ORIGINAL RESEARCH PAPER

Anaesthesiology

COMPARATIVE STUDY OF ISOFURANE AND HALOTHANE ON BIS INDEX AT EQUAL END-TIDAL MINIMUM ALVEOLAR CONCENTRATION IN SPINE SURGERY.

KEY WORDS: Isofurane, Halothane, Bis, Spine Surgery.

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ABSTRACT

Introduction Awareness can be defined as the subjective experience of external or internal stimuli. BIS index remains the most validated form of consciousness of brain function monitoring used within the clinical context of anesthesia and sedation care.
Material & Methods The study was conducted in SMS Medical College and attached hospital, Jaipur after approval from the institutional ethical committee. Hospital based, double blinded, randomized comparative study. Sample size was calculated to be 16 subjects in each of the two groups at (alpha) error 0.05 in power 80% assuming detectable difference in mean BIS values of Isoflurane and halothane to be 5.4 and 5.2. Hence for study purpose 25 subjects will be taken in each of the two groups.
Results The mean BIS value for isoflurane group at 0.5 MAC was 55.44±1.873 as compared to mean BIS value 66.04±1.541 for halothane group. (P value= 0.000 S). Similarly, we seen significant difference in mean BIS value for isoflurane and halothane at 1 MAC and 1.5 MAC (wash-in phase). During wash out phase mean BIS value for isoflurane and halothane At 1 MAC and at 0.5 MAC have significant difference.
Conclusion At equal – MAC end tidal concentration isoflurane produces less BIS values than halothane. The BIS values for volatile anesthetics may be agent specific. No significant effect on hemodynamic, HR and blood pressure with isoflurane and halothane both.

INTRODUCTION:

The BIS index is a processed EEG parameter with extensive validation and demonstrated clinical utility. It is derived utilizing a composite of measures form EEG single processing techniques including bispectral analysis, power spectral analysis, and time domain analysis. These measures were combined via an algorithm to optimize the correlation between the EEG and the clinical effects of anesthesia, and quantified using the BIS index range. Today, the BIS index remains the most validated form of consciousness of brain function monitoring used within the clinical context of anesthesia and sedation care. Bispectral analysis is a single processing methodology that assesses relationship among single components and captures synchronization within signals like the EEG. By quantifying the correlation between all the frequencies within the signal. Bispectral analysis yields an additional EEG facet of brain activity. [1] The four key EEG features that characterized the full spectrum of anesthetic- induced changes were the degree of high frequency (14 to 30 Hz) activation, the amount of low- frequency synchronization, the presence of nearly suppressed periods within the EEG, and the presence of fully suppressed (i.e., isoelectric , " flat line") periods within the EEG. THE BIS INDEX: The index is a number between 0 and 100 scaled to correlate with important end points and EEG states during administration of anesthetic agents (Figure 2). BIS values near 100 represent an: awake "clinical state while 0 denotes the maximal EEG effect possible (i.e. an isoelectric EEG) [2]

AIMS AND OBJECTIVES

This study was done in SMS Medical College & associated Hospitals with the following objectives.

1- To asses and compare the changes in Bispectral index values
2- To asses and compare the changes in Hemodynamic parameters.
3- To asses and compare any significant side effects of the drugs used

MATERIAL AND METHODS

Study Location

The study were conducted in the department of Anesthesiology, S.M.S. Medical College and attached group of Hospitals, Jaipur with due permission from the institutional ethical committee and board and written informed patient consent.

Study design

Hospital – based – double blinded, randomized comparative study.

Sample Size-

Sample size was calculated to be 16 subjects in each of the two groups at α (alpha) error 0.05 in power 80% assuming detectable difference in mean BIS values of Isoflurane and halothane to be 5.4 and 5.2. Hence for study purpose 25 subjects will be taken in each of the two groups.

Group-

The patients were divided into two groups of 25 each according to drugs used.

Group I – ISOFLURANE.
Group H – HALOTHANE.
Randomizations were achieved by using chit in box method.

ELIGIBILITY CRITERIA

Inclusion criteria-

1. Patients with ASA grade 1 and 2
2. Patients of age group 30 to 60 years of either sex undergoing spine surgery in neurosurgery o.t under general anesthesia.
3. Duration of surgery lasting > 60 min

EXCLUSION CRITERIA

1. Major organ dysfunction.
2. Patients with impaired LFT/RFT
3. Patients with respiratory, cardiac or neurological disease
4. Patients having known allergy to anesthetic agents used in study

Technique -

On arrival in the operation theatre, weight, fasting status, consent and PAC will be checked. Baseline parameters { Spo2, Pulse rate (PR), Systolic blood pressure (SBP), Diastolic blood pressure (DBP), Bispetral index monitoring was initiated using the aspect ' Quatro' 4 point BIS sensor and the patient's awake BIS was recorded. The spacelabs Healthcare BIS acquires real time EEG data and processes it into a BIS number between 0 and 100. The halothane and Isoflurane vaporizers were used. Baseline BIS were recorded.

