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Pain Management Of Patients Under General Anesthesia Nalbuphine Alone Or Nalbuphine With Ketorolac In A Tertiary Care Hospital Of Multan

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ABSTRACT

Background: Pain is a significant and intricate phenomenon. Since it lessens patient anguish and guarantees a quick, pain-free recovery following general anesthesia, adequate intraoperative and postoperative pain management is crucial.
Objective: To assess how well nalbuphine alone and nalbuphine with ketorolac work together to treat pain after open cholecystectomy while under general anesthesia.
Methodology: Using the lottery approach, patients were split into two groups: Group-A received
0.15 mg of nalbuphine per kilogram, while Group-B received 0.075 mg of nalbuphine per kilogram with 14 mg of ketorolac. At the onset of surgery, they were all administered normal anesthetic medications and analgesics in the aforementioned dosage. The Numerical Pain Rating Scale was used to quantify the postoperative pain severity of *patients ten, twenty, and one hours after they were moved to recovery. Deliverance anodyne for moderate to severe pain was noted at 30 minutes. Additionally, nausea, vomiting, and tiredness were observed by both groups.
Results: In our investigation, we found that patients in Group A had mild pain 5 (6.7%) one hour after surgery, while Group B had minor discomfort 35 (46.7%). The percentage of patients in Group A 10 (13.3%) and Group B 55 (73.3%) who received the rescue analgesia Nalbuphine (0.15 mg/kg) differed statistically significantly. Group A, 7 had a higher level of sedation (9.85%) than Group B 4 (5.3%). The frequency of nausea and vomiting was n7 (9.3%) in Group A and n5 (6.6%) in Group B. Twenty minutes after moving to the recovery area, Group A had a n7 (9.3%) repeat analgesia for pain levels of four or above, but Group B had a n60 (80%), yielding a 0.000 *p* value. The primary finding was the statistically significant difference in the residual analgesia of nalbuphine (0.15 mg/kg) between Group A and Group B.
Conclusion: Compared to a combination of Nalbuphine (0.075 mg/kg) and ketorolac (14 mg), intravenous Nalbuphine (0.15 mg/kg) was more effective in lowering the severity of pain and the need for postoperative analgesics following surgery.

INTRODUCTION

Acute postoperative pain is a common occurrence for most surgical patients. While adequate intraoperative and postoperative pain management is crucial for reducing patient distress and ensuring a quick, painless recovery following general anesthesia, research indicates that less than half of patients receive appropriate postoperative pain relief and this usually happens because of selection of non optimum potency and dosage of analgesics. Poorly managed postoperative pain can have detrimental acute effects, such as unpropitious physiological reciprocation, and raise the risk of postoperative barriers and constant postoperative pain. (Paladini *et al.*, 2023)
A complex reaction to tissue damage sustained during surgery, persistent post-operative pain triggers hypersensitivity of the central nervous system, resulting in pain in regions not immediately impacted by the operation. Astute or prolonged postoperative pain can complicate wound healing and the subsequent return to regular activities, increase the peril of postoperative issues, and elevate medical care costs, it may also result in many sort of side effects which can increase distress in the patients and lead the patients to many drawbacks compromising the optimum surgical care (Kraychete *et al*., 2016)
A straightforward and efficient analgesic technique for big incisions in abdominal surgery is local wound infiltration (LWI), in which the local anesthetic and/or other medications are administered directly at the site of the incision which usually include bupivacaine or rupivacaine. A significant drawback of LWI, similar to nerve block, is the inadequate analgesia duration brought on by the use of local anesthetics alone. Immediate postoperative pain alleviation is not as valuable as perioperative pain improvement. In order to address these problems, local anesthetics are frequently adjuvanted with opioids, nonsteroidal anti-inflammatory medications (NSAIDs), dexmedetomidine, dexamethasone, ketamine, dormicum and magnesium to increase the duration and efficacy of LWI.(Bai *et al.*, 2020, Ponce de León-Ballesteros *et al*., 2022)

NSAIDs and opioids are the two most important types of analgesics. In comparison to a placebo, the analgesic effects of NSAIDs (ketorolac) and opioids (nalbuphine) as local anesthetic adjuvants in various nerve blocks are well documented.
The choice between the two always has been problem in perioperative pain management due to lack of valid research and different experiences of different doctors. Ketorolac 30–60 mg may be an effective infiltration agent for LWI, with peripheral analgesia that goes beyond the effects of systemic absorption, according to high-quality research. However, since research to date have been of varying quality, high-quality randomized controlled trials should be carried out to validate the findings. However, it should be highlighted that no study has verified the therapeutic benefit of nalbuphine on LWI, despite earlier research showing that it served as an adjuvant in intraspinal and nerve block to give longer and more effective postoperative analgesia. (Amin *et al.*, 2020)

