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ORIGINAL RESEARCH

Chemotherapy-Induced Nausea and Vomiting (CINV) Based on Blood Types among Cancer Patients in Yogyakarta, Indonesia

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Abstract

Background: Studies related to blood type in cancer patients have been conducted extensively, but they are inclined to cancer incidence or survival rate. Meanwhile, there is limited research on Chemotherapy-Induced Nausea and Vomiting (CINV), the most disturbing side effect of chemotherapy, in relation to blood type.
Purpose: This study aimed to compare CINV frequency in cancer patients by blood groups in Yogyakarta, Indonesia.
Methods: A descriptive comparative study with a cross-sectional approach was conducted purposively on 70 chemotherapy patients in two hospitals in Yogyakarta. Patients with anticipatory CINV and brain cancer (primary or metastases) were excluded. The data were collected between July and November 2020 using a sheet for patient characteristics and a filled-in diary from the first to the seventh day post-chemotherapy to collect CINV data. The descriptive statistics and Kruskal Wallis test were used to analyze the data.
Results: Of 70 total samples, most of them were breast cancer (71.4%) and were in stage IV (50%). They received chemotherapy alone as their primary therapy (94.3%) and received moderate to high emetogenic agents (31.4% and 35.7%). Samples mostly had A blood type (34.3%) and had undergone chemotherapy for 3-18 months (min-max). As many as 64.6% of patients experienced CINV with a delayed type and experienced moderate severity (52.9%). The bivariate test showed no difference in CINV frequencies based on blood groups in general (p=0.068). However, based on the CINV onset, there was a significant difference in CINV frequencies in the A blood group against other blood groups (p=0.020) on the fourth post-chemotherapy day.
Conclusions: Unless the fourth-day post-chemotherapy, the frequency of CINV based on blood groups showed no difference. Since CINV incidence is still high, the provision of both pharmacological and non-pharmacological therapy to treat CINV has to be given to patients after chemotherapy. Blood group factors can be considered for more extensive management, especially in delayed CINV cases.

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1. Introduction

Non-communicable diseases (NCDs) are currently considered the most significant cause of death worldwide. Cancer, one of the NCDs, is the most significant barrier to increasing life expectancy in almost all countries in the 21st century (Bray et al., 2018). Lung, colorectal, and breast cancer have the most considerable incidence and are among the top five causes of death worldwide (International Agency For Research of Cancer, 2018). Cancer prevalence in Indonesia increased from 1.4‰ in 2013 to 1.49 ‰ in 2018. Among the provinces, Yogyakarta has the highest prevalence, with 4.86‰ in 2018 (Ministry of Health The Republic of Indonesia, 2019). From 2019 to 2020, there was a total of 9,333 cancer cases recorded in Yogyakarta province (Solikhah et al., 2022).

Cancer patients experience many problems that arise due to their illness. Cancer-related complaints are fatigue, pain, anxiety, and depression. Complaints are also still reported even though the patient has undergone surgery, radiotherapy, hormone therapy, and chemotherapy to treat the disease (Do et al., 2015; Habibi et al., 2016). Surgery in cancer cases aims to remove the patient's tumor mass or tissue (Angahar, 2017). For example, breast cancer patients undergoing mastectomy usually complain of sequelae due to the procedure, including limitations in the shoulder joints, arm and hand weakness, lymphedema, pain, and sensory disturbances (Do et al.,

2015). Meanwhile, other adjuvant therapies, such as hormone therapies, radiotherapies, and chemotherapies in breast cancer patients aim to reduce recurrence and death rates, although these therapies cause side effects that can harm the quality of life (Angahar, 2017; Do et al., 2015).

