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Comparing Postoperative Fentanyl Use: Ibuprofen VS Ibuprofen-Dexamethasone as Preemptive Analgesia

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Abstract

Background: Fentanyl is the most frequently used opioid analgesic for managing postoperative pain. While effective, it is associated with various side effects. Postoperative pain is mainly due to acute tissue damage. Several studies have shown that administering preemptive analgesia before anesthesia can help reduce postoperative pain, thus decreasing the need for fentanyl and its side effects.
Methods: This research employed a randomized controlled trial (RCT) with a double-blind design. Postoperative pain was measured using the Numeric Rating Scale (NRS). Patients with an NRS score above 6 received fentanyl. Statistical analysis was conducted to compare the impact of preemptive analgesia with Ibuprofen 800 mg alone versus Ibuprofen 800 mg combined with Dexamethasone 10 mg in patients undergoing postoperative gynecological abdominal surgery.
Results: The findings revealed a significant difference in NRS pain scores between the groups. The group receiving the combination of Ibuprofen 800 mg and Dexamethasone 10 mg had a 69% reduction in the need for postoperative fentanyl compared to the group that received only Ibuprofen.
Conclusion: Patients who received preemptive analgesia with Ibuprofen and Dexamethasone had lower pain scores and a reduced need for fentanyl in the postoperative period compared to those receiving Ibuprofen alone.

Keywords: *Postoperative pain, fentanyl, preemptive analgesia, ibuprofen, dexamethasone*

Introduction

Gynaecological and obstetric surgery often results in post-surgical pain of significant intensity. In Indonesia, the prevalence of gynaecological cases requiring abdominal surgery is still relatively high. For instance, ovarian cancer has an average of 13,310 new cases annually. Data from the Ministry of Health indicates that the highest number of new cases was reported in 2020, totaling 14,896, with 70% of these patients undergoing gynecological abdominal surgeries. At RSUD Arifin Achmad in Riau Province, 106 gynecological laparotomies were performed over the course of the year 2023.[1]

Post-surgical pain management should apply a multimodal analgesia approach, which involves a combination of two or more analgesics, including preemptive analgesics. This principle incorporates anaesthetic drugs and techniques that address various pain mechanisms, both at peripheral and central levels, as described in preemptive multimodal analgesia. The effectiveness of preemptive analgesics, as part of multimodal analgesia, can be evaluated by comparing postoperative pain intensity in patients who have received preemptive analgesics beforehand. [2,3]

An example of a preemptive analgesic is intravenous ibuprofen. Also known as isobutylphenylpropanoic acid, ibuprofen is a non-steroidal anti-inflammatory drug (NSAID) that provides pain relief, reduces fever, and has anti-inflammatory properties. Its mechanism of action works by inhibiting the cyclooxygenase enzyme, which prevents the conversion of arachidonic acid into prostaglandins. Ibuprofen has been widely used in preemptive analgesia in various studies. A study in gynaecological surgery patients compared the effectiveness of ibuprofen 800 mg as a preemptive analgesic with paracetamol 1 gram. Results using the Visual Analogue Scale (VAS) showed that the group receiving preemptive ibuprofen experienced a greater decrease in postoperative pain scores compared to the paracetamol group.[4-6]

Uncontrolled postoperative pain can lead to various systemic complications, such as increased metabolic stress, impaired cardiovascular function, and reduced patient mobility. In cases where pain scores are ≥7 on the VAS, strong analgesic interventions like opioids are required. Fentanyl, a potent opioid, is often the first choice for managing severe postoperative pain. [7-9]

A previous meta-analysis by Soffin demonstrated that intravenous fentanyl can reduce the postoperative pain scale by 4-5 points on the VAS within 5 minutes of administration, with optimal analgesic effects occurring within 15 minutes, lasting 30-45 minutes. While effective, fentanyl use requires close monitoring for side effects such as respiratory depression and intestinal motility disorders.[10,11]

This study aims to explore alternative approaches to postoperative pain management, particularly by administering preemptive analgesics to reduce the postoperative pain scale, thus impacting the use of fentanyl as a postoperative analgesic. [12,13]

Methods

Study Design

This research used a randomized controlled trial (RCT) with a double-blind methodology. It was conducted in the central surgery room of Arifin Achmad Hospital in Riau Province from July 2024 to November 2024, after obtaining approval from the Health Research Ethics Commission and approval from the hospital administration.

Population and Sampling

The study group consisted of patients aged 18–59 years, categorized as ASA physical status class I–II, who were scheduled for elective gynecological abdominal surgeries under general anesthesia in the central surgical room at RSUD Arifin Achmad, Riau Province. Participants were selected from the overall population based on specific inclusion and exclusion criteria.