Although opioids are commonly used in pain treatment, (NSAIDs) have been utilized extensively with good outcomes in reducing pain and postoperative analgesia needs. Their adverse effects, including bradycardia, nausea, vomiting, dry mouth and respiratory depression, have restricted their use, and a side effects which although occurs very rarely-a period of irregular heartbeats impacts it a lot. (Kao *et al*., 2017)
The phenanthrene family includes the semi-synthetic opioid analgesic nalbuphine. Nalbuphine has been demonstrated to have opioid antagonist activity, however it does not negate the effects of an opioid analgesic administered to nondependent patients right before, during, or after an injection.(Eladi *et al*., 2019).When combined with nalbuphine, the prescribed opioid analgesic, general anesthetics, tranquilizers, sedatives, and other CNS depressants may have an extra effect

but in order to achieve pain free outcomes adverse effects (drug incompatibility-the major one)can never be ignored. The dosage of one or both drugs should be lowered in such a combined therapy scenario. (Chou *et al.*, 2016)

Preoperative, perioperative, and postoperative handling scenarios are accessible to reduce and manage postoperative pain. Nonsteroidal anti-inflammatory medications (NSAIDs) and opioids are frequently used to treat postoperative pain, but a thorough research can add on in their use in a very proficient way. (Mayoral Rojals *et al*., 2022)

However, these medications have adverse effects when administered systemically, such as nausea, vomiting, dry mouth, issues with GIT movements, dizziness, drowsiness, and pruritus; in particular, opioids can cause respiratory depression, and NSAIDs can impair renal function. Although it is a very technique-dependent and intrusive treatment, epidural analgesia combined with local anesthetics is an efficient way to manage postoperative pain following lower abdomen or lower extremities surgery. (Wick *et al.*, 2017)
The opioid agonist-antagonist nalbuphine, which belongs to the phenanthrene class is prescribed for mild to moderate pain, and its analgesic and perhaps anti-pruritic sequel are arbitrated by activities on the μ and κ-receptors. Due to these plus points nabuphine is usually being used more likely than any other analgesic or combination of analgesics. (Zeng *et al.*, 2015)
Because it acts as an agonist on the central nervous system's (CNS) κ opioid receptors, nalbuphine is a semi-synthetic opioid with strong analgesic effects. But because of its agonistic effects on the μ2 opioid receptors, and its use is frequently linked to drowsiness, euphoria, and retention of urine.It has a brief half-life of roughly three to six hours (Fournier et al., 2000). Nalbuphine has been administered to children at 100–150 μg/kg bolus dosages to manage moderate–severe pain without causing major side effects .(Lejus *et al*., 1997). Five to ten minutes after intravenous injection, it starts to work, and it lasts for three to six hours. So if dose is managed well, it could be an efficient agent for management of pain following the surgery. (Lejus *et al*., 1996)
The powerful analgesic medication Tramadol, a derivative of amino cyclohexanol, inhibits the reuptake of noradrenaline, serotonin, and 5-hydroxytryptamine, and it binds to μ1 and μ2 opioid receptors in a moderate manner increases the descent pain pathways' inhibitory effects.(Houmes *et al*., 1992)
Its administration results in reduced incidence of nausea and vomiting when compared to morphine. To manage pain following surgery, an intravenous bolus.The effects of 750 μg/kg of tramadol are equivalent to those of 100 μg/kg of morphine and 100 μg/kg of nalbuphine.Tramadol used intravenously may reduce side effects while maintaining or enhancing its analgesic effectiveness.
In light of this, we planned this pilot study to compare the effects of continuous intravenous infusions of tramadol and nalbuphine for postoperative analgesia and to assess the occurrence of adverse events in a preliminary manner.(Bosenberg *et al*., 2003).

Finding postoperative rescue analgesics and comparing the potency of nalbuphine (0.15 mg/kg) by itself versus nalbuphine (0.075 mg/kg) + ketorolac (14 mg) for pain management and optimal intraoperative pain management in patients undertaking general anesthesia were the goals of this study. Optimizing pain relief while minimizing side effects is the aim of multimode analgesia, which blends many analgesic classes. This is the study's justification.

Rationale

Rationale of this study is to compare the effect of nalbuphine alone and nalbuphine with ketorolac regarding analgesia. This study aims to get the pain scores in both cases and to assess how much patients need rescue analgesia in any method of analgesia mentioned above. This study will also determine the possible side effects of using nalbuphine alone or along with ketorolac in pain management.

