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LETTER TO THE EDITOR

Artifactual increase in bispectral index caused by connector contaminated with povidone–iodine

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To the Editor,

Bispectral index (BIS) is a monitor for hypnotic states and reduces the risk of awareness in patients undergoing general anesthesia [1]. However, BIS values often fail to reflect the actual hypnotic state of patients in a clinical setting. Electromyography (EMG) hyperactivity or artifact signal pollution caused by electrical device interference can be displayed as an increase in the BIS value [2, 3].

Our patient was scheduled to undergo Burr hole trephination due to chronic subdural hematoma. The patient's vital signs, train of four (TOF), and BIS were routinely monitored, and the patient was anesthetized with total intravenous anesthesia using a target-concentration infusion system of propofol and remifentanil. The BIS monitor probe was placed on only the right side of the forehead because the patient was alert and the hematoma was not significantly large. For a few minutes after commencement of the surgery, the procedure progressed without complications, however, after 30 min, the BIS increased to 80 without a concomitant change in the vital signs. We assumed that the target concentration of propofol was low and we increased it, but the BIS did not decline. Although the TOF ratio was 0, rocuronium, a neuromuscular blocking agent, was administered to exclude EMG activation. Subsequently, the BIS decreased to its previous level of 40, but within a few minutes, it increased to over 80. No changes were observed in blood pressure or pulse rate. Good access and functionality of the anesthetic intravenous line was confirmed. Once more, the propofol concentration was increased and rocuronium was injected, but this time, the BIS level did not drop below 80. We hypothesized that this situation might have been caused by artifacts. When the surgery ended, using another BIS machine, we attached a new BIS sensor to the patient's head and placed it superior to the existing BIS sensor (Fig. 1a). We observed a significant difference between the new (28) and the existing (90) BIS level (Fig. 1b). On visual inspection of the first BIS sensor, it was confirmed that the connector site was contaminated with povidone–iodine (Fig. 2). The increase in BIS was attributed to an artifact error due to povidone–iodine contamination, the BIS sensor was removed in order to dress the patient's surgical site, and the patient began to awaken from anesthesia. Since the TOF ratio of the patient was 0, and therefore, suggestive of a deep block, 4 mg/kg of sugammadex was administered. The recovery time to a TOF ratio of 0.9 was 3 min, and the patient was extubated on regaining consciousness. The patient was transferred to the post-anesthesia care unit without any complications. The next day, the patient was interviewed to confirm the absence of side effects such as awareness during surgery. When the contaminated part of the BIS sensor was wiped clean and re-used, it was found to be working adequately and faultlessly.

In this patient, although the blood pressure and pulse rate were stable, and the anesthetic intravenous line was functional, the BIS values increased. The povidone–iodine solution penetrated the connector site at the time of surgical draping and created an artifact. This artifact is theorized to have caused an overcurrent that resulted in an increase in the EEG frequency (particularly in the EMG region) and therefore, precipitated an increase in the BIS. There have been reports of cases of increase in the BIS due to various artifactual causes. The nerve stimulator used for monitoring of the facial nerve may increase the EMG and, subsequently, the BIS values [4]. The BIS is also affected by electrocautery [5]. In patients with severe ischemic brain injury, it has been reported that the BIS, which should be lowered, is recorded at normal levels due to ECG artifacts [6]. The BIS is also affected by detachment of the endovascular coil used in interventional neuroradiology [7]. However, as in our case, a BIS connector contaminated with povidone–iodine

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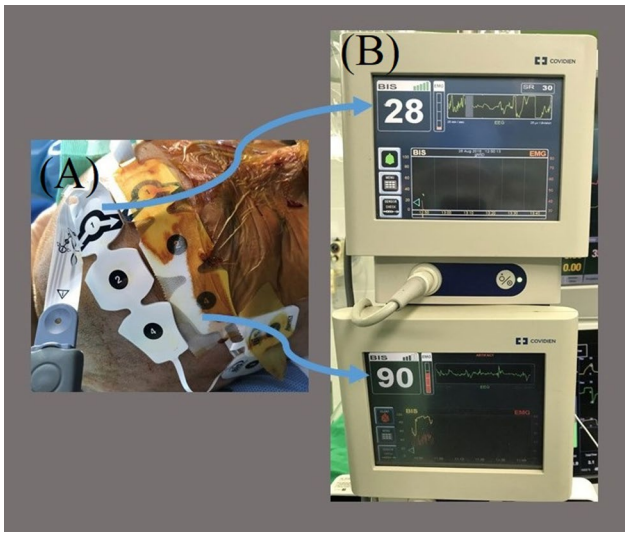

Fig. 1 Simultaneous BIS measurement with both the contaminated and new machine and sensor (upper arrow). It can be seen that the BIS value measured by the newly attached sensor is markedly lower

Fig. 2 Povidone–iodine contaminated BIS connector

may increase the BIS value. Particularly if the surgical site is the head, it may be necessary to seal the connector site with transparent tape to avoid contamination with povidone–iodine and to observe for possible contamination.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

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