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A comparative study of haemodynamic responses of butorphanol and fentanyl while surgeries

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***Abstract*---**Background: In spite of several new airway devices emerging in recent times, direct laryngoscopy and endotracheal intubation still reigns as the gold standard in airway management, Butorphanol is a morphinan chemically related to levorphanol and has mixed agonist-antagonist properties. It is more potent and it has advantage of producing less addiction and respiratory depression. Fentanyl is μ, receptor agonist, structurally related to phenylpiperidines having clinical potency ratio 50 – 100 times of morphine. It is more potent. Butorphanol tartarate is a totally synthetic narcotic antagonist analgesic, which does not require opium alkaloids for its synthesis. Aim and objectives: Comparing the haemodynamic parameters (pulse, SBP, DBP, MAP, SpO2) during general anaesthesia in patients receiving butorphanol and fentanyl. Material and Methods: This is a double-blind randomised study comparing the two opioids, fentanyl and butorphanol, was carried out in Muzaffarnagar Medical College & Hospital, Muzaffarnagar, Uttar Pradesh, India. In our study 62 cases were divided randomly into two groups. Group A patients received inj .butorphanol tartarate and Group B patients received inj fentanyl citrate. The complete data was recorded by a single observer regarding haemodynamic parameters (systolic blood pressure, diastolic blood pressure, heart rate etc.)

intraoperatively as well as postoperatively. Results: However haemodynamic parameters remained on higher side for first 5 minutes in those who received fentanyl. After 15 minutes difference in parameters in both groups was statistically non significant.

***Keywords*---**Heart rate, Blood pressure, Haemodynamic responses, Butorphanol, Fentanyl, Spo2, Pulse rate, surgeries.

Introduction

Some pharmacological agents used to suppress the pressor response are volatile anaesthetic agents [1] lignocaine, [2] opioids,[1] vasodilators (Sodium nitroprusside,[2] nitroglycerine,[3] calcium channel blockers[4] and adrenergic blockers[5]. The nonpharmacological methods include smooth and gentle intubation with a shorter duration of laryngoscopy, use of LMA [6] and blocking glossopharyngeal and superior laryngeal nerves[7]. Butorphanol is an agonist-antagonist opioid, an agonist at K-receptors. Its activity at μ-receptors is either antagonistic or partially agonistic. It is five to eight times as potent as morphine and is available only in parenteral form, whereas the duration of action of butorphanol is similar to that of morphine, its plasma half-life is only 2 to 3 hours. Side effects after butorphanol include drowsiness, sweating, nausea and CNS stimulation.Since past time, opioids are used alone or in combination with other agents like sedatives or anticholinergics as premedicant. The goal of opioid premedication is to provide Moderate sedation, Anxiolysis, Mainyain haemodynamic stability. Potential risk of opioid administration include Oversedation, Respiratory depression and Nausea and vomiting. Lundy in 1920, coined the term "Balanced anaesthesia". In this, the analgesia component is provided by opioids. Opioid agents can be classified as Naturally occurring (Morphine, codeine), Synthetics (Morphinan derivative like Butorphanol), Phenylpiperedine series like Pethidine, Fentanyl, Sufentanyl and Semisynthetic like Heroine. An ideal perioperative analgesic should offer protection against the pressor response should provide intense analgesia sufficient to relieve pain of surgical incision, maintain the haemodynamic parameters and should provide adequate postoperative analgesia. At the same time, the drug should be devoid of side effects of morphine like nausea, vomiting, pruritus, respiratory depression. Fentanyl citrate is a completely synthetic opioid. It is more potent and has a better margin of safety than meperidine.[8,9,10] Butorphanol tartarate is a totally synthetic narcotic antagonist analgesic, which does not require opium alkaloids for its synthesis. This drug with its combined antinarcotic and potent analgesic properties offers promise as an agent with a low propensity for producing addiction and respiratory depression.[11] Some past studies observed That the analgesic effect of butorphanol appeared in every respect to approximate that of morphine sulfate with negligible side effects. The data demonstrates that butorphanol is a useful analgesic for use in a balanced anaesthesia technique with a low side effect incidence.[12] Present study was conducted to compare control of haemodynamic changesin Butorphenol and fentanyl as a component of balanced anaesthesia. The purpose of this study was to compare Butorphanol, a new opioid with Fentanyl a popular short duration opioid as a component of balanced general endotracheal anaesthesia.

