



Duration of Postoperative Analgesia with Intravenous Nalbuphine versus Intravenous Butorphanol in Patients Undergoing Short Surgical Procedures under TIVA

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/JPRI/2022/v34i5B34677

Open Peer Review History:

This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: <https://www.sdiarticle5.com/review-history/79380>

Original Research Article

Received 14 November 2021

Accepted 06 January 2022

Published 27 January 2022

ABSTRACT

Aims and Objectives: To compare the duration of post operative analgesia of nalbuphine 0.3 mg/kg IV and butorphanol 0.04 mg/kg IV in patients posted for short surgical procedures under TIVA. Also to observe the sedation score as well as the side effects like nausea, emesis, pruritis, hypotension, respiratory depression.

Materials and Methods: By closed envelope technique, sixty female patients of ASA Class I and II aged 20-60 years, who were posted for short gynaecological surgeries under TIVA were randomly allocated into two groups: Group N (nalbuphine) and Group B (butorphanol). Just prior to surgery, Group N patients got IV Nalbuphine 0.3 mg/kg, while Group B patients received IV Butorphanol 0.04 mg/kg. Patients were asked to rate their pain intensity on a VAS scale in the course of the

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postoperative period, and the duration of postoperative analgesia was compared between the two groups. The Modified Ramsay sedation scale was exercised to assess sedation at the time of pain complaint, and patients were additionally monitored for 24 hours post the surgery for any adverse or side effects.

Results: In group N, 63.33% of patients had duration of pain relief ranging 31-50 minutes, with mean duration of analgesia being 46.333 ± 2.061 . In group B, 60% of patients had duration of pain relief ranging from 11-30 minutes, with mean duration being 19.167 ± 1.68 minutes. In group N, 63.33% of patients had score for sedation as 3 and rest (36.67%) had a score for sedation as 2. In group B, 80% of patients had a score for sedation as 2 and rest (20%) had a score for sedation as 1.

Conclusion: When compared to IV Butorphanol, intravenous Nalbuphine delivers a more effective post-operative analgesia with better sedation. IV Nalbuphine is recommended for post operative analgesia in patients undergoing short surgical procedures. Both the drugs did not cause any side effects.

Keywords: Postoperative analgesia; intravenous; nalbuphine; butorphanol.

1. INTRODUCTION

TIVA (Total intravenous anaesthesia) is a type of general anaesthetic used for short surgical procedures that involves a mix of drugs administered solely through the intravenous route, in the absence of inhalational anaesthetics (gas anaesthesia) [1].

Some of the potential benefits of total intravenous anaesthesia (TIVA) include reduced nausea and vomiting post operatively, more anticipated and prompt recovery, significant hemodynamic stability, hypoxic pulmonary vasoconstriction is preserved, lowering in intra cerebral pressure (ICP) as well as a lower risk of organ toxicity. When utilised in circumstances where post-operative pain control is essential, TIVA (total intravenous anaesthesia) is merely an anaesthetic method [2].

TIVA can be carried out using a single medication or in combination with other IV drugs. Hypnotics and short-acting opioids are two of the most regularly used medication classes [3].

Propofol is the sole active intravenous drug (hypnotic) currently appropriate for anaesthesia induction as well as its maintenance. Many advantages of propofol-based TIVA include quick recovery of psychomotor function and consciousness, antiemetic action, and a reduced incidence of postoperative nausea and emesis [4].

For the majority of surgery patients, pain perception is a serious concern. Postoperative pain is a type of acute pain that triggers a systemic stress response [5], which includes neuroendocrine, immunological, and

haematological reactions. Catabolism of stored body fuels is the overall metabolic effect [6].

Despite advances in pain relief management, most of the patients carry on to suffer from excruciating pain following surgery [7]. The novel anaesthetic aims not just in pain reduction but it also aims at the betterment of the quality of life of the sufferer and his/her speed recovery with lowering medical costs.

For a long time, opioids have been the go-to treatment for immediate postoperative pain, especially moderate to severe pain. Though, mu agonists such as morphine can cause major adverse effects such as delayed respiratory depression pruritus, increased frequency of micturition, poor bladder control (retention), nausea, vomiting, etc. These side effects could make patients uncomfortable and lengthen their stay in the hospital, limiting their effectiveness as a post-operative pain reliever.

Both Butorphanol and Nalbuphine are partial agonist-antagonists, acting as agonists on the kappa receptor while acting as antagonists or partial agonists on the mu receptor. Analgesia with less undesired side effects, such as respiratory depression, are among the advantages of partial agonists. They can be administered intramuscularly, intravenously, epidurally, or transnasally. When compared to powerful opioids like morphine or fentanyl, they are commonly available and unrestricted.

