LETTER

Electroacupuncture interferes with bispectral index monitoring

As we were interested in the use of bispectral index (BIS) monitoring during the application of acupuncture, we conducted a PubMed search on 31 July 2012 using the keywords ‘acupuncture’ and ‘bispectral index’. This yielded 23 articles reporting the use of BIS during evaluation of the effects of acupuncture. Except for the paper by Zheng et al1 recently published in this journal, none of these articles mentioned the possible interaction of the acupuncture point stimulation procedure with EEG, which is the primary signal used in the BIS algorithm for monitoring the depth of anaesthesia. We present a clinical case which supports the concerns of Zheng et al on the influence of electroacupuncture (EA) on EEG.

After giving informed consent, a 73-year-old woman received auricular EA during elective extracranial skin surgery. Total intravenous anaesthesia was induced and maintained with propofol (4–8 mg/kg/h), and the opioid analgesic sufentanil was given in a total dose of 50 μg during 140 min of anaesthesia to blunt noxious responses and keep the heart rate and blood pressure within 20% of the baseline level. The patient did not receive any other drugs which might have influenced the EEG signal during EA and BIS monitoring. The airway was secured with an endotracheal tube and lung ventilation was mechanically controlled to keep end-tidal carbon dioxide at 4.5–5.3 kPa. The depth of anaesthesia was measured using a BIS Intellivue MP70 monitor (Philips Medical Systems, Germany). The body temperature was maintained within 1°C of the baseline level.

Two steel needles 0.22×13 mm (Vinco, China) were inserted 1.5 cm apart at the auricular concha ipsilateral to the attached BIS sensor. Stimulation was applied using the PuntoBravo device (MTR GmbH, Germany) yielding biphasic rectangular impulses with a length of 200 μs, intensity of 5 mA and varying frequencies (figure 1).

As a result, EA caused clear changes in the raw EEG curve which is used for BIS calculation. The signal quality index (SQ on figure 1) decreased and electromyographic activity (EMG) and burst suppression index increased during EA compared with no stimulation (upper curve on figure 1). It is known that even smaller artefacts introduced by EMG or electric devices into raw EEG may be misinterpreted by the BIS algorithm as cerebral activity and thus lead to falsely high BIS values.2

We observed EEG artefacts under EA with 5 mA applied to the concha of the ear—that is, remote from the BIS sensor where acquisition of the EEG signal takes place. We presume that the stimulation of acupuncture points VG24 and Yintang (vicinity to BIS sensor) with

Figure 1 Screenshots taken during monitoring of the bispectral index (BIS) in a patient during general anaesthesia without electroacupuncture (upper screenshot) and under stimulation with various frequencies. On the left side of each screenshot is a raw EEG curve, in the middle is the BIS trend in time, and on the right side are the numerical values of BIS, electromyographic activity (EMG) and signal quality index (SQ). BSV, Burst Suppression Verhaeltnis (German)=Rate. Note that EMG and BSV values increased and the SQ value decreased during electroacupuncture in comparison with baseline (no intervention).
10–15 mA might produce even stronger changes in the EEG signal. Zhang et al solved this problem in their investigation by stimulating the needles intermittently with BIS measurement. However, the issue of EA and EEG interaction might be of interest for future studies where the authors wish to stimulate acupuncture points of cranial location and simultaneously measure the intraoperative effects of acupuncture on the depth of anaesthesia using one of the available monitors (eg, BIS). To evaluate the exact influence of EA on BIS values, an appropriate experimental investigation in patients undergoing extracranial surgery under general anaesthesia is required.

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