Material and Methods

This is a double-blind randomised study comparing the two opioids, fentanyl and butorphanol, was carried out in Muzaffarnagar Medical College & Hospital, Muzaffarnagar, Uttar Pradesh, India. In our study 62 cases were divided randomly into two groups Group A: patients receiving inj .butorphanol tartarate 20µg/kg intravenously prior to induction. Group B: patients receiving inj .fentanyl citrate 1µg/kg intravenously prior to induction.

Inclusion criteria:

1. Physical status of ASA I and ASA II
2. Age group between 18 to 55 years.
3. Gender-Both Males and Females TO be posted for various surgeries under general anaesthesia

Exclusion criteria:

Patients were excluded from study if their clinical examination or laboratory investigations were consistant with reasonable suspicion of

1. Cardiovascular diseases like hypertension, ischemic heart disease, valvular heart disease.
2. Respiratory diseases like asthma, pulmonary tuberculosis, COPD Renal or hepatic derangements
3. Haematological derangements
4. Those adjudged to be mentally of limited competene or taking psychotherapeutic drugs.
5. Pregnant females
6. History of narcotic abuse Written informed consent was taken from all the patients.

Patients under the study were thoroughly assessed preoperatively regarding detailed history, physical examination and all necessary investigations. No premedication was given except Inj. Glycopyrrolate 5 µg/kg intravenously. Vital parameters like pulse, blood pressure both systolic and diastolic, respiratory rate, oxygen saturation were measured. A single observer made all observations. After keeping complete resuscitation and anaesthesia instruments ready, intravenous line was secured with an intracath. 3 minutes prior to induction patients were given an equianalgesic dose of Inj. Butorphanol 20µg/kg intravenously or Inj. Fentanyl 1µg/kg intravenously based on body weight in double blind fashion. Following preoxygenation for 5 minutes, general anaesthesia was induced with Inj. Thiopentone sodium 4 mg/kg intravenously slowly followed by tracheal intubation under direct laryngoscopic vision with adequate sized endotracheal tube facilitated by Inj. Succinyl Choline 2 mg/kg intravenously. Anaesthesia was maintained with 40% 02:60% N20 with intermittent isoflurane depending on the depth of anaesthesia and long acting depolarizing muscle relaxant. Inj. Vecuronium bromide 0.08 mg/kg intravenously on controlled ventilation with Bains' circuit. Vital parameters including pulse, blood pressure, oxygen saturation, were monitored just prior to induction, 1and 2 minute after induction and 1 and 3 minute after tracheal intubation and 15 minutes interval thereafter. During recovery patient's activity, respiration, alertness, color was evaluated every

30 minutes for 90 minutes. The complete data was recorded by a single observer regarding haemodynamic parameters intraoperatively as well as postoperatively.

Results

Mean age and mean weight of patients in Group A was 30.20 ± 1.68 years and 55.70 ± 1.01 kgs respectively. Mean age and weight of group B were 31.47±1.40 years and 57.80±0.78 kgs respectively. In Group A out of 31 patients 19 were males and 12 were females. In Group B out of 31 patients 15 were males and 16 were females. Mean duration of surgery in Group A and Group B. It was 90.17 ± 2.40 minutes in Group A and 83.83 ± 2.57 minutes in Group B. The mean age, sex and duration of surgery of patients. By statistical analysis, they were found comparable.

Table 1
Comparison of Group A and Group B according to Mean Haemodynamic parameters preoperatively

Parameter	Group A	Group B	T	
Pulse(/min)	87.33±1.069	86.53±0.9682	0.5546	NS
Systolic BP(mmHg)	119.3±1.741	120.2± 1.136	0.4490	NS
Diastolic BP(mmHg)	72.9±0.9953	74.67±0.9700	1.247	NS

Unpaired t test. ns:-not significant, s:-significant.

Table 1 show mean haemodynamic parameters preoperatively. When subjected to statistical analysis, they were found to be comparable.

Table 2
Comparison of Group A and Group B according to Mean pulse (per min).

	Time(Min)	Group A	Group B	T	NS
Induction	1	81.87±0.7236	80.17±0.8457	1.527	NS
	2	82.50±0.6622	81.07±0.8509	1.329	NS
	1	86.50±0.6041	91.80±0.7198	5.64	S
Intubation	3	77.20±0.5390	84.33±0.5194	9.53	S
	15	75.21±0.5331	76.27±0.5050	1.444	NS
	30	75.07±0.5273	76.33±0.4161	1.886	NS
	45	74.57±0.6621	75.07±0.5402	0.5851	NS
Intra operative	60	75.00±0.7176	75.23±0.6319	0.244	NS
	75	74.81±0.6052	74.35±0.7741	0.4734	NS
	90	74.70±0.7317	74.06±0.9936	0.525	NS

Unpaired t test. ns:-not significant, s:-significant.

