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New findings and trends for depth of anesthesia monitoring

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The first article on the qCON was published in 2014, accompanied by an editorial by Johan Ræder in Acta Anaesthesiologica Scandinavica [1]. Over the last four years, a number of papers and abstracts have been published validating the qCON.

The present article by Kim et al. [2] 'Influence of electrocautery-induced electromagnetic interference on quantitative electroencephalographic monitoring of hypnosis during general anesthesia: comparison between the ADMS® and the BIS VISTA™' [2], compares the qCON with the BIS and their resistance to electrocautery. This is an important issue because electroencephalogram (EEG) monitors, which show too high values during the maintenance phase, could give rise to wrong conclusions, and hence erroneous administration of anesthetics. In the worst case, if a processed EEG monitor shows a too high value, for example, 50 instead the real value 30, then too deep anesthesia may not be detected. Recent science has shown that too deep anesthesia might lead to post-operative cognitive dysfunction, which is a serious adverse effect of anesthesia.

The article by Kim et al. [2] shows that the BIS increased on average 16 units during extended use of electrocautery, while the qCON only increased 1 unit.

The EEG is a small electrical signal and is therefore susceptible to external interference. Consequently, the design of the electronics of the monitors must be of high quality to ensure that electrical interferences do not affect the index.

The EEG reflects the changes in the brain caused by the anesthetics. For two decades, depth of anesthesia monitors have been on the market to predict the hypnotic effect of intravenous as well as volatile anesthesia [3,4]. The new trend is to include predictions of the nociception/antinociception balance as well. The Conox monitor is equipped with an index of nociception, the qNOX, which is a prediction of the probability of response to noxious stimulation during surgery. The qNOX is an index using a scale from 0 to 99 where 99 indicates high probability of response to noxious stimulation. Decreasing index values mean less probability of response to surgical stimuli [1].

There are other methods for prediction of the antinociception balance based on hemodynamic parameters such as heart rate variability [5] or the surgical pleth index [6]. Another method is based on the change of the size of the pupil [7].

Another new trend is advisory systems or closed loop where a processed EEG monitor is controlling the amount of anesthetics to be administered to the patient. Rugloop, developed by Tom de Smet and Michel Struys, uses a TCI system to define a closed loop algorithm for the control of Propofol. The system is performing well and described in a number of articles [8].

Besides, Medsteer has the capacity of controlling both Propofol and remifentanil. They have used the qCON and qNOX in their closed loop system and shown that closed loop ensures a higher percentage of patients within the adequate anesthesia range and hence lowering the risk of awareness on one side and too deep anesthesia on the other side [9].

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