Study on Comparison of Two Opioids IV Fentanyl with IV Butorphanol in Propofol based Anaesthesia to Attenuate Haemodynamic Response in Abdominal Surgical Cases

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ABSTRACT

Introduction: Opioids when combined with propofol not only have a synergistic anaesthetic effect but also they successfully blunt the haemodynamic response to the noxious stimuli during surgery. Current study two opioid analgesics, fentanyl and butorphanol are used in propofol based anaesthesia in the abdominal surgery cases to study their effectiveness in attenuating the haemodynamic response.

Material and Methods: Cross-sectional study was undertaken on 60 adult patients admitted for abdominal surgeries. Participants were divided in two equal groups where group 1 received Inj. Fentanyl (2mcg/Kg) and group 2 received Inj. Butorphanol (20mcg/Kg).The hamodynamic variables HR, SBP, DBP and MAP recorded prior to study drug administration i.e. at preoperative (POP), Post study drug administration (POSD), at induction (IND) at laryngoscopy (LYNG), at intubation (INTUB), every 1 minute after intubation and at skin incision (INC). Descriptive analysis was done by summarizing the continuous data in mean and standard deviation. Student t-test was used to study the mean difference between the two study groups.

Conclusions: Fentanyl and Butorphanol were effective in controlling HR, SBP, DBP and MAP which are constituents of haemodynamic response to laryngoscopy and intubation. Fentanyl offered better haemodynamic stability with laryngoscopy, intubation and skin incision.

Results: After administration of IV Fentanyl and Butorhanol mean HR decreased from 86.83±11.91 to 85.63±11.60 ($p<0.05$) and 90.97±14.13 to 87.63±13 ($p<0.05$) respectively. There was statistically significant difference in both the groups in mean SBP at every one minute after intubation upto skin incision (INC). The mean DBP at laryngoscopy between two groups were significant ($p=0.006$).

Keywords: Fentanyl, Butorphanol, haemodynamic response, abdominal surgery.

INTRODUCTION

With the advent of newer drugs, the practice of anesthesia has revolutionized. Rapid smooth induction, rapid recovery, perioperative hemodynamic stability, minimum post-operative pulmonary complications and effective analgesia intra-operatively and post-operatively are the main aspects of anesthesia in abdominal surgical cases.

Ever since propofol had been used as the induction agent, potent and short acting opioids like fentanyl and sufentanyl and inhalational agents like isoflurane, sevoflurane have gained popularity in anesthesia. However in spite of much progress in anesthesia the various noxious stimuli encountered during conduct of general anesthesia like laryngoscopy, intubation, skin incision and manipulation of vital organs are difficult to attenuate these responses. These noxious stimuli manifest as circulatory disturbances such as tachycardia, hypertension and cardiac arrhythmias[1] which are known as pressor response.[2] Balanced anesthesia with combination of opioids and propofol has gained widespread acceptance as one of the methods to attenuate pressor response.

In this study two opioid analgesics, fentanyl and Butorphanol were used in propofol based anesthesia in the abdominal surgery cases. They are studied for their effectiveness in attenuating the hemodynamic response to the noxious stimuli viz.laryngoscopy, intubation and skin incision.

MATERIAL AND METHODS

In this hospital based cross-sectional study, two opioid analgesics were used in propofol based anesthesia in 60 abdominal surgery cases. They were compared for their ability to attenuate the response to noxious stimuli during induction and maintenance of anesthesia. Patients of either sex, age group between 18 to 60 years and weight between 20 to 70 Kg, were selected for study. Prior to selection all patients were subjected to detailed pre anesthetic checkup and they belonged to ASA Grade 1 and MPC Grade 1 or 2. All patients with airway disease, hypertension, diabetes, coronary artery disease and cerebrovascular disease were excluded from the study. They were allocated to two group's viz. Group I and Group II with 30 patients in each group. Group I was received Inj. Fentanyl 2 mcg/kg given slowly IV before Induction and group II received Inj Butorphanol 20 mcg/kg given slowly IV before Induction.

Standard anesthetic technique was used for all 60 subjects Tab. Alprazolam 0.25 mg 1 HS and 1 Tab. 2 hrs prior to surgery with sip of water was given as premedication.

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All patients were fasted for eight hours and peripheral intravenous line was secured with 18 G intravenous cannula. Base line parameters like HR, SBP, DBP, MAP and SPO_2, were monitored continuously. Capnometer (EtCO2) attached after intubation.