The radiotherapy has short-term side effects such as fatigue and skin rash. Long-term effects of radiotherapy are lymphedema, cardiopulmonary toxicity, and brachial nerve palsy. However, of the several side effects of adjuvant therapies, chemotherapy has the most dominant side effect because it has a toxic effect on healthy cells and tissues. Short-term adverse effects of chemotherapy include nausea, vomiting, diarrhea, headache, thrombosis, muscle aches, neuropathic problems, and fatigue (Do et al., 2015). Meanwhile, the long-term side effects of chemotherapy include bone marrow suppression, neuropathies, gastrointestinal disorders, hair loss, fatigue, and skin disorders (Chan & Ismail, 2014). Among the side effects caused by chemotherapy, nausea, and vomiting are the most disturbing and debilitating effects for cancer patients (Dranitsaris et al., 2017). Nausea and vomiting caused by chemotherapy are known as chemotherapy-induced nausea and vomiting (CINV), which affects almost 70-80% of chemotherapy patients (Levine & Shega, 2013). If CINV is not controlled, it can lead to dehydration, anorexia, weight loss, electrolyte disturbances, and reducing the patient's quality of life. Fear of CINV can also delay chemotherapy, reduce chemotherapy dosages, and even discontinue chemotherapy. All of these things can result in reduced benefits from the therapy in the form of symptom control and prolonging the patient's life (Do et al., 2015).

CINV occurs when the medulla oblongata, the vomiting center (VC) that controls the vomiting response in humans is stimulated. The vomiting center integrates various inputs from both peripheral and central parts of the body, eliciting an emetic reflex in response. The peripheral pathway originates from the gastrointestinal tract, where stimuli are transmitted via the abdominal vagal afferents (Aapro, 2018). Vagal afferent fibers in the stomach express various receptors (e.g., 5-HT3, neurokinin 1, and cholecystokinin-1) that can trigger an emetic response when stimulated, with 5-HT3 as the primary mediator. Vagal afferent fibers terminate in the dorsal vagal complex, which consists of the nucleus tractus solitarius (NTS), the area postrema, and the dorsal motor nucleus. In turn, the NTS and the area postrema (also known as the chemoreceptor trigger zone) transmit impulses to the vomiting center (Aapro, 2018; Gupta et al., 2021). Meanwhile, the central emesis pathway describes how brain input to the vomiting center will evoke an emetic response. The vomiting center receives direct cholinergic and histaminic input in response to pain, vestibular disturbances, or emotional factors. The vomiting center also receives input from the chemoceptor trigger zone or postrema area in response to endogenous toxins and other chemical stimuli (e.g., chemotherapy or other drugs)(Gupta et al., 2021; Shankar, 2015).

Several risk factors influence the incidence and severity of CINV in cancer patients undergoing chemotherapy, and these risk factors come from the treatment and patient characteristics (Navari & Rapoport, 2016). Risk factors derived from the given treatments include emetogenic agents, dosage, route of administration, duration of infusion, and combination of chemotherapeutic agents. Risk factors derived from patient characteristics were gender (women are more at risk), age being less than 50 years, an alcohol-free history, a history of previous chemotherapy-induced emesis, and a history of being a non-smoker (Navari & Rapoport, 2016; Sekine et al., 2013). However, the blood group factor is rarely mentioned among the various factors typically discussed.

The relationship between blood type and nausea and vomiting was previously studied by Habibi et al. (2016) in a different setting. They examined the relationship between the ABO blood group system and the incidence of nausea and vomiting in cancer patients receiving radiotherapy. The theoretical basis of this study was that the ABO blood type system could affect the condition of radiotherapy-induced nausea and vomiting (RINV) through its capacity to modulate the hemostatic system and the inflammatory response that would stimulate the nausea center in the medulla oblongata. The results indicated that blood type is significantly related to RINV conditions, where patients with blood type A are the most affected by RINV (Habibi et al., 2016). Other studies related to blood type in cancer patients have been conducted several times but tend to be more about the relationship between blood type and cancer incidence or with the survival rate of cancer patients. The relationship between blood type and cancer incidence has been meta-analyzed by Zhang et al. (2014), who stated that there is a relationship between blood types and cancer risks where A blood type is the most at risk for cancer, and O blood type is the least at risk

of developing cancer. This was also reinforced by research conducted by Meo et al. (2017), who found that there was a relationship between ABO blood type and the incidence of breast cancer in women, where people in the A blood group had the highest and people in AB blood group had the lowest incidence of breast cancer. It can, therefore, be concluded that research on the relationship or comparison between ABO blood groups and CINV is still scarce, even in Yogyakarta, which has the highest cancer prevalence rate in Indonesia. Therefore, this study aimed to compare CINV frequency based on blood types in cancer patients in Yogyakarta.

