Evaluation of a new method of assessing depth of sedation using two-choice visual reaction time testing on a mobile phone


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Background

- An objective measure of the degree of sedation produced by propofol would be useful both in clinical practice to help reduce the incidence of over-sedation and in research studies.
- A number of methods for monitoring level of sedation have been suggested previously however none is ideal.
- Observer or patient-rated sedation scales
- EEG measures
- Bispectral index
- Auditory evoked potentials
- Visual reaction time (VRT) has recently been suggested as a useful measure of depth of sedation
- Until now, measurement of VRT has only been described using equipment that is inconvenient in the clinical setting (patients wearing goggles attached to a personal computer)
- It is now possible to perform similar tests of VRT using handheld computers or mobile telephones

Aims

In this study we assessed whether VRT, measured by a two-choice test using a specially programmed mobile telephone, was correlated with level of propofol sedation

Methods

- Unpremedicated ASA I and II patients were studied immediately before elective surgery
- 2 baseline recordings of VRT were performed using the ArrowRT programme (www.penscreen.com) on a mobile telephone
- Propofol was then given by effect-site target-controlled infusion with a customised system (Marsh model with a kα = 0.8/min)
- Initially, an effect-site target concentration (CeT) of 0.3 mcg/ml was set and this was increased in 0.2 mcg/ml increments until the patient became too drowsy to carry out the test
- At each level of sedation, once the calculated effect-site concentration (CeCALC) reached the target:
  - 2 measurements of VRT were made, each test lasted one minute
  - Patients were asked to rate their level of sedation using visual analogue scales (VAS) (Figure 1)
  - An observer’s assessment was made using the validated Observer’s Assessment of Alertness/Sedation (OAA/S) scale (Figure 2)

Results

- 20 patients (13 M; aged 46 ± 10 (mean ± SD), range 28 - 64) were studied
- VRT increased with increasing propofol effect-site concentration in all patients (Figure 3)
- There was little change in VRT at a CeCALC up to 0.7 but a marked increase in VRT at higher propofol concentrations
- The increase in VRT from baseline before patients became unable to carry out the test was 187 ± 96% (range 85 - 472%)
- The CeCALC at this point was 1.64 ± 0.38 (range 1.1 - 2.5mcg/ml)
- To allow for the fact that individual subjects differed in their response to propofol, a dose metamer was calculated for each subject. This was scaled so that 1.0 was the dose at which the VRT was 1.5x the baseline level. This allowed the dose-responses to be compared more easily (Figure 4)
- Patient VAS scores also increased with increasing propofol CeCALC but the last score measured before the patient became too drowsy to complete further VAS assessments was very variable (range 4 - 99 mm)
- OAA/S score fell with increasing propofol CeCALC. In all 19 subjects who completed the study to the point where they were unable to carry out the VRT and VAS tests, OAA/S score had fallen to 3
- OAA/S score was better correlated with VRT (Spearman’s r = -0.85) (Figure 5) than with VAS (r = -0.64) (Figure 6)

Discussion

- Increasing levels of propofol sedation cause an increase in two-choice VRT that is particularly marked just before the patient becomes too drowsy to carry out the test
- The pattern of increased VRT at higher propofol CeCALC is similar to that documented by Kim et al. However, we have shown with the aid of a dose metamer (Figure 4) that this response is not linear as Kim et al suggested
- VRT appears superior to patient-rated VAS scores in the assessment of depth of propofol sedation
- We have shown that VRT can be measured conveniently using a specially programmed mobile telephone which is portable and easy to use

References