Bispectral Index Profile During General Anaesthesia Using Nitrous Oxide For Lower Segment Caesarean Delivery

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Citation

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Abstract

Because of its antinociceptive effect N_2O decreases the minimum alveolar concentration (MAC) of volatile anesthetics and may attenuate the increase in blood pressure and heart rate caused by surgical stimulation. Nitrous oxide used alone has no effect on BIS in humans even when it produces loss of consciousness. Patients undergoing lower segment caesarean section (LSCS) under general anesthesia are at increased risk of intraoperative awareness and subsequent recall. We have studied the effect of N_2O/O_2/sevoflurane anesthesia on bispectral index (BIS) values, versus O_2/air/sevoflurane anesthesia for LSCS. Twenty ASA I&II patients receiving general anesthesia (GA) for elective LSCS were studied. During anesthesia, BIS values and other observations were recorded. Neither BIS nor mean blood pressure were significantly different between the two groups ($p > 0.05$). A median BIS of 60 (range 40-70) recorded during surgery. Hemodynamic stability all over study period was satisfactory in both groups. We concluded that, BIS during O_2/N_2O/sevoflurane anesthesia for LSCS did not change significantly compared to O_2/air/sevoflurane anesthesia.

INTRODUCTION

Early studies reported incidences of 7% for the recall of pain and 17% for occurrence of unpleasant dreams in patients undergoing general anesthesia for LSCS ([1]). BIS has been reported to measure the hypnotic component of the anesthetic state and has been shown to correlate well with the degree of sedation using many anesthetics ([2,3]). Inadequate hypnosis in the absence of opioid analgesia may account for the increased incidence of awareness in LSCS. Because of its antinociceptive effect, N_2O decreases the minimum alveolar anesthetic concentration (MAC) of volatile anesthetics and may attenuate the increase in blood pressure and heart rate caused by surgical stimulation ([4,5]). N_2O, alone has no effect on BIS in humans even when it produces loss of consciousness ([6]).

We have studied the effect of N_2O/O_2/sevoflurane anesthesia on BIS versus O_2/air/sevoflurane anesthesia for LSCS.

PATIENTS & METHODS

After hospital Ethics Committee approval and written informed consent, 20 ASA I&II patients receiving general anesthesia for LSCS were studied. General anesthesia was conducted by same specialist anesthetist. All patients were premedicated with oral ranitidine 150 mg & 10mg metoclopromide 2 hr preoperatively and oral sodium citrate 30 ml 30 min before surgery. Standard monitoring included non-invasive blood pressure (NIBP), electrocardiogram (ECG), pulse oximeter (SpO_2), end-tidal carbon dioxide ($ETCO_2$), inspired oxygen fraction (FiO_2), inspired nitrous oxide fraction (FiN_2O), inspired and end-tidal fraction of sevoflurane. BIS was connected and numerical values displayed (A-1000 monitor, Aspect Medical Systems Inc., U.S.A.). The patients were randomly assigned to one of two groups (10 each) according to which gas mixture they received: 50% air /O_2 (air group) or 66% N_2O/O_2 (N_2O group). Before induction of anesthesia 0.5 mg /kg ketamine was given; then rapid sequence induction was performed with thiopentone and suxamethonium, at doses of 5 $mg.kg_{-1}$ and 1 $mg.kg_{-1}$ respectively. After tracheal intubations, anesthesia was maintained with sevoflurane (1 MAC) in both groups. Thereafter, 66% nitrous oxide in 33% oxygen was administered at fresh gas flows of 3 liters/min in (N_2O group). Intravenous fentanyl 1 $ug.kg_{-1}$ and synthetic oxytocin 10 units were administered to all patients. Muscle relaxation was maintained with Cisatracurium 0.06 mg/kg as initial bolus and additional boluses were given when required.

During anesthesia, BIS values and other observations were recorded at 2 min intervals until delivery at the following

stages, laryngoscope and endotracheal intubation, skin incision, uterine incision, delivery, subcutaneous layer closure, skin closure, cessation of inhalation agents, intravenous atropine and neostigmine administration, eye-opening and extubation. NO_2 was ceased at skin closure. After administration of atropine and neostigmine, sevoflurane was turned off. The patient was asked at 1 min intervals to open the eyes. Then all patients were assessed in the postoperative recovery unit using Aldrete score and interviewed in the ward on the first postoperative day regarding the experience of dreaming or recall. Data are presented as mean ± SEM. Statistical analysis of the results was accomplished using Student's t-test (two-tailed) for continuous data and Chi-square test for categorical data. Data were processed using Sigma Stat for Windows, Version 11 (SPSS11). P<0.05 was considered significant.

RESULTS

There was no significant difference between both groups regarding demographic data (Table1). Apgar score >6 in both groups was reported. There was no significant uterine atony or post partum hemorrhage reported in both groups. There was no significant difference between both groups regarding time intervals until extubation (P>0.05) (Table 2).

BIS values showed non significant differences between the two groups (P>0.05). A median BIS of 60 (range 40-70) was recorded on most occasions during surgery. Maximum reduction in BIS was found after orotracheal intubations from pre-induction values for both groups. However, these changes were comparable in the two groups (Figure 1). There was no recall or dreaming reported by any patient in recovery room or 24 hr after surgery in both groups. Three cases in the air group and one case in N_2O group developed visual hallucination in the form of sharp lightening and red coloration following ketamine administration.

Figure 1

Table 1: Demographic data between both groups.