Induction of anaesthesia

Three minutes after Inj. Fentanyl/ Inj. Butorphanol, patients were preoxygenated with 100% oxygen for 5 minutes and were induced with Inj Propofol 2 - 2.5 mg/kg slow IV in both the groups till loss of consciousness. This was followed by Inj. Suxamethonium 2 mg/kg for muscle relaxation to facilitate endotracheal intubation. After assisting ventilation after noting apnoea, assessment of tone of abdominal muscles till wearing off fasciculations, laryngoscopy was done and intubation with appropriate size endotracheal tube was achieved. Bilateral air entry was confirmed, EtCo2 reading noted and the endotracheal tube was firmly secured using adhesive tape.

Maintenance of anesthesia

Anesthesia was maintained with Oxygen 40% and Nitrous Oxide 60% on IPPV using Close Circuit circle absorber and muscle relaxation using Inj. Vecuronium as single bolus dose and later at fixed interval throughout the procedure.

Reversal and Extubation

After completion of surgery and achieving complete haemostasis and placement of dressing at the site of surgery, residual neuromuscular blockade was antagonized with a combination of Inj Neostigmine 0.05 mg/kg and Inj Glycopyrrolate 8mcg/kg IV, Nitrous oxide was discontinued and 100% O_2 administered. The Patients were extubated after thorough oral and endotracheal suctioning.

All the vital parameter like HR, SBP, DBP and MAP were monitored carefully from preoperative to post extubation period and reading noted at following events

1. Preoperative - prior to study drug administration (POP).
2. Post study drug administration (PoSD).
3. Induction with Inj. Propofol (IND).
4. Laryngoscopy (LYNG).
5. Intubation (INTUB).
6. Every one minute after intubation.
7. Skin incision (INC).

Institutional ethics committee approval was obtained before starting of the study and written informed consent was taken and confidentiality was ensured.

STATISTICAL ANALYSIS

Data was analyzed by using SPSS version 11.5. Mean and standard deviation was used to summarize the data and unpaired student t-test was used to study the statistical significance. P value of <0.05 was considered as significant.

RESULTS

Study includes 60 participants divided equally into two groups. Group I Comprised of 19 female and 11 male patients and mean age and weight of the participants was found to be 43.47±12.29 years and 57.13±5.75kg.Group II Comprised of 13 female and 17 male patients and mean age and weight of the participants was 46.27±11.80 years and 60.10±5.93kg. Study groups were comparable with respect to age weight and sex and difference was not significant (p<0.05).

Heart Rate

As shown in the table no 1 preoperative HR in both groups were comparable and statistical difference between them was not significant (p=0.225). At Post study drug administration (POSD) and at induction with inj. Propofol the mean HR between both groups were comparable and difference between them statistically not significant. (p=0.545 at POSD and p=0.493 at IND). At laryngoscopy (LYNG) the mean HR between both groups was comparable and difference was not significant statistically (p=0.053). At intubation (INTUB) the mean HR in both groups was increased. Difference between both the groups was significant (p=0.021) statistically.

The mean HR in fentanyl groups started decreasing from

Parameters	Group I	Group II	p value
Age (Years)	43.47±12.29	46.27±11.80	0.372
Weight (Kg)	57.13±5.75	60.10±5.93	0.054
Gender (M: F)	19:11	13:17	0.6
p>0.05 Not Significant			

Table-1: Demographic data of study population

Heart Rate At	Group I Mean and SD	Group II Mean and SD	Unpaired t-test	
			t-value	p-value
Preoperative	86.83±11.91	90.97±14.13	-1.225	0.225
Post study drug administration	85.63±11.60	87.63±13.74	-0.609	0.545
Induction	80.50±11.36	82.70±13.29	-0.689	0.493
Laryngoscopy	87.63±10.20	93.43±12.46	-1.973	0.053
Intubation	90.23±9.02	96.40±11.00	-2.375	0.021
1 min after intubation	89.27±8.94	97.70±12.05	-3.079	0.001
2 min after intubation	86.97±8.60	98.60±12.48	-4.205	0.001
3 min after intubation	84.90±9.26	98.43±13.60	-4.506	0.001
4 min after intubation	83.07±9.17	94.90±12.20	-4.247	0.001
5 min after intubation	81.10±8.57	91.93±11.11	-4.228	0.001
6 min after intubation	80.10±8.63	87.37±10.53	-2.924	0.005
At skin Incision	80.40±7.50	86.67±9.00	-2.930	0.005
p≤0.05 – Significant				

Table-2: Comparison of heart rate at various intervals between Fentanyl and Butorphanol groups