1.1 Aims and Objectives

Aim: To assess the efficacy of inj. Nalbuphine given intra venously with Intra venous inj.

butorphanol in patients posted for short surgical procedures under Total Intravenous anaesthesia (TIVA).

Objectives:

Primary objective: To compare the duration of post operative analgesia of intra venous nalbuphine 0.3 mg/kg and intra venous butorphanol 0.04 mg/kg in patients posted for short surgical procedures under Total Intravenous anaesthesia (TIVA).

Secondary objectives: To observe:

- 1) The sedation score
- 2) Side effects like nausea, emesis, sedation, shivering, pruritis, depressed respiration.

1.2 Sample Size Calculation

Sample size calculation was done using OpenEpi, version 3.

Assuming duration of analgesia of 9.07 hours and standard deviation of 4.71hours, keeping the power at 80% and confidence interval at 95% (alpha error at 0.05) a sample of 28 patients would be required to detect the minimum of 50% difference in the duration of analgesia between the two groups. We include 30 patients in each group to compensate for the possible dropouts.

2. MATERIALS AND METHODS

Sixty female patients undergoing short gynecological procedures under Total Intravenous anaesthesia (TIVA) were allocated randomly into two equal groups of 30 each by closed envelope technique. Group N who were given intravenous Inj. Nalbuphine 0.3mg/kg and Group B, who were given intravenous Inj. Butorphanol 0.04 mg/kg.

After preoperative / pre anaesthetic check up, patients were enrolled in the study as per following criteria.

2.1 Criteria for Inclusion

1. Patients classified as ASA grade I and II
2. Female patients in age group of 20-60 years
3. Posted for surgeries short gynaecological procedures like dilatation & curettage and suction evacuation under Total Intravenous anaesthesia (TIVA)

4. Patients who gave consent to participate in study.

2.2 Criteria for Exclusion

1. Patients who are allergic to the drugs.
2. Patients who are on
 - Oral anticoagulant therapy.
 - Neuroleptic agent.
 - Mono amino oxidase inhibitor.
3. Patients with
 - History of epilepsy/ seizure.
 - Increased intracranial tension.
 - History of motion sickness.
 - History of opioid use over the last 1 month.
4. Patients not willing to participate in study.
5. Intraoperative sedation or analgesic given Intravenously or intra muscularly.

On the day of operation, an informed written consent was obtained. The Visual analogue pain scale was taught to all of the patients (VAS) and pain descriptor terms in a language they understood.

The visual analogue scale, which is described below, was used to assess pain.

The Visual Analogue Scale (VAS) is a 10-centimeter line with two end points: "no pain" and "pain as bad as it gets." On this line, the patient is requested to make a mark reflecting the severity of the pain. The VAS score is calculated by measuring the distance in centimeters between the end of the scale that indicates "no pain" and the point indicated by the patient [8].

On the operating room table, baseline heart rate (HR), blood pressure (BP), respiration rate (RR), SPO2 and temperature (in degree celcius) were noted.

Patients in both the groups were given intravenous Inj. Glyco 0.2mg, intravenous Inj. Midaz 1mg and study drug intravenously (nalbuphine or butorphanol) and intravenous Inj. Propofol 2 mg/kg for induction and supplementation as required (0.25 mg/kg) through out the procedure.

No other analgesics or sedatives drug were given intraoperatively. No inhalation agents were used intraoperatively.

Intraoperative haemodynamic monitoring was done as per conventional method.

Patients were sent to a post-operative recovery room after the surgery, where vital signs such as

baseline heart rate (HR), blood pressure (BP), respiration rate (RR), SPO2 and temperature (in degree celcius) were checked every 30 minutes.

When the patient complains of pain, VAS>4, the duration of postoperative analgesia was documented. (In the recovery room, the time interval between the onset of analgesia and the patient complaining of pain (i.e. VAS score >4) is regarded as the duration of analgesia).

Any adverse effects like nausea, emesis, pruritis, hypotension, respiratory depression and others were recorded.

3. RESULTS

3.1 Duration of Analgesia

When the patient complains of pain, VAS>4, the duration of postoperative analgesia was documented.

63.33% of patients in group N were having a range of 31-50 minutes of analgesic duration, with a mean analgesic duration being 46.333 ± 2.061 minutes with minimum of 21-30 minutes analgesic duration was seen in 10% of group N participants and a maximum analgesic duration of 61-70 minutes was seen in 6.67% of group N participants.

