

To Compare the Pain-Relieving Effectiveness of Butorphanol and Fentanyl in Different Surgical Procedures

Nikita¹, Smita Bharti², Sudama Prasad³

¹Senior Resident, Department of Anesthesia, PMCH, Patna, Bihar, India

²Senior Resident, Department of Anesthesia, PMCH, Patna, Bihar, India

³Professor & Head, Department of Anesthesia, Patna Medical College & Hospital, Patna, Bihar, India

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Corresponding Author: Dr. Smita Bharti

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Abstract

Aim: To compare the pain-relieving effectiveness of Butorphanol and Fentanyl in different surgical procedures.

Material and Methods: A prospective randomized, double-blind study was conducted in the Department of Anesthesia, PMCH, Patna, Bihar, India for 12 months. Physical status of ASA I and ASA II Age group between 18 to 55years. Gender-Both Males and Females were included in this study. Patients with Cardiovascular diseases like hypertension, ischemic heart disease, valvular heart disease Respiratory diseases like asthma, pulmonary tuberculosis, COPD Renal or hepatic derangement, Haematological derangements Those taking psychotherapeutic drugs. Pregnant females History of narcotic abuse.

Results: The study compared the analgesic efficacy and safety profile of Butorphanol and Fentanyl in patients undergoing general anesthesia for various surgeries. Both groups were comparable in terms of demographic data, including age and weight, with no statistically significant differences observed. The duration of surgery was slightly longer in Group A (Butorphanol) compared to Group B (Fentanyl), but the difference was not statistically significant. Baseline VAS and sedation scores were similar between the two groups, indicating comparable preoperative pain and sedation levels. Sedation scores during surgery were higher in Group A at 30 and 60 minutes, with statistically significant differences, suggesting that Butorphanol provided more sedation compared to Fentanyl during these time points. VAS scores for pain were significantly higher in Group B at 60 and 90 minutes postoperatively, indicating that Butorphanol provided better postoperative analgesia compared to Fentanyl. Rescue analgesia was administered to more patients in Group B, but the differences were not statistically significant.

Conclusion: Both butorphanol and fentanyl are cardio stable and provide intense intraoperative analgesia. Butorphanol provides significant postoperative analgesia for a longer duration as compared to fentanyl.

Keywords: Pain-relieving, Butorphanol, Fentanyl

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Introduction

Effective pain management is a critical component of perioperative care, ensuring patient comfort, facilitating recovery, and reducing the risk of postoperative complications. Among the various pharmacological agents used for analgesia in the perioperative setting, Butorphanol and Fentanyl are two opioids frequently employed due to their potent analgesic properties. [1-5] This introduction explores the pharmacology, clinical applications, and comparative efficacy of Butorphanol and Fentanyl in various surgical settings. Butorphanol is a synthetic opioid agonist-antagonist analgesic. It acts primarily on kappa opioid receptors, providing analgesia, and has partial agonist activity at mu opioid receptors. This dual action confers a ceiling effect on respiratory depression, making

Butorphanol a safer option in terms of respiratory side effects compared to pure mu agonists like Fentanyl. Butorphanol's analgesic efficacy and safety profile have led to its use in managing moderate to severe pain, including postoperative pain, labor pain, and pain associated with migraines. [6-9] Fentanyl, a potent synthetic opioid, acts primarily as a mu opioid receptor agonist. It is characterized by rapid onset and short duration of action, making it an ideal agent for both induction and maintenance of anesthesia, as well as for managing acute pain in the perioperative period. Fentanyl's high lipid solubility allows for quick penetration of the central nervous system, contributing to its potent analgesic effects. However, its use requires careful monitoring due to

the risk of respiratory depression and other opioid-related adverse effects. Both Butorphanol and Fentanyl are widely used in various surgical procedures, including general, orthopedic, and gynecological surgeries. Their roles in anesthesia can vary, from premedication and intraoperative analgesia to postoperative pain management.

Butorphanol: Known for its effective analgesia with fewer respiratory depressant effects, Butorphanol is often preferred in settings where respiratory function monitoring is limited. Studies have demonstrated its efficacy in managing postoperative pain, reducing the need for additional analgesics, and enhancing patient comfort.