- 2 IV lines with 18/20 G cannula will be secured.
- Premedication with were given before start of induction of anesthesia.
- PR, SBP, DBP, SpO2, BIS was recorded.

All the monitoring and recording were made by another anesthesiologist.

Premedication & Induction –
Patient was ventilated with face mask with 100% oxygen for 3 minutes. Inj. Glycopyrolate (0.005 mg/kg) , Inj Propofol 2-mg/kg and inj. Fentanyl 2ug/kg . Inj. Rocuronium 0.9 mg/kg.

Maintenance - Was done with N2O (66%) + oxygen and atracurium.
Reversal – Was done with Inj. Neostigmine (0.05 mg/kg) and inj. Glycopyrolate (0.01 mg/kg).

Statistical analysis- Was done after applying standard qualitative and quantitative tests (e.g. student – t-test).

RESULTS

Study was conducted in SMS Medical College & associated hospitals. Statistical analysis was done after applying standard qualitative and quantitative tests (e.g. student – t-test).

Demographic Profile

	Group I	Group H	P Value
Age	41.24±8.318	37.24±8.318	0.079
Sex(M/F)	20/5	17/8	
ASA (1/2)	22/3	21/4	
Height	156.00±2.61	155.56±2.95	0.57

(Wash –in Phase)

Parameters of the cases after 10 minutes at different MAC Concentration:

	0.5 MAC			1 MAC			1.5 MAC		
Group	Group H	Group I		Group H	Group I		Group H	Group I	
	Mean±SD	Mean±SD	P value	Mean±SD	Mean±SD	P value	Mean±SD	Mean±SD	P value
BIS (N=25)	66.04±1.541	55.44±1.873	.000	54.60±2.041	42.52±2.874	<0.001S	39.48±4.124	34.76±3.072	<0.001S
SBP(N=25)	133.52±6.721	134.68±7.052	.554	127.08±8.703	128.16±8.980	.668	118.28±9.956	119.88±10.353	.580
DBP(N=25)	84.240±2.818	85.72±2.94	.075	82.04±4.774	83.64±4.462	.227	79.12±5.102	80.20±5.236	.464
MBP(N=25)	100.67±3.95	102.04±4.251	.244	97.06±5.919	98.48±5.949	.400	92.18±6.640	93.43±6.888	.516
Spo^2 (N=25)	100.00±0.00	100.00±0.00	NA	100.00±0.00	100.00±0.00	NA	100.00±0.00	100.00±0.00	NA
PR (N=25)	85.60±	86.88±9.094	.613	80.08±7.371	80.36±8.065	0.689	75.00±5.538	76.40±5.831	.388

(Wash –Out Phase)

Parameters of the cases after 10 minutes at different MAC Concentration:

	0.5 MAC			1 MAC			1.5 MAC		
Group	Group H	Group I		Group H	Group I		Group H	Group I	
	Mean±SD	Mean±SD	P value	Mean±SD	Mean±SD	P value	Mean±SD	Mean±SD	P value
BIS (N=25)	66.04±1.485	54.96±2.091	.000	54.20±2.309	42.32±3.119	<0.001S	39.48±4.124	34.76±3.072	<0.001S
SBP(N=25)	126.04±9.528	126.60±9.725	.838	121.76±9.735	122.96±9.035	.653	118.28±9.956	119.88±10.353	.580
DBP(N=25)	81.72±4.677	82.80±4.406	.405	79.68±5.391	81.60±5.008	.198	79.12±5.102	80.20±5.236	.464
MBP(N=25)	96.48±6.222	97.40±6.114	.600	93.72±6.677	93.39±6.297	.368	92.18±6.640	93.43±6.888	.516
Spo^2 (N=25)	100.00±0.00	100.00±0.00	NA	100.00±0.00	100.00±0.00	NA	100.00±0.00	100.00±0.00	NA
PR (N=25)	80.92±4.838	81.76±5.118	.554	76.75±5.075	77.00±6.014	.781	75.00±5.538	76.40±5.831	.388

The demographic profile of the patients in terms of age, sex ratio, ASA grade, height and duration of surgery was comparable in both the group. The mean BIS value for isoflurane group at 0.5 MAC was 55.44±1.873 as compared to mean BIS value 66.04±1.541 for halothane group. (P value= 0.000 S). Similarly, we seen significant difference in mean BIS value for isoflurane and halothane at 1 MAC and 1.5 MAC (wash-in phase). During wash out phase mean BIS value for isoflurane and halothane At 1 MAC and at 0.5 MAC have significant difference. There was no significant difference in heart rate, systolic BP, Diastolic BP, mean arterial pressure, oxygen saturation in both group at various MAC.