The inclusion criteria were: patients aged 18–59 years, a body mass index (BMI) between 18.5–29.9 kg/m², ASA physical status class I–II, and undergoing surgery with general anesthesia. The exclusion criteria included: patients with a history of chronic or cancer-related pain, psychiatric disorders or cognitive impairments, alcohol use, the use of anti-inflammatory drugs, neuropathic analgesics, or opioid analgesics, those undergoing chemotherapy, and patients allergic to the medications used in the study.

Variables and Operational Definitions

This study explores the connection between dependent and independent variables to gain a deeper understanding of patient characteristics and treatment outcomes. The dependent variables were the postoperative pain scale, measured using the Numeric Rating Scale (NRS), and postoperative fentanyl consumption. Pain was assessed by self-report using a scale from 0 to 10. Fentanyl use as a postoperative analgesic was quantified by the total administered dose (in micrograms). The independent variables included the administration of preemptive analgesics, consisting of either 800 mg of intravenous ibuprofen alone or a combination of 800 mg of intravenous ibuprofen with 10 mg of intravenous dexamethasone.[14]

Data Collection and Presentation

Samples were taken using consecutive sampling, where patients meeting the inclusion and exclusion criteria were selected until the required sample size was reached. Patients scheduled for gynaecological abdominal surgery were randomly divided into two groups one day before surgery: Group A received intravenous preemptive analgesic ibuprofen 800 mg, while Group B received intravenous preemptive analgesic ibuprofen 800 mg combined with 10 mg of dexamethasone.

Data Analysis

The gathered data were analyzed and presented through narratives, tables, and graphs, including means, standard deviations, frequencies, and percentages, using SPSS (Statistical Package for Social Sciences) version 25. The Shapiro-Wilk test was performed to evaluate the data distribution. Numerical variables were reported as mean ± standard deviation (mean ± SD), and for normally distributed data, the T-test for independent samples (parametric test) was used.

Ethical Considerations

This study was approved by the Ethics Committee of the Faculty of Medicine, Riau University, under ethical approval number B/047/UN19.5.1.1.8/UEPKK/2024.

Results

A total of 38 participants were included in the study, with an equal distribution between two intervention groups. The first group was given a preemptive analgesic dose of 800 mg ibuprofen, while the second group received a combination of 800 mg ibuprofen and 10 mg dexamethasone. The participants were aged 18–59 years and classified under ASA I–II physical status. They were scheduled to undergo elective abdominal gynaecological surgery at the Central Surgical Installation of RSUD Arifin Achmad, Riau Province. The sample recruitment period lasted from July to November 2024, with all participants meeting the predetermined inclusion criteria (Table 1).

Regarding sample characteristics, the mean age in the Ibuprofen 800 mg preemptive analgesic group was 42.68 ± 9.79 years, while the mean age in the Ibuprofen 800 mg combined with dexamethasone 10 mg group was 44.05 ± 7.09 years. There were no significant differences in age, body mass index (BMI), or duration of surgery between the two groups. The distribution of sample characteristics was assessed using the Shapiro-Wilk normality test, and it was found that the characteristics of the patient samples in this study were normally distributed (P > 0.05) (Table 1).

Table 1. Distribution of Sample Characteristics

Characteristics	**Ibuprofen 800 mg (n=19)**	***P - value***	**Ibuprofen 800 mg + Dexa 10 mg (n=19)**	***P - value***
	Mean ± SD		**Mean ± SD**	
Age (years)*	42.68 ± 9.79	0.184	44.05 ± 7.09	0.142
BMI (kg/m^2)*	23.52 ± 4.199	0.225	24.11 ± 4.13	0.061
Duration of operation (Hours)*	2.96 ± 0.56	0.220	3.09 ± 0.54	0.365

* Normality Test with Shapiro-Wilk

In this study, the Numeric Rating Scale (NRS) pain scores were assessed 24 hours postoperatively in each treatment group. The NRS scores were compared to assess the effectiveness of the two preemptive analgesic treatments (Table 2).

Table 2. Comparison of NRS pain scale in 24 hours between the two treatment groups

Numeric Rating Scale	**Ibuprofen 800 mg (n = 19)**	**Ibuprofen 800 mg + Dexa 10 mg (n = 19)**	***P - value***
NRS 24 Hour	**Mean ± SD**	**Mean ± SD**	<0.001
	2.72 ± 1.02	2.00 ± 0.89	

*T Group Test

The results showed that the mean NRS pain score for the Ibuprofen 800 mg preemptive analgesic group was 2.72 ± 1.02, while the group receiving Ibuprofen 800 mg combined with Dexamethasone 10 mg had a mean score of 2.00 ± 0.89. A comparison using the T-test revealed a statistically significant difference (P = 0.000), indicating that the Ibuprofen-Dexamethasone combination group experienced lower postoperative pain scores (Table 2).

