ASIAN JOURNAL OF PHARMACEUTICAL AND CLINICAL RESEARCH

INNOVARE ACADEMIC SCIENCES
Knowledge to Innovation

Vol 16, Issue 6, 2023

Online - 2455-3891
Print - 0974-2441

Research Article

PRESCRIPTION PATTERN OF PROPHYLACTIC ANTIEMETICS IN BREAST CANCER PATIENTS: A RETROSPECTIVE OBSERVATIONAL STUDY IN A TERTIARY CARE HOSPITAL

DWIPEN KHANIKAR[1], INDRANI BHAGAWATI[2], MITRA BHATTACHARYYA[3], LAKHIMI BORAH[2]*, KAMAL OJHA[1], NEELAKSHI MAHANTA[4], DIPTIMAYEE DEVI[1], PARTHA PRASANNA D SINGH[1], SUKAINNYA BURAGOHAIN[5]

[1]Department of Pharmacology, Gauhati Medical College and Hospital, Guwahati, Assam, India. [2]Department of Pharmacology, Nalbari Medical College and Hospital, Nalbari, Assam, India. [3]Department of Pharmacology, Tezpur Medical College and Hospital, Tezpur, Assam, India. [4]Department of Medical Oncology, State Cancer Institute, Gauhati Medical College, Guwahati, Assam, India. [5]Department of Pharmacology, Jorhat Medical College and Hospital, Jorhat, Assam, India. Email: borahlpharma@gmail.com

Received: 14 January 2023, Revised and Accepted: 09 February 2023

ABSTRACT

Objective: The aim of the study was to study the prescription pattern of prophylactic antiemetics in breast cancer patients.

Methods: A retrospective observational study was carried out. Over a period of 3 months, all chemotherapy order sheets of breast cancer patients were collected and evaluated for prophylaxis of chemotherapy-induced nausea and vomiting (CINV). We compared each antiemetic drug used for CINV prophylaxis with international antiemetic guidelines, the National Comprehensive Cancer Network (NCCN).

Results: A total of 103 breast cancer patients were included in the study, for which 141 chemotherapy physician prescriptions included antiemetic drugs. Approximately 51.06% of anticancer agents had high emetic risk, 2.13% had moderate emetic risk, and 43.26% and 3.55% of anticancer agents had low and minimal emetic risk, respectively. Most frequently prescribed anticancer drug was paclitaxel 49 (34.75%). About 43.97% of the antiemetic regimen were found following NCCN guidelines.

Conclusion: The development of institutional policy for assessment and guidance of the chemotherapy-induced nausea and vomiting prophylaxis may improve the consistency between antiemetic prescribing and guidelines.

Keywords: Breast cancer, Antiemetic, Chemotherapy, Nausea, Vomiting.

© 2023 The Authors. Published by Innovare Academic Sciences Pvt Ltd. This is an open access article under the CC BY license (http://creativecommons.org/licenses/by/4.0/) DOI: http://dx.doi.org/10.22159/ajpcr.2023v16i6.47336. Journal homepage: https://innovareacademics.in/journals/index.php/ajpcr

INTRODUCTION

Chemotherapy-induced nausea and vomiting (CINV) is a common complication of cancer chemotherapy that can severely affect patients' quality of life (QoL) [1]. In general, CINV is classified into acute CINV, which occurs within 24 h of chemotherapy and delayed CINV, which occurs 24 h and up to 5 days after chemotherapy administration [2]. Other important subtypes are anticipatory, breakthrough, and refractory emesis [3].

Multiple clinical studies have shown that patient characteristics can predict those who are at higher risk in developing CINV [4-6]. The incidence of CINV in chemonaive patients is up to 20% in patients without risk factors and 76% in those with risk factors [7]. At present, the identified risk factors include young age, female gender, minimal alcohol intake, history of motion sickness, history of morning sickness during pregnancy, and prior adverse experience with chemotherapy [8].

The standard treatment for breast cancer involves the use of chemotherapy [9]. However, combination chemotherapy regimens are associated with better response rates compared to single-agent therapies. However, it is associated with CINV, a serious adverse effect that is able to negatively impact on patients QoL and also patients' compliance [10-12].

Multiple practice-based guidelines are recommending the use of antiemetic drugs against CINV [13-15].

