Educational Software For Teaching: Neuromonitoring In Anesthesia And Critical Care
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Abstract
NEURALIS is a specific interactive, multiple-choice educational software package for neuromonitoring in anesthesia and critical care. The system runs on Windows 95, 98 or NT 4.0. The system is based on a databank consisting of a presentation module and a question-answer module. Both components contain texts, diagrams and bit maps. The contents are organized in six categories for users to assess their knowledge. The question blocks contain a variable redundancy mechanism and the individual questions can be configured in an increasing order or randomly. NEURALIS was evaluated by 108 participants at three international postgraduate workshops for neuromonitoring. On a scale of one to five (1 = excellent, 5 = poor), the average score was 1.13. This indicates a very good acceptance of this educational tool by users.

INTRODUCTION
The use of computer-assisted learning is increasing rapidly in undergraduate and postgraduate medical education. NEURALIS, developed in 1995 and updated regularly, is one of the first comprehensive medical educational software packages. It was developed with a multiple-choice mode for postgraduate training in neuromonitoring in anesthesia and critical care and is also being used for training medical students.

METHODS
NEURALIS was developed with the CBT tool BD EXPERT to run on Windows 95, 98 or NT 4.0. The educational objectives are organized in blocks on electrophysiology in anesthesia and critical care, electroencephalography, evoked potentials and technical and clinical methods.

With automatic statistical evaluation, both the student and the teacher can evaluate the answers to individual questions as well as knowledge in the different subject blocks. Then a training program can be planned. In the question module the user can choose an adaptable redundancy mechanism and an increasingly consistent question mechanism as well as a subject-oriented or random query mode. The answer module contains a correct-incorrect evaluation as well as an evaluation compartment. The system can be expanded with animations and video clips.

To evaluate the acceptance of NEURALIS as a postgraduate teaching tool, the system was evaluated by 108 anesthesiologists, critical care specialists and biomedical engineers on a five point scale (1 = excellent, 2 = good, 3 = satisfactory, 4 = fair, 5 = poor).

RESULTS
The following figures are examples from the question–answer module from different subject groups.

Fig 1 a,b – 4 a,b: NEURALIS-examples.
Figure 1

Anesthesia
Which is anesthetic agent leads to an increased amplitude of cortical somatosensory evoked responses?
- Propofol
- Etomidate
- Thiopental
- Midazolam

Figure 2

SSEP

cervical
cortical

Figure 3

VEP
At which VEP scalp distribution is the patient in a deep coma (GCS 3)?
- VEP preserved in the occipital lead
- VEP preserved over the vertex

Figure 4

ANSWER INCORRECT
In a deep coma VEP is preserved in the occipital lead and absent over the vertex and in the remaining leads.

Figure 5

Intensive Care
Which electrical signals in the brain can be absent in patients with isolated brainstem death? (multiple answers possible)
- EEG
- BAEP
- Cerebral SSEP
- VEP

Figure 6

ANSWER INCORRECT
Cortical somatosensory evoked potentials and brainstem auditory evoked potentials are absent in isolated brainstem death (see figure) because the respective pathways in the brainstem can be interrupted.
The mean score in the evaluation of NEURALIS by 108 postgraduate users was 1.13 (Figure 5).

Figure 5: Statistical analysis of NEURALIS acceptance.

We have used NEURALIS since 1995 and presented the system in 1997 [8]. The system has been updated repeatedly to keep pace with advances in neuromonitoring and has been used with high acceptance (Fig. 5) in postgraduate training [http://www.anaesth.med.tu-muenchen.de/neuro.html] as well as in the education of medical students. Up to now the software is only designed for german language and is used as a part of the postgraduate training. It is not commercially available at the moment.

References
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