LITERATURE REVIEW

Globally, pain is a major surgical complication that hinders normal bodily functions and raises postoperative morbidity, hospitalization, and infection susceptibility, all of which subscribe to the occurrence of agonizing pain and discomfort. Effective pain management after surgery is crucial because it reduces patient suffering and promotes a quick and easy recovery, it also shortens the hospital stay and is helpul economically without compromising any perioperative protocols. Additionally, it lessens the stress reaction before surgery, which is crucial for patients whose respiratory and cardiovascular systems are weakened.(Samina *et al.*, 2023)

Depending on the surgical type, the duration of action varies. For 6±1 hours, patients undergoing small procedures were pain-free, and for 4±2 hours, patients undergoing moderate surgeries were pain-free. Additionally, Bupivacaine 0.25%, or 80% in minor procedures and 60% in moderate surgeries, improved pain alleviation. For mild procedures, the proportion of pain alleviation using ketorolac was 60%, whereas for moderate surgeries, it was 50%. On average, three to four ampules of bupivacaine and eight to ten ampules of ketorolac were consumed. Bupivacaine and ketorolac cost 19 and 90 rupees per ampule, respectively.

In another study, the best method for managing pain and reducing the need for analgesics after adenotonsillectomy surgery was shown to be intravenous ketorolac as opposed to nalbuphine. Two equal groups were formed from a group of 100 children's patients having tonsillectomy or adenotonsillectomy. Group A: 50 patients were given 0.9 mg/kg of intravenous ketorolac. Group B: 50 patients were given 0.25 mg/kg of nalbuphine intravenously. Following recovery from anesthesia, the FLACC (Face, Legs, Activity, Cry, Consol ability) pain score was assessed (postoperatively).

The pain scores of groups "A" and "B" differed statistically significantly, with the pain scores in "A" (ranging from 3.18 ± 0.87 to 4.68 ± 0.74) being lower than those in "B" (ranging from 3.90 ± 0.76 to 5.54 ± 0.73) and the probability value < 0.05, with the exception of 90 and 120 minutes, when it was found to be statistically insignificant. Neither group experienced any significant surgical complications. It has been determined that intravenous ketorolac reduces pain intensity and the need for postoperative analgesics during adenotonsillectomy in children more effectively than intravenous nalbuphine. (Eladi et al., 2019b).

From January 1st to June 30th, 2021, this study was carried out at the Surgical Intensive Care Unit (SICU) at the National Institute of Cardiovascular Diseases Hospital in Karachi, Pakistan.

60 patients undergoing elective heart surgery were randomly assigned to receive either 30 control patients on paracetamol or 30 treatment patients on ketorolac. The control group also received a background infusion of Nalbuphine at a modest dose and for a brief period of time. One gram of paracetamol is injected every six hours.

OBJECTIVES

To evaluate the analgesic efficacy: Examine the differences in pain alleviation between nalbuphine and ketorolac versus nalbuphine alone in individuals undergoing general anesthesia.

To determine the prevalence of adverse effects: Examine the frequency of side symptoms

linked to each treatment plan, including nausea, vomiting, respiratory depression, and others.

METHODOLOGY

STUDY DESIGN

Prospective Study

SETTING

Bakhtawar Amin Medical and Dental Hospital

SAMPLE SIZE

WHO sample size calculator 85% statistical power 5% level of significance
Group A 25%
Group B 8.35%
Calculated sample size is 150
SAMPLING TECHNIQUE

Purposive Sampling Technique

SAMPLE SELECTION

Inclusion Criteria:

Patients with age varying from 18 to 65

Patients undergoing elective mentioned surgical procedure in General Anesthesia Patients providing a written consent
Patients falling in ASA Grade 1 and 2

Exclusion Criteria

Patients who are allergic to NSAIDS and opioids Patients with Heart issues, Respiratory problems
Patients with bleeding issues or already taking analgesics or anticoagulant therapy Patients undergoing emergency surgery

DATA COLLECTION PROCEDURE

The comparative study of prospective design was carried out at the Bakhtawar Amin Medical and Dental Hospital's department of anesthesiology for a period of six months following approval from the hospital's ethical committee.
Every patient at our facility having a hernia repaired was included in the study. A day before surgery, all patients were contacted, given a thorough explanation of the entire process, and then asked for their written agreement after being taken in confidence. A thorough history was obtained regarding any systemic issues, medication allergies, past drug usage, and any prior anesthetic

experience. A complete physical examination, evaluation of the airway, and chest auscultations were performed. Complete blood count (CBC), ECG, chest X-ray, LFTs, RFTs, and viral markers were among the lab reports gathered and assessed. For six hours for food and four hours for liquids, NPO status was created. G IC cannulation was performed to obtain IV access as soon as the patient arrived in Operating Room. After getting the patients cannulated, all the required equipments and devices for monitoring of vitals were connected to the patients. Marked incision site was checked and other preoperative protocols were achieved and double checked.

