

Letter to the Editor: Transient BIS elevations during caloric testing in brain death: artifactual or physiological?

Ceylan Delice M.¹, Kavrut Ozturk N.²

¹Department of Anesthesiology and Reanimation, Van Training and Research Hospital, Van, Turkey

²Department of Anesthesiology and Reanimation, Antalya Training and Research Hospital, Antalya, Turkey

Dear Editor,

We present an unusual bispectral index (BIS) monitoring phenomenon observed during standard brain death testing, which may carry clinical implications for BIS interpretation in neurocritical care practice.

During a routine evaluation of brain death, 72 hours after traumatic brain injury, in a 40-year-old male, we observed a physiologically unexpected BIS response. At our center, the BIS™ VISTA Monitor (Covidien, Mansfield, MA, USA) is routinely used for neurological monitoring in patients with severe brain injury. Typically, transient low BIS values (0–10) are attributed to signal noise or electrode artifacts and are occasionally encountered, even in patients with clinically confirmed brain death.

In this case, corneal reflexes, deep tracheal suctioning, and oculocephalic maneuvers produced no observable changes in BIS. Bilateral caloric testing was then performed using 20 mL of ice-cold saline (0–4 °C) instilled into the external auditory canal over 30 seconds. The patient's head was elevated and rotated according to standard protocols. During right-sided irrigation, the BIS rose abruptly to 56; on the left, it peaked at 15. BIS values returned to baseline (0–5) within minutes in both instances.

Importantly, no neuromuscular blocking agents were administered. The patient subsequently met all established brain death criteria, including the absence of brainstem reflexes, positive apnea testing, lack of cerebral perfusion on CT angiography, and a predominantly isoelectric EEG. Given that BIS is intended to quantify cortical electrical activity, such elevations are paradoxical in the context of irreversible cessation of intracranial function. While not approved for brain death confirmation, BIS monitoring may respond to extracranial stimuli through electromyographic (EMG), autonomic, or mechanical pathways. Caloric testing is a brainstem evaluation, and under typical circumstances, should not affect BIS which targets cortical signals.

We propose several mechanisms for these findings. Cold vestibular stimulation may activate subtle EMG activity around the forehead or periorbital region, leading to artifacts. Escudero and colleagues and Vivien et al. reported similar findings, where BIS values in brain-dead

patients normalized after administration of neuromuscular blockade, implicating EMG interference [1, 2].

Cold saline may also transiently alter electrode–skin interface conductivity, particularly in critically ill patients with fragile skin, generating artifacts unrelated to cerebral activity. Hamal et al. emphasized the susceptibility of BIS to such signal distortion [3]. Other confounders include ECG pulsation, subtle movement, or impedance fluctuations. Myles and Cairo et al. reported BIS elevation due to unfiltered cardiac signals in an otherwise isoelectric patient under full neuromuscular blockade [4].

Although spinal reflexes may persist in brain-dead patients, they are not expected to affect BIS directly. However, muscle contractions near BIS sensors, triggered peripherally, could produce misleading elevations. Additionally, thermal stimuli may provoke vasomotor or autonomic reactions, leading to electrode noise [5, 6].

Vestibular stimulation may also influence autonomic tone or cardiovascular rhythm. These fluctuations could result in pulsatile pressure changes detectable at the BIS electrode. Myles et al. [7] emphasized the vulnerability of BIS to extracerebral signals in low-amplitude EEG states.

BIS was designed for anesthetized patients with preserved brain function. It cannot reliably differentiate between cortical and extracranial signals in the context of brain injury or brain death [8]. These limitations may lead to misinterpretation of values, particularly when BIS is used outside its validated indications.

In summary, we report transient and reproducible BIS elevations in a clinically and electrophysiologically confirmed brain-dead patient during caloric testing. This paradox highlights an interpretive limitation of BIS in neurocritical care and underscores the need for caution when incidental BIS activity is observed in this context. We encourage further electrophysiologic investigation to clarify BIS behavior in brain-dead patients.

This article complies with institutional ethical standards. All procedures were performed as part of routine brain death assessment, and no identifiable patient data were included.

CORRESPONDING AUTHOR:

Dr. Meltem Ceylan Delice, ceylanmeltem93@gmail.com

Článek přijat redakcí: 24. 8. 2025; Článek přijat k tisku: 21. 10. 2025

Cit. zkr: Anest intenziv Med. 2025;36(4):296-297