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# Comparison of Butorphanol Versus Fentanyl on Intraoperative Anaesthesia Course and Post-Op Recovery Characteristic in Patient Undergoing Laparoscopic Surgery

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**Abstract:** ***Aims and Objectives: Primary-To compare the analgesic efficacy of fentanyl and butorphanol , Secondary-To compare recovery characteristic of fentanyl and butorphanol. Material and Methods: After approval from institutional ethical committee 60 patients were randomly divided to 2 groups, FENTANYL GROUP: Inj.fentanyl 2ug/kg iv given 4min before induction BUTORPHANOL GROUP: Inj.butorphanol 15-20 ug/kg iv given 4min before induction. Rescue analgesia: Inj.Diclofenac sodium 1.5 mg/kg sos in both groups. Expected Results: Butorphanol and fentanyl both are cardiostable, but there is significant fall in heart rate and blood pressure observed in patients who received butorphanol as premedication compared to the patients who received fentanyl. Conclusion: Butorphanol and Fentanyl both are cardio stable. But less haemodynamic variations are observed in the Butorphanol group. Recovery time in Butorphanol group is prolonged (6.13 min) when compared to Fentanyl group (3.42 min) Post operative sedation and analgesia remained for longer duration in Butorphanol group.Thus considering analgesia and haemodynamics, it is concluded that Butorphanol is better than Fentanyl.***

**Keywords:** Butorphanol, Fentanyl, Laparoscopic Surgery, Pain Relief, Sedation

## 1. Introduction

- Pain relief has many advantages, namely, reduction in metabolic response to trauma, there by prevent postoperative negative nitrogen balance.
- Moreover pain-free patients have better mobility with immediate benefits in reduced incidence of chest infections and deep vein thrombosis.[1]
- Opioids are the most potent pain-relieving drugs .of all analgesics, they have the broadest range of efficacy and provide most reliable and effective method for rapid pain relief.
- Laparoscopy has been promoted aggressively and has advantages like shorter hospital stay, reduced stress response to surgery, rapid return of GI function, reduced postoperative pain and analgesic requirements, improved postop respiratory function, less postop wound infection, better cosmetic appearance.[1]
- The purpose of this study is to compare equipotent moderate doses of two different analgesics i.e., butorphanol and fentanyl in healthy adult patients undergoing laparoscopic surgery under general anaesthesia in terms of intra-operative haemodynamics and post-operative pain relief.

## 2. Material & Methods

After approval from institutional ethical committee, written informed consent and thorough pre-anesthetic evaluation, 60 patients of either sex, age group
(20 – 60 years), were randomly divided to 2 groups,

**A)Fentanyl Group:**
Inj.fentanyl 2ug/kg iv given 4min before induction
Rescue analgesia: Inj.Diclofenac sodium 1.5mg/kg iv sos

***B)Butorphanol Group:***
Inj.butorphanol 25ug/kg iv given 4min before induction
Rescue analgesia: Inj.Diclofenac sodium 1.5mg/kg iv sos
This observational study was conducted from March 2017 to Aug 2017,about 60 patients of ASA-1 or ASA-2 who were scheduled for laparoscopic surgery were thoroughly evaluated and assessed. They were explained about the nature and consequences of the study and also about the visual analogue scale for grading of pain intensity. Informed and written consent was obtained from all the patients. After selection, patients were randomised in to the 2 said groups. After the patient came inside operation theatre, monitors namely pulse oximeter, cardioscope, blood pressure cuff were attached and baseline values were recorded. They were premedicated with inj. glycopyrrolate: 0.004 mg/kg im 30minutes before OT. Injection ondansetron 4mg iv given 4 min before OT.After premedication pulse rate, blood pressure, SpO2 readings was recorded. Later inj. fentanyl (2

µg/kg) or injection butorphanol (15-20 µg/kg) was given i.v. over a period of 30 seconds.