National Comprehensive Cancer Network (NCCN) guidelines provide a classification that addresses the likelihood of CINV that is primarily related to the emetogenic potential of the specific chemotherapeutic drugs. Anthracycline-based chemotherapy is a highly emetogenic chemotherapy (HEC) [16]. Thus, chemotherapy drugs can be categorized as highly emetogenic (>90% frequency of emesis, for example, combination of anthracycline and cyclophosphamide (AC), cisplatin and cyclophosphamide >1500 mg/m^2), moderately emetogenic (30%–90% frequency of emesis, for example, carboplatin, cyclophosphamide ≤1500 mg/m^2, daunorubicin, doxorubicin, epirubicin, and ifosfamide), low emetogenic (10–30% frequency of emesis, for example, cytarabine 100–200 mg/m^2, docetaxel, etoposide, 5-fluorouracil, gemcitabine, and paclitaxel), and minimal emetogenic (<10% frequency of emesis, for example, bleomycin, vinblastine, vincristine, and vinorelbine). The frequencies are in the absence of effective antiemetic prophylaxis [17-21].

Multinational Association of Supportive Care in Cancer/European Society for Medical Oncology (MASCC/ESMO) antiemetic guidelines [22,23] recommend prophylaxis with a 5-hydroxytryptamine-3 receptor antagonist (5-HT$_3$RA) and dexamethasone for patients treated with moderately emetogenic chemotherapy (MEC) other than carboplatin-based regimens. However, for the prevention of CINV associated with HEC (including AC) and carboplatin based regimens, the triple combination of a 5-HT$_3$RA, a neurokinin-1 receptor antagonist (NK$_1$RA), and dexamethasone is advised, along with addition of olanzapine to the triplet when occurrence of nausea is an issue. Similar recommendations have been issued by the NCCN [24] and the American Society of Clinical Oncology [17] for CINV prophylaxis in the HEC and MEC settings. Recently, additional formulations of NK$_1$RAs that increase the convenience of administration of antiemetics have been developed and approved in the U.S. in 2018, for example, intravenous (IV) NEPA (fixed combination of fosnetupitant and palonosetron) [25], aprepitant emulsion for injection [26], and rolapitant injectable emulsion [27,28]; IV NEPA also recently received approval in Europe [29]. After the occurrence of anaphylaxis, anaphylactic shock, and hypersensitivity reactions in the clinic with rolapitant injectable

emulsion, a safety warning was issued [30] that led to the suspension of its distribution [31]. The new IV formulations of NEPA and aprepitant have recently been incorporated in the NCCN antiemetic guidelines and are recommended for the HEC and MEC settings [24]. Moreover, IV NEPA is advised as an alternative to oral NEPA in the HEC (AC) and carboplatin settings by MASCC/ESMO [22,23].

The prevention is the main goal of international antiemetic guidelines. Correct management of nausea and vomiting in the first chemotherapy cycle is critical as CINV occurrence during first administration of emetogenic chemotherapy can lead to increased CINV risk in subsequent cycles [32,33]. Hence, it is advisable to adhere by the guideline-consistent usage of antiemetic regimens for good compliance to the chemotherapy with cancer [34-36]. Conversely, non-adherence to antiemetic guidelines lead to suboptimal CINV control [36]. However, several studies have reported low guideline adherence for patients receiving HEC and MEC both in Europe [36-38] and the U.S. [39].

The present research aims to study about the prescription pattern of prophylactic antiemetics in breast cancer patients receiving chemotherapy in a tertiary care hospital in Assam.

MATERIALS AND METHODS

Objective

The aim of the study was to study the prescription pattern of prophylactic antiemetics in breast cancer patients.

Methods

The study was done at State Cancer Institute, Gauhati Medical College, Guwahati. It was a retrospective observational study. The study was carried out for a period of 3 months. It included 103 breast cancer patients undergoing chemotherapy who were prescribed with antiemetics. A suitable data collection form was used to collect data. The data were transferred to Microsoft Excel 2010 and descriptive statistics such as frequency and percentage were calculated. The Institutional Ethics Committee permission was obtained from Gauhati Medical College and Hospital to carry out this study.

Inclusion criteria includes

The following criteria were included in the study:

- Patients 18 years of age or older with breast cancer who were scheduled to receive chemotherapy regimen
- Patients who are prescribed with antiemetics during chemotherapy.

Exclusion criteria includes

The following criteria were excluded from the study:

- Patients who do not receive any antiemetics
- Patients with incomplete prescription information.

RESULTS

In this study, we enrolled 103 breast cancer patients who fulfilled the inclusion criteria. Among 103 breast cancer patients, majority 102 (99.03%) were found to be female patients and only 1 (0.97%) was a male patient who underwent chemotherapy with antiemetics (Fig. 1).

Among the recruited patients, majority of patients were in the age group of 40–49 years (32, 31.07%), followed by 50–59 years (26, 25.24%), and the mean age was found to be 49±11.16 years (Fig. 2).

Again when we recorded their medical history, we found that majority of them did not suffer from any other comorbidities, that is, 96 (93.21%) out of 103 patients and rest were either hypertensive 2 (1.94%) or diabetic 2 (1.94%) or both hypertensive and diabetic 2 (1.94%) and only 1 (0.97%) patient was hypothyroid (Fig. 3).