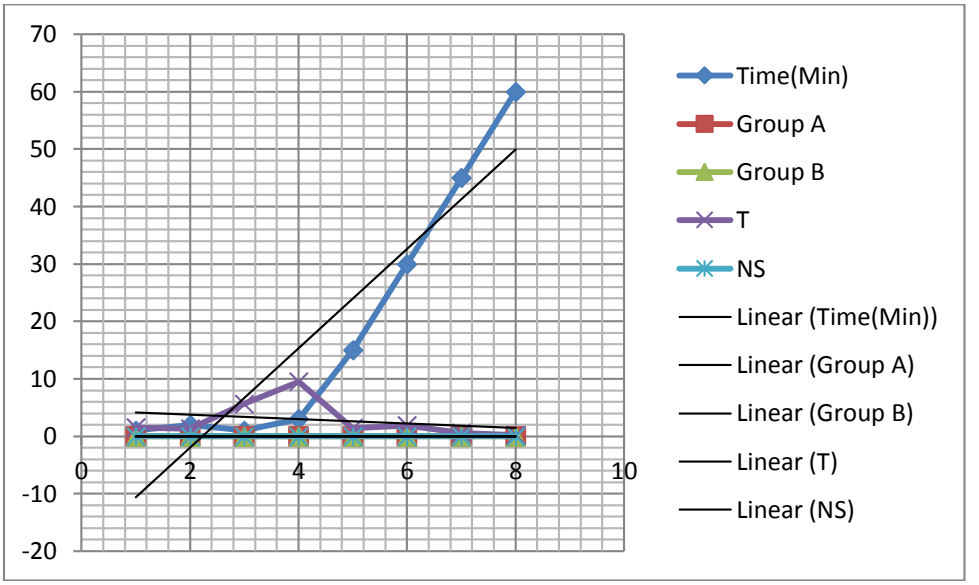

Figure 1. Mean pulse (per min) in Group A and Group B.

As in Figure 1 and Table 2, Mean pulse 1 minute after intubation in group A was 86.50±0.6041 and in group B was 91.80±0.7198.Also,mean pulse 3 minutes after intubation in group A was 77.20±0.5390 and in group B was 84.33±0.5194.When analysed statistically mean pulse at both intervals were significantly higher in group B.

Table 3
Comparison of Group A and Group B according to Mean systolic blood pressure (mmHg)

	Time(Min)	Group A	Group B	T	NS
Induction	1	111.4 ± 0.89	113.7 ± 1.02	1.67	NS
	2	111.9 ± 0.80	114.5 ± 1.09	1.957	NS
	1	115.0 ± 0.96	127.9 ± 1.02	9.21	S
Intubation	3	112.9 ± 1.18	121.0 ± 1.52	4.18	S
	15	104.5 ± 0.97	113.6 ± 0.97	6.65	S
	30	105.8 ± 0.98	108.8 ± 1.37	1.77	NS
	45	109.3 ± 1.25	111.2 ± 1.15	1.13	NS
Intra operative	60	108.5 ± 1.00	111.1 ± 0.86	1.9	NS
	75	109.1 ± 1.50	109.7 ± 1.92	0.27	NS
	90	121.0 ± 1.49	118.9 ± 2.09	0.83	NS

