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Original Research Article

Comparison between Inj. Fentanyl vs Inj. Dexmedetomidine Infusion to Assess Awareness during General Anaesthesia Using Bis Monitor

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Abstract

Background: Awareness during general anaesthesia is very distressing for a patient, particularly if accompanied by recall of the painful nature of surgery. This can result in serious emotional injury and post-traumatic stress disorder. Awareness may have psychological sequelae for the patient and medico-legal consequences for anaesthetist, so it becomes imperative for any anaesthetist to monitor and prevent awareness during intra-operative period.

Aims: Aim of the study was to monitor depth of anaesthesia and occurrence of awareness using BIS monitor in patients and to study and compare use of Inj. Dexmedetomidine and Inj. Fentanyl intraoperative to prevent awareness.

Material and Methods: Two groups of patients 25 in each undergoing general anaesthesia for elective surgeries were studied after proper informed consent. Group D (Inj. Dexmedetomidine) and Group F (Inj. Fentanyl) were monitored with BIS index for awareness during anaesthesia and compared.

Statistical analysis: Chi-square test, unpaired student 't' test.

Results: There is a significant difference between SBP and DBP of group D and group F. Systolic and Diastolic blood pressure were significantly lower in Dexmedetomidine group. There is significant difference in BIS score between group D and group F after induction (P value <0.0001), which is lower in Group D and difference remains significant until end of the surgery.

Conclusions: We concluded that Dexmedetomidine gives better depth of anaesthesia. Both Dexmedetomidine and Fentanyl reduce the awareness but compared to fentanyl, dexmedetomidine provides a lower BIS score.

Keywords: Awareness, Bispectral index monitor, Depth of anaesthesia, Dexmedetomidine, Fentanyl.

Introduction

Awareness during general anaesthesia is very distressing for a patient, particularly if accompanied by recall of the painful nature of surgery. This can result in serious emotional injury and post-traumatic stress disorder.[1] There are two types of

awareness, explicit memory which is intentional recall or conscious recollection of intraoperative events and responsiveness to auditory stimuli during operation is implicit memory. Awareness may have psychological sequelae for the patient and medico-legal consequences for anaesthetist. Awareness during anaesthesia may be experienced by 1 or 2 cases out of every 1000 patients who receive general anaesthesia (0.1-0.2%). [2]Anaesthetic concentrations that block awareness are less than those that prevent motor responses to pain. An inadequately anaesthetized patient usually communicates by movement. The use of muscle relaxants renders such a patient motionless and can put the anaesthesiologist into a false sense of security. [2]

Intraoperative awareness can be due to some anaesthetic techniques such as the use of nitrous oxide, opioids and muscle relaxants, difficult intubation, Premature discontinuation of anesthetic. Machine malfunction or misuse of the technique like failure to check equipment vaporizer and circuit leaks, errors in intravenous infusion, accidental administration of muscle relaxants to patients who are awake. Increased anesthetic requirement in chronic alcohol, opioids, or cocaine abuse. [3]

There are many methods to prevent awareness during surgery like, premedication with amnesic drugs (e.g., benzodiazepines), meticulous checking of the anaesthesia delivery system before induction. Depth of anaesthesia could be judged by many conventional monitoring systems like, ECG, blood pressure, heart rate, *end-tidal* anaesthetic analyzer and capnography. The signs of awareness are generated through sympathetic activation, Tachycardia, hypertension, sweating, pupillary dilatation, lacrimation, and sweating are often used as clinical signs of an inadequate level of anaesthesia secondary to sympathetic activation. However, the signs of increased autonomic activity may be absent during treatment with many drugs like opioids, cholinergic and beta-adrenergic antagonists, vasodilators, and antihypertensive agents.

Now, specialized devices that monitor brain electrical activity for assessing the anaesthetic effect, record EEG activity from electrodes placed on the forehead. These devices are further divided into those that process spontaneous EEG and electromyographic activity and those that acquire evoked responses to auditory stimuli. Bispectral index [5,6,7], Entropy, Narcotrend, Patient State Analyser, SNAP index, Cerebral State Monitor are different types of spontaneous electroencephalographic activity monitors. Auditory Evoked Potential Monitor requires auditory stimuli. [2,4]

The aim of this study was to monitor depth of anaesthesia and occurrence of awareness using BIS monitor [8,9] in patients, to study and compare the use of Inj. Dexmedetomidine and Inj. Fentanyl intraoperative to prevent awareness.

Materials and Method

After approval from Institutional Ethics Committee, this prospective randomized study was carried out over a period of one year at a tertiary health care center.50 patients of ASA grade I and II, between ages of 20 to 60 years from either sex were randomly selected. Patients were divided into two groups of 25 each.

