

Comparison of Bispectral Index and Patient State Index during Induction of Anesthesia for Open Heart Surgery

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Introduction

The bispectral index (BIS) and the patient state index (PSI) have both been shown to correlate with the hypnotic effect of anesthetic drugs (1, 2). We compared BIS and PSI during induction of anesthesia for open heart surgery.

Methods

After ethical approval and written informed consent were obtained, 36 cardiac risk patients (NYHA III to IV, mean age 65 [35-81], SD +/- 11.6, male/ female = 25/11) were monitored during induction of anesthesia for open heart surgery. To collect information on the hypnotic depth, in each patient BIS was obtained by bifrontal montage of the electrodes (A 1000, version 3.31, Aspect Medical Systems) and in addition the PSI via the PSArray electrode (PSA 4000, version 2.11, Physiometrix). A standardized anesthetic drug regimen using etomidate, sufentanil and pancuronium for induction and optional isoflurane for maintenance (max. 0.5 MAC) was administered according to common clinical standards. Time points of special interest were: awake before induction, after injection of drugs, loss of consciousness (LOC), insertion of tracheal tube after 3 min, insertion of gastric tube after ca. 20 min. Both BIS and PSI were recorded simultaneously; impedances of all electrodes were permanently kept under 10 kW. All data were automatically stored online on a laptop computer; all clinical events were marked.

Results

After induction of anesthesia, PSI fell from 96.5 +/- 3 to 19.3 +/- 4.3 (Δ PSI 77.2 +/- 5.7). BIS fell from 95.9 +/- 1.4 to 38.5 +/- 6.2 (Δ BIS 57.3 +/- 6.3). After intubation we saw a rise in PSI from 19.5 +/- 6 to 35.3 +/- 13.5 (Δ PSI 15.8 +/- 10.5), BIS rose from 39.4 +/- 5.6 to 50.6 +/- 12 (Δ BIS 11.2 +/- 10.3). The intubation was reflected by a PSI rise > 20% in 24 patients, and by a BIS rise > 20% in 14 patients. In n=1 patient we saw no PSI change > 20% and in n=10 patients we found no BIS change > 20%. After insertion of the gastric tube we observed a rise in PSI from 22.5 +/- 8.9 to 44.7 +/- 18.7 (Δ PSI 22.2 +/- 14.9), respectively from 48.7 +/- 6.4 to 62.1 +/- 12.2 for the BIS (Δ BIS 13.4 +/- 8.1). In all patients there was a rise of PSI > 20% after insertion of the gastric tube, but only in n=13 there was a BIS increase > 20%. In n=11 there was no BIS rise > 20%. The response of the indices to intubation and insertion of the gastric tube is shown in a frequency table (only measurements without artifacts, etc. were included).

Conclusions

Both indices followed the clinical endpoint LOC time synchronously and without delay. Deep hypnosis (mainly no burst suppression) monitored by the PSI could be observed around 19.3 +/- 4 and corresponded to a BIS of 38.5 +/- 6.2. Especially during the very first minutes after induction, a homogenous deep sedation could be documented with both indices. After intubation, and particularly after the insertion of the gastric tube, a greater scatter of PSI and BIS values could be observed due to the intraindividual pharmacodynamics of the anesthetic drug boli, with an apparent more distinct response of the PSI. In this period a more shallow anesthesia was administered, maintained only by maximum 0.5 MAC of isoflurane. We conclude that BIS and PSI both reflect reliably the loss of consciousness during the induction phase of anesthesia for cardiac risk patients and that both indices closely followed the changes in hypnotic levels.

References: 1) *J Cardiothorac Vasc Anesth* 2000; 14: 693-7. 2) *Memory and Awareness in Anaesthesia IV*, Imp College Press, London 2000, 144-52.

intubation	PSI	BIS	gastric tube	PSI	BIS
rise > 20%	24	14	rise > 20%	24	13
rise < 20%	1	10	rise < 20%	0	11
n	25	24	n	24	24