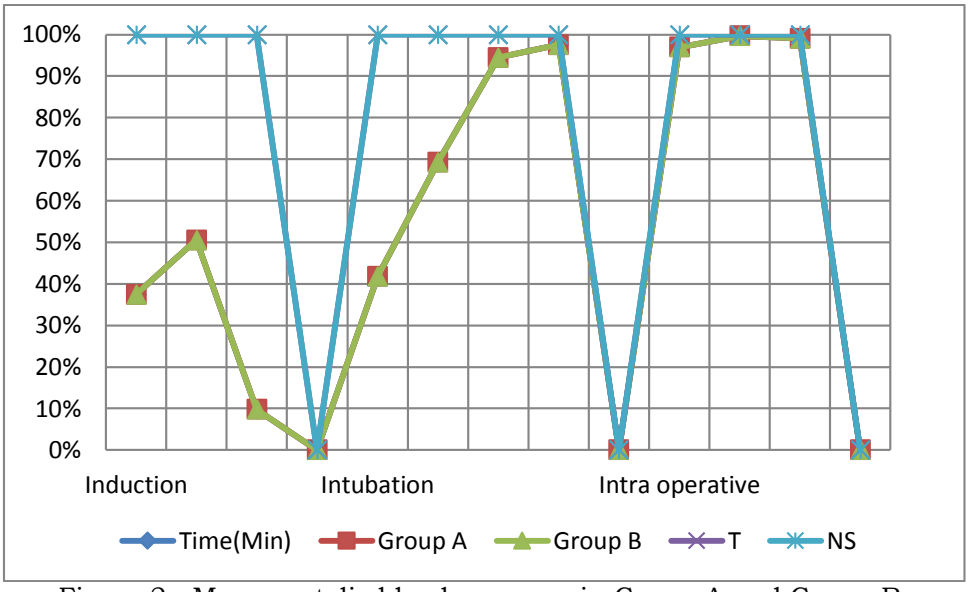

Figure 2. Mean systolic blood pressure in Group A and Group B.

Table 3 and Figure 2 shows mean Systolic blood pressure in both the groups. After statistical analysis it was observed change in Systolic blood pressure was insignificant.

Table 4
Comparison of Group A and Group B according to Mean diastolic blood pressure (mmHg)

	Time(Min)	Group A	Group B	T	NS
Induction	1	72.93± 0.99	74.67±0.970	1.247	NS
	2	72.93±0.995	74.67±0.970	1.247	NS
	1	75.13±0.856	74.80±0.734	0.295	NS
Intubation	3	73.73±0.923	72.67±0.609	0.964	NS
	15	73.47±0.670	71.80±0.501	1.99	NS
	30	72.07±0.464	73.60±0.674	1.87	NS
	45	72.87±0.728	73.47±1.205	0.426	NS
Intra operative	60	74.00±0.868	71.6± 0.894	1.871	NS
	75	69.85±1.174	73.22±1.704	1.66	NS
	90	74.87±1.088	76.88±1.991	0.951	NS

Unpaired t test. ns:-not significant s:-significant.

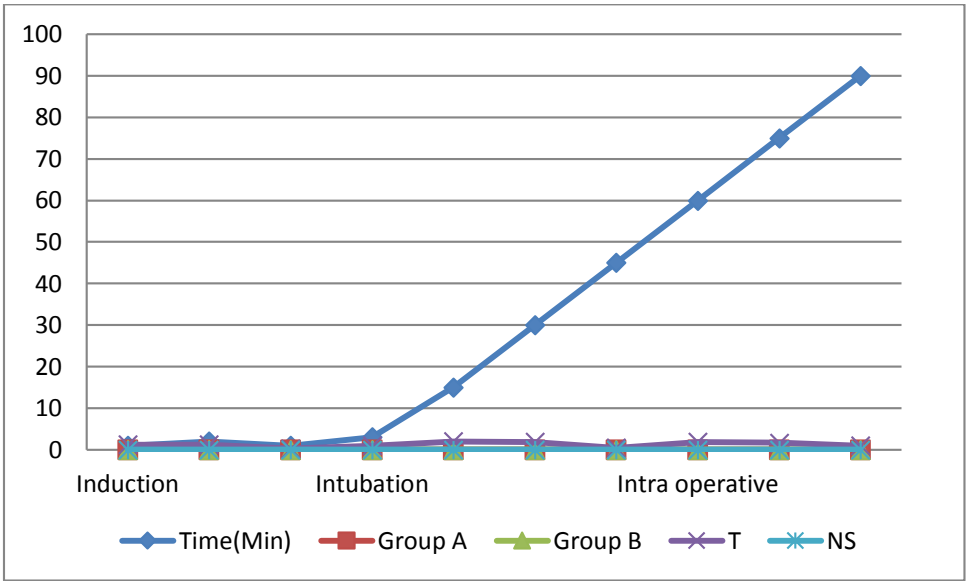

Figure 3. Mean diastolic blood pressure in A and Group B.

Table 4 and Figure 3 shows mean diastolic blood pressure in both the groups. After statistical analysis it was observed change in diastolic blood pressure was insignificant.

