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COMPARISON OF BISPECTRAL INDEX VALUES PRODUCED BY ISOFLURANE & SEVOFLURANE AT EQUAL END-TIDAL MAC IN TRAUMA SURGERIES UNDER GENERAL ANAESTHESIA.

Anaesthesiology

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ABSTRACT

Back ground and aims: Awareness can be defined as the subjective experience of external or internal stimuli and one's own existence in space and time at any given movement. A comparison of BIS values produced by sevoflurane, isoflurane at equal MAC and assessing which is better hypnotic agent.

Method: - The study universe was randomly divided into 2 groups with 63 subjects of ASA I & II of age group 20 to 60 years of either sex. Group I (n=63) - Isoflurane (0.5,1, 1.5 MAC). Group S (n=63) - Sevoflurane (0.5,1, 1.5 MAC).

Five minutes prior to induction both the groups were administered inj fentanyl 2µg/kg(i.v), induced by inj.propofol 2 mg/kg and inj. Rocuronium 1mg/kg10 min after the incision, the end-tidal concentration of the inhaled anaesthetic agent was adjusted to 0.5 MAC and kept constant for 10 min Then the inspired concentration of the inhaled anaesthetic agent was increase to 1.0 and 1.5 MAC collecting the data each time at the end of 10 min. The concentration were then decreased in the same graded manner from 1.5MAC to 1 and finally to 0.5 MAC, recording the various parameters each time. After each increment or decrement of the inhaled anaesthetic agent, the concentrations were kept constant for 10 min. BIS and hemodynamic were recorded after 10 min at each end tidal MAC conc. Chi-square test & Unpaired t-test was used to find out significant of proportion and the difference in means respectively.

Result :- BIS value significant lower with sevoflurane as compared to isoflurane at equi-MAC. ($P < 0.05$)

Conclusion: - The equi-MAC sevoflurane produces lower BIS values, so better

Hypnotic agent as compared to isoflurane

KEYWORDS

Bispectral Index, Sevoflurane, Isoflurane

INTRODUCTION

Awareness can be defined as the subjective experience of external or internal stimuli and one's own existence in space and time at any given movement.[1]

Cause of awareness: Overly light anesthesia & failure of drug delivery systems.

Methods of assessing depth of anesthesia:

A. Subjective methods

1. Autonomic response
- Hemodynamic change
- Sweating
- Pupillary dilation

2. Isolated forearm technique

B. Objectives methods

1. Spontaneous surface electromyogram(SEMG)
2. Lower esophageal contractility (LOC)
3. Heart rate variability (HRV)
4. Electroencephalogram and derived indices
- Spectral edge frequency
- Median frequency
- Bispectral index

5. Evoked potentials
- Auditory evoked potentials
- Visual evoked potentials
- Somatosensory evoked potentials
- Auditory evoked potentials index[3]

Major consequence of intra operative awareness in a patient is its long time psychological events such as PTSD (post traumatic stress disorder).

The incidence of intraoperative awareness has been reported to be 0.2-1% but it may be as high as 40% in high risk situations like trauma, caesarean sections and during cardiac surgery.

The bispectral index (BIS index**)** directly reflects the activity of cerebral cortex and correlates with level of consciousness.[12]

- The monitor generates a dimensionless number on a continuous scale of 0-100, with 100 representing normal cortical electrical activity and 0 indicating cortical electrical silence.[13]
- Anesthetic agents (Isoflurane and Sevoflurane) vary in their relative hypnotic and immobilizing potentials. Therefore, equal MAC of Isoflurane and Sevoflurane produce different BIS values.
- Sevoflurane more potent hypnotic than Isoflurane thus it produces less BIS value than Isoflurane at equal end tidal MAC.

HYPOTHESIS

- **Null Hypothesis (H0)**: There is no significant difference between the value of BIS index produces by isoflurane and sevoflurane at Equal End- tidal MAC multiples.
- **Alternate Hypothesis (H1)**: There is significant difference between the value of BIS index produces by isoflurane and sevoflurane at Equal End-tidal MAC multiples.

AIM

Comparison of BIS values produced by sevoflurane, isoflurane at equal MAC and assessing which is better hypnotic agent.

