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Original Research Article

BIS values at loss of consciousness, return of consciousness & immediate post-operative period in patients with intracranial space occupying lesion vs patients posted for other neurosurgical procedures: A prospective, randomized and controlled study

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Abstract

Background: Bispectral index is an accepted monitoring to assess the depth of anaesthesia and helps the anaesthesiologist to prevent awareness during surgical procedures under general anaesthesia. The influence of frontal brain tumours on bispectral index (BIS) measurements is unknown. The aim of our study was to determine whether BIS values recorded at loss and return of consciousness (LOC and ROC, respectively) differ between patients with unilateral frontal brain tumours and control patients.

Methods: We enrolled 30 patients with a frontal brain tumour and 30 control patients. Bilateral BIS measurements were done during induction of propofol anaesthesia, during recovery of consciousness, and during a second induction of anaesthesia. The isolated-forearm test was used to determine the moments of LOC1, ROC and LOC2.

Results: The median BIS values recorded at LOC1, ROC and LOC2 did not differ between the groups. There were no significant inter-hemispheric differences in BIS in tumour and control patients.

Conclusions: The presence of a frontal brain tumour did not affect ipsilateral BIS values and so need not influence the placement of unilateral BIS electrodes if BIS monitoring is used to titrate the dose of propofol during anaesthesia.

Keywords: Brain tumour, bispectral index, depth of anaesthesia, monitoring

Introduction

One of the objectives of modern anaesthesia is to ensure adequate depth of anaesthesia to prevent awareness without inadvertently overloading the patients with potent drugs. The main objective of modern anaesthesia is the ability to monitor depth of anaesthesia, so that the patient will not have awareness during surgery and all the dreadful complications of it are

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prevented. The overall incidence of intraoperative awareness with recall is about 0.2-3%, but it may be upto 40% in certain high-risk patients like, those with multiple trauma, caesarean section, cardiac surgery and haemo dynamically unstable patients, in whom anesthetic drugs are given in low doses. Various methods have been described to measure the depth of anaesthesia from time to time.

Methods of assesing depth of anaesthesia
i) Subjective methods

1. Autonomic response (Hemodynamic changes-hypertension, tachycardia, Lacrimation, Sweating, Pupillary dilatation.
2. Isolated forearm technique.

ii) Objective methods

1. SEMG-Spontaneous Surface Electromyogram.
2. Lower esophageal contractility.
3. Heart rate variability.
4. EEG & derived indices.
5. Evoked potentials (Auditory Evoked Potentials).

BIS-Bispectral index is E.E.G derived index.

Bispectral Index (BIS)

The depth of pharmacologically induced unconsciousness during anesthesia is measured by BISPECTRAL INDEX (BIS). Use of the BIS monitor is thought to reduce the incidence of intra-operative awareness during anaesthesia. Many anesthesiologists measure and record the BIS during craniotomy for excision of brain tumors and use the BIS to guide titration of the anesthetic agents. There have been few studies investigating the influence of brain tumors on the reliability of the BIS.

BIS algorithm

The BIS algorithm uses a complex formula with advanced artifact rejection techniques to define a dimensionless BIS value from 0 (isoelectric EEG) to 100 (alert and oriented) that is relatively independent of hypnotic agent.
In January 2004, BIS received an FDA approved indication for reducing the incidence of intraoperative awareness during general anesthesia. Bispectral analysis is a statistical technique that allows study of phenomena with nonlinear character such as surf beats and wave breaking. Bispectral analysis represents a different description of the EEG in that inter frequency phase relationships are measured, i.e. the bispectrum quantifies relationships among the underlying sinusoidal components of the EEG. Several variables from the EEG time domain (burst suppression) and frequency domain (power spectrum, bispectrum, beta ratio, Synch Fast Slow) are combined into a single index of hypnotic level.

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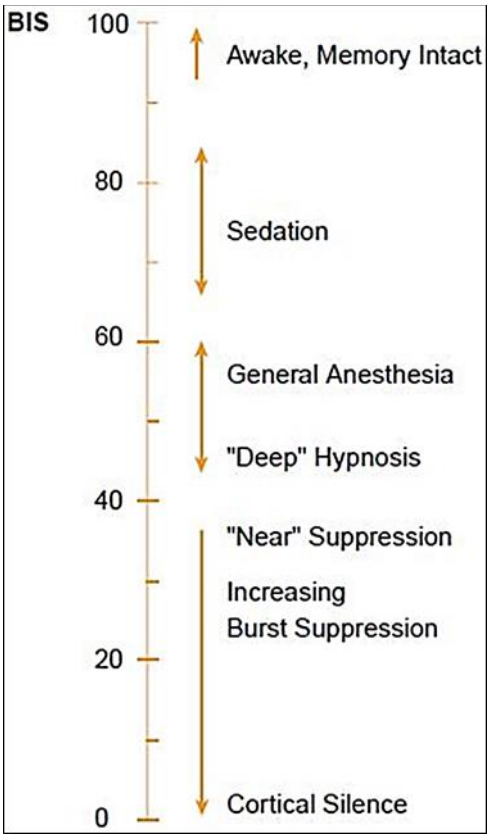

Aim of the study

To determine whether BIS values recorded at loss and return of consciousness and in the immediate postoperative period differ between patients with Intracranial space occupying lesions and other neuro surgical cases (control) patients.