Discussion

This study was undertaken to compare the effectiveness of these two opiolds viz fentanyl and butorphanol as a perioperative analgesic. The study included 60 cases divided into 2 groups of 30 each receiving butorphanol 20 µg/kg intravenously or fentanyl 1µg/kg intravenously in equianalgesic doses.ASA I and II patients of either sex were selected. Age, weight and sex distribution in both the groups was comparable.[13] Preoperative haemodynamic parameters and haemodynamic parameters 1 and 2 min after induction were comparable. Laryngoscopy and intubation are associated with a pressor response i.e., tachycardia, hypertension with its deleterious effects. It is especially important to block the pressor response in patients with cardiovascular disease, old age etc. Various methods have been studied for amelioration of this response like local anaesthetics, nitroglycerine, calcium channel blockers, β blockers and narcotics. In our study we observed that butorphanol offers better protection against the pressor response of laryngoscopy and intubation.[14,15,16] Mean pulse 1 minute after intubation in group A was 86.50±0.6041 and in group B it was 91.80±0.7198.Also,mean pulse 3 minutes after intubation in group A was 77.20±0.5390 and in group B it was 84.33±0.5194.When analysed statistically mean pulse at both intervals were significantly higher in group B. Mean systolic blood pressure in group A 1 minute after intubation was 115.0 ± 0.96 mm of Hg, 3 minutes after intubation it was 112±1.18 mm of Hg and 15 minutes after intubation it was 104±0.97 mm of Hg while in group B it was 127.9±1.02 mm of Hg, 1 minute after intubation, 121.0±1.52 mm of Hg 3 minutes after intubation and 113.6±0.97 mm of Hg, 15 minutes after intubation. After statistical analysis mean systolic blood pressure in group B 1minute, 3minutes and 15 minutes after

intubation was significantly higher than corresponding mean systolic blood pressure in group A In 1987 Sujit K. Pandit MD, Sarla P. Kothary MD, Uma A. Pandit MD, Mary K. Mathai MD et al compared equianalgesic doses of butorphanol (40 µg/kg ') and fentanyl (2.0 µg/kg) were compared as to balanced general anaesthesia for outpatient laparoscopic procedures [18]. They observed that induction, maintenance and recovery characteristics were not different in the two groups except that the post-intubation arterial pressure and heart rate in the fentanyl group were significantly higher than the base line values. 6 In 1991 Beverly K. Philip MD, David A. Scott MD, Dubravka Freiberger MD, et al compared butorphanol with fentanyl as the narcotic component of general anaesthesia for ambulatory laparoscopic surgery.[19] This double-blind, randomized study enrolled 60 healthy women who received equianalgesic doses of fentanyl 1µg/kg (F, n = 30) or butorphanol 20 µg/kg (B, n = 30) prior to induction of anaesthesia. Tracheal anaesthesia was maintained with nitrous oxide/oxygen, isoflurane, and succinylcholine by infusion, intraoperatively, patients who received B demonstrated lower pulse rate before and after intubation ($P < 0.01$) and lower diastolic blood pressure after intubation ($P < 0.01$). Anesthesiologists judged the maintenance phase as satisfactory.7 In 2007 Singh N., Verma R.K, Jaiswal S, Rao P. B .et al compared the analgesic efficacy and recovery characteristics of fentanyl and butorphanol as analgesic under TIVA (Total Intravenous Anesthesia) for laparoscopic cholecystectomy and find out the better combination along with propofol.[17] They observed that Suppression of sympathetic response to laryngoscopy and intubation was better with butorphanol than fentanyl.8 These findings regarding pressor response i.e. increase in pulse ,systolic and diastolic blood pressure etc. to laryngoscopy and intubation are comparable with our study Narcotics are known to be cardiostable agents providing haemodynamic stability intraoperatively. This is because of intense analgesia, suppression of sympathoadrenal response and lack of significant cardiovascular depressant effects. When we compared the haemodynamic parameters i.e., pulse and blood pressure thoughout the intraoperative period, we observed that both the drugs provided stable cardiovascular system without undue swings in pulse and blood pressure intraoperatively. Pandit SK, Kothari SD et al., in 1987 in their study of comparison of fentanyl and butorphanol for outpatient anaesthesia, concluded that induction and maintenance between the 2 groups are not different.6 Beverly K, Phillip MD et al., in their study in 1991 compared butorphanol with fentanyl in anaesthesia for ambulatory laparascopy also observed that vitals are comparable in both the groups introperatively. These findings are comparable with the results of intraoprative haemodynamic parameters in our study.

Conclusion

Hence, we conclude that butorphanol could be an effective alternative to fentanyl for the attenuation of the haemodynamic and also Butorphanol is a better ameliorator of pressor response to laryngoscopy and intubation as compared to fentanyl.

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Conflict of Interests: None

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