2. Methods

2.1 Research design

The study was a comparative descriptive study with a cross-sectional approach to find the differences in the incidence of CINV in cancer patients based on blood types.

2.2 Setting and samples

The study was conducted in two hospitals (a public and a private hospital) in Yogyakarta from July to November 2020. The inclusion criteria were adult cancer patients (age 18 years or older) undergoing chemotherapy and receiving standard hospital antiemetic drugs and being able to communicate both verbally and in writing. The exclusion criteria were patients that had nausea and vomiting one day before chemotherapy (anticipatory CINV) and had a brain tumor (primary or metastasized). The study did not control for confounding factors such as a history of gastrointestinal irritation, chemotherapy dosage, chemotherapy emetogenicity, and the type of therapy given. However, the data on confounding factors would be used as enrichment material during the discussion.

This study used a Slovin formula (Adhikari, 2021) for sample size calculation with a 95% confidence level. The population of cancer patients undergoing chemotherapy in 2020 at the two hospitals was 107, and the measurement, according to the formula, determined that 84 was the minimum sample. Out of those eligible to be in the sample at the public hospital, only 35 participated, while five refused to take part in the study. Those eligible in the private hospital were 43, while three people did not return the diary. Therefore, the total sample obtained comprised 70 respondents rather than the 84 respondents needed for the minimum sample.

2.3 Measurement and data collection

This study used a checklist and diary as tools for data collection. The checklist collected demographic data such as age, gender, marital status, educational background, monthly income, and blood group. It also collected data related to the disease and its therapies, such as primary cancers, stages, metastasis conditions, therapy types, history of gastrointestinal irritation, emetogenic agents, how long they had been diagnosed, and chemotherapy.

For the incidence of CINV, the study used a diary that used questions adopted from two similar previous studies in India and Iran (Habibi et al., 2016; Kapoor et al., 2020). The diary contained questions about the incidence of CINV, frequency of nausea/vomiting, onset of nausea/vomiting, duration of nausea/vomiting, time of severe nausea/vomiting, severity of nausea/vomiting, usage of antiemetics, and types of antiemetics used. The severity of nausea/vomiting in the study was measured using the Baxter Animated Retching Faces (BARF) nausea scale that was recommended for use with children and adults (Sisman et al., 2016). The scale ranged from 0 to 5, for an assessment of 0=no nausea to 5=very severe nausea (Sisman et al., 2016). The intra-class coefficient (95% CI) of BARF scores was 0.88 (0.76-0.94) (Watcha et al., 2018), and 9/10 (90%) experts agreed that the faces on the BARF scale represented the increasing intensity of nausea (Sisman et al., 2016), so it proved that the BARF nausea scale was a valid and reliable tool. The nausea/vomiting severity data were then coded into 0-1 as mild, 2 as moderate, 3-4 as severe, and 5 as very severe.

The data collection process gathered both primary and secondary data. Primary demographic data were collected through interviews with COVID-19 precautions approved by the hospitals, while secondary data were collected from medical records related to treatments and to confirm demographic data that may have been dubious. CINV data were obtained using the CINV diaries, which were distributed and taken home by each patient to be filled out from day 1 (after leaving the chemotherapy room for up to 24 hours) up to day 7 with a total of 7 days. CINV symptoms could appear at different stages of the chemotherapy. Acute CINV is predominantly mediated by

5-HT3 and occurs within 24 hours of the start of chemotherapy (Aapro, 2018). Meanwhile, delayed CINV occurs between 24 hours and 7 days following treatment (Gupta et al., 2021; Hayashi et al., 2021). Patients were considered to have CINV if, within 7 days, they experienced at least 1 occurrence of CINV. Patients filled out their CINV diaries independently for 7 days following the instructions. The completed diaries were then returned to the researchers when they visited for the next chemotherapy session. The researchers periodically followed up if there were difficulties while filling out the diary and reminded patients to return the completed diaries.

