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The Role of Gabapentin and Dexamethasone in the Incidence of Postoperative Nausea and Vomiting and Serotonin Levels in Patients Undergoing Laparoscopic Cholecystectomy
Azhar Safa'at¹, Syamsul Hilal Salam^{1,2}, Andi Adil^{1,2}, Muh. Ramli Ahmad^{1,2}, Faisal Muchtar^{1,2}, Madonna D. Datu^{1,2} & Nur Surya Wirawan^{1,2}

¹ Department of Anesthesiology, Intensive Care, and Pain Management, Faculty of Medicine, Hasanuddin University, Jl. Perintis Kemerdekaan KM. 10, 90245, Makassar, Indonesia

² Department of Anesthesiology, Intensive Care, and Pain Management, Dr. Wahidin Sudirohusodo General Hospital, Jl. Perintis Kemerdekaan KM. 10, 90245, Makassar, Indonesia

* Author: Email: azharsafaat.27@gmail.com; Telp: +62 823-4726-4414.

* Corresponding Author: Email: syamsulhsalam@yahoo.com; Telp: +62 812-4242-0927.

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ABSTRACT

BACKGROUND: Postoperative nausea and vomiting are frequent issues after surgery, such as laparoscopic cholecystectomy. Gabapentin and dexamethasone have been recognized as potential treatments to lower the occurrence of nausea and vomiting and affect serotonin levels, which are involved in regulating nausea. This study seeks to evaluate the effects of gabapentin and dexamethasone on nausea and vomiting incidence and serotonin levels in patients undergoing laparoscopic cholecystectomy.

METHODS: This research utilized a single-blind randomized clinical trial design, conducted at Dr. Wahidin Sudirohusodo General Hospital and its affiliated hospitals in Makassar. The research sample comprised patients who met the inclusion and exclusion criteria. Sampling was done using consecutive sampling and divided into three groups: one group receiving gabapentin, another receiving dexamethasone, and a third group receiving a combination of gabapentin and dexamethasone. Data were collected on the incidence of nausea and vomiting and serotonin levels before and after drug administration.

RESULTS: The results revealed no significant difference in the rates of nausea and vomiting across the three groups. However, there was a notable difference in postoperative serotonin levels, with the group treated with both gabapentin and dexamethasone demonstrating a more substantial reduction in serotonin levels compared to the other groups ($p < 0.05$).

CONCLUSION: Gabapentin, dexamethasone, and their combination all effectively lower postoperative serotonin levels, with the combination of gabapentin and dexamethasone yielding the most significant reduction. Nevertheless, there was no notable difference in the incidence of nausea and vomiting among the treatments.

Keywords: Postoperative nausea and vomiting, Gabapentin, Dexamethasone, Serotonin, Laparoscopic cholecystectomy

INTRODUCTION

Postoperative nausea and vomiting (PONV) is a common issue that frequently occurs as a significant side effect of surgery and anesthesia, particularly after laparoscopic

cholecystectomy, where the incidence can range from 14% to 72% within the first 24 hours postoperatively.^{(1),(2),(3)} This condition negatively impacts patients' quality of life, prolongs recovery time, and can lead to serious complications such as dehydration, wound disruption, and the risk of pulmonary aspiration, which in turn decreases patient satisfaction and increases healthcare costs.^{(2),(4)} Various prevention and treatment strategies, including the use of prophylactic antiemetics before surgery, are considered standard protocols to reduce nausea and vomiting.⁽⁵⁾

Gabapentin and dexamethasone are two agents often considered in the management of PONV. Gabapentin, which is typically used as a non-opioid analgesic, has shown potential as an antiemetic prophylaxis through various mechanisms, although studies on its effectiveness yield varying results.⁽⁴⁾ On the other hand, dexamethasone, known for its anti-inflammatory and antiemetic effects, has been effective in alleviating postoperative nausea and vomiting by diminishing inflammation and reducing serotonin receptor sensitivity. Nonetheless, it may also result in side effects, including a greater risk of infection and metabolic disturbances.^{(6),(7),(8)}

Previous research has shown that gabapentin can reduce the incidence of PONV, but its effectiveness compared to dexamethasone and their combination still requires further exploration. Research by Ridha et al. demonstrated that the combination of gabapentin and ondansetron is more effective than the combination of dexamethasone and ondansetron in reducing nausea and vomiting in patients undergoing laparoscopic cholecystectomy.⁽⁹⁾ However, previous research has not directly compared the effects of gabapentin and dexamethasone on serotonin levels.