Using the lottery approach, the patients were split into groups A and B, and their names and ID numbers were recorded to ensure their identity. Group A received 0.15 mg/kg of nalbuphine, while Group B received 0.075 mg/kg of nalbuphine plus 14 mg of ketorolac.

Propofol (1.5–2 mg/kg) was utilized for induction, and atracurium (0.5 mg/kg) was used for ETT intubation. Low flow oxygen and isoflurane were utilized to maintain GA.Atracurium was used to relax the muscles in order to sustain GA. A thorough general anesthesia attaining the suitable stage was maintained throughout the surgery. ECG, non- invasive blood pressure (NIBP), heart rate, and pulse oximetry were used to monitor the three leads. ETT was taken out once the anesthesia (neuromuscular blockade) was reversed with neoparalyte and patients were extubated and shifted to the recovery area after getting their surgical site dressing. In the recovery area it was optimum time to monitor the desire goal, collect data for these, so researchers along with senior anesthetists and physicians were present there. Everyone played his/her pre-defined role in order to achieve a comprehensive data and close monitoring of patients so that any sort of little thing could not escape from eye.

Preoperative section of proforma was filled by patients preoperatively and when patients were shifted to recovery room, the assessment was done by an anesthetist with gap of every five minutes. Findings were filled on proforma portion filled by the researcher and doctors. Various factors were kept in mind like monitoring and grading the pain score in both groups, monitoring of any side effects like nausea and vomiting, any period of irregular heartbeat, any event of shallow breathing in any patient. Moreover, if we had to give rescue analgesia ,it was given to the patient in which it was needed and a thorough record was kept.

STUDY INSTRUMENT

Data collection proforma and Richmond Agitation Sedation Score (RASS)

STATISTICAL ANALYSIS

Statistical Software: Software called SPSS version 22 was used to examine the data.

Descriptive Statistics: Mean was added for all quantitative variables such as age. For qualitative variables like sedation, nausea & vomiting, gender, lowered bowel movements, period of irregular heart beats,dry mouth and rescue analgesia percentage and frequencies got calculated. Stacked column ,stacked line,bar charts, stacked cubes
were used to describe and demonstrate the results/comparisons of these variables.

Categorical Data Analysis: The chi-square test was used to compare the pain scores in both groups after 10, 20, and 1 hour after moving to the recovery room and reusing the opioid analgesic nalbuphine (0.15 mg/kg) for moderate to severe pain consisting patients from both groups with pain scores ≥ 4 – 10 at 30 minutes after getting shifted to the recovery area. A p-value of less than 0.05 was considered significant.

RESULTS

Prior to surgery, each patient received 0.15 mg of nalbuphine per kilogram for group A and 0.075 mg of nalbuphine per kilogram with 14 mg of ketorolac for group B. A physician who was not informed of the patient's medication regimen used the Numerical Pain Rating Scale (Figure 4.1) to measure the patients' postoperative pain condition at 10, 20, and 1 hour after the patient was moved to recovery. According to the pain scale, a score of 0 to 3 denotes low or light pain, 4-6 denotes moderate pain, and 7–10 denotes severe pain.

Additionally, patients' postoperative sedation was evaluated using the Richmond Agitation Sedation Scale (RASS) (Table 4.1). 10 mg/kg of paracetamol was administered to patients whose pain scores were equal to or higher than 4. It was recorded as well. Reusing the analgesic Nalbuphine (0.15 mg/kg) at 20 minutes was also recorded if paracetamol continued to be ineffective. Patients were moved to their designated wards following a final evaluation by a senior anesthesiologist and an hour in the recovery area.

Out of total 150 patients, Group A with Nalbuphine and Group B included 75 patients with Nalbuphine plus Ketorolac. The mean age of the patients in Group A was 35.34±6.21, while the mean age of the patients in Group B was 34.6±4.32. The frequency of female participants was 57 (76%) and the frequency of male participants was 18 (24%) in Group A, while in Group B the frequency of female participants was 35 (46.6%) and the frequency of male participants was 40 (53.4%). Frequency of genders in both groups is demonstrated below in figure-4.2

In terms of sedation, sedation rate was higher in Group A 7 (9.85%) than Group B 4 (5.3%) . Sedation rate in both groups is demonstrated below in Figure-4.3