2.4 Data analysis

The collected data were then analyzed descriptively for univariate data such as demographic, disease, and therapy characteristics. A normality test using the Kolmogorov-Smirnov test resulted in p=0.000, or the data were not normally distributed. Therefore, the comparison of CINV data based on blood groups used the Kruskal-Wallis test.

2.5 Ethical considerations

The ethics committee of Universitas Jenderal Achmad Yani Yogyakarta approved this research with registry number: Skep/056/KEPK/VII/2020. The respondents also filled out and signed the informed consent forms, and this study did not discriminate against the samples. The researchers destroyed the hard file data (CINV diaries and demographic and disease form sheets) four months after the analysis to ensure they were correctly used.

3. Results

3.1 Demographic characteristics of the participants

The study ascertained the demographic characteristics of the cancer patients as presented in Table 1. The mean age of the participants was 54.4 years (SD=11.32 years). The patients in both hospitals were mostly female (85.8%), married (88.6%), with a senior high school education background (32.9%), income below the minimum wage (68.6%), and A blood type group (34.3%).

Table 1. Demographic characteristics of the participants (n=70)

Characteristics	f	%	Mean	SD
Age (year)			54.4	11.32
Gender				
Male	10	14.3		
Female	60	85.8		
Marriage Status				
Widow/Widower	8	11.4		
Married	62	88.6		
Education Background				
Elementary School	19	27.1		
Junior High School	12	17.1		
Senior High School	23	32.9		
University	16	22.9		
Income				
Below RMW*	48	68.6		
Above RMW	22	31.4		
Blood Group				
A	24	34.3		
B	19	27.1		
O	22	31.4		
AB	5	7.1		

*Note. *RMW=Regional Minimum Wage*

3.2 Characteristics of the diseases and treatments

Concerning the patient disease and treatments (Table 2), most patients had breast cancer (71.4%), were in stage IV (50%), received chemotherapy (94.3%), were not in metastatic condition (75.7%), and had not experienced previous gastrointestinal (GIT) issues (85.7%). The patients in this study received chemotherapy with moderate (31.4%) and high (35.7%)

emetogenic agents. The patients had been diagnosed with cancer for at least three months, and the longest had been diagnosed for 84 months. As for the duration of chemotherapy, the patients had undergone chemotherapy for at least three months and, at most, for 18 months.

Table 2. Characteristics of the diseases and treatments (n=70)

Characteristics	f	%	Min	Max
Primary cancer				
Breast	50	71.4		
Lung	11	15.7		
Lymphoma	3	4.3		
Bladder	3	4.3		
Colorectal	3	4.3		
Stage of cancer				
II	10	14.3		
III	25	35.7		
IV	35	50		
Therapy type				
Chemotherapy	66	94.3		
Chemoradiation	4	5.7		
Metastasis				
No	53	75.7		
Yes	17	24.3		
GIT irritation history				
No	60	85.7		
Yes	10	14.3		
Emetogenic agent*				
Minimal	7	10		
Low	16	22.9		
Moderate	22	31.4		
High	25	35.7		
Length of diagnosis (months)			3.00	84.00
Length of chemotherapy (months)			3.00	18.00

*Note. *The emetogenicity of the chemotherapy drugs table (Celio, 2022; Gupta et al., 2021).*

3.3 Characteristics of CINV and its frequency among blood group

Table 3 shows that most patients (68.6%) experienced CINV, with 64.6% experiencing delayed CINV (31/48 samples). CINV mainly occurred 3 and 4 days after chemotherapy (22.15%), and as many as 52.9% of patients stated that their CINV was in the moderate category.

Table 3. CINV characteristics among cancer patients (n=70)

CINV characteristics	f	%
CINV		
No	22	31.4
Yes	48	68.6
CINV Type (*n*=48)		
Acute	17	35.4
Delayed	31	64.6
CINV daily occurrence		
Day 1	17	10.76
Day 2	26	16.46
Day 3	35	22.15
Day 4	35	22.15
Day 5	23	14.56
Day 6	12	7.59
Day 7	10	6.33
CINV Severity		
Mild	22	31.4
Moderate	37	52.9
Severe	10	14.3
Very Severe	1	1.4

The total frequency of CINV from day one to seven among the patients was calculated and compared based on blood group (Table 4). The results indicated that there was no significant difference in the mean rank of CINV frequency based on blood types in chemotherapy patients (p=0.068). The results showed a significant difference in the mean rank of CINV frequency in cancer patients on the fourth day after chemotherapy (p=0.020). The A blood type patients experienced the highest frequency of CINV (mean=44.21) on day four.