	N2O Mean ± SEM	Air Mean ± SEM	P-value
Age	33.1±1.44	33.0±1.72	0.965
Weight	82.45±3.38	78.81±4.77	0.541
Height	158.3±1.94	156.0±2.05	0.426
BMI	32.94±1.19	32.49±2.05	0.854
GW	37.9±0.1	37.1±0.9	0.399
Blood lose	500.0±47.1	490.0±50.4	0.886
Apger-1	6.7±0.45	6.7±0.34	0.999
Apger-5	8.6±0.22	8.8±0.13	0.449

P ‹ o.o5 considered significant.

Figure 2

Table 2: Various time intervals in minutes. (mean±SEM)

	N2O group	Air group	P-value
Induction to skin incision time	3.2±0.44	2.4±0.16	0.117
Skin incision to uterus incision time	5.8±0.57	6.0±0.89	0.853
Uterus incision to delivery time	2.6±0.31	2.7±0.42	0.85
Delivery to uterus closure time	14.3±2.42	12.4±1.84	0.54
Uterus closure to skin closure time	17.8±1.63	28.3±5.45	0.094
Skin closure to extubation time	8.5±0.64	8.2±1.7	0.873
Duration of anesthesia	52.2±3.14	60.0±6.6	0.305

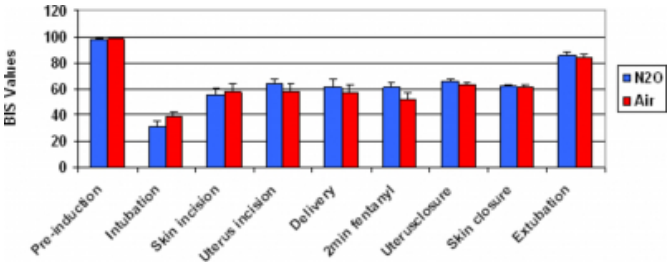
Figure 3

Table 3: BIS values. (mean±SEM)

	N2O group	Air group	P-value
Pre-induction	97.5 ± 0.342	97.8 ± 0.133	0.424
Intubations	31.3 ± 4.339	38.5 ± 4.47	0.263
Skin incision	55.3 ± 5.22	57.7 ±5.71	0.76
Uterus incision	63.4 ± 3.84	58.2 ± 5.95	0.474
Delivery	61.4 ± 5.45	57.4 ± 5.33	0.606
2 min after fentanyl	60.9 ± 3.36	52.0 ± 5.2	0.168
Uterus closure	65.3 ± 2.19	63.2 ± 1.29	0.419
Skin closure	61.7 ± 1.56	61.1 ± 1.87	0.808
Extubation	85.9 ± 2.42	84.3 ± 1.85	0.606

Figure 4

Figure 1



DISCUSSION

The incidence of awareness in obstetrics has been reported to be about 1.3% following rigid general anesthetic protocol and 0.4% if more flexible anesthetic approach is adopted ([7]). Unconscious learning may occur during emergency caesarean section ([8]). In a study using isolated forearm technique in 30 parturient, there was high incidence of intra-operative responsiveness without recall and the authors

concluded that allowing surgery to proceed immediately after endotracheal intubation did not provide adequate anesthesia at the time of skin incision ([9]). BIS is potentially useful aid for titration of inhalation agents in this group of patients, to ensure adequate hypnosis without compromising fetal outcome. It was reported that BIS reflects direct and indirect memory function during caesarean section [10] .

In our study, the median BIS value was 60 at skin incision suggesting that an end-tidal sevoflurane with either nitrous oxide or air may be adequate. However, the Apgar scores and hemodynamic parameters did not suggest excessive drug dosing. BIS monitoring has proven to be useful in tracking hypnotic levels and improving titration of anesthetic drugs ([11, 12]). Below BIS value of 70, there is a very low probability of recall. The range between 60 and 70 may be considered deep sedation or light anesthesia. Below 60, the patient is usually unconscious. However, these BIS values with nitrous oxide had not been validated in pregnancy. In this observational study we recorded a median BIS value of 60 at skin incision which is similar to the BIS level at hypnosis reported by other investigators [13]. At intubation, uterine incision and delivery, the median BIS value was 60, with a range of 40-60.

Other studies relied on recall to assess adequacy of anesthesia [14,15,16,17]. Even under hypnosis, only a fraction of information may be available for recall, although it may be remembered in other ways this may be due to spontaneous memory decay, or retrograde amnesia induced by drugs used after delivery [18,19] .We evaluated the component of explicit memory, but BIS monitoring during caesarean section has shown that learning can occur in the absence of conscious recall ([20]). This weak form of explicit memory was reported in the absence of conscious recall at BIS level of 76.3 (±3.0), the mean BIS during word presentation during the procedure ([20]). In the absence of an adequately powered trial, it is not possible currently to conclude that BIS monitoring could reduce the incidence of awareness.

The current technique for caesarean section includes nitrous oxide, or air, the risk of awareness was not different in either group monitored by BIS. In studies involving inhalation of 70% nitrous oxide in healthy volunteers, adding nitrous oxide to the anesthetic produced no change of BIS values ([21]). Moreover, with propofol and remifentanil, nitrous oxide prevented movement during tracheal intubation BIS did not change ([22]).

In conclusion, O_2/NO_2/sevoflurane anesthesia for LSCS did not alter BIS profile significantly compared to O_2/Air/sevoflurane.

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