completed with direct measurement of brain temperature [15].

This Letter to the editor is a response to the article available online at https://doi.org/10.1007/s10877-019-00274-3.

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