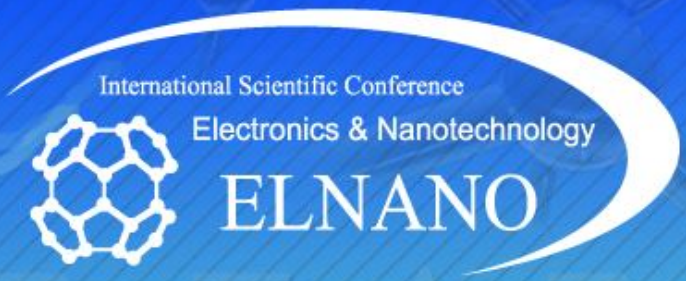
National Technical University of Ukraine "Kyiv Polytechnic Institute"

Electronics and Nanotechnology

Proceedings of the

XXXI International Scientific Conference



April 12-14, 2011

Kyiv, Ukraine

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ELECTRONICS AND NANOTECHNOLOGY

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2011

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Organized by

National Technical University of Ukraine «Kyiv Polytechnic Institute»;
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Health Protection and Medical Provision Central Administrative Board of Kyiv Municipal State Administration;
International Research and Training Center for Informational Technologies and Systems;
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Methods of monitoring depth of anesthesia

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Abstract – **The basic methods for assessing depth of anesthesia are presented, and the modern devices for control during the operations are considered. Much attention is paid to currently existing algorithms and systems for evaluating depth of anesthesia using human electroencephalogram. A detailed analysis of the advantages and disadvantages of each considered technique is done.**

Keywords – **general anaesthesia, consciousness, anaesthesia monitors**

I. INTRODUCTION

There is still no single indicator that would adequately assess depth of anesthesia during surgery. Therefore the depth of anesthesia is measured by aggregate vital functions of the patient's, such as pupil reflex, the parameters of the cardiovascular system (heart rate, blood pressure, and electrocardiogram parameters), and analysis of patient expiration gases. These evaluation parameters are not very reliable because they depend on many factors, including age, sex, character of human disease and character of surgical intervention. This makes control of anesthesia in a complex process with high probability of mistake [1].

II. MAIN PART

The first EEG-mono-parameter was the Bispectral-Index or BIS, which was first introduced in 1992 and after 1999 others followed (e.g., Narcotrend, AEP-Monitor/2, PSA, CSM etc.) These monitoring systems analyze the biopetential fluctuations measured from the patient’s forehead. After the signals are digitazed, the pre-processing unit determines which part of the signal is going to be analyzed. Next, the artefact algorithm is applied to remove possible artifacts stemming from eye movement, swallowing or heart activity. The quality of the artifact removal algorithm is therefore crucial for the reliability of the depth of general anesthesia (DGA) monitor. On the other hand, these artifacts are sometimes used as surrogate parameters, e.g., detection of swallowing determines the steady state of GA. Furthermore, the electromyogram (EMG) can also be used as surrogate parameter since the movements of the facial muscles are clearly visible in the frequency spectrum above 30 Hz. Consequently, the increase of the EMG surrogate parameter is interpreted as a decrease of the anaesthetic’s effect and vice versa. Next, algorithms in commercial monitors were trained and tested for the signals from the databases. The measured signal is then compared with the samples from the database and classified. Consequently, the index is as good as the database for which it was trained. Finally, the calculated index values are post-processed to minimize fluctuations on the output.

This is done by averaging over past index values, which stabilizes the index, but adds delay into the index calculations. Therefore, all commercial indices are: (a) constructed abstract quantities that are not directly linked to any physiological parameters and (b) have an inherent time delay (Figure 1). In the report some of the depth of anaesthesia monitors will be presented, which are in use in clinical practice and have endured some amount of clinical testing [2].

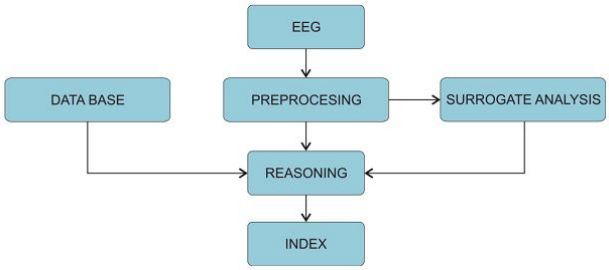

Fig.1.The conceptual diagram of a DGA monitor [2]

III. CONCLUSION

Despite the high level of development of modern medicine there is no single method of assessment of depth of anesthesia. The systems used mow have significant disadvantages. DGA monitors directly measure the concentration-dependent affect of a limited number of general anaesthetics on the brain and indirectly the state of consciousness during GA. However, despite this, attempts to create a universal indicator of anesthesia bring scientists to understand the processes in the human brain during GA.

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