LETTER

Reply to Chawla and Seneff: Near-death electrical brain activity in humans and animals requires additional studies

We concur with Chawla and Seneff (1) on the importance of gaining scientific understanding of the dying process (2) and are aware of their interesting study demonstrating a brief surge of electrical activity in dying human patients (3).

Chawla and Seneff (1) state that our study "largely confirms" their hypothesis (3) that the "end-of-life electrical surges" (the term used by Chawla and Seneff) "could be responsible for near-death experiences." Although there are compelling similarities, we would like to clarify several points of distinction between their study and our recently published work (2).

First, the details of the algorithm used to generate Bispectral Index (BIS) values [reported for six of seven patients in the Chawla et al. study (3)] are proprietary, and therefore it is currently impossible to make a direct comparison of our study with those using the BIS monitor.

Second, BIS and related monitors, such as the SEDline, have been used primarily to monitor depth of anesthesia during surgery. These processes have not been validated for monitoring features of conscious information processing in waking humans. In contrast, the parameters examined in our study (power density, coherence, directed connectivity, and cross-frequency coupling) have been investigated in the brains of waking individuals by various investigators, as cited in our paper (2). Furthermore, because they are derived from scalp electroencephalogram, current depth-of-anesthesia monitors are not as reliable for high-frequency and low-amplitude brain activity as the intracranial electrodes used in our study.

Third, the critically ill patients studied by Chawla's team were reported to be "previously neurologically intact" (3). The criteria used to assess neurologic status were not specified. Patients with poor neurological function before arrest may exhibit different characteristics compared with patients reporting near-death experiences, who are largely cardiac arrest survivors with no known neurological deficits. Our study used perfectly healthy animals, thus ruling out the potential contribution of aberrant and pathological neuronal activity in the near-death surge of brain activity.

To compare our studies with those using the BIS or other monitors, one would need to perform the two kinds of analyses simultaneously in the same individuals (rats or humans). This type of study may bridge human and animal studies, and facilitate the understanding of neurophysiology of the dying brain.

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1 Chawla L, Seneff MG (2013) End-of-life electrical surges. *Proc Natl Acad Sci USA* 110:E4123.

2 Borjigin J, et al. (2013) Surge of neurophysiological coherence and connectivity in the dying brain. *Proc Natl Acad Sci USA* 110(35): 14432–14437.

3 Chawla LS, Akst S, Junker C, Jacobs B, Seneff MG (2009) Surges of electroencephalogram activity at the time of death: A case series. *J Palliat Med* 12(12):1095–1100.

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The authors declare no conflict of interest.

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