Patients with history of psychiatric illness, psychosis or memory impairment, surgery involving forehead, history of brain injury and surgery, history of epilepsy or allergy were excluded from the study.

Pre-anesthetic assessment was carried out on the day before surgery and routine investigations were done. A detailed history was taken, and the patients were thoroughly examined. Informed consent was obtained

from each patient before surgery. After shifting the patient to the operating room and before giving premedication vital like Pulse, BP, ECG, SPO2, were recorded. All the patients were given Inj. Glycopyrrolate 0.004 mg/kg IV, Inj. Ondansetron 0.08 mg/kg IV, Inj. Midazolam 0.02 mg/kg IV.

Group D was given Inj. Dexmedetomidine with loading dose of 1 mcg/kg [10] over 10 minutes IV and maintenance dose of 0.2-0.7mcg/kg/hr titrated to maintain BIS value between 40-60.

Group F was given Inj. fentanyl 1 mcg/kg IV[11] immediately before intubation and intermittent dose of 0.5 mcg/kg given at 30 min interval intraoperatively to maintain BIS value between 40-60.

All patients were induced with Inj. propofol (2-2.5 mg/kg IV), Inj. Succinylcholine (1.5-2 mg/kg IV) and intubated with cuffed endotracheal tube of appropriate size. Maintenance was done with O2 + N2O + Sevoflurane (MAC1.5-2) + Inj. Atracurium (0.5 mg/kg loading dose and maintenance dose of 0.1mg/kg IV).

Heart Rate, blood pressure, SPO2, BIS were recorded before induction, after induction, after incision and at the regular intervals throughout the surgery. Reversal of anaesthesia was achieved using Inj. Neostigmine (0.05mg/kg IV) + Inj. Glycopyrrolate (0.01 mg/kg IV).

Patients were shifted to recovery room after complete recovery of muscle power tone and reflexes. At emergence, patients were assessed by Ramsay sedation score [12] in the immediate postoperative period.

The patients were subjected to a structured interview for awareness and recall 24 hours after tracheal extubation (Brice Questionnaire) [13] 1. What was the last thing you remember before going to sleep for the operation? 2. What was the first thing you remember after waking after the operation? 3. Do you remember anything in between these two periods? 4. Did you have any dreams during your operation? 5. What was the most unpleasant thing you remember from your operation and anaesthesia? (noises/voices, feeling anything, or waking up)?

Ramsay Sedation Score:[12]

Score	
1	Patient anxious and agitated or restless
2	Patient co-operative oriented tranquil
3	Patient responds to command
4	Patient exhibits brisk response to light glabellar tap or auditory stimulus
5	Sluggish response to light glabellar tap on auditory stimulus
6	Patient exhibits no response

Results

The age distribution of patients in both groups are comparable ($p>0.05$). The mean age of Group D is 40.36 years and Group F is 38.52 years. In group D, 56% of patients were male and 44% were female while in Group F, 64% of patients were male and 36% were female. So, the gender distribution of patients in both groups is comparable. The weight distribution of patients in both groups are comparable ($p>0.05$). Mean weight of Group D is 57.04 kg and Group F is 54 kg.

There is a significant difference between SBP and DBP of group D and group F around 30 min. ($p = 0.0002$) till end of surgery. Systolic and Diastolic blood pressure significantly lower in

dexmedetomidine group than fentanyl after incision, at 30 min, at 60 min, after 90 min and till end of surgery. [Table 1]

There is a significant difference (p = 0.0006) in heart rate between the group D and group F after 90 mins. In Group D, Heart rate is significantly lower after 90 min than group F. [Table 2]

There is significant difference in BIS score between group D and group F after induction (p<0.0001), which is lower in Group D and difference remains significant until end of the surgery. After end of the surgery, there is no significant difference between both groups. [Table 3] There is significant difference in Ramsay sedation score between group D and group F (p<0.0001), which is lower in Group D. [Table 4]

Table 1: Comparison of Blood Pressure (BP) between two groups

Time	Group D		Group F		P Value	
	SBP	DBP	SBP	DBP	SBP	DBP
T0 (before induction)	126±11	81±6	126±11	81±6	0.8638	0.7851
T1 (after induction)	120±11	78±6	124±12	80±7	0.2601	0.4274
T2 (after incision)	116±10	76±5	121±9	80±6	0.0416*	0.0324*
T30 (at 30 min)	111±10	74±5	121±9	80±5	0.0002*	0.0002*
T60 (after 60 min)	106±8	72±5	121±7.5	81±5	<0.0001*	<0.0001*
T90 (after 90 min)	107±8	73±5	122±7	81±6	<0.0001*	<0.0001*
TE (at end of surgery)	106±7	72±5	126±6	82±5	<0.0001*	<0.0001*