Systolic BP At	Group I Mean and SD	Group II Mean and SD	Unpaired t-test	
			t-value	p-value
Preoperative	132.90±10.86	131.93±8.20	0.389	0.699
Post study drug administration	128.87±9.88	128.73±9.34	0.054	0.957
Induction	114.57±7.70	115.80±6.83	-0.656	0.514
Laryngoscopy	127.93±8.18	136.07±9.82	-3.486	0.001
Intubation	130.07±11.09	139.00±8.66	-3.477	0.001
1 min after intubation	128.70±10.90	139.77±7.61	-4.561	0.001
2 min after intubation	125.00±11.16	140.03±7.50	-6.125	0.001
3 min after intubation	122.57±10.18	139.17±9.78	-6.413	0.001
4 min after intubation	121.10±8.70	135.67±9.99	-6.023	0.001
5 min after intubation	119.87±791	128.20±7.00	-4.323	0.001
6 min after intubation	119.43±7.26	127.03±5.51	-4.568	0.001
At skin Incision	121.27±7.86	128.80±5.77	-4.234	0.001
p≤0.05 – Significant				

Table-3: Comparison of systolic Blood Pressure at various intervals between Fentanyl and Butorphanol groups

Diastolic BP At	Group I Mean and SD	Group II Mean and SD	Unpaired t-test	
			t-value	p-value
Preoperative	75.80±8.05	75.47±9.08	0.150	0.881
Post study drug administration	73.80±7.28	74.37±9.52	-0.259	0.797
Induction	69.83±7.84	71.27±8.57	-0.676	0.502
Laryngoscopy	74.10±7.26	80.13±9.09	-2.842	0.006
Intubation	74.90±7.60	81.77±8.80	-3.233	0.001
1 min after intubation	73.90±8.92	82.23±9.07	-3.587	0.001
2 min after intubation	72.63±8.69	81.97±9.69	-3.926	0.0001
3 min after intubation	71.30±8.44	81.27±9.63	-4.262	0.001
4 min after intubation	71.67±9.27	80.07±9.55	-3.457	0.001
5 min after intubation	70.67±7.32	77.27±9.27	-3.061	0.003
6 min after intubation	70.93±6.88	76.90±9.03	-2.879	0.001
At skin Incision	71.97±7.30	78.17±8.27	-3.078	0.003
p≤0.05 – Significant				

Table-4: Comparison of diastolic blood pressure at various intervals between Fentanyl and Butorphanol groups

MAP At	Group I Mean and SD	Group II Mean and SD	Unpaired t-test	
			t-value	p-value
Preoperative	94.83±8.10	94.29±8.00	0.262	0.794
Post study drug administration	92.16±7.16	92.49±8.19	-0.168	0.867
Induction	84.74±7.25	86.11±7.43	-0.721	1 0.474
Laryngoscopy	92.04±6.62	98.78±8.37	-3.454	0.001
Intubation	93.29±8.02	100.84±7.92	-3.672	2 0.001
1 min after intubation	92.17±8.84	101.41±7.92	-4.266	0.001
2 min after intubation	90.09±8.80	101.32±8.33	-5.077	0.001
3 min after intubation	88.39±8.32	100.57±8.80	-5.507	0.001
4 min after intubation	88.14±8.33	98.60±9.12	-4.636	0.001
5 min after intubation	87.07±6.75	94.24±7.90	-3.784	0.001
6 min after intubation	87.10±6.36	93.61±7.33	-3.676	0.001
At skin Incision	88.40±6.90	95.04±6.81	-3.754	0.001
p≤0.05 – Significant				

Table-5: Comparison of map at various intervals between Fentanyl and Butorphanol groups

1 min after intubation (89.27±8.94) but the mean HR in Butorphanol group increased up to 4 min after intubation (94.90±12.20). The difference in mean HR in both groups was significant statistically from intubation up to skin incision (INC) with $p<0.05$.

Systolic Blood Pressure

The differences in mean systolic BP between Fentanyl and Butorphanol group at preoperative (POP), Post study drug administration (POSD) and induction (IND) level were not significant.

At laryngoscopy (LYNG) the mean SBP in Fentanyl group increased to 127.93±8.18 from a value of 114±7.70 at induction. The mean systolic BP in Butorphanol group at laryngoscopy increased to 136.07±9.82mmHg from a value

of 115.80±6.83 at induction. This difference was found to be significant (p=0.001) statistically.

At intubation (INTUB) the mean SBP in both groups was increased and difference was significant statistically (p=0.001).There was statistically significant difference in both the groups in mean SBP at every one minute after intubation up to skin incision (INC).