Table 4. CINV frequencies comparison based on blood group (n=70)

Blood Group	CINV frequency		
	f	mean rank	*p*
Total CINV in 7 days			
A	24	42.02	
B	19	27.66	0.068*
O	22	32.86	
AB	5	45.60	
CINV Day 1			
A	24	33.23	
B	19	34.76	0.127*
O	22	35.18	
AB	5	50.60	
CINV Day 2			
A	24	37.90	
B	19	31.92	0.428*
O	22	33.89	
AB	5	44.70	
CINV Day 3			
A	24	42.90	
B	19	28.95	0.077*
O	22	32.23	
AB	5	39.30	
CINV Day 4			
A	24	44.21	
B	19	26.95	0.020*
O	22	32.30	
AB	5	40.30	
CINV Day 5			
A	24	42.48	
B	19	28.92	0.055*
O	22	32.89	
AB	5	38.50	
CINV Day 6			
A	24	38.13	
B	19	33.45	0.495*
O	22	35.77	
AB	5	29.50	
CINV Day 7			
A	24	38.31	
B	19	32.68	0.365*
O	22	35.89	
AB	5	31.00	

*Note. *Kruskal-Wallis Test*

4. Discussion

This study aimed to compare CINV frequencies based on blood types in cancer patients. As many as 70 cancer patients who participated in this study were monitored to see the incidence and frequency of nausea and vomiting that occurred due to chemotherapy (CINV) from the end of the chemotherapy (day 1) and then each day up to the seventh day after the chemotherapy. The results showed no significant difference between CINV frequency in cancer patients with blood types A, B, O, and AB who received chemotherapy in general. This is somewhat different from the

results of Habibi et al. (2016) but with a different setting, namely the comparison of radiotherapy-induced nausea and vomiting (RINV) in cancer patients. In their study, A blood type is the blood group that is most at risk of developing RINV compared to other blood groups (Habibi et al., 2016). Their statement supports the statement of Elahimanesh et al. (2013), who stated that A blood type is the blood group which is most sensitive to radiotherapy. The association between Rhesus antigen and the time of maximum severity of RINV may indicate that Rhesus antigen affects the time of maximum severity of RINV (Habibi et al., 2016). The relationship between the ABO blood group and CINV has not been specifically studied yet. However, it must be noted that there is a relation between the ABO blood group and cardiovascular diseases such as ischemic heart diseases (Parente et al., 2020) and cancers (Zhang et al., 2014) such as gastric cancer (Mao et al., 2019), and breast cancer (Meo et al., 2017).

CINV in this study was defined as nausea and/or vomiting that occurred at least once during the administering of chemotherapy (considered to be the first day) up to the sixth day after chemotherapy (considered day 7). About 20 to 30 percent of patients experienced nausea and vomiting secondary to the administration of cytostatic drugs (Shinta & Surarso, 2016). The results showed a higher result since the incidence of CINV in cancer patients in this study was 68.6%. The results regarding CINV incidence in this research supported a previous study that stated that the risk of nausea and vomiting in chemotherapy patients was thought to be between 70 and 80 percent, and the same proportion of patients would suffer the symptom if they had not had enough antiemetic medication (Al Qadire, 2018; Lavdaniti & Tsitsis, 2014). Most patients in this study experienced delayed-type CINV, and the others experienced acute-type CINV. Acute CINV occurs within 1–2 hours of chemotherapy administration and can last up to 24 hours, while delayed CINV presents more than 24 hours and up to 7 days after the chemotherapy is administered (Hayashi et al., 2021; Rapoport, 2017). This result is in line with a study that stated that with antiemetic prophylaxis, acute nausea occurs in up to 35% and acute vomiting occurs in approximately 13% of chemotherapy patients (Escobar et al., 2015; Gupta et al., 2021), while the incidence of delayed nausea and vomiting among patients after antiemetic prophylaxis is 20–50% (Escobar et al., 2015; Gupta et al., 2021). The CINV experienced by the patients in this study reached a peak on the third and fourth days, with the patient's perception of their CINV being moderate.

