

## **Comparison of the Ability of the Quantum Consciousness Index and Bispectral Index to Predict Propofol Effect-Site Concentrations and Probability of Tolerance to Laryngoscopy During Propofol and Remifentanyl Induction**

**Objective:** The present study compares the performance of two electroencephalographic derived depth of anesthesia monitors, the Bispectral Index (BIS) (Covidien, US) and the Quantum Consciousness Index (qCON) (Quantum Medical, Spain). We compared prediction probability (Pk)[1] to detect effect-site concentration of propofol (CePROP) and probability of tolerance to laryngoscopy (PTOL) during effect-site controlled induction of anesthesia with four different combinations of CePROP and effect-site concentrations of remifentanyl (CeREMI).

**Methods:** After IRB approval, 80 patients scheduled for elective surgery were randomized in four groups. Anesthesia was induced using effect-site controlled, target controlled infusion with CePROP set to 8.6, 5.9, 3.6 or 2 $\mu$ g/mL while the corresponding CeREMI was set to 1, 2, 4 and 8 ng/mL respectively. When titrated to steady-state conditions each of these combinations yield a PTOL of 90% according to Bouillon et al. [2,3]. The BIS and qCON, CePROP and CeREMI were recorded every second while the (non-steady state) PTOL and Noxious Stimulation Response Index (NSRI) were computed post hoc using the formula of Luginbühl et al [4,5] NSRI is a derivative of PTOL and is proposed as measure of potency of combined opioids and hypnotics.[5] Data were used from 2.5 minutes before to 11 minutes after starting pumps.

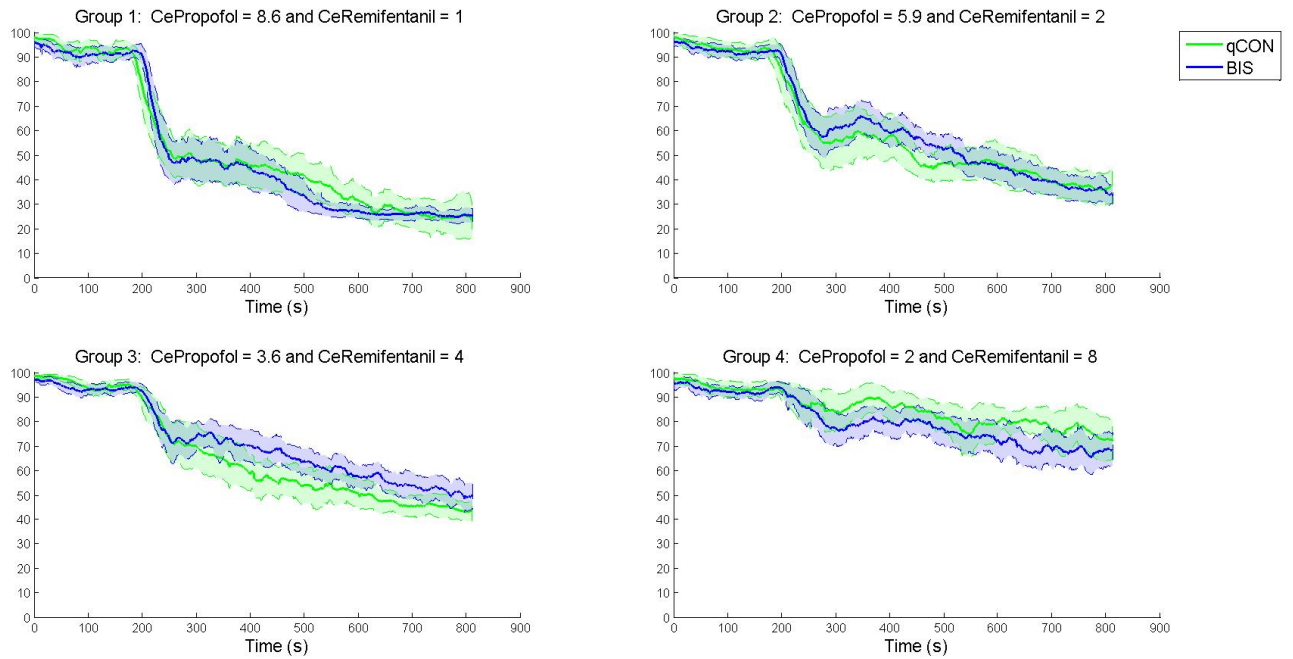
The prediction probability (Pk) [1] for CePROP and NSRI was obtained for each index by averaging ten thousand Pk values that were calculated using one data point per patient in each iteration to guarantee independent inputs. The two sets of Pk's were tested for Gaussianity (Lilliefors test). The sets of Pk values did not follow a Gaussian distribution. Wilcoxon rank test was used to compare the sets of Pk's for respectively CePROP and NSRI.

**Results:** Patients enrolled were adults from both genders with age  $53 \pm 13$  years, weight  $79 \pm 14$ kg and height  $174 \pm 9$ cm (mean  $\pm$  standard deviation). Figure 1 shows the average trend of qCON and BIS in each of the groups. qCON showed an average Pk value of  $0.849 \pm 0.028$  (Pk $\pm$ SE) for CePROP and  $0.885 \pm 0.034$  for NSRI; Pk values of the BIS were  $0.863 \pm 0.027$  and  $0.909 \pm 0.031$  respectively. No statistical significant difference in Pk's was found between qCON and BIS for predicting CePROP and NSRI, respectively.

**Conclusions:** BIS and qCON show similar predictive performance for CePROP and NSRI during induction of anesthesia using four different targets of CePROP and CeREMI all yielding a similar PTOL (90%) after 11 minutes of drug administration. The comparability in predictive performance of qCON and BIS is independent of group randomization. The similarity in results for NSRI (or PTOL) are probably related to CePROP that is a part of the NSRI formula.

1. Smith WD, Dutton RC, Smith NT. Stat Med 1996; 15: 1199-215.

2. Bouillon TW, Bruhn J, Radulescu L et al. Anesthesiology 2004; 100: 1353-72
3. Bouillon TW: Handbook of Experimental Pharmacology 182. Ed. Schuttler J, Schwilden H. Berlin Heidelberg, Springer-Verlag, 2008, pp 471-87
4. Luginbühl M, Schumacher PM, Vuilleumier P et al. Anesthesiology 2010; 112:872-80
5. Vereecke HEM. Hannivoort LN, Proost JH et al. Abstract ISAP 2014.



**Figure 1:** qCON and BIS average values versus time (solid lines) and 95% confidence intervals (dashed lines) during induction for the four combinations of CePROP and CeREMI.