Therefore, this research aims to analyze the role of gabapentin, dexamethasone, and their combination in the incidence of nausea and vomiting and serotonin levels in patients undergoing laparoscopic cholecystectomy. It is hoped that the results of this research will

provide new insights into the management of PONV and assist in the development of more effective anesthesia protocols.

METHOD AND MATERIAL

Subjects and Data Collection

This research employs a single-blind randomized clinical trial design to evaluate the role of gabapentin and dexamethasone in the incidence of nausea and vomiting and serotonin levels in patients undergoing laparoscopic cholecystectomy. The study is conducted at Dr. Wahidin Sudirohusodo General Hospital and its network hospitals in Makassar, starting from March 2024 until the sample size is achieved. The study population consists of all patients undergoing laparoscopic cholecystectomy at these hospitals. The research sample is selected using consecutive sampling based on the schedule of operations. Inclusion criteria include patients aged 18-64 years with ASA physical status I-II who are undergoing general anesthesia. Exclusion criteria are applied to ensure the validity of the sample. These criteria include patients with a history of motion sickness, previous postoperative vomiting, and certain medical conditions, in order to maintain the internal validity of the study.

Subjects who fulfill the inclusion and exclusion criteria are then divided into three groups: Group G receives 100 mg of gabapentin orally 2 hours before surgery; Group D receives 10 mg of dexamethasone intravenously 30 minutes before surgery; and Group G-D receives a combination of 100 mg of gabapentin orally and 10 mg of dexamethasone intravenously. Data collection includes measuring serotonin levels through venous blood samples taken before premedication and 1 hour after surgery. Additionally, patients are observed for 24 hours postoperatively to record the incidence of nausea and vomiting and the use of antiemetics, in order to evaluate the effectiveness of the interventions provided.

The data are analyzed using SPSS version 26. One-Way ANOVA and Kruskal-Wallis tests are employed to evaluate differences among groups, while Chi-Square tests are used to explore relationships between categorical variables. The research complies with the ethical standards established by the Biomedical Research Ethics Committee at Hasanuddin University's Faculty of Medicine, ensuring that informed consent is obtained from each patient before participation.

RESULT

This research involved 45 patients undergoing laparoscopic cholecystectomy. The sample was randomly divided into three intervention groups: the Gabapentin (G) group, the Dexamethasone (D) group, and the Gabapentin-Dexamethasone (G-D) combination group, each consisting of 15 samples. The results indicate that there were no significant differences in sample characteristics, including age, gender, smoking history, history of PONV, duration of surgery, and analgesia among the three groups, with all p-values above 0.05. This indicates that the sample populations in the three groups are homogeneous (Table 1). Table 2 shows that the incidence of postoperative nausea and vomiting did not differ significantly among the treatment groups, with a p-value of 0.516. Serotonin levels also did not show a significant difference among the three groups at time T1 (before medication), with a p-value of 0.067. However, there was a significant difference in serotonin levels at time T2 (one hour after surgery) among the treatment groups, with a p-value of 0.044. The change in serotonin levels between T1 and T2 also showed a significant difference, with a p-value of 0.002, where the Gabapentin-Dexamethasone group experienced a greater reduction compared to the other groups (Table 3).

DISCUSSION

The research indicates that the demographic and clinical characteristics of the 45 samples across the three intervention groups, which include Gabapentin, Dexamethasone,

and the Gabapentin-Dexamethasone combination, do not differ significantly, thus ensuring homogeneity and comparability. The uniformity in sample characteristics guarantees that the assessment of postoperative nausea and vomiting, as well as serotonin levels, remains unaffected by variations in demographic or clinical factors, thereby ensuring the validity of the group comparisons.