After 4 min induction of anaesthesia was started using inj.propofol(1-2 mg/kg) till loss of eyelash reflex. Pulse rate, BP were recorded. After checking ventilation, intubating dose of succinylcholine 1.5-2 mg/kg i.v was administered. Within 90-120 seconds laryngoscopy was done, pulse rate, BP were recorded. Intubation was done with appropriate size PVC cuffed endotracheal tube within 60-120 seconds after giving succinylcholine. pulse, B.P were recorded after every 1 min from the time of intubation for 5 min, then every 5 min till 15 min and then every 10 min till end of surgery. Anaesthesia was maintained with nitrous oxide + oxygen + isoflurane/sevoflurane to maintain adequate depth of anaesthesia as judged by pulse rate, B.P with controlled ventilation. Muscle relaxation was maintained with inj. vecuronium using loading dose of 0.08 mg/kg and top-ups of 0.02 mg/kg as needed. Pulse rate, BP, ETCO2, SpO2 were monitored throughout the surgical procedures every 5 min and recorded every 10 min. Intra-abdominal pressure was monitored and noted down. After complete reversal of N-M blockade with inj. neostigmine 0.06 mg/kg and inj. glycopyrrolate 0.008 mg/kg, patients were extubated when adequate, spontaneous and regular respiration was established. Time was noted between discontinuation of inhaled anaesthetics and extubation and between time of last dose of vecuronium and extubation. Post-operative patient were shifted to recovery room, where patients were monitored for sedation till Ramsay score of 3 was achieved and they were also monitored for pain and analgesic requirement 1 hourly. At visual analogue score of 4, rescue analgesia was given with inj. tramadol 1 mg/kg. At the end of observation period, patients were asked to express their opinion concerning efficacy of pain relief. Opinion was graded as excellent, good, fair and poor. Any adverse drug reaction or complications noted were recorded and analysed.

**Statistical analysis**

The data thus obtained was statistically analyzed using paired and unpaired student t' test and Chi-square test. For all statistical comparisons, $P<0.05$ was taken as significant.

## 3. Results

The demographic data of both groups were recorded. The mean age and mean weight of the patients in group B and group F were found statistically not significant. The sex and ASA grades of both groups were compared with Chi-Square test and the values are statistically insignificant.

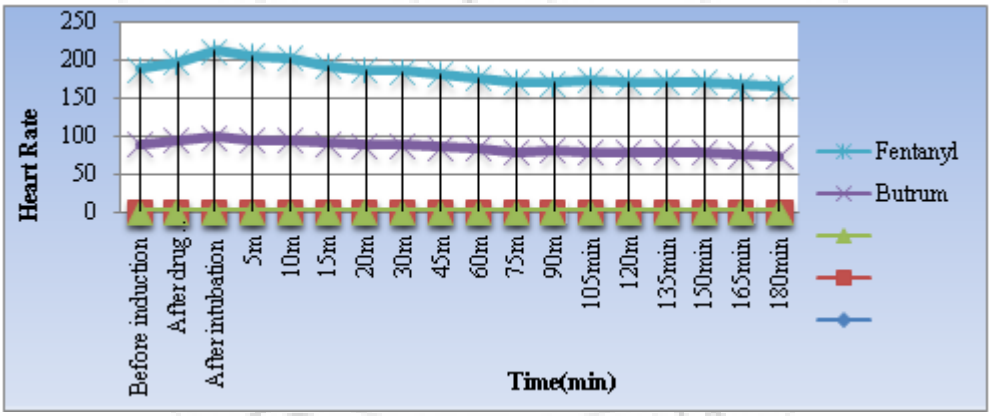


**Figure 1**

The mean of intraoperative Heart rate was 88.48±7.15 in butorphanol and 97.10±8.29 in fentanyl as shown in Figure 1.There was significant fall observed in the heart rate in butorphanol group 5 min after intubation and this fall persisted till 45 min after pneumoperitoneum ($p<0.05$).While in fentanyl group, there was significant fall in the heart rate after intubation and this persisted till, the creation of pneumoperitoneum. But the changes in the heart rate in both the groups were not up to the extent of bradycardia/tachycardia.