60% of patients in group B were having a range of 11-30 minutes of analgesic duration, with a

mean analgesic duration being 19.167 ± 1.68 minutes with minimum analgesic duration of 5-10 minutes was seen in 30% of group B participants and a maximum analgesic duration of 31-40 minutes was seen in 10% of group N participants.

When comparing groups N and B, a statistical analysis using a student unpaired t-test revealed that group N had a statistically significant increase in analgesia duration. ($t=55.9594$ with $df=31$, $p<0.0000001$).

3.2 Assessment of Sedation

It was done using Modified Ramsay sedation

In group N, 63.33% of patients were having a sedation score of 3 and rest (36.67%) were having a sedation score of 2.

In group B, 80% of patients were having had a sedation score of 2 and rest (20%) had a sedation score of 1.

3.3 Side Effects

Patients were also observed for 24 hours post operatively for any side effects. None of the patients participated in the study showed any of the side effects like nausea, vomiting, pruritis, respiratory depressions, hypotension or others.

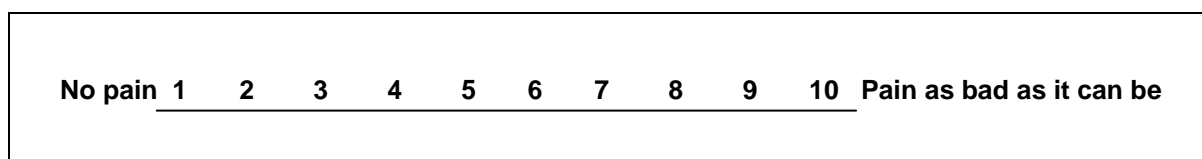


Fig. 1. Visual analogue scale

Chart 1. Sedation assessment was done using the ‘Modified Ramsay’ scale for sedation, which is as follows [9]

| Definition | Score |
|--|-------|
| Anxiousness, restlessness, agitation | 01 |
| Cooperative, orientate, calm | 02 |
| Responds only to orders | 03 |
| Response on light glabellar tapping being brisk or strident noise | 04 |
| Response on light glabellar tapping being sluggish or strident noise | 05 |
| Un responsiveness | 06 |

Table 1. Analgesic duration

| Analgesic duration (minutes) | Group N No of cases (%) | Group B No of cases (%) |
|-------------------------------------|------------------------------------|------------------------------------|
| 5-10 | 0 (0) | 9 (30) |
| 11-20 | 0 (0) | 12 (40) |
| 21-30 | 3 (10) | 6 (20) |
| 31-40 | 11 (36.67) | 3 (10) |
| 41-50 | 8 (26.66) | 0 (0) |
| 51-60 | 6 (20) | 0 (0) |
| 61-70 | 2 (6.67) | 0 (0) |

Table 2. Sedation score

| Sedation score | Group N Number of cases (in %) | Group B Number of cases (in %) |
|-----------------------|---|---|
| 1 | 0 (0) | 6 (20) |
| 2 | 11 (36.67) | 24 (80) |
| 3 | 19 (63.33) | 0 (0) |
| 4 | 0 (0) | 0 (0) |
| 5 | 0 (0) | 0 (0) |
| 6 | 0 (0) | 0 (0) |

4. DISCUSSION

In our study, 63.33% of patients in group N were having a range of 31-50 minutes of analgesic duration, with a mean analgesic duration being 46.333 ± 2.061 minutes with minimum of 21-30 minutes analgesic duration was seen in 10% of group N participants and a maximum analgesic duration of 61-70 minutes was seen in 6.67% of group N participants. 60% of patients in group B were having a range of 11-30 minutes of analgesic duration, with a mean analgesic duration being 19.167 ± 1.68 minutes with minimum analgesic duration of 5-10 minutes was seen in 30% of group B participants and a maximum analgesic duration of 31-40 minutes was seen in 10% of group N participants.

Regarding the sedation, In group N, 63.33% of patients were having a sedation score of 3 and rest (36.67%) were having a sedation score of 2. In group B, 80% of patients were having a sedation score of 2 and rest (20%) had a sedation score of 1.

Both the drugs used in our study did not showed any of the side effects like nausea, vomiting, pruritis, respiratory depressions, hypotension etc.

Vidhya N et al after comparing the efficacy of butorphanol with nalbuphine for balanced anaesthesia and post-operative analgesia in patients posted for laparoscopic surgery

concluded that Butorphanol is more efficacious as an analgesic with better hemodynamic stability than Nalbuphine [10].