Although there was no significant difference between the frequency of CINV in general based on blood types, there was a significant difference in the frequency of CINV based on blood types that occurred on the fourth day after chemotherapy. The results showed that A blood type had a high mean frequency of CINV that increased after the first day and peaked on the third and fourth days compared to other blood types. The result that showed A blood type has a higher incidence of CINV is similar to a previous study related to the ABO blood group and RINV conducted by Habibi et al. (2016) and a study in 2010 in pregnancy setting by Phan (2010). They stated that A blood type has a higher incidence of nausea and vomiting than the other blood types in the setting. In addition, based on the mean rank increase of CINV, there was a possibility that A blood type was associated with a high incidence of delayed-type CINV. Delayed CINV is predominantly driven by a central pathway involving the neurotransmitter/neuromodulator substance P and usually occurs on the second day after chemotherapy until the fifth to seventh day (Hayashi et al., 2021; Rapoport, 2017). The cause of the high rate of delayed CINV in the A blood group in this study is unknown. However, the high rate of delayed CINV in the entire sample in this study could relate to the emetogenic agents given to the patient. Delayed CINV is more problematic than acute CINV in patients receiving moderate or high emetogenic agents. Based on a study in Rapoport (2017), adult patients who received chemotherapy for the first time and received highly emetogenic chemotherapy (HEC) and moderate emetogenic chemotherapy (MEC) agents experienced delayed nausea and vomiting in 50 and 60% for HEC and 58 and 28% for MEC. Meanwhile, those with acute CINV had 12 and 33% for HEC and 13 and 37% for MEC (Rapoport, 2017).

In addition, the AB blood group had the highest mean frequency of CINV on the first day and then decreased until the sixth day, after which it did not increase on the seventh day. So, it also can be concluded that there is a possibility that blood type AB is associated with acute-type CINV in cancer patients receiving chemotherapy. Acute CINV occurs within the first 24 hours after chemotherapy, and it is largely mediated by 5-HT3 receptors in the intestine that interact with serotonin, which is induced by the generated free radicals after the administration of

chemotherapy and projected to the area postrema and nucleus tractus solitarius (NTS), stimulating the vomiting reflex (Rapoport, 2017). The high rate of acute CINV in AB blood type patients in this study is supported by a previous study in a different setting, which found that post-adenotonsillectomy patients with AB and B blood groups experienced a significantly higher incidence of postoperative nausea and vomiting (PONV) than the A and O blood groups did within 24 hours (Shen et al., 2022). Higher PONV in postoperative patients could be caused by higher preoperative anxiety. A study found preoperative anxiety differences between ABO blood types, and it was found that the AB group displayed a high preoperative anxiety level (Xu et al., 2019). A high level of preoperative anxiety has been reported as one of the risk factors resulting in postoperative nausea and vomiting (PONV) because it decreases the pH of the stomach content while increasing its volume (Alipour et al., 2021; Xu et al., 2019). This study did not discuss surgery on the patients; however, it did not rule out the possibility of anxiety experienced by patients ahead of the chemotherapy procedure, which can be a factor in increasing the incidence of acute CINV.

The most common primary cancer suffered by the patients in this study was breast cancer, and they were in stage IV. This result is in line with worldwide observations that show breast cancer is a prevalent tumor in women, as it accounts for 22% of all cancers in women (Jannat et al., 2022). Breast cancer causes a burden in terms of prevention, diagnosis, and treatment regardless of a nation's economic situation. Breast cancer has high incidence and fatality rates in developed nations like the U.S. Even while mortality rates are rising, developing nations still have low incidence rates, suggesting that these nations lack the resources for preventive screening for early detection and proper treatment (Francies et al., 2020). Yogyakarta province has the highest prevalence of cancer in Indonesia (Hutajulu et al., 2022; Ministry of Health Republic of Indonesia, 2019). After more than 30 years of breast cancer history in this country, the pattern is still the same that most breast cancer patients have sought medical attention when their diseases were already advanced (stage III or IV)(Gautama, 2022).