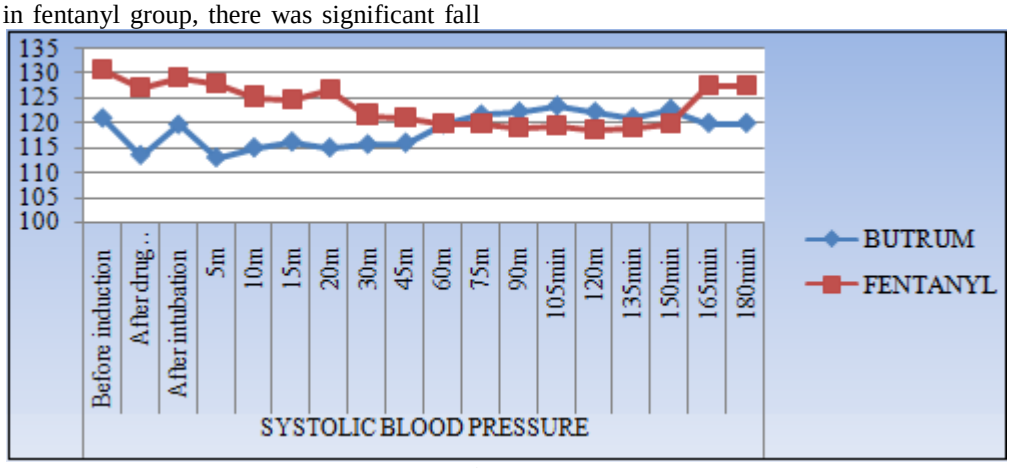


**Figure 2**

The mean of SBP was 116.2±7.15 in Butorphanol and 127.06± 8.13 in Fentanyl. As shown in Figure 2,there was significant fall in the systolic blood pressure in butorphanol group after intubation and persisted till 20min after intubation($p<0.05$). In fentanyl group (Group F) there was significant fall in the systolic blood pressure started after intubation and persisted till 20 min after intubation ($p<0.05$). No significant difference was found in systolic blood pressure till 20 min after intubation ($p>0.05$), and then onwards significant changes ($p<0.05$) were noted till 4th hour of postoperative period when both groups are compared.

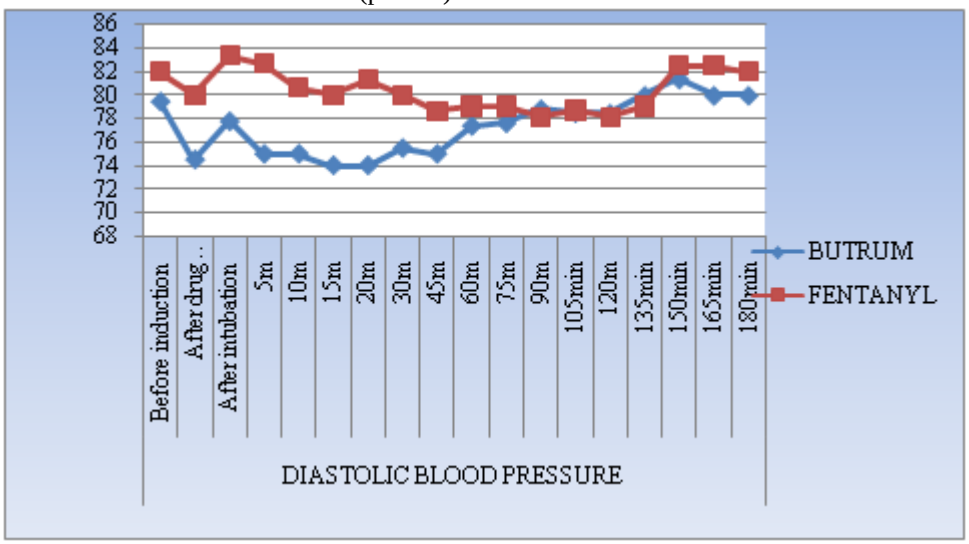


**Figure 3**

The mean of DBP was 77.4±7.15 in Butorphanol and 82.10±8.13 in Fentanyl. As shown in Figure 3, in Group B there was significant fall in the DBP after intubation and persisted till 15 min after pneumoperitoneum ($p<0.05$). In fentanyl group (Group F) there was significant change in DBP started after intubation and persisted till 15 min after intubation ($p<0.05$). Comparing both the groups, the statistical difference in DBP started at 12 min after intubation and persisted till 4th hour of post-operative period ($p<0.05$).

Group F patients complain of feeling pain at 15 min after extubation in comparison to Group B patients who reported pain after 3 hours (Figure 4) and comparison of both the groups was found to be significant till 4th hour of post-operative period ($P<0.001$). Post-op VAS score was higher in Fentanyl (9.40±0.13) compared to Butorphanol (7.15±0.28). Rescue analgesia was given in the form of Inj. tramadol hydrochloride when the VAS score was 5 or more out of 10. As shown in Figure 4 number of patients requiring rescue analgesia during the first postoperative hour was found to be 0 in group B while it was 15 in group F. Rescue analgesia (injection tramadol 1 mg/Kg IV) was administered when the visual analogue scale score was ≥4 on a scale of 0 to 10. The mean number of rescue analgesic doses required in both groups did not differ substantially.