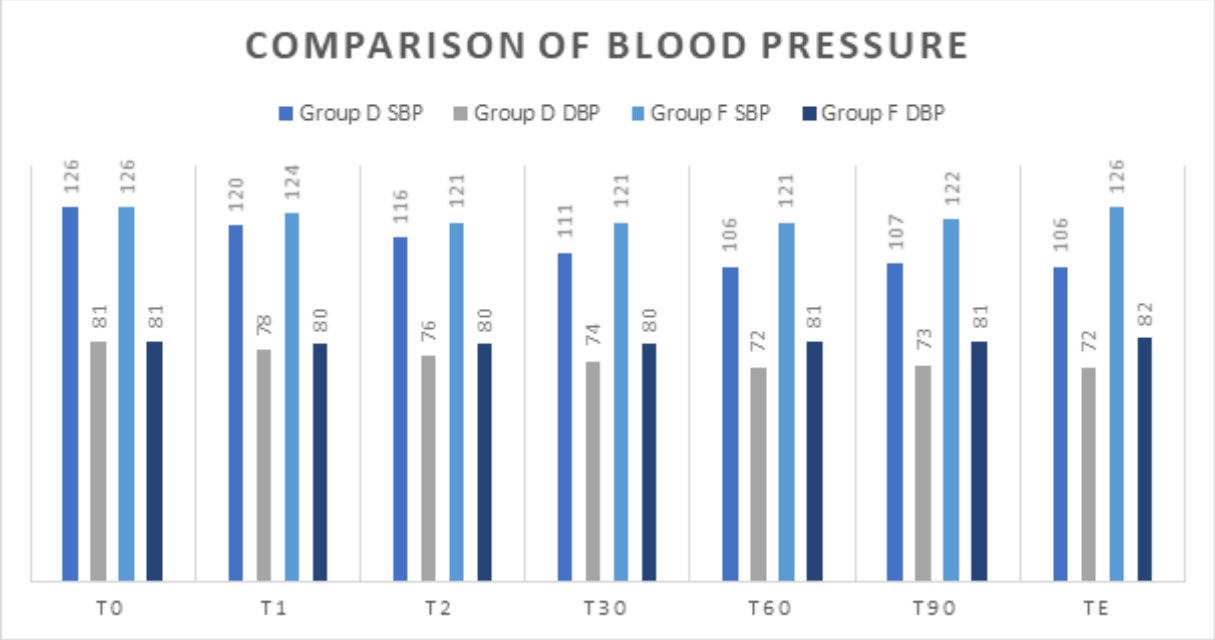

Chart 1: Comparison of Blood Pressure (BP) between two groups.

Table 2: Comparison of Heart Rate (HR) between two groups

Time	Mean heart rate		P Value
	Group D	Group F	
T0 (before induction)	96	91	0.0893
T1 (after induction)	92	86	0.0552
T2 (after incision)	89	84	0.6115
T30 (at 30 min)	83	85	0.5075
T60 (after 60 min)	81	85	0.102
T90 (after 90 min)	78	86	0.0006*
TE (at end of surgery)	77	87	<0.0001*

