

Detection of Awareness during Anesthesia: Bispectral Index™ (BIS™) or Patient State Index (PSI)?

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Introduction

Patient state index (PSI, Physiometrix Inc.) and bispectral index™ (BIS™, Aspect Medical Systems, Inc.) are both EEG-derived parameters correlating with the hypnotic component of anesthesia [1, 2]. The present study evaluates the ability of BIS™ and PSI to separate unconscious from conscious patients and to detect a period of awareness.

Methods

Following written informed consent, 40 unpremedicated patients scheduled for surgery under general anesthesia were enrolled into the HIC-approved study. Standard monitoring parameters, BIS™ and PSI were continuously recorded. Patients were randomly assigned to one of the following anesthetic regimens: 1: sevoflurane (S) + remifentanyl (R) (≤ 0.1 mcg kg⁻¹ min⁻¹), 2: S + R (≥ 0.2 mcg kg⁻¹ min⁻¹), 3: Propofol (P) + R (≤ 0.1 mcg kg⁻¹ min⁻¹), 4: P + R (≥ 0.2 mcg kg⁻¹ min⁻¹). From induction of anesthesia, every 30 sec patients were asked to squeeze the investigator's hand. R infusion was started. In groups 1 and 2, S was administered via mask, in groups 3 and 4 P was injected (50 mg, followed by 20 mg boluses until loss of consciousness (LOC1) occurred). Following LOC1, circulation of the right forearm was separated from the body by a tourniquet for 5 min, maintaining ability to follow command while succinylcholine (1.0 mg/kg) was given and patients were intubated. Following intubation, P or S was stopped until patients followed command (return of consciousness, ROC1). P or S was re-started, LOC2 occurred. At the end of surgery, drugs were discontinued. Following ROC2, patients were extubated. After compensation for index calculation time, BIS™ and PSI at LOC1+2 were compared with BIS™ and PSI at ROC1+2 (student t). Prediction probability [3] was calculated from BIS™ and PSI values 30 sec before (time interval of command) and immediately following LOC1+2 and ROC1+2.

Results

Figure 1 shows BIS™ and PSI values at LOC1+2 and ROC 1+2. At LOC1+2, BIS™ (66±17) and PSI (55±23) were significantly lower than at ROC1+2 (BIS™: 79±14; PSI: 77±18, mean±SD, p<0.01). Prediction probability was 0.68±0.03 (BIS) and 0.69±0.03 (PSI).

Discussion

Despite of significant differences between mean values at awareness and mean values at unconsciousness with both BIS™ and PSI, both parameters may not be sufficient to detect awareness in an individual patient. This is mainly due to inter-individual variability and is reflected by a prediction probability of less than 70%.

References: [1] Br J Anaesth 87: 421-8, 2001 [2] *Anesthesiology* 86, 836-47, 1997 [3] *Anesthesiology* 84, 38-51, 1996.