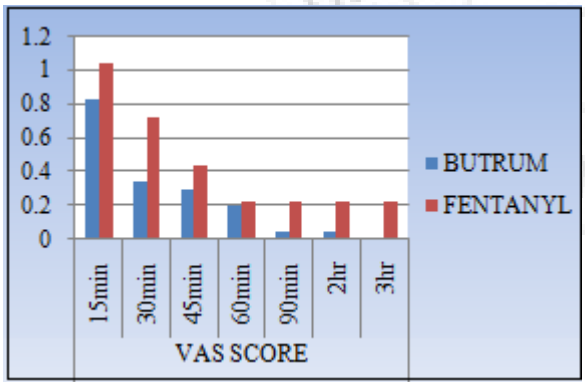


**Figure 4**

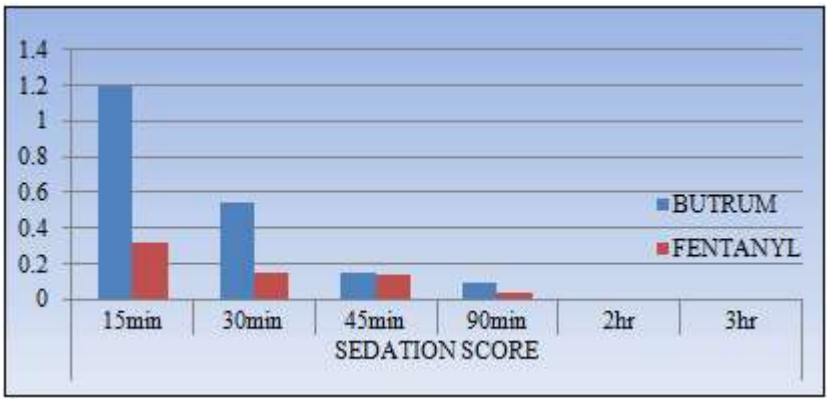


**Figure 5**

In the post-operative period, in group B sedation remained for longer period for about 3 hours after extubation, while in case of group F sedation remained for 30 min only after extubation. Post-op Sedation score is higher in Butorphanol (0.33±7.15) min.compared to Fentanyl (0.12±8.13)min. In the study, throughout their stay in post anaesthesia care unit, patient's postoperative sedation was assessed using Ramsay's sedation score. Mean sedation score were higher in the first half hour in group B which was statistically very highly significant. Subsequently mean sedation scores were equal. Though patients in group B showed significant levels of sedation, for first half hour none of the patients had any episode of desaturation (SpO2 <95%) and did not require any further intervention.

**Table 1**

| | Butrum | Fentanyl | P value | Statistical significance |
|---|---|---|---|---|
| Duration of surgery(Min) | 71.66±16.38 | 72.08±20.22 | 0.94 | Not significant |
| Recovery Time(Min) | 6.13±1.02 | 3.42±0.91 | <0.001 | Significant |
| Duration of analgesia | 248.97±45.98 | 83.97±19.40 | <0.001 | Significant |

Recovery time was more in Butorphanol (6.13±1.02min) compared to Fentanyl(3.42±0.91min) group

There were complications like nausea, vomiting, and rashes observed in few of the cases (*vide infra*). The incidence of nausea was 8 out of 30 in Group B and 2 out of 30 in Group F where as occured vomiting in 1 out of 30 in Group B and 4 out of 30 in Group F. There was incidence of rash (3%) in case of Group F; no rash occured in Group B subjects.

## 4. Discussion

The present study compared two opioids - butorphanol and fentanyl as a component of balanced anaesthesia. An ideal opioid successfully prevent unwanted responses to various stimuli, requires little supplementation, does not depress cardiovascular function and produce post-operative analgesia with minimal side effects. Both the group of drugs has haemodynamic stability, analgesia, sedation and decreases the requirement of other anesthetic drugs and are available at low cost. So we have chosen butorphanol and fentanyl.