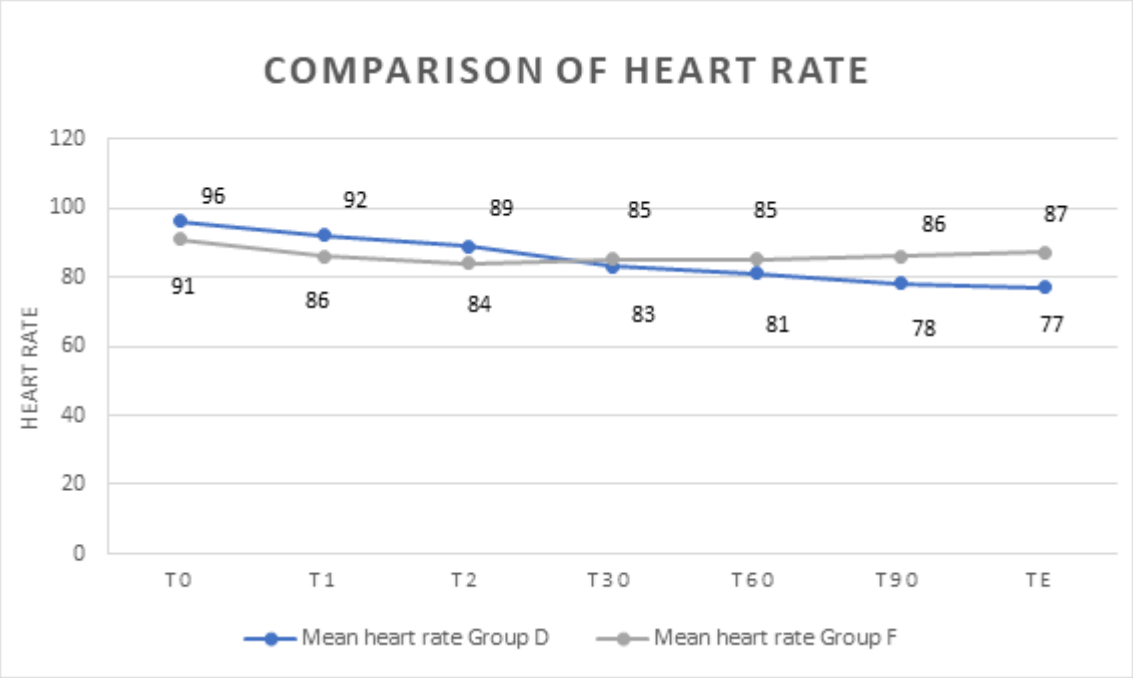

Chart 2: Comparison of Heart Rate (HR) between two groups.

Table 3: Comparison of mean BIS Score between two groups

Time	Group D	Group F	P Value
T0(before induction)	90	91	0.0914
T1(after induction)	47	52	<0.0001*
T2(after incision)	47	54	<0.0001*
T30(at 30 min)	49	56	<0.0001*
T60(after 60 min)	49	57	<0.0001*
T90(after 90 min)	50	56	<0.0001*
TE (at end of surgery)	88	88	0.6956

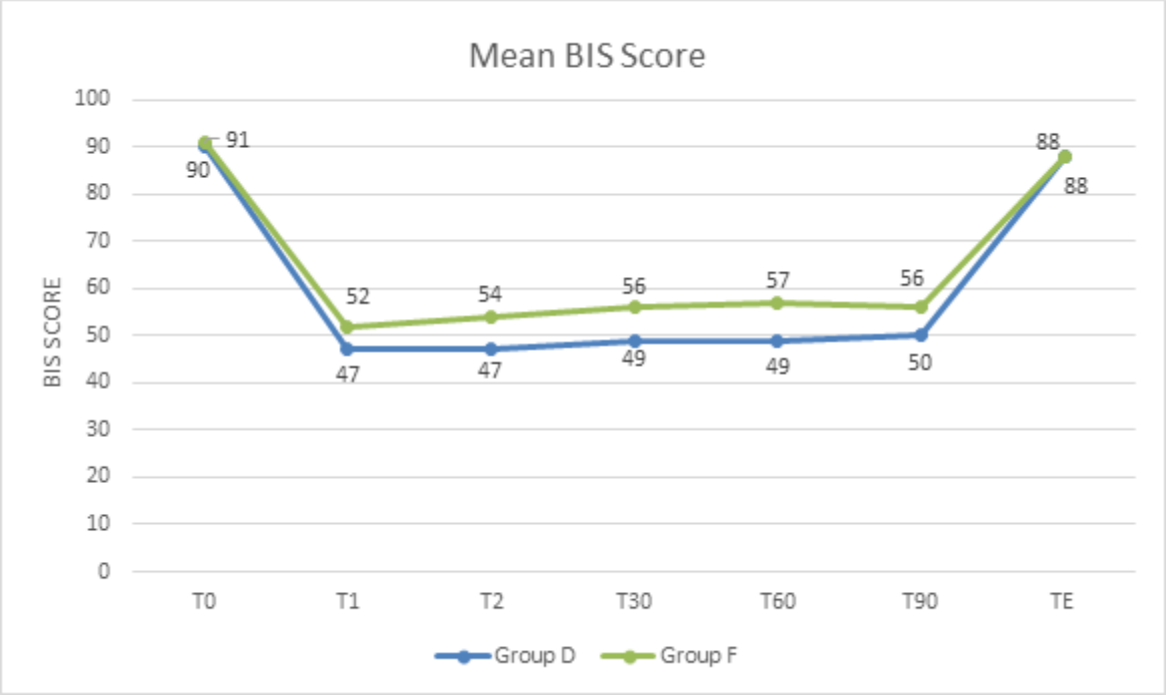

Chart 3: Comparison of mean BIS Score between two groups.

Table 4: Comparison of mean of Ramsay sedation score between two groups.