Swapna Banerjee and Shaswat Kumar Pattnaik compared post operative analgesia with epidural nalbuphine, butorphanol and fentanyl in lower abdominal surgeries concluded that fentanyl produces the faster onset of analgesia and Butorphanol gives longer duration of analgesia [11].

V.V Lokeswari et al. [12] compared intramuscular nalbuphine with intramuscular butorphanol for postoperative pain relief concluded that intramuscular nalbuphine group patients were haemodynamically stable with better post operative analgesia.

Praveen P.V.V.S.B et al when IM nalbuphine, butorphanol, and pentazocine were tested for post-operative analgesia in participants having abdominal hysterectomy, concluded that nalbuphine and butorphanol offered superior analgesia than pentazocine [13].

JJ Wang et al. [14] compared analgesic efficacy of epidural butorphanol, nalbuphine, Meperidine and morphine concluded that both epidural nalbuphine and butorphanol demonstrated a very similar analgesic profile and when compared to morphine they exhibit faster onset of action with shorter duration.

Viviane et al. after comparing nalbuphine and butorphanol, either alone or in conjunction with acepromazine, it was found that butorphanol provided superior sedation than nalbuphine when used alone or in combination with acepromazine [15].

Zucker et al in 1987 compared nalbuphine with butorphanol to assess the respiratory depression in patients undergoing procedure under general anaesthesia. They concluded that butorphanol caused significantly pronounced respiratory depression compared to that caused by nalbuphine [16].

J Malek et al. [17] in 1988 compared the post-operative analgesic efficacy of injectable Tramadol (100 mg), Butorphanol (2 mg), Nalbuphine (20 mg), and Buprenorphine (0.3 mg) in adult patients who had had cholecystectomy under GA. They came to the conclusion that all of the medicines were effective in the treatment of post-operative pain. Buprenorphine and tramadol had a longer duration of analgesia and fewer side effects than other opioids.

Babu S et al in 2017 did a study for comparing the post operative analgesic quality as well as the side-effect properties of butorphanol and nalbuphine which are epidurally administered as an adjuvant to 0.2 percent ropivacaine, and it was discovered that ropivacaine with nalbuphine administered via thoracic epidural route is more effectual than ropivacaine with butorphanol for instant post operative pain mitigation in patients subjected for exploratory laparotomy under emergency [18].

Kim DH and Park CH in 1998 conducted a study to find out the analgesic efficacy, dose requirement and adverse reactions of butorphanol and nalbuphine when given via patient controlled analgesia (PCA) along with ketorolac after TAH (total abdominal hysterectomy). They determined that butorphanol and nalbuphine were both effective for PCA for post operative pain relief, and that ketorolac 180 mg with butorphanol 9 mg or nalbuphine 70 mg could be effective for 48-hour pain relief [19].

Priti M Chawda et al in 2010 investigated the efficacy of nalbuphine in reducing increases in heart rate (HR) and mean arterial pressure in response to laryngo-scopy and oro-tracheal intubation. Patients received a 0.2 mg/kg IV bolus dose of saline or nalbuphine 5 minutes

before laryngoscopy. They found that a dose of 0.2 mg/kg of Nalbuphine avoided a significant increase in heart rate (HR) and mean arterial pressure (MAP) during laryngo-scopy and oro-tracheal intubation [20].

Ahsan-ul-Haq et al in 2005 did a study to see how effective nalbuphine is at preventing heart rate (HR) and blood pressure (BP) increases while laryngo-scopy and oro-tracheal intubation. They came to the conclusion that 0.2 mg/kg of IV Nalbuphine could avoid a significant increase in HR (heart rate) and MAP (mean arterial pressure) during laryngo-scopy and oro-tracheal intubation [21].

5. CONCLUSION

Intravenous Nalbuphine provides longer duration of analgesia and better sedation when compared to intravenous Butorphanol. Both intravenous Nalbuphine and intravenous Butorphanol are safe as no side effects were observed. This study recommends intravenous Nalbuphine as an analgesic for short gynecological procedures under Total intravenous anaesthesia (TIVA).

CONSENT

As per international standard or university standard, written consent has been collected and preserved by the author(s).

ETHICAL APPROVAL

After Institutional Ethical Committee clearance, the study was done in the Department of Anaesthesiology, Acharya Vinoba Bhave Rural Hospital, JNMC, Sawangi (Meghe), Wardha district, Maharashtra.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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Peer-review history:

The peer review history for this paper can be accessed here:
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