DISCUSSION

BIS incorporates different information from the raw EEG: power and frequency, activation and burst suppression are integrated in a single number. Halothane and isoflurane differently effect spectral power and median power of EEG. Halothane produces relatively fast EEG rhythms whereas isoflurane produces mainly slow waves. Halothane is known to have a Greater analgesic and immobilizing effect (through its spinal action) as compared to isoflurane [3] In our study, we obtained the mean baseline BIS value for Halothane group F(N=25) was 97.24±.779 and for Isoflurane group (N=25) was 97.32±.627.691(P value 0.691.NS). Umamahesswara Rao GS Et al [4] concluded that BIS and SEF 95 values decreased significantly with increasing concentrations of both the anesthetic agents (P<0.001). At any given MAC concentration of the anesthetic, BIS values were significantly lower under isoflurane compared with halothane anesthesia both during wash-in and wash – out phases (P<0.001). In conclusion, BIS values are significantly lower under isoflurane compared with halothane anesthesia at similar MAC concentrations. Neerja bharti et al [5] stated that the BIS values decreased significantly with increasing MAC concentrations during wash-in phase and increased significantly with decreasing MAC concentrations during wash-out phase in both the groups. BIS values were significantly (P<0.05) lower in isoflurane group as compared to halothane group at each target MAC value during anaesthesia. In a previous study by Davidson et al [6] in children, also reported significant low BIS values with isoflurane than halothane at 1MAC. Using an unpaired t-test to compare the BIS at 1 MAC for halothane in the Halothane group with the BIS for isoflurane in the Isoflurane group, the BIS at 1 MAC for halothane remained significantly greater. The difference in means was 20.5(95% CI 15.0 to 26.1, P<0.0001). In present study done by us, there was a significant difference in mean BIS values of isoflurane and halothane at 0.5 MAC (wash-in phase) after 10 minutes recording. The mean BIS value for isoflurane group at 0.5 MAC was 55.44±1.873 as compared to mean BIS value 66.04±1.541 for halothane group. (P value = .000 S). Similarly, we have seen significant difference in mean BIS value for isoflurane and halothane at 1 MAC and 1.5 MAC (wash – in phage). At 1.0 MAC (wash-in phase) mean BIS value for isoflurane was 42.52±2.874 and for halothane was 54.60±2.04 (p value = 0.001 S). At 1.5 MAC (wash – in phase) mean BIS value for isoflurane was 34.76±3.072 and for halothane was 39.48±4.124 (p value = 0.001 S). Guignard B et al [7] demonstrated that BIS value in a range of 40-92 have been proposed for producing adequate degree of hypnosis during anesthesia. They found that the BIS value at 1 MAC of halothane (543.60±2.041) was adequate for hypnotic effect. In contrast the BIS value at 1 MAC of isoflurane was (42+52±2.874) which show the possibility that 1 MAC of isoflurane is more than enough for adequate hypnotic effect. This finding is in consistent with the fact that the use of BIS monitoring for titration of anaesthesia agent reduces intraoperative isoflurane consumption. Jonathan 1 et al [8] found that BIS value during surgical levels of halothane anesthesia is significantly higher than those found at equi-potent concentrations of sevoflurane. In our study, during wash- out phage mean BIS value for isoflurane and halothane AT 1 MAC and at 0.5 MAC have significant difference.

Davidson AJ et al[6] Conducted study on 40 children, BIS awake date for this study was not significant for halothane and isoflurane group. In the Isoflurane group the children awoke form isoflurane and in the halothane group from halothane. Neerja Bharti et al [5] Stated that the BIS does indeed selectively measure the hypnotic or obtunding aspects of anaesthesia rather than the immobilizing action of anaesthesia. At low concentrations of anesthetic agent the predominant EEG determinant is arousal and BIS is fewer agents specific. This is consistent with the findings that BIS –awake value were similar between the agents. The time taken for awakening was 9.2±3.4 min in halothane group and 6.3±2.8 min in isoflurane group ($P<0.05$). In our study, there were no significant difference in BIS value among the group at eye opening, we obtained mean BIS value for isoflurane group was 88.80±1.826 and for halothane group was 89.60±1.848 with the p value of 0.130 (NS). Our results were in favor with the previous studies done by neerja bharti et al and Davidson J et al [6,5].

CONCLUSION

At equal – MAC end tidal concentration isoflurane produces less BIS values than halothane. The BIS values for volatile anesthetics may be agent specific. No significant effect on hemodynamic, HR and blood pressure with isoflurane and halothane both. Use of BIS helps in careful titration of hypnotic agents and so an earlier recovery form anaesthesia.

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