This study showed that most patients were in a high stage of cancer (stage III and IV), experienced no metastasic condition, and received chemotherapy as their definitive therapy. In high-stage cancer, whether it has metastasized or not, chemotherapy is one of the modalities of treatment that is given either in the form of definitive or adjuvant therapies. Chemotherapy is a cancer treatment that uses substances or medications that can destroy cancer cells. It is a treatment that may be administered locally or systemically (Shinta & Surarso, 2016). It can be successful depending on the type of cancer and how advanced it is. Chemotherapy can cure cancers by destroying cancer cells to the point that doctors can no longer detect them in the patient's body, and they will not grow back. Chemotherapy can also control cancer by keeping it from spreading, slowing its growth, destroying cancer cells that have spread to other body parts, or easing its symptoms. Chemotherapy is also called palliative care when it shrinks tumors that cause pain or pressure (National Cancer Institute, 2018).

Aside from CINV, chemotherapy has also been shown to interfere with the digestive tract, causing diarrhea and constipation as one of its side effects (Escalante et al., 2017). The patients in this study had no previous history of gastrointestinal irritation, and the rest had gastrointestinal irritation after chemotherapy. Nausea and vomiting are also side effects of chemotherapy on the gastrointestinal tract due to high doses of the treatment's agents with high emetogenic agents. Patients receiving chemotherapy experience different degrees of nausea and vomiting depending on the emetogenic potential of the anti-cancer drugs given and the patient's individual characteristics (Navari & Rapoport, 2016; Rapoport, 2017; Sekine et al., 2013). In this study, 31.4% of the patients received moderate emetogenic agents, and 35.7% received high emetogenic agents in their chemotherapy regimen. Chemotherapeutic drugs' inherent emetogenicity, or relative propensity to induce emesis, varies widely. The treatment is divided into four groups, which are highly emetogenic chemotherapy (HEC; affecting >90% of patients), moderately emetogenic chemotherapy (MEC; 30–90% of patients), low emetogenic chemotherapy (LEC; 10–30% of patients), and minimally emetogenic chemotherapy (<10% of patients). While multi-target antiemetic regimens are advised for both emetogenicity categories of HEC and MEC drugs, which both cause CINV during the acute and delayed phases, LEC agents only cause acute CINV, and single-agent prophylaxis prior to chemotherapy administration is advised (Celio, 2022).

5. Implication and limitation

The description of CINV in cancer patients based on blood type can be used as additional information in the nursing management of CINV, where it should be noted that cancer patients with blood type A are more at risk of developing delayed CINV, which has a higher incidence than with other blood types. One limitation of this study is the small number of subjects (less than what is calculated to be the minimum sample size) and the diversity of primary cancer types being studied. The other limitations were confounding factors such as the history of gastrointestinal irritation, chemotherapy dosages, chemotherapy emetogenicity, and the type of therapy given, all of which were not controlled.

6. Conclusion

In general, there was no difference in the incidence of CINV based on the blood group; however, based on the onset of CINV, there was a significantly higher incidence in the A blood type group compared to the other blood groups on the fourth day after chemotherapy. Therefore, in terms of clinical practice, the researchers suggest that management or other complementary therapies need to be provided to cancer patients undergoing chemotherapy aside from additional antiemetic drugs they receive in hospitals. Management of CINV can be more focused on patients with the delayed type of CINV because its incidence is higher. Furthermore, A more extensive and homogeneous study is needed in order to increase the understanding of CINV's etiology by controlling for several factors such as a larger sample, uniformity of cancer cases, emetogenic therapy, and what prophylactic antiemetic regimens are given in order to prove further explore the correlation between blood group and CINV. Further research may also be needed to determine the mechanism of nausea and vomiting based on blood type and whether a relationship between CINV and blood type is demonstrated.

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Author contribution

DKR and MN have a mutually supportive role in making this research publication. The design and conception of the study were contributions from all authors. DKR and MN prepared the material, and they also collected the data. DKR wrote the final draft of the manuscript as well as the analysis.

Conflict of interest

The researcher states that there is no conflict of interest in this study.

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