OBJECTIVES

A. PRIMARY OBJECTIVE

- To assess and compare the changes in BIS Index values**.**

B. SECONDARY OBJECTIVE

- To assess and compare the changes in Hemodynamic parameters (HR, SBP, DBP, MBP).
- To assess and compare any significant side effects (Nausea, vomiting, shivering, respiratory depression, sedation, hypotension, bradycardia etc.) of the drugs used**.**

METHODOLOGY

The study was conducted in the Deptt. of Anesthesiology, S.M.S Medical College, Jaipur with due permission from the institutional ethics committee and review board and written informed patient consent.

- **Study design-**

Hospital based, Randomized single blinded, interventional comparative study.

Sample size was calculated to be 63 subjects for each of the two groups at α error 0.05 and power 80% detectable. Minimum mean of difference to be detected in BIS value 1.5 MAC value of isoflurane and sevoflurane 2±3.97. The study universe was randomly divided by sealed envelope method into 2 groups with 63 subjects of ASA I & II of

age group 20 to 60 years of either sex in each groups(n=63) according to the drugs to be used for trauma surgeries.

- **Group I (n=63)** - ISOFLURANE (0.5,1, 1.5 MAC).
- **Group S (n=63)** - SEVOFLURANE (0.5,1, 1.5 MAC).

All patient were fasted overnight and received Tab. Alprazolam 0.5mg orally at night and 2 hr before surgery.

- On arrival in the operation theatre, weight, fasting status, consent and PAC was checked. Baseline parameters [SPO_2, Pulse rate (PR), Systolic blood pressure (SBP), Diastolic blood pressure (DBP), were recorded. Bispectral index monitoring was initiated the Aspect 'Quatro'4 point BIS sensor and the patient's awake BIS was recorded. The vaporizers used were Blease Datum L series isoflurane and sevoflurane vaporizers.
- 2 peripheral IV lines with 18/20 G cannula were secured, RL started.

Premedication with Inj. Glycopyrolate (0.005 mg/kg) was given, preoxygenated for 3 minutes before start of induction of anesthesia. PR, SBP, DBP, BIS was recorded

Induction – Five minutes prior to induction both the groups were administered inj Fentanyl 2µg/kg(i.v), induced by inj.propofol 2 mg/kg and inj. Rocuronium 1mg/kg .

Intubation-was done with cuffed endotracheal tube of appropriate size after direct laryngoscopy. Tube position was checked by auscultation. Anesthesia was maintained with N2O (66%) in oxygen and isoflurane and sevoflurane according to group.

Supplemental doses of fentanyl 1.0 µg/kg i.v was given if there was a persistent rise in HR (>100beats/min) or blood pressure (>20% of baseline). Body temperature was maintained above 35.50˚C in all cases. Patient were put to Mechanical ventilation and end-tidal carbon dioxide concentration range 32-35 mmHg was maintained. Muscle relaxation was provided by subsequent doses of inj atracurium (0.1mg/kg).

The inspired and end-tidal concentration of inhalation agent and carbon dioxide were measured. 10 min after the incision, the end-tidal concentration of the inhaled anaesthetic agent was adjusted to 0.5 MAC and kept constant for 10 min(for BIS values to stabilize) and various parameters including the BIS were recorded. The BIS were recorded only when the signal quality index was above 50%.

Then the inspired concentration of the inhaled anaesthetic agent was increase to 1.0 and 1.5 MAC collecting the data each time at the end of 10 min. The concentration were then decreased in the same graded manner from 1.5MAC to 1 and finally to 0.5 MAC, recording the various parameters each time. After each increment or decrement of the inhaled anaesthetic agent, the concentrations were kept constant for 10 min.

The inhalation agent was discontinued just before skin closure.

BIS and hemodynamic were recorded after 10 min at each end tidal MAC conc.(from start of inhalation and increasing MAC to 0.5,1,1.5 and then decreasing MAC to 1,0.5) and eye opening. Reversal- was done with inj. Neostigmine (0.05 mg/kg) and inj. glycopyrrolate (0.01 mg/kg). Hemodynamic measurements and BIS was recorded at eye opening. Extubation was done as per standard criterias.

- BIS and Haemodyamic parameters were obtained every 10 min till end of surgery.
- Any intraoperative complication were recorded and managed.