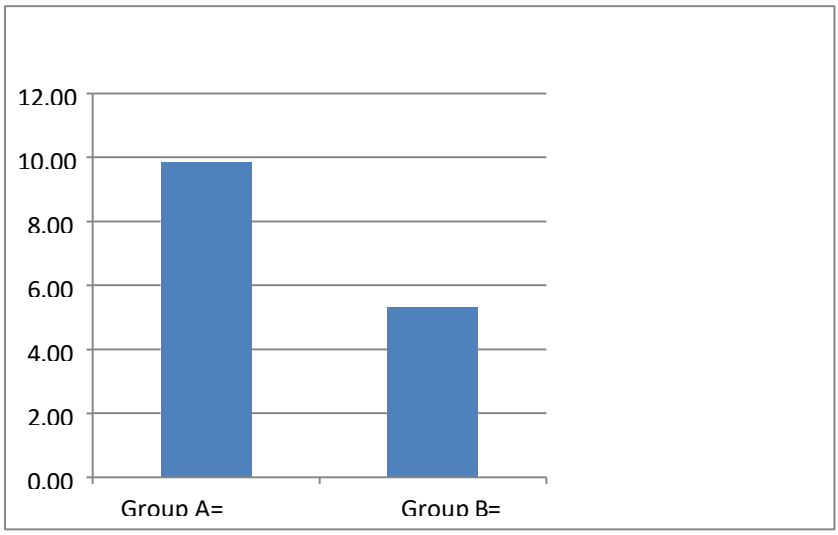

Figure-4.3:Demonstration of sedation rate in both groups

Furthermore, pain score in both groups was as follows:

Group A			
	Pain in 10 minutes	**Pain in 20 minutes**	**Pain after 1 hour**
No Pain	40(53.3%)	30(40%)	35(46.6%)
Mild Pain	30(40%)	30(40%)	40(53.3%)
Moderate Pain	5(6.7%)	15(20%)	0(0%)
Severe Pain	5(6.7%)	0(0%)	0(0%)

Table-4.2: Pain Score in Group A (nalbuphine) n:75

			Group B
	Pain in 10 minutes	**Pain in 20 minutes**	**Pain after one hour**
No Pain	10(13%)	7(9%)	10(13%)
Mild Pain	10(13%)	14(18.6%)	65(87%)
Moderate Pain	25(33.3%)	55(73.3%)	0(0%)
Severe Pai	30(40%)	0(0%)	0(0%)

n			

Table-4.3: Pain Score in Group B (nalbuphine plus ketorolac) n:75

Forty patients in group A experienced no pain during the first ten minutes, according to the pain score for objective 1.5 patients experienced moderate pain, 5 experienced severe pain, and 30 experienced mild pain. Thirty had no discomfort, thirty had medium pain, and fifteen had severe pain after twenty minutes. Forty experienced light pain and thirty-five had no pain after an hour of shifting to recuperation. They were with Nalbuphine.

There were ten patients in group B (nalbuphine with ketorolac) who had no pain, ten who had light discomfort, twenty-five who had moderate pain, and thirty who had severe pain. In 20 minutes, 7 people reported no discomfort, 14 reported light pain, and 55 reported moderate pain. After an hour, 65 people reported mild pain, whereas 10 reported no pain. This indicates that Group A in which alone Nalbuphine was used had statistically more frequency of patients with pain free or lesser pain score.

Moreover, patients were monitored for any more side effect of these analgesics. The most common possible side effect from previous literature was nausea and vomiting, so each patient was monitored closely for this situation. Group A in which alone Nalbuphine(0.15mg/kg) was used had 7 patients with nausea and vomiting which was 9.3% of total population of Group A ,while in group B treated with Nalbuphine(0.75mg/kg) along with Ketorolac (14mg), 5 (6.6%)patients had nausea and vomiting. So it was clear that rate of nausea and vomiting side effect was more in Group A. Moreover, frequency percentage of patients with nausea and vomiting is demonstrated in Figure-4.4

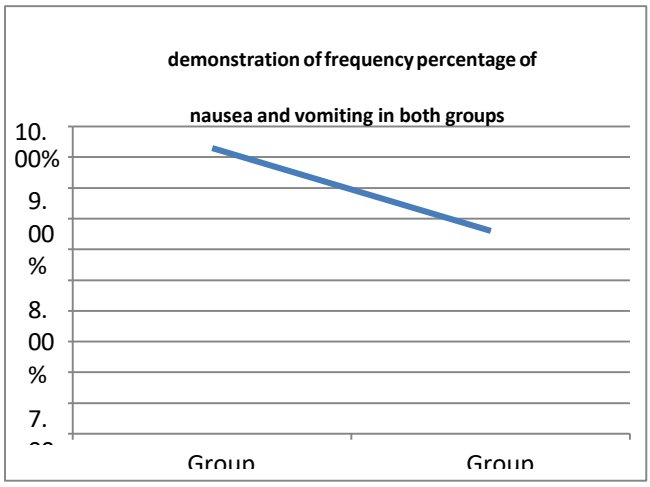

Figure-4.4: Demonstration of frequency percentage of nausea and vomiting in both groups

