Journal of Experimental and Clinical Medicine
https://dergipark.org.tr/omujecm

Case Report

J Exp Clin Med
2023; 40(1): 186-187
doi: 10.52142/omujecm.40.1.35

Post arrest bispectral index monitoring

Serdar ÖZDEMİR[1,*], Oktay ÖCAL[2], Hasan DEMİR[2], Yasin METİNER[3], Tuba CİMİLLİ[2], Aysel HÜNÜK[4], Özge ECMEL ONUR[5]

[1]Department of Emergency Medicine, University of Health Sciences Ümraniye Training and Research Hospital, İstanbul, Türkiye
[2]Department of Emergency Medicine, University of Health Sciences Fatih Sultan Mehmet Training and Research Hospital, İstanbul, Türkiye
[3]Department of Emergency Medicine, Bitlis Tatvan State Hospital, Bitlis, Türkiye
[4]Department of Emergency Medicine, İstanbul Tuzla State Hospital, İstanbul, Türkiye
[5]Department of Emergency Medicine, Marmara University, İstanbul, Türkiye

Received: 06.02.2022 • **Accepted/Published Online:** 01.07.2022 • **Final Version:** 18.03.2023

Abstract

The bispectral index is an electroencephalography-based technology used to monitor sedation. BIS is a processed EEG parameter designed specifically to assess patient responses to sedation and anesthesia. This case report aimed to discuss the bispectral index changes during resuscitation of a patient who applied at the emergency unit with cardiopulmonary arrest in light of the literature.

Keywords: bispectral Index, electroencephalography, cardiopulmonary arrest, cardiopulmonary resuscitation

1. Introduction

Cardiopulmonary resuscitation (CPR) includes medical support in circulatory and respiratory arrest. The quality of CPR, especially the quality of chest compressions and minimization of interruptions, are the most critical determinants of the cause of cardiac arrest and its treatment success. Cellular damage from ischemia/reperfusion injury is a dynamic process, and in cardiac arrest, there is a therapeutic window in which effects can be reduced after resuscitation. Neurological prognosis is very difficult to determine early after resuscitation from cardiac arrest. In most cases, attempts to determine prognosis are not possible from the return of spontaneous circulation (ROSC) to at least the 72-hour mark (1).

Bispectral index (BIS) is an electroencephalography (EEG) based technology used to monitor sedation. BIS is a processed EEG parameter designed specifically to assess patient responses to sedation and anesthesia. It is used primarily in an operating room setting and is increasingly used in the ICU. It has a sensor placed across the patient's forehead to detect the electrical activity in the brain (2). We performed the multivariate statistical analysis and combined relevant EEG features to produce the BIS, a number strongly correlated to the clinical endpoint of the hypnotic state and displayed on a linear scale (0-100). This scale includes arousal states such as awake, sedation, deep sedation, and coma. A BIS value as 100 means an awake state, while a value below 60 and 40 means deep sedation and deep anesthesia or hypnotic state, respectively (3).

This report aimed to present our case who applied at the emergency unit with cardiopulmonary arrest and was monitored by BIS during CPR.

2. Case

A 64-year-old man applied at the emergency unit with cardiopulmonary arrest. His family mentioned that he was admitted to the hospital several times and discharged from the coronary intensive care unit a week ago. The patient had a history of hypertension and congestive heart failure. We performed cardiopulmonary resuscitation successfully for half an hour. After resuscitation, his vital signs were the following: Body temperature 36.1°C; blood pressure 85/64 mmHg; and heart rate 74 beats per minute. We monitored the patient with BIS. BIS values remained between 0 and 10 for half an hour. Then his BIS started to rise, and it reached 61 in the fiftieth minute after resuscitation (figure 1). Widespread ST depression was present on post-resuscitation electrocardiography. Echocardiography evinced ejection fraction as 20%. We admitted the patient to the intensive care unit. He was extubated after three days of ventilatory support. We discharged the patient without any sequelae after 5 days of

*Correspondence: dr.serdar55@hotmail.com

intensive care follow-up and 3 days of clinical follow-up. An informed consent form about publication of this case was obtained from the patient and his son.

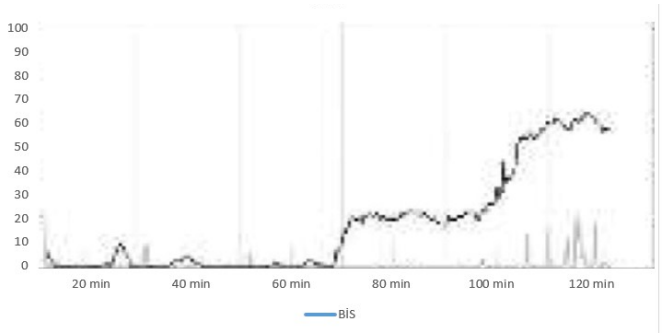

Fig. 1 Bispectral index

3. Discussion

BIS is a parameter originating from a mathematical analysis of data taken from the electroencephalogram. It is a simple, easy to interpret and noninvasive method. A BIS of 100 represents an awake individual, while a BIS of 0 represents complete electrical silence (2). Using BIS may greatly benefit clinical management by assessing the central nervous system function. A high BIS value reflects cerebral activity and should encourage the team to continue CPR. On the other hand, it is not clear to stop CPR and make death decisions according to a low BIS. Many care reports showed the potential benefit of BIS monitoring during resuscitation from cardiopulmonary arrest. Our case showed that BIS could be low, even zero in post-resuscitation, but it could rise after an hour.

EEG changes due to impaired cerebral perfusion and cerebral ischemia are defined as isoelectric EEG monitoring following voltage loss. In the literature, BIS changes due to cerebral hypoperfusion and stroke have been reported as case reports in patients who underwent perioperative BIS monitoring (5,6). Welsby et al. reported a patient with an unexpected BIS decrease during coronary bypass graft operation and a post-operative stroke. They claimed to have encountered a stroke and that this decrease might have been due to it (5). Morimato et al. suggested that this decrease might have been due to cerebral hypoperfusion in a patient who had a BIS decrease during an arteriovenous shunt operation (6). A study evaluating the relationship between ischemic stroke and BIS reported a low BIS in patients with acute ischemic stroke. The authors associated this lowness with low EEG waveforms caused by cerebral hypoperfusion (7). Similarly, Küsken et al. showed that it associated with pathological findings in patients with head injury (8).

Researchers in the literature have shown that ROSC was associated with sharp increases in cytokines and other inflammatory response markers (9). On the other hand, arterial carbon dioxide levels and partial pressure after ROSC have been shown to correlate with clinical outcomes. Additionally, specifically, hypocapnia is associated with worse neurological outcomes (10).

In conclusion, based on our clinical experience in this case, we think that BIS may be a predictor like other effective predictors of ROSC. We believe that researchers should be encouraged to do more research on the relationship between BIS and ROSC.

Conflict of interest

None to declare.

Funding

None to declare.

Acknowledgments

None to declare.

Authors' contributions

Concept: S.Ö., O.Ö., H.D., Y.M., T.C., A.H., Ö.E.O., Design: S.Ö., O.Ö., Ö.E.O., Data Collection or Processing: S.Ö., O.Ö., H.D., Analysis or Interpretation: S.Ö., Ö.E.O., Literature Search: S.Ö., O.Ö., H.D., Y.M., T.C., Writing: S.Ö., H.D., Y.M., T.C., A.H., Ö.E.O.

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