

Auditory Evoked Potentials (AEP) for the measurement of depth of anaesthesia

Can AEP predict patients' reaction to well-defined stimuli?

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ABSTRACT

This PhD dissertation is based on three scientific papers. The work was performed at the departments of anaesthesiology at Vejle Hospital and Odense University Hospital.

Background: Anaesthetists currently have no effective objective method available for determining depth of anaesthesia. This readily results in under- or over-dosing of anaesthetics with a risk of awareness under anaesthesia, cardiovascular system side effects, or prolonged emergence from anaesthesia. Today, several monitors for the measurement of the depth of hypnosis are available. The purpose of the study is to evaluate critically one of them, while this expensive type of monitor is being introduced in Danish operating theatres.

The initial point of our series of experiments is the following: As clinical anaesthetists we would like to know if our patients are sufficiently anaesthetised to certain strong stimuli, which are about to happen. It isn't sufficient to assess, after the fact, in what manner the patient reacted. A patient can appear to be anaesthetised one moment, at a given level of stimulation, and a few seconds later, at e.g. endotracheal intubation, skin-incision etc. show signs of insufficient anaesthesia.

Auditory Evoked Potentials (AEP) have been shown to be an effective method for measuring depth of hypnosis. A new monitor for AEP measurement has been developed in Denmark (A-line AEP Monitor), which expresses the depth of anaesthesia by an index (A-Line ARX Index = AAI).

Aim: To assess the precision of a prototype of the A-line AEP Monitor and to test the hypothesis that the depth of anaesthesia index shows a graded response with changing steady-state end-expiratory concentrations of sevoflurane. Furthermore we assessed the efficacy of the A-line AEP Monitor as a tool for predicting satisfying conditions for the insertion of a laryngeal mask airway and endotracheal intubation.

Results: In study 1 it could be demonstrated that the prototype version provided satisfactory precision. The attenuation of the A-line ARX index for middle latency AEP during general anaesthesia was profound. However, the monitor did not show a graded response with changing end-expiratory steady-state concentrations of sevoflurane. Study 2 and 3 showed that A-Line ARX Index could indicate the level of depth of anaesthesia necessary for acceptable laryngeal mask insertion conditions and endotracheal intubation under general anaesthesia with sevoflurane. However, end-expiratory sevoflurane concentration predicted insertion conditions better than AAI and may turn out to be more useful in the clinical setting.