STATISTICAL ANALYSIS

- The quantitative data was expressed in mean

OBSERVATIONS

Table 1 : Comparison of BIS values among study groups

Time	Group I	Group S	P value
Baseline	96.3 ± 0.8	96.3 ± 0.6	0.602
0.5 MAC IN	57 ± 1.6	55.4 ± 1.9	<0.001(S)
1 MAC IN	47.6 ± 2.9	46.5 ± 2	0.014 (S)
1.5 MAC IN	45.5 ± 4.1	41.7 ± 3	<0.001 (S)
1 MAC OUT	53.1 ± 2.3	47.4 ± 3.1	<0.001(S)
0.5 MAC OUT	60 ± 1.5	51.9 ± 2.1	<0.001(S)
SURGERY END	91.6 ± 1.8	91.8 ± 1.8	0.457

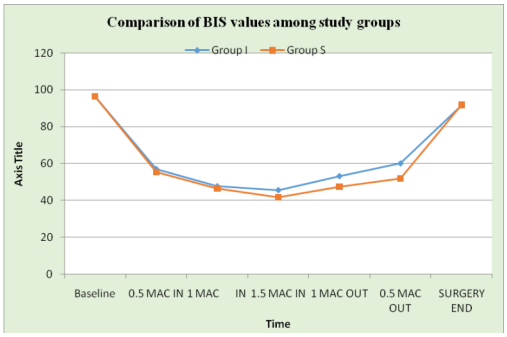

Table 2 : Comparison of the hemodynamic parameters among study groups

Time	isoflurane		sevoflurane		P value	
	HR	MBP	HR	MBP	HR	MBP
Baseline	79 ± 4.8	92.7 ± 3.6	78 ± 4.3	93.4 ± 3.8	0.186	0.305
0.5 Mac In	74 ± 9.5	89.3 ± 4.4	75.8 ± 9.1	90.0 ± 4	0.305	0.030 (S)
1 Mac In	72.9 ± 8.4	86.6 ± 6.2	73 ± 7.6	89.6 ± 6.2	0.947	0.008 (S)
1.5 Mac In	65.3 ± 6	80.7 ± 7.1	70.9 ± 5.7	84.5 ± 6.8	<0.001 (S)	0.003 (S)
1 Mac Out	73.4 ± 5.4	83.3 ± 6.4	72.7 ± 5.2	87 ± 6.9	0.409	0.002 (S)
0.5 Mac Out	74.7 ± 5.3	85.6 ± 6.2	75 ± 5	88.4 ± 6.3	0.757	0.014 (S)
Surgery end	79.5 ± 7	91.2 ± 3.9	78.9 ± 6.8	92 ± 3.7	0.624	0.217

DISCUSSION

1. The demographic profile of patients and mean duration of surgery comparable in both the study groups. (P value > 0.05)
2. The Baseline hemodynamic variables & BIS were similar in the two groups with no statistically significant difference. (P value >0.05)

It was observed that mean baseline BIS value were nearly similar in the two groups and no statistical significant difference was present (p value=0.602).

BIS value significant lower with sevoflurane as compared to isoflurane at equi-MAC. (P < 0.05)

There was significant reduction in HR was observed with isoflurane at 1.5 MAC . (P value< 0.05). There was significant drop in SBP & DBP with isoflurane at 1MAC, 1.5 MAC. (P value<0.05)

There was no significant difference between the baseline MBP in group I(92.7±3.6) and group S (93.4±3.8). p value=0.305

A significant drop in MBP was observed with isoflurane at 0.5, 1, 1.5 MAC respectively. P value <0.05

The neuro-physiologic properties of isoflurane and sevoflurane have been reported to be similar, both cause a dose related depression of the central nervous system. For isoflurane & sevoflurane, 0.25 MAC produces amnesia. At 1 MAC, both EEG frequency and voltage increase. At deeper level of anaesthesia, voltage and frequency decrease. Burst suppression occurs at 1.5 MAC, and an isoelectric pattern appears at 2 MAC.

CONCLUSION

The equi-MAC sevoflurane produces lower BIS values, so it is a better Hypnotic agent as compared to isoflurane. The heart rate and blood pressure were more stable with sevoflurane as compared to isoflurane. Also, use of BIS helps in careful titration of hypnotic agents and an earlier recovery from anaesthesia.

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