In this study, we had recruited 103 breast cancer patients receiving chemotherapy, along with prophylactic antiemetic agents. We had analyzed 141 prescriptions and found that the same patient received

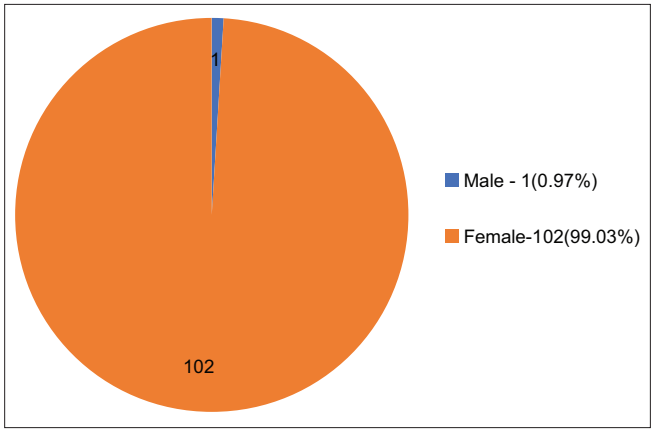

Fig. 1: Gender distribution

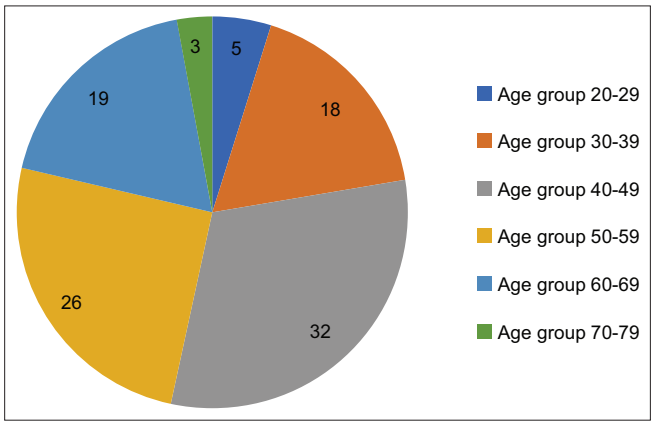

Fig. 2: Age distribution (in years)

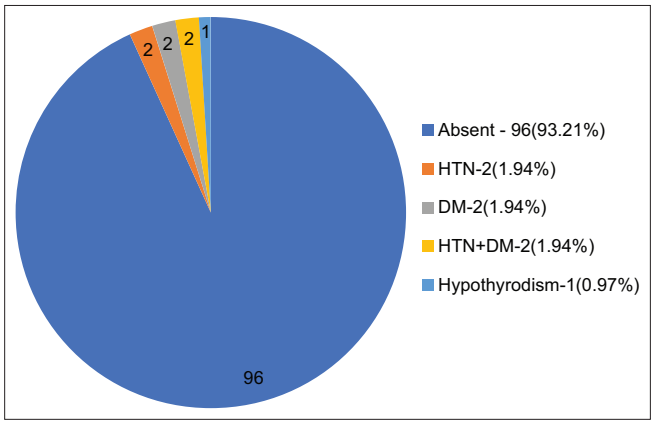

Fig. 3: Comorbidities

more than one regimen of chemotherapy agents. Prophylactic antiemetic therapy was also analyzed using the standard international guidelines, that is, NCCN.

When we classify the chemotherapeutic regimens according to the level of their emetogenic risk using NCCN guidelines, 72 (51.06%) chemotherapy regimen were with high emetogenic potential, 3 (2.13%) regimen with moderate emetogenic potential, 61 (43.26%) regimen with low emetogenic potential, and 5(3.55%) regimen with minimal emetogenic potential (Table 1).

In this study, it was seen that most commonly prescribed anticancer agent was paclitaxel (49, 34.75%) followed by anthracycline +

cyclophosphamide (AC) combination (47, 33.33%). AC combination was the most frequently used chemotherapeutic regimen in the HEC group, epirubicin + cyclophosphamide regimen in the MEC group, paclitaxel in the LEC, and pertuzumab + trastuzumab regimen in the minimal emetic risk group (Table 2).

Appropriate antiemetic drugs were prescribed to 58 (80.56), 2 (66.67), 2 (3.28) of HEC, MEC, and LEC regimen, respectively. Fourteen (19.44) of HEC, 1 (33.33) of MEC, and 59 (96.72) of LEC regimen were prescribed with antiemetic therapy which did not follow NCCN guidelines (Table 3).

Patients receiving minimal emetogenic potential chemotherapy without antiemetic therapy as per guideline were not included in our study. Five patients who were receiving antiemetic prophylaxis