Fentanyl: Due to its potent analgesic properties and rapid onset, Fentanyl is extensively used for induction and maintenance of anesthesia. It provides excellent intraoperative analgesia, contributing to stable hemodynamics during surgery. Its use in patient-controlled analgesia (PCA) devices for postoperative pain management is also well documented. [9-12]

Material and Methods

A prospective randomized, double-blind study was conducted in the Department of Anesthesia, PMCH, Patna, Bihar, India for 12 months

Inclusion Criteria:

Physical status of ASA I and ASA II Age group between 18 to 55years. Gender-Both Males and Females.

Exclusion Criteria:

Patients with Cardiovascular diseases like hypertension, ischemic heart disease, valvular heart disease Respiratory diseases like asthma, pulmonary tuberculosis, COPD Renal or hepatic derangement, Haematological derangements Those taking psycho therapeutic drugs. Pregnant females History of narcotic abuse.

In our study 60 cases were divided randomly into two groups. Group A patients received inj. butorphanol tartarate 20 μ g/kg intravenously prior to induction and Group B patients received inj. fentanyl citrate 1 μ g/kg intravenously prior to induction. A valid written consent was taken from patients after explaining study and procedure to them. 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 μ g/kg intravenously. Vital parameters like pulse, blood pressure both systolic and diastolic, respiratory rate, oxygen saturation were measured. 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 20 μ g/kg intravenously or Inj. Fentanyl 1 μ g/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%O₂:60% N₂O 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, 1 and 2 minute after induction and 1 and 3 minute after tracheal intubation and 15 minutes interval thereafter. single observer made all observations. During recovery patient's activity, respiration, alertness, color was evaluated every 30 minutes for 90 minutes. Sedation and pain was assessed using Ramsay Sedation scale and Visual Analog Scale at every 30 minutes interval for first 90 minutes. Baseline visual analogue scale and sedation score were assessed. Visual Analog Scale consisted of a 10 cm Scale, representing varying intensity of pain from 0 (no pain) to 10 (worst imaginable pain).

Results

The study compared the analgesic efficacy and safety profile of Butorphanol and Fentanyl in patients undergoing general anesthesia for various surgeries. Both groups were comparable in terms of demographic data, including age and weight, with no statistically significant differences observed (Table 1). The duration of surgery was slightly longer in Group A (Butorphanol) compared to Group B (Fentanyl), but the difference was not statistically significant (Table 2). Baseline VAS and sedation scores were similar between the two groups, indicating comparable preoperative pain and sedation levels (Table 3). Sedation scores during surgery were higher in Group A at 30 and 60 minutes, with statistically significant differences, suggesting that Butorphanol provided more sedation compared to Fentanyl during these time points (Table 4). VAS scores for pain were significantly higher in Group B at 60 and 90 minutes postoperatively, indicating that Butorphanol provided better postoperative analgesia compared to Fentanyl (Table 5). Rescue analgesia was administered to more patients in Group B, but the differences were not statistically significant (Table 6).

Table 1: Age and Weight Distribution of Cases in Study

Parameter	Group A (Butorphanol)	Group B (Fentanyl)	T-value	p-value	Significance
Age (years)	30.20 ± 1.68	31.47 ± 40	0.57	>0.05	Not Significant (Ns)
Weight (kg)	55.70 ± 1.01	57.80 ± 0.72	1.63	>0.05	Not Significant (Ns)

Table 2: Mean Duration of Surgery

Group	Mean Duration of Surgery (mins)
Group A	90.17 ± 2.40
Group B	83.83 ± 2.57

Table 3: Baseline VAS and Sedation Score of Patients

Parameter	Group A (Butorphanol)	Group B (Fentanyl)	p-value	Significance
Baseline VAS	1.133 ± 1.432	1.133 ± 1.709	>0.05	Not Significant (Ns)
Baseline Sedation	1.333 ± 0.4795	1.267 ± 0.4498	>0.05	Not Significant (Ns)

Table 4: Sedation Score in Group A and Group B During Surgery

Timepoint	Group A (Butorphanol)	Group B (Fentanyl)	p-value	Significance
30 mins	2.333 ± 0.1465	1.800 ± 0.1114	0.008	Significant (S)
60 mins	1.600 ± 0.1135	1.300 ± 0.08510	0.041	Significant (S)
90 mins	1.300 ± 0.4661	1.100 ± 0.3051	0.056	Not Significant (Ns)

Table 5: Comparison of Group A and Group B According to VAS Score (Pain)