Recovery Time	Mean of Ramsay Sedation Score		
	Group D	Group F	P Value
R0 (Arrival at Recovery)	3.92	3.08	<0.0001*
R10 (After 10 minutes of arrival)	2.88	2.04	<0.0001*
R20 (After 20 minutes of arrival)	1.84	1.08	<0.0001*
R30 (After 30 minutes of arrival)	1	1.04	-

Table 5: Comparison of Brice Questionaries between two groups

Questions		Group D	Group F
Last thing you remember before anaesthesia	Being in operation theatre	2	2
	Feeling pain from intravenous line	1	3
	No recall	22	20
First thing you remember after waking up	Hearing voices	10	12
	No recall	15	13
Any recall between these 2 periods	Yes	0	5
	No	25	25
Did you dream during anaesthesia	Yes	2	6
	No	23	19

Discussion

General anaesthesia includes amnesia, hypnosis, analgesia, and immobility. But all this in general anaesthesia may not be achieved as muscle relaxants may interfere in our evaluation of depth of anaesthesia due to lack of motor activity and may make patients aware of the intraoperative events. Intraoperative awareness is a result of imbalance in the depth of anaesthesia. For achieving the adequate depth of anaesthesia, we should use intravenous anesthetic agents in hypnotic doses are recommended which ensures amnesia in patients. In this study we use Dexmedetomidine and Fentanyl as hypnotic to reduce awareness.

We found that blood pressure was not significant between two groups before induction (P value 0.8638 for systolic, P value 0.7851 for diastolic) and after induction (P value 0.2601 for systolic, P value 0.4274 for diastolic). But there was a significant difference of blood pressure in group D and group F around 30min. (P value <0.0001). Uddalak Chattopadhyay et al [14] study also concluded thatblood pressure was less in Dexmedetomidine group similar to our study.

In our study, Heart rate was subsequently decreased in both the groups, but we have found that the mean heart rate of group D (78±9) was significantly lower than the group F (86±7) after 90 min of surgery. This result is same as study of Sen S et al [15] and Uddalak Chattopadhyay et al [14]study they also found that heart rate was lower in Dexmedetomidine group.

In our study we use BIS to monitor adequate depth of anaesthesia. BIS is a continuous non-invasive electroencephalographic method that has been proposed to monitor the hypnotic state during sedation and anaesthesia. Its use has been documented to be associated with lesser chance of intraoperative awareness. Our study showed that BIS score was lower in Dexmedetomidine group than Fentanyl group. (P value <0.0001). Despite the difference in BIS equal depth was achieved with both the drugs with no recall in any patient as assessed by modified Brice questionnaire.

Similar results were found by Ahmed et al [10] who studied intraoperative awareness and recall. They obtained result that BIS score showed variable trend between the groups and were significantly lower in Dexmedetomidine group (P value <0.001). They concluded that administration of Dexmedetomidine was as effective in reducing awareness and recall. Aida alkaissi et al [16] also found same results regarding BIS score and they also found that BIS prevents awareness intraoperatively, while Dr. Shah Vandana et al [17] concluded that Dexmedetomidine maintain adequate depth of anaesthesia (using BIS monitor).

We found that Ramsay sedation score after extubation was lower in Dexmedetomidine group than Fentanyl group which is statistically significant. (P value <0.0001). Hong Soo Jung et al [18], in their study evaluated modified OAA/S score, the BIS, the vital signs and perioperative side effects to compare the efficacy of three drugs (Fentanyl, Remifentanyl and Dexmedetomidine), modified OAA/S score was significantly lower in Dexmedetomidine group at 0, 5 and 10 min after arrival at PACU (P value <0.05). In our study we have also observed that Ramsay sedation score was lower in Dexmedetomidine group.

In our study we found no recall in either of the group (Group D & Group F). Amrita Roy et al [19]conducted a study of comparison between Dexmedetomidine and Propofol for maintaining depth of anaesthesia and concluded that Dexmedetomidine was comparable and even better than Propofol in maintaining depth of anaesthesia without any

awareness. In our study, we also concluded that there was no awareness in Dexmedetomidine group.

Conclusion

In General Anaesthesia, depth of anaesthesia and awareness are important parameters as they keep the patients away from postoperative stress and they are also medicolegal importance for anaesthetist. We through this study, concluded that Dexmedetomidine gives better depth of anaesthesia. We also conclude that, if we keep BIS score between 40 to 60, it reduces the risk of awareness during anaesthesia. Both Dexmedetomidine and Fentanyl reduce the awareness but compared to Fentanyl, Dexmedetomidine provides lower BIS score. By using Ramsay sedation score, we also concluded that Dexmedetomidine provides better sedation postoperatively than Fentanyl.

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