Psychomotor testing to detect changes in cerebral function

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Previous work has suggested that atmospheric nitrogen may have a detectable effect on cerebral function.[1] From the oil/gas solubility of nitrogen it can be theoretically predicted that the fractional MAC (f MAC) of nitrogen in air at 1 ATA to be 2–4% of 1 MAC. On the hypothesis that changes of cerebral function of this order may be detected by psychomotor testing a comprehensive computer program named 'Psychom' has been developed to perform this task based on responses to sound and visual stimuli. An IBM ×86 compatible personal computer (PC) was used for the development of the software, data acquisition and analysis. Modern PCs of this family allow the production of both sound and visual stimuli, using interface devices such as push buttons and measure the time with very high precision (up to processor frequency). The Windows NT operating system was chosen as the software platform. The programming language used for the software development was C++ with Borland C++ Builder 6, as interactive development environment (IDE). Visual component library (VCL) was used as the basis for the program. The hardware interaction between the user and the software has been accomplished via two custom-made push button switches. Technology from a standard USB/PC2 mouse controller has been used for the development of the switches. The developed system allows the operator to design, save and load different experimental protocols with windows based easy-to-use visual interface. The duration and nature (fixed or random time intervals) of both stimuli can be easily configured by the user using a drop down selection menu. During an experiment the system continually collects data

and performs basic statistical analysis corresponding to the subject's visual and/or sound responses. The statistical results can be viewed at the end of the experiment using a specially designed adjustable viewer. Also, during acquisition, the data are saved in a file in a format that can be easily accessed and used for further offline processing and analysis by conventional commercial statistical packages. Preliminary laboratory tests were carried out on healthy volunteers to evaluate the functionality of the system. An experimental protocol has been suggested and implemented. This protocol allows the generation of sound and visual stimuli to run simultaneously at random intervals (1–3 s) for a period of 3 min. Two volunteers, one that is accustomed and one that is not accustomed to drinking alcohol, were selected to perform the tests before and after the intake of 100 ml of 40% alcohol. The performance of the system was successful and statistical results were automatically generated at the end of the test. The reaction times for visual stimuli before and after the intake of alcohol were 393 and 560 ms correspondingly. Similarly for the sound stimuli the reaction times were 433 and 602 ms. In the subject accustomed to alcohol no significant effect was found.

These preliminary encouraging results confirm the successful operation of this new software system and suggest further evaluation on more rigorous clinical studies.

Keywords: anaesthetics gases, nitrogen; brain, cerebral function; brain, psychomotor tests

Reference

1 White DC, Lockwood GG. *Br J Anaesth* 2003; **91**: 465P