Timepoint	Group A (Butorphanol)	Group B (Fentanyl)	p-value	Significance
30 mins	2.000 ± 0.203	2.300 ± 0.249	0.306	Not Significant (Ns)
60 mins	2.900 ± 0.199	3.533 ± 0.177	0.023	Significant (S)
90 mins	3.233 ± 0.170	4.333 ± 0.1541	0.001	Significant (S)

Table 6: Comparison of Group A and Group B According to Rescue Analgesia

Timepoint	Group A (Butorphanol)	Group B (Fentanyl)	p-value	Significance
30 mins	3	5	>0.05	Not Significant (Ns)
60 mins	5	8	>0.05	Not Significant (Ns)
90 mins	7	10	>0.05	Not Significant (Ns)

Rescue analgesia was given as intramuscular Diclofenac sodium when the VAS score was ≥ 4 .

Discussion

The assessment of analgesic drugs is difficult because of the subjective nature of pain. Although many methods have been described, no evaluation process has proven itself to be entirely satisfactory. Pain can be assessed by the patient himself with the help of linear visual analog scale or objectively by observing the patient for facial expression, complaints of pain and side effects like tachycardia, hypertension, tachypnea and restlessness. The subjective method by far is the best method which we have used in our study. The visual analog scale (VAS) is linear 10cm scale with lowest score of 0 corresponding to no pain and highest score of 10 corresponding to worst or intolerable pain perceived by patients. VAS score was assessed at the interval of 30 minutes postoperatively. When VAS in both groups were compared butorphanol was significantly superior than fentanyl. VAS score at 60 min 2.90 ± 0.19 (butorphanol) Vs 3.53 ± 0.17 (fentanyl) and VAS score at 90 min. 3.23 ±

0.17 (butorphanol) Vs 4.33 ± 0.15 (fentanyl)]. This can be explained by the fact that fentanyl has significantly shorter duration of action. We have chosen 60 cases. The mean duration of surgery of fentanyl group was 83.83 ± 2.57 minutes. So in majority of cases, by the time the surgery was completed the action of fentanyl had weaned off. The mean duration of surgery of butorphanol group was 90.17 ± 2.40 minutes. Because butorphanol has a longer duration of action, the dose given at the time of induction continued to have analgesic effects in the immediate postoperative period, proving superior to fentanyl for conferring postoperative analgesia. Because of superior postoperative analgesia number of patients who were given rescue analgesic was less in butorphanol group. 4 patients of group A were given rescue analgesic as compared to 6 of group B 30 minutes postoperatively. While 60 and 90 minutes postoperatively no of patients of group A requiring rescue analgesic were 9 and 10 as compared to 14 and 24 of group B respectively. Rescue analgesia was given as a non narcotic NSAID diclofenac sodium 75 mg intramuscularly when the VAS scores reached ≥ 4 . We wanted to compare the severity of side effects in both the groups. Sedation is one of the important

side effects of opioids. To assess the effect of sedation of both groups, it was necessary that the rescue analgesia had no sedative property. Hence, we used a non narcotic NSAID diclofenac sodium 75 mg intramuscularly. [2,3] In 1994, Atkinson BD, Truitt LT *et al.*, in their study compared the analgesic properties of butorphanol and fentanyl. They concluded that butorphanol provided better postoperative analgesia than fentanyl with fewer patient requests for more pain relief.⁴ Del Pizzo studied butorphanol in comparison to morphine for postoperative pain and, observed that duration of action of butorphanol appeared in every aspect to approximate that of morphine sulfate. Aside from sedation, which is a positive attribute for the drugs utilized in recovery room. [5] In 2004, Usmani H; Quadir A; Jamil SN; Bahl N; Rizvi A *et al* compared butorphanol and fentanyl for balanced anaesthesia in patients undergoing laparoscopic cholecystectomy. They observed that the proportion of patients with moderate-severe pain during postoperative period was significantly higher in fentanyl group as compared to butorphanol group. Time to first rescue analgesic (tramadol hydrochloride) was also significantly prolonged in butorphanol group as compared to fentanyl group. The incidence of side effects was comparable in both the groups. Thus, butorphanol is an effective analgesic for patients undergoing laparoscopic cholecystectomy under general anaesthesia. [6] The results were comparable to those of our study. Thus, butorphanol definitely provided analgesia of longer duration.

Conclusion

Both butorphanol and fentanyl are cardio stable and provide intense intraoperative analgesia. Butorphanol provides significant postoperative analgesia for a longer duration as compared to fentanyl.

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