Regarding postoperative nausea and vomiting, this research shows no significant difference among the three intervention groups. The incidence of nausea and vomiting was generally mild or absent, indicating similar effectiveness of Gabapentin, Dexamethasone, and their combination in preventing these symptoms after laparoscopic cholecystectomy. These results align with previous studies, including those by Kaur et al., which suggest that Gabapentin and Dexamethasone have comparable effectiveness in preventing postoperative nausea and vomiting.⁽¹⁰⁾

In measuring serotonin levels, the results show that at time T_1 (before the administration of prophylactic medication), there were no significant differences. However, serotonin levels at time T_2 (one hour after surgery) showed significant differences between the intervention groups, indicating that the three treatments affected serotonin levels differently after medication administration. The change in serotonin levels from T_1 to T_2 indicates a significant difference, with the Gabapentin-Dexamethasone combination group experiencing a greater decrease in serotonin levels compared to the groups receiving the medications separately. The lower serotonin levels after medication administration suggest that the Gabapentin-Dexamethasone combination is more effective in reducing serotonin levels, which may contribute to a reduction in the incidence of nausea and vomiting.

Although this research provides new insights into the role of Gabapentin, Dexamethasone, and their combination in influencing postoperative serotonin levels, it does not evaluate the specific causes of changes in serotonin levels or the long-term effects of

the interventions. Therefore, further research is needed to confirm these findings and explore the mechanisms behind the observed changes in serotonin levels.

CONCLUSION

Based on the research findings, it can be concluded that there are no significant differences in postoperative nausea and vomiting between the administration of Gabapentin, Dexamethasone, and their combination in patients undergoing laparoscopic cholecystectomy. However, there are significant differences in serotonin levels post-surgery after medication administration, with the Gabapentin-Dexamethasone combination being considered more effective in reducing serotonin levels compared to the groups receiving the medications separately.

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Conflict of Interest

The authors declare that they have no conflicts of interest with any financial organizations related to the topic discussed in the manuscript.

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Author Contributions

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TABLE

Table 1. Characteristics of Variables

Characteristics	Group G	Group D	Group G-D	p
Age (Years)	36,6 ± 10,73	38,47 ± 10,29	44,47 ± 11,12	0,123 ^a
Weight (kg)	58,93 ± 5,89	59 ± 8,41	55,67 ± 6,16	0,116 ^b
Gender				
Male	7 (46,7)	8 (53,3)	7 (46,7)	0,915 ^c
Female	8 (53,3)	7 (46,7)	8 (53,3)	
Smoking History				
Yes	6 (40)	5 (33,3)	5 (33,3)	0,908 ^c
No	9 (60)	10 (66,7)	10 (66,7)	
PONV History				
Yes	0	0	0	-
No	15 (100)	15 (100)	15 (100)	
Surgical Duration (minutes)	106 ± 15,49	113,33 ± 19,88	109,33 ± 14,86	0,581 ^b
Analgesia (mcg)	177,53 ± 17,95	167,33 ± 21,54	162,67 ± 20,86	0,073 ^b

Numeric data are shown as mean ± standard deviation, while categorical data are reported as n (%). ^aOne Way Anova Test, ^bKruskal Wallis Test, ^c Chi Square Test

Table 2. Incidence of Nausea and Vomiting

Nausea And Vomiting	Group G	Group D	Group G-D	p
None	8 (53,3)	11 (73,3)	9 (60)	0,516
Mild	7 (46,7)	4 (26,7)	6 (40)	
Moderate	0	0	0	
Severe	0	0	0	

"Data are presented as n (%) using the Chi-Square test."

Table 3. Serotonin Levels

Serotonin Levels	Group G	Group D	Group G-D	p
T_1 (umol/L)	0,313 ± 0,087	0,282 ± 0,059	0,344 ± 0,073	0,067 ^b
T_2 (umol/L)	0,356 ± 0,063	0,320 ± 0,072	0,284 ± 0,091	0,044 ^a
Δ	0,043 ± 0,104	0,038 ± 0,089	-0,060 ± 0,059	0,002 ^b

Data are presented as mean ± standard deviation. ^aOne Way Anova Test, ^bKruskal Wallis Test.