Interference with BISTS™ values from a forced-air warming device

Editor—Bispectral Index™ (BIS, Covidien®, USA) is a dimensionless number derived by processing EEG signals according to a proprietary algorithm. Since its introduction in the 1990s as a monitor designed to ‘measure’ the hypnotic state of a patient under anesthesia and possibly reduce the incidence of awareness and recall, there have been conflicting reports on whether its use actually reduces incidence of awareness.1 2 Nonetheless, it is used in many institutions. In spite of advances in BISTM technology and improved artifact detection, there have been reports of interference leading to values inconsistent with the hypnotic state of the patient.3 We report a case of interference of BISTM readings with a forced-air warming device. A 50-yr-old morbidly obese woman was undergoing a robotic laparoscopic hysterectomy. Standard ASA and neuromuscular monitoring was used. An upper body forced-air warming device (Bair Hugger™, Arizant HealthCare Inc., MN, USA) was applied to maintain core temperature. Anaesthesia was maintained through the surgery, persistent hypertension unresponsive to boluses of esmolol and hydromorphone was noted. A BISTM monitor (A-2000 XP Platform™ series) applied at this time to detect level of consciousness during the case gave a value of 90–95 at 1.2 MAC of sevoflurane, which persisted at that range despite boluses of propofol. Signal quality index (SQI) was adequate with no visible artifacts on EEG trace; but there was significant facial EMG activity. Concurrent train-of-four monitor revealed no twitches. Fine vibratory movement of the plastic flap of the Bair Hugger™ covering the patient’s face was noted. Hypothesizing that these clinically inconsistent BISTM values were artifactualy elevated as a result of mechanical interference, we interposed a small towel as a barrier between the plastic flap and BISTM sensor and noted immediate decrease in EMG activity with BISTM values dropping to 25–30, necessitating a reduction in sevoflurane concentration. Her haemodynamics stabilized with additional doses of esmolol and the rest of the operative course was uneventful. She denied any intraoperative recall on interview in the postanaesthesia care unit.

BISTM is subject to interferences both pharmacological and non-pharmacological (mechanical/electrical).3 Electrocautery, pacers, endoscopic shoulder shaving systems, ENT positioning systems, and forced-air warming devices have been reported to cause interference.3 4 5 While some distort SQI and cause visible artifacts, other devices do not, making such detection challenging.3 Interference from forced-air warming devices has been reported with earlier versions of BISTM (BISTM A-1000 and A-2000)5 but not the newer A-2000 XP version which incorporates an SQI and facial EMG bar to detect fidelity of signals. It seems likely that the interference resulted from transmission of mechanical vibration of the plastic flap of the warming device to the BISTM sensor on the forehead. This is supported by the observation that the BISTM and EMG readings immediately fell to clinically consistent values when these were separated. BISTM remains susceptible to interference despite technical advances and risks inadvertent anaesthetic overdose. BISTM values should be interpreted with caution in situations where they are inconsistent with clinical judgement.

Declaration of interest

None declared.

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3 Dahaba AA. Different conditions that could result in the Bispectral Index indicating an incorrect hypnotic state. Anesth Analg 2005; 101: 765–73
4 Guignard B, Chauvin M. Bispectral index increases and decreases are not always signs of inadequate anesthesia. Anesthesiology 2000; 92: 903
and is a cause of patient dissatisfaction. Laryngoscopy and tracheal intubation can cause injury to the pharyngeal mucosa which results in inflammation leading to POST. The use of smaller tracheal tubes, supraglottic devices, careful instrumentation of the airway, gentle suction of the oropharynx, water-soluble jelly on the tracheal tube, lower intracuff pressure, gargles, etc. have been used to reduce the incidence of POST.

It is known that N-methyl-D-aspartate (NMDA) has a role in nociception and inflammation. NMDA receptors are found in peripheral nerves and in the central nervous system. Hence NMDA antagonists such as ketamine work on peripheral nerve endings in pharyngeal mucosa and can decrease the incidence of sore throat. Magnesium is an antagonist of the NMDA receptor ion channel and it is available as powder, paste, or solution. We evaluated the efficacy of nebulized magnesium sulphate for attenuating POST. Forty adult patients, ASA I or II, of either sex, undergoing elective open cholecystectomy were randomized in two groups. Group C received 3 ml saline nebulization and Group M received 3 ml (225 mg) of isotonic magnesium sulphate nebulization for 15 min, 5 min before induction of anaesthesia. We assessed the incidence and severity of POST at rest and on swallowing and side-effects at 0, 2, 4, and 24 h in the postoperative period. The incidence and severity of POST was found to be reduced at rest and on swallowing for all time points (P<0.05).

We chose nebulization over a gargle as it can be used in unconscious patients and children. We conclude that nebulization with magnesium sulphate before induction of anaesthesia is an effective method for decreasing incidence of POST.

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7 Ascher P, Nowak L. Electrophysiology studies of NMDA receptors. Trends Neurosci 1987; 10: 284–8
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**Is age a predictor of mortality in a UK medical high dependency unit?**

Editor—I welcomed the recent study on mortality in a UK high dependency unit. I particularly enjoyed the editor’s key points which I repeat here:

- Age does not predict the outcome from a medical high dependency unit in the UK.
- More than two organ support and pre-admission moderate/nursing home care are associated with worse outcome.
- Selected elderly patients should not be denied higher levels of care.

The editor’s second point is a useful guide to point out to my medical colleagues and fellow anaesthetists, who have limited interest in critical care. Also, most importantly, these points help those of us practicing in the District General Hospitals manage our meagre resources efficiently. For the sake of completeness and without blinding us again with statistics—the sample size is small—100. I have been in critical care a little more than 10 yr and I cannot agree more with the editor’s summary.

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**Reply from the authors**

Editor—We thank Dr Adegoke for his comments on our paper. The arguments we make are likely to become only more relevant as the pressure placed on critical care resources increases with the combination of an ageing population in an economic downturn. We recognize that the sample size is relatively small, although this does represent a prospective series in which significant findings were obtained from a pre-planned analysis. Medical high dependency units represent an under-researched area which has unique patient cohorts and requirements. Further work is needed to better define the outcomes for these patients,