Moreover, the study also evaluated the use of fentanyl as a postoperative analgesic in both groups. The group receiving the combination of Ibuprofen 800 mg and Dexamethasone 10 mg showed a 69% reduction in fentanyl consumption compared to the Ibuprofen-only group. Statistical analysis confirmed a significant difference in postoperative fentanyl usage between the two groups (P < 0.05) (Table 3).

Table 3. Comparison of postoperative Fentanyl usage

Opioid	**Ibuprofen 800 mg (n=19)**	**Ibuprofen 800 mg + Dexa 10 mg (n=19)**	***P-value***
Fentanyl dose (mcg)	**Mean ± SD**	**Mean ± SD**	0.037*
	15.78 ± 5.47	2.63 ± 2.63	

*T Group Test

Discussions

The study found that the sample characteristics, with a mean age ranging from 42 to 44 years in both groups, showed no statistically significant difference in age between the two groups (P > 0.05). Age is a significant risk factor and predictor in gynecological conditions requiring surgical intervention, such as open laparotomy. The findings regarding the age of the sample in this study are consistent with previous research, which found that the majority of patients undergoing gynecological laparotomy for ovarian cysts were aged between 37.5 and 45.6 years, with the most common age being 42 years.[14,15,16]

Regarding body mass index (BMI), the majority of participants in both groups had an average BMI within the normal range of 23-24 kg/m². Statistically, there was no significant difference in the BMI distribution between the two groups (P > 0.05). This result aligns with a prior study that reported that most patients undergoing

gynecological laparotomy for uterine myoma had a BMI in the normal range (18.5-25 kg/m²), with 33.4% falling within this category.[17]

When analyzing the duration of surgery, the average time for open laparotomy procedures was found to be between 2.9 and 3 hours. No significant difference was noted in the duration of surgery between the two groups ($P > 0.05$). This is consistent with a previous study, which reported an average surgery duration for gynecological laparotomy cases ranging from 3 to 4 hours, with the number of cases reaching 198 (35.29%).[18]

A significant difference was observed in the NRS pain scale between the two groups within 24 hours post-surgery. The group that received the preemptive analgesic combination of Ibuprofen 800 mg and Dexamethasone 10 mg had a significantly lower pain score, with a mean difference of 0.72 and a standard deviation difference ($P < 0.05$). This finding is consistent with a previous study comparing the 24-hour NRS pain scale in spinal stabilization surgery patients, where the combination group also reported less pain, with a mean difference of 1.17 and a statistically significant result ($P = 0.015$). [19]

The improved effectiveness of the combination of Ibuprofen 800 mg and Dexamethasone 10 mg as a preemptive analgesic, compared to ibuprofen alone, may be attributed to its ability to suppress postoperative inflammatory mediators, particularly Interleukin-6 (IL-6). This is supported by a previous study that followed Darise's research, where the combination group demonstrated a lower NRS pain scale in spinal stabilization surgery patients. In that study, IL-6 levels were measured at three different times: 30 minutes after preemptive analgesic administration (before anesthesia induction), 2 hours post-surgery, and 24 hours post-surgery. The results showed that the combination group maintained lower IL-6 levels from the first 30 minutes, with no significant increase at 2 hours post-surgery, in contrast to the ibuprofen-only group, which experienced an increase in IL-6 levels. At 24 hours post-surgery, the difference in IL-6 levels between the two groups remained statistically significant ($P = 0.44$) . This mechanism suggests that more effective suppression of inflammatory factors in the combination group was associated with decreased pain and improved NRS scores 24 hours post-surgery. [20]

With the reduction in pain scale due to the preemptive analgesic's ability to suppress inflammatory pain, there was a 69% decrease in fentanyl usage in the group receiving the combination of Ibuprofen 800 mg and Dexamethasone 10 mg. The benefit of this study lies in the potential to propose a new protocol for preemptive analgesia using Ibuprofen-Dexamethasone in the perioperative period for patients undergoing laparotomy. This approach has been shown to reduce postoperative pain, making patients more comfortable and promoting faster recovery. The reduction in postoperative fentanyl usage can also decrease the undesirable side effects of opioids, such as respiratory depression and the potential for intoxication due to high-dose administration. The limitations of this study are the possibility of bias in the measurement of postoperative pain scales because the study was conducted on a limited number of samples and only at one center.[20]

Conclusions

There are differences in the use of postoperative Fentanyl and the Numeric Rating Scale (NRS) pain scale in the two groups, in the group with preemptive analgesic administration of Ibuprofen 800 mg combined with dexamethasone 10 mg is better in reducing the value of the NRS pain scale compared to the single preemptive analgesic administration of Ibuprofen 800 mg in gynecological laparotomy surgery, so that with the decrease in the NRS pain scale in the Ibuprofen 800 mg preemptive analgesic group combined with dexamethasone 10 mg, the use of postoperative Fentanyl in this group is also reduced.

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Declarations of competing interest

No potential competing interest was reported by the authors.

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