Diastolic Blood Pressure (DBP)

The mean DBP in Fentanyl and Butorphanol group at preoperative (p=0.881), Post study drug administration (POSD) (p=0.797) and at induction (p=0.502) were comparable and difference between them was not significant statistically (p<0.05).

The mean DBP at laryngoscopy between two groups were significant (p=0.006). The mean DBP at intubation when compared between two groups were significant (p=0.002) statistically. The mean DBP in both groups were compared at every one minute after intubation up to 6 min and difference was statistically significant. At skin incision the difference in mean DBP compared in both groups was significant (p=0.003) statistically.

Mean arterial pressure (MAP)

The MAP was compared between both Fentanyl and Butorphanol group and there was no significant difference at preoperative (POP), at post study drug administration (POSD) and at induction (IND) with p value of <0.05.

There was statistically significant difference in MAP at laryngoscopy (p=0.001). At intubation there was significant statistical difference in MAP (p=0.001). The MAP in Butorphanol group increased significantly right from intubation up to 4 minute after intubation and when both groups were compared the difference in MAP from laryngoscopy onwards up to skin incision was significant statistically.

DISCUSSION

Present study 60 patients divided into two equal groups of age group between 18-60 years and weights ranging from 20-70kg belonging to both sexes were included. Both groups were comparable with respect to age, weight and gender and difference was not significant statistically. Similar study done by Ahire et al and Gupta et al there was no difference between two groups with respect to age and gender.[3,4]

In our study, the mean HR when compared between fentanyl and Butorphanol group then there was no statistically significant difference during laryngoscopy. But the mean HR was increased significantly (p<0.05) in Butorphanol group during intubation and up to skin incision. Bruder N et al[5] noted that average increase HR by 20% at laryngosocpy and intubation and protective effect of fentanyl starts at 2µgm/kg IV. In 2002 Yushi–U Adaehi et al[6] using inj fentanyl 2µgm/kg IV immediately before the induction of anaesthesia found that the administration of fentanyl suppresses the haemodynamic responses to endotrecheal intubation more than it does to laryngoscopy. In 2007 Dr Anila Malde et al[7] by using IV fentanyl (2µgm/kg IV) or lidocaine (1.5mg/kg) or saline 5 minutes before intubation found that lidocaine and fentanyl both attenuated the rise in pulse rate, though fentanyl was better.

In our study, after administration of inj. fentanyl the mean SBP decreased significantly below preoperative value. This effect was due to vagotonic action of opioids.[8] After induction with inj propofol there was statistically significant (p<0.05) fall in mean SBP below preoperative value in fentanyl group. This decline in fentanyl group was due to additive action of propofol and fentanyl. Mean SBP in both groups at preoperative level at post study drug administration (POSD) and induction (IND) comparable and statistically not significant (Graph 8). Thus when mean SBP was compared between fentanyl and butorphanol group, there was statistically significant (p<0.05) rise in butorphanol group during laryngoscopy, at intubation upto skin incision. 1996 Kietzman D et al[9], compared the effects of sufentanil propofol with fentanyl propofol anaesthesia and concluded that in both regimes, the sympatho adrenal stress response to major abdominal surgery was nearly completely suppressed resulting in stable haemodynamics during the operation. Ahire et al in 2016 reported that pulse rate and systolic blood pressure dropped to a greater level with Patients receiving butorphanol 20 µg/kg i.v. than with Patients receiving fentanyl 1 µg/kg i.v.[3].

In our study, the mean DBP in both fentanyl and butorphanol group at preoperative level, at post study drug administration (POSD) and at induction (IND) were comparable and statistically not significant. However the mean DBP from induction until 6th minute and skin incision was statistically significant with raise in the mean DBP in Butorphanol group. In contrast Balsubramaniam et al in 2016 reported fall in mean DBP in Butorphanol group from induction until the 1oth minute after induction.[10]

When MAP in both butorphanol and fentanyl group was compared then there was no statistical difference at preoperative (POP), post study drug administration (POSD) and induction (IND). The MAP was significantly higher in Butorphanol group during laryngoscopy, at intubation upto skin incision than fentanyl group. There was significant (p<0.05) rise in MAP in butorphanol group during laryngoscopy at intubation and upto 4 minute after intubation.

CONCLUSION

Study concludes that fentanyl and butorphanol, both are effective in attenuating the increase in HR, Mean SBP, Mean DBP and MAP to stimuli like laryngoscopy, intubation and skin incision although fentanyl was superior to attain haemodynamic stability than butorphanol and was significant statistically.

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