Patients with pain score of 4 or more than it after 20 minutes of getting shifted in recovery received a dose of rescue analgesia with nalbuphine(0.15mg/kg) .Group A had a n7 (9.3%) rescue analgesia for pain scores equal to or greater than 4 at 20 minutes after shifting to the recovery area, while Group B had a n60 (80%), producing a 0.000 p value. The significantly significant difference between Group A and Group B in the rescue analgesia of nalbuphine (0.15 mg/kg) was the main finding. Group A had many times lower rate of rescue analgesia than Group B, so it indicated that using an opioid analgesic alone reduces the possibility of having a rescue analgesia because of higher pain score than using a low dose of opioid analgesic nalbuphine along with ketorolac.

Percentage of rescue analgesia is shown in Figure 4.5:

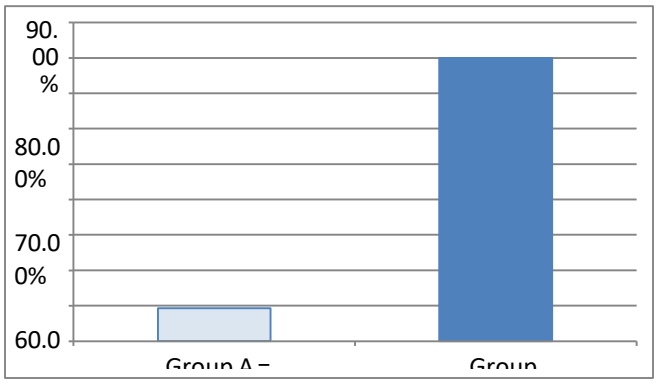

Figure-4.5: Demonstration of rescue analgesia %age

Previous studies and experiences demonstrate that opioid may result in shallow breathing or respiratory depression. Since respiratory depression or shallow breathing is one of the negative effects of opioid analgesics and can result in severe outcome, so the patients' shallow breathing status was also tracked when they were moved to the recovery area. Throughout their stay in the recovery room, patients were constantly watched for any such side effects. One patient (1.3%)from Group B (with nalbuphine and ketorolac) and three patients from Group A (with nalbuphine alone) both displayed a pattern of shallow breathing, which was 2.7%. This indicates that while nalbuphine alone (0.15 mg/kg) may raise the risk of shallow breathing, its use in combination with ketorolac at a lower dosage (0.075 mg/kg) decreases that risk.

The outcome of shallow breathing percentage is shown in Figure-4.4

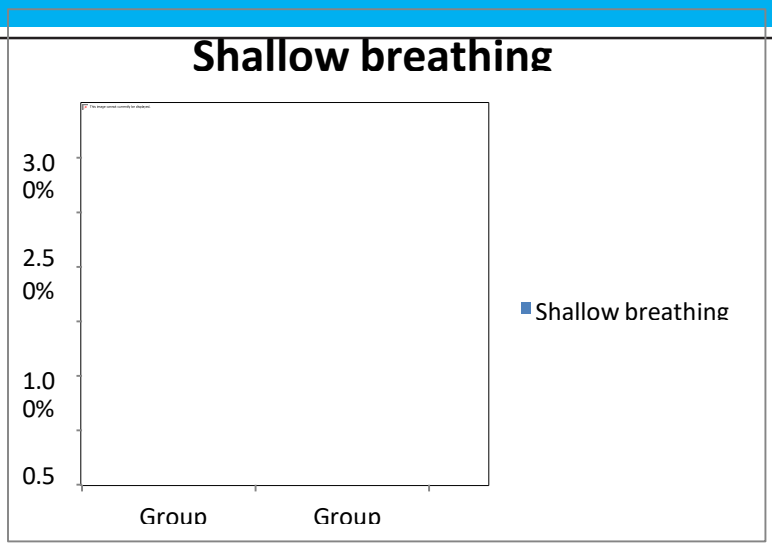

Figure-4.6: Demonstration of shallow breathing in both groups

DISCUSSION

In patients receiving general anesthesia, postoperative pain management is a crucial but mostly unexplored topic. A wide range of acute post-operative pain management strategies are being presented. 15% to 60% of acute post-operative patients experience moderate to severe pain.(Manne and Gondi, 2017). Narcotic analgesics, nonsteroidal anti-inflammatory medicines (NSAIDs), and neuroaxial medications and blocks have all been compared in various studies
.(Stricker *et al*., 2017) Narcotic analgesics are most frequently utilized for acute post-operative pain treatment following major procedures.