Many of the earlier studies have used varying doses of butorphanol (20 µg/kg-40 µg/kg) and fentanyl (1-3 µg/kg). [2]**Pandit et al** compared butorphanol 40 µg/kg with fentanyl 2 µg/kg and reported a higher incidence of pain in fentanyl group and more drowsiness in butorphanol group. 40% of patients in each group required anti-emetic therapy. [5]**Arora et al,**[6]**Kaur et al** and [1]**Satyanarayana et al** compared the same doses of butorphanol and fentanyl, but the incidence of drowsiness was not significantly different in both groups. In a study conducted by [7]**Wetchler**, he compared Butorphanol 20 µg/kg, butorphanol 40 µg/kg, and fentanyl 2 µg/kg and concluded 20 µg/kg butorphanol and 2 µg/kg of fentanyl appears to be suitable to use as a preinduction narcotic analgesic. Whereas Butorphanol 40 µg/kg appears to be unsuitable due to increased duration of nausea, dizziness, time to reach a score of 10 on APARS and discharge-ready status. From these studies we concluded higher doses of Butorphanol (40 to 60 µg/kg) resulted in prolonged sedative effects and delayed discharge and increased doses of Fentanyl prolong recovery. Hence, we chose to limit the doses of opioids and add instead propofol to complete the balanced general anaesthetic. Hence in our study, we have chosen equipotent doses of butorphanol (15-20 µg/kg) and fentanyl (2 µg/kg) to limit the doses of opioids and instead added propofol to complete the balanced general anaesthetic as done by [8]**Philip** and [4]**S.Ahire**.

In our study both pulse and systolic blood pressure dropped to a greater level with group B than group F after administration of butorphanol or fentanyl. The 'p' values are highly significant after giving opioids and at the time of induction (<0.001). From the above data it is clear that butorphanol 25 µg/kg i.v. prevents response to endotracheal intubation to a greater extent than fentanyl 1 µg/kg i.v. These results are in accordance with the studies conducted by [4]**S.Ahire et al**. He compared the effect of butorphanol and fentanyl in attenuating the pressure response to laryngoscopy and intubation and demonstrated better protection against autonomic stimulation to tracheal intubation and surgical incision in butorphanol group. [8]**Philip et al** also found anesthetic maintenance more satisfactory in butorphanol group.

In present study, From Figure 1 and Figure 2 it was observed that the heart rate and systolic blood pressure intraoperatively remained consistently lower in Group B and determines Butorphanol is an acceptable alternative opioid to Fentanyl to use as a component of balance general anaesthesia. Post-operative sedation was assessed by Ramsay score. In our study we found that mean sedation

score were higher in the first half hour in group B which was statistically very highly significant (p=0.001). Subsequently mean sedation scores were equal. Though patients in group B showed significant levels of sedation, for first half hour none of the patients had any episode of desaturation (SpO2 <95%) and did not require any further intervention. This is may be due to kappa agonist effect of butorphanol. Post-operative pain was analysed by VAS score. In our study, during the first 30 minute in the postoperative period, patients receiving butorphanol had not complained of any pain whereas mean VAS Score was higher in patients receiving fentanyl, similar observation also stated by [8]**Philip et al.**

Post-operative side effects were compared in both groups. In our study eight patients of group B experienced nausea and 1 vomited, while it was 2 and 4 in group F. Findings of Pandit et al alsondemonstrated that nausea and vomiting were the most common side effects in 55% patients of butorphanol group and 61% in the Fentanyl group. A similar observations were also stated by [8]**Philip** , [4]**S.Ahire** and [3]**Verma RK** with no significant difference in side effects in both groups except sedation which was statistically significant in butorphanol group. Other side effects included nausea, vomiting, excitement, headache, light headedness, dizziness were comparable in both groups. Thus in the present study, results suggested that butorphanol is an acceptable alternative opioid to fentanyl for use as a component of balanced general anaesthesia at the doses studied.

## 5. Conclusion

- Both butorphanol and fentanyl are cardiostable drugs but there is significant fall in heart rate and blood pressure observed in patients who received butorphanol as premedication compared to the patients received fentanyl.
- There is intra operative rise in heart rate and blood pressure with fentanyl however the rise in heart rate and blood pressure are not up to the 20% of pre-operative value. post-operative sedation and analgesia remained for longer time in patients of butorphanol group than fentanyl group.
- From the study, we can recommend Butorphanol for its better analgesic effects than fentanyl for patients undergoing laparoscopic surgery.

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