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Axel R. Heller, Thea Koch, P. Panousis

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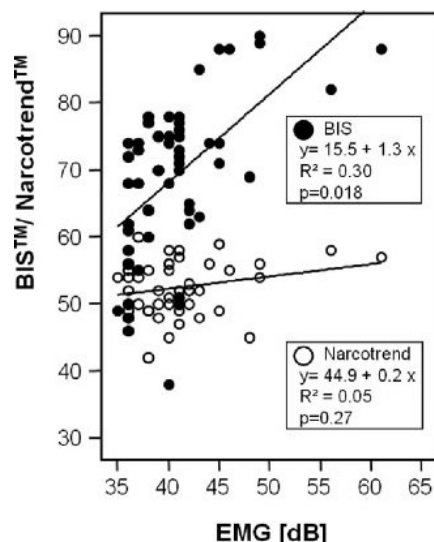
## The Effects of Electromyographic Activity on the Bispectral Index During Combined Anesthesia

### To the Editor:

Liu et al. (1) addressed an interesting topic in their article concerning the influence of a muscle relaxant bolus on the Bispectral Index (BIS) and Datex-Ohmeda entropy during induction of anesthesia. We would like to add a similar observation about the effect of electromyographic activity (EMG) on the accuracy of the BIS.

After obtaining IRB approval and written informed consent from each patient, we enrolled 60 patients in a study designed to investigate the effects of different concentrations of epidurally administered ropivacaine on the desflurane requirement under the combination of thoracic epidural analgesia and general anesthesia. After inserting a midthoracic epidural catheter, followed by induction of general anesthesia, we gave patients 10 mL ropivacaine 0.3% and 10  $\mu$ g sufentanil epidurally every 60 min. We maintained anesthesia with 1.5%–2.0% desflurane and 65% N<sub>2</sub>O. We continuously recorded the output of the BIS® XP monitor and the Narcotrend™ (MonitorTechnik, version 2.0 AF).

In six patients EMG activity increased to more than 35 dB during surgery as indicated by the BIS® XP module's EMG signal. This was accompanied by an increase in BIS from 40–55 to 70–80, indicating inadequate anesthetic depth. There was no change in the Narcotrend,



**Figure 1.** Scatterplot of BIS and Narcotrend values vs. EMG in six patients with EMG activity above 35 dB. In these six patients the increased EMG was significantly correlated with increasing BIS. There was no correlation between EMG and Narcotrend.

nor was there any clinical evidence of inadequate anesthesia. In the other 54 patients, EMG remained less than 35 dB during surgery.

In the six patients with EMG activity, the end-tidal concentration of desflurane was set to an age-adapted 1 MAC, and patients received additional remifentanyl, as mandated by the study protocol. These interventions did not alter the BIS values. On the basis of the findings of Bruhn et al. (2), we then gave these six patients a bolus of 10 mg atracurium. The BIS declined within 2 min to a value between 40 and 50, and the EMG value decreased to 25–30 dB. We analyzed the BIS and Narcotrend data for these six patients and found a significant correlation between the BIS and the EMG more than 35 dB. Narcotrend values did not correlate significantly with the EMG (Figure 1).

Similar to the findings of Liu et al., we found that the BIS XP is clearly affected by high levels of EMG activity.

Periklis Panousis, MD

Thea Koch, MD, PhD

Axel R. Heller, MD, PhD, DEAA  
Department of Anesthesiology and Intensive  
Care Therapy