When compared to other opioids, ketorolac, medication used to minister to pain, has less respiratory detrimental effects.(Wang *et al*., 2009). Ketorolac inhibits cyclooxygenase 1 and 2 (COX1 and COX2), which reduces prostaglandin synthesis.(Wang *et al*., 2009) Numerous research evaluated various medication regimens and routes for effective analgesia. (Alhashemi and Daghistani, 2006) In contrast, Group A, which received nalbuphine, statistically remained pain-free longer than Group B, which received nalbuphine plus ketorolac.

Forrest et al. reported that when it came to managing pain following tonsillectomy, ketorolac outperformed opioid medications. This resulted from lower rates of drowsiness, nausea, vomiting, and depression of the central nervous system.(Forrest *et al*., 1997) In dispute with our study, Tarkkila and Saarnivaara examined the effects of diclofenac, ketoprofen, and ketorolac on post-operative pain following an elective tonsillectomy. They reported better pain management and reduced narcotic use.(Tarkkila and Saarnivaara, 1999)

These results ran counter to what we found. According to Carney et al. Ketorolac reduced surgical morbidity and opioid use. Compared to morphine, ketorolac did not raise the risk of bleeding or renal damage. (Carney *et al*., 2001) Shende and Das reported good analgesia and decreased disgorgement while using Ketorolac. (Shende and Das, 1999). Moyao-Garcia discovered that for the treatment of APSP in children following inguinal herniotomy, tramadol was noticeably superior to nalbuphine.(Moyao-García *et al*., 2009)

Amir H examined the effectiveness of pethidine and ketorolac in reducing postoperative pain during the first 24 hours following tonsillectomy. Following tonsillectomy, 100 patients in the 5– 12 age range got injections of either ketorolac (0.5 mg/kg) or pethidine (1 mg/kg) six hours after the procedure. In the ward and recovery area, patients were evaluated for any side effects and for pain

using a pain scale. It was also noted how much rescue analgesia each group needed.

They came to the conclusion that, at the stated dosages, ketorolac had analgesic effects comparable to those of pethidine, but with a significantly lower incidence of nausea, vomiting, and drowsiness during the first 24 hours following adenotonsillectomy.(Shrestha et al., 2019).

In our study one hour after surgery, we found that patients in Group A experienced minor pain 5 (6.7%) compared to Group B 35 (46.7%). There was a statistically significant difference in the number of patients who received rescue analgesia Nalbuphine (0.15 mg/kg) between Group A 10 (13.3%) and Group B 55 (73.3%).

Therefore, after extubation from general anesthesia during a laparotomy, intravenous Nalbuphine (0.15 mg/kg) in Group A decreases postoperative analgesic requisite more effectively than Nalbuphine (0.75 mg/kg) + Ketorolac (14 mg) jointly in Group B. Using the Ramsay sedation score at 5 and 30 minutes after moving to the recovery room, we found that patients in "Group A" were significantly more sedated than patients in "Group B."

Sedation was higher in Group A 7 (9.85%) than Group B 4 (5.3%), which was statistically significant. Therefore, Nalbuphine (0.15mg/kg) alone is more sedative and causes less agitation during the early postoperative period, which is lodged in the recovery of patients after operations under general anesthesia.

The frequency of nausea and vomiting was n7 (9.3%) in Group A and n5 (6.6%) in Group B. Reuse analgesia with Nalbuphine (0.15 mg/kg) showed a statistically significant difference between Group A and Group B. Reuse analgesia found in Group A n7 (9.3%) for pain scores of 4 or higher 20 minutes after moving to the recovery area. In contrast, it was found to be n60 (80%) in group B, producing a 0.000 p value.

Opioid-induced vomiting is expound by redone lower esophageal sphincter activity, which leads to sphincter relaxation, albeit the precise process is unknown. Opioids slow stomach emptying through peripheral, spinal, and supraspinal (vagus nerve-mediated) processes; however, this effect is negligible at the dose of nalbuphine (0.075 mg/kg) utilized in our investigation. When compared to other regimens, intravenous nalbuphine (0.075 mg/kg) is the most effective method for managing postoperative pain in patients receiving general anesthesia for open cholecystectomy. It is also cost-efficient and safe from adverse effects.

Since respiratory depression or shallow breathing is one of the negative effects of opioid analgesics, the patients' shallow breathing status was also tracked when they were moved to the recovery area. One patient from Group B (with nalbuphine and ketorolac) and three patients from Group A (with nalbuphine alone) both displayed a pattern of shallow breathing, which was 2.7%. This indicates that while nalbuphine alone (0.15 mg/kg) may raise the risk of shallow breathing, its use in combination with ketorolac at a lower dosage (0.075 mg/kg) decreases that risk.