Materials & Methods

The study was conducted in the Neurosurgery Operation Theatre Government general hospital attached to Guntur Medical college, Guntur between January 2022 to June 2022, after obtaining institutional ethical committee's approval & informed consent from the patients. Sample size was calculated with SPSS with Sample Power. 60 patients belonging to ASA class I-III, of either gender, who underwent general anesthesia for elective neurosurgical procedures, aged more than 18 years were taken up for study.
They were randomly assigned into 2 groups. Group A (n = 30) Patients posted for intracranial space occupying lesion surgeries. (Marshall grade I, II, III). Group B (n = 30) patients posted for other neuro surgical procedures.

Exclusion criteria

1) Patients with any sensorimotor or cognitive deficits that may have interfered with assessments of consciousness were not considered eligible for the study.
2) Any conditions or treatments that could potentially interfere with respiratory or cardiovascular status of the patient during the study.
3) Patients grading ASA IV& V.
4) Patients requiring post-operative elective ventilation.

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On arrival in the operating theatre, an i.v. cannula was inserted in the non-dominant upper limb, to deliver the required drugs & fluids.
Routine cardiovascular and respiratory monitors are connected.
BIS electrodes were placed as recommended by the manufacturer and electro encephalographic activity was recorded using a monitor.
Routine pre-medication was given and pre-oxygenated with 100% O_2 for 5 min. Induction of anaesthesia with inj. Propofol 2-2.5 mg/kg i.v.
During induction of anaesthesia, patients were verbally prompted every 10sec to squeeze the dominant hand. The second failure of the patient to respond to the verbal command was taken as loss of consciousness & BIS value at that time was noted. To facilitate registration of subsequent responses to commands, the isolated forearm technique was applied. Before administration of muscle relaxant, a padded tourniquet was applied to the dominant upper arm and inflated 20% above the systolic arterial pressure. Intubated with appropriate size oral endotracheal tube after administration of Rocuronium bromide 0.6-0.8mg/kg.
Intermittent positive pressure ventilation was maintained with 6-8ml/kg tidal volume and frequency was adjusted to maintain EtCo2 in the range of 30-35mm Hg in oxygen & nitrous oxide mixture 40%: 60%.
Maintenance of anaesthesia was done with increments of Vecuronium, Fentanyl, Sevoflurane 0.5-1% and Propofol infusion 60-80 micro grams /kg/min.
Intra-operatively BIS values are maintained in the range 40-60.
Patients requiring vaso-pressor support are excluded from the study, because of the fact that sympathomimetic agents may influence the BIS [6].
Once surgery was complete, sevoflurane was turned off, propofol infusion was cut off in both the groups. Patients were again prompted verbally every 10 sec to squeeze the dominant hand. The second subsequent purposeful response to this prompt was noted as return of consciousness (ROC) and BIS value at that time was noted. Mechanical ventilation was then converted to manual ventilation with 100% oxygen at 8L/min and reversal agents (Glycopyrrolate 0.004mg/kg & neostigmine 0.05 mg/kg) were given.
Extubation was done after thorough suctioning, when patients began breathing spontaneously and were able to respond to other verbal requests. Patients were observed for one hour of immediate postoperative period and BIS values are noted. In both the groups we have observed and compared BIS values at

1) Loss of consciousness (LOC).
2) Return of consciousness (ROC).
3) 1st hour of postoperative period (pop).

Statistical analysis

Differences in patient characteristic variables were tested for statistical significance with Student's t-test for continuous variables and the x2 test for categorical variables. Differences in these values between the groups were tested for statistical significance with the Mann-Whitney U-test or Student's t-test as appropriate.
Data analysis was performed by unpaired student's t-test. $p<0.05$ was considered statistically significant and a p value <0.0001 was considered statistically very significant.

Discussion

Depth of Anaesthesia monitoring is considered very important tool in the armamentarium of modern anesthetist to prevent awareness during anaesthesia and to prevent the over dosage of anaesthetic drugs. Objective methods of depth of anaesthesia monitoring are preferred to subjective methods. BIS monitoring is a derivative E.E.G with numerical values to assess the

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depth of anaesthesia during surgical procedures. The presence of a tumour, or of cerebral oedema, in the vicinity of an EEG electrode may result in recorded electrical activity that is different from that found on the contralateral normal side. Likewise, it may also result in recorded activity that has different morphology, frequency, or phase content for a given state of consciousness, when compared with other patients. Since the BIS calculation depends on all of these factors, we conducted this study to investigate whether the presence of brain tumours has an influence on measured BIS values recorded at transitions between consciousness and unconsciousness.

In our study, when the demographic data in both the groups were compared, there was no statistically significant difference between the two groups.

In patients with tumours, we found no significant differences between BIS values, compared to other neuro surgical patients posted for different surgeries under general anaesthesia.

These findings are consistent with those of Ferreira and colleagues[1] who reported that even though BIS values were higher in patients with brain tumours during induction, the BIS values at the moment of LOC did not significantly differ between both groups.

In conclusion, BIS values at LOC and ROC are similar in patients with brain tumours, to those recorded in control patients.

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