1 patient from group A(Group with alone nalbuphine) reported the outcome of dry mouth which was 1.33% of population while in Group B(with nalbuphine along with ketorolac) had n 4(5.33%). It indicated that using nalbuphine along with ketorolac have high incidence of dry mouth than using nalbuphine alone.

Since irregular heartbeat was one of the rare side effects of using nalbuphine alone that had been reported in previous literature, we also assigned a senior physician to closely monitor the cardiovascular status of patients in both groups. However, none of the patients in either group experienced any CVS-related side effects, so it is important to remember that no cardiac patients were added to the study population (as stated in our inclusion and exclusion criteria), so all patients had healthy hearts while receiving nalbuphine alone or in combination with ketorolac.

In our study two patients from Group B were reported with disturbed bowel movements they got no bowel movements and doctors found no bowel sound in those patients,it was one of the side effects that appeared in Group B which was treated with nalbuphine along with ketorolac(n:2, 2.66% of total

population.No one from Group A(which was treated with nalbuphine alone. had lowered bowel movements(0%).This indicates that combination of opioid nalbuphine with ketorolac can disturb bowel movements but to a low rate. Disturbed GIT functions cause much
discomfort in patient due to peri-operative NPO status while patient feel lowered movements of bowel it can lead to constipation or diarrhea after breaking NPO which gets much tough to manage postoperatively. Diarrhea can lead to severe outcomes due to compromised nutritional status peri-operatively. Bowel movements shouls be normal when NPO gets quitted after TFO. So incidence of disturbed bowel is higher in using nalbuphine along with ketorolac than using nalbuphine alone for management of pain under general anesthesia.
We had followups for both groups in ICU to check whether anyone had constipation or diarrhea specially the two patients from Group B which had disturbed bowel sounds postoperatively.When we monitored these two patient with upset GIT functions in ICU, one patient got diarrhea when his NPO status was broken. It was a bad incidence reported by combined usage of nalbuphine and ketorolac.

CONCLUSION

It was determined that intravenous Nalbuphine (0.15 mg/kg) is superior than Nalbuphine (0.075 mg/kg + Ketorolac 14 mg in combination for lowering pain intensity and the need for re-use analgesics following a Laparotomy. Due to the extremely low rate of postoperative problems, such as respiratory depression, it is generally safe.
The findings of this study show that nalbuphine by itself effectively reduces pain in individuals undergoing general anesthesia, and that there are no appreciable further advantages when combined with ketorolac. When compared to the combo group, the study discovered that nalbuphine alone produced similar pain scores and opioid usage. These results imply that nalbuphine by itself might be a sufficient and successful alternative for surgical patients' pain management.
Clinically noteworthy is the discovery that nalbuphine alone produced less adverse effects, which implies that patients may tolerate this treatment plan better. Additionally, nalbuphine's decreased risk of side effects could lead to better patient results and satisfaction.
On the other hand, it was discovered that nalbuphine and ketorolac together increased the likelihood of side effects, such as bleeding problems and gastrointestinal issues. These results imply that the combination of ketorolac and nalbuphine may not significantly reduce pain but rather raise the risk of patient injury.
The findings of this study have significant clinical practice implications since they give anesthesiologists and pain management specialists evidence-based recommendations. Nalbuphine by itself might be a helpful tactic for maximizing pain control in postoperative patients while lowering the possibility of side effects.

In summary, this study shows that nalbuphine by itself is a safe and efficient way to treat pain in patients undergoing general anesthesia. Because of its lower risk of side effects, it may be chosen over nalbuphine and ketorolac together. To validate these results and investigate the possible advantages of nalbuphine alone in other therapeutic contexts, more research is required.

Outcome and Utilization

Pain Management of Patients under General Anesthesia: Nalbuphine Alone or Nalbuphine with Ketorolac," may include improved pain relief, reduced opioid consumption, and decreased incidence of opioid-related adverse effects. The utilization of this project may involve informing evidence-based practice guidelines for pain management in surgical patients, optimizing anesthesia protocols, and enhancing patient safety and satisfaction. Additionally, the findings may contribute to the

development of multimodal analgesia strategies, promoting the use of non- opioid adjuvants like ketorolac, and guiding future research on opioid-sparing techniques in anesthesia practice.

Limitations

Because all of the patients were moved from the operating room recovery area and released after 48 to 72 hours, the study's limitation was that patients were not monitored for longer than an hour. After they left the hospital, it would have been extremely difficult to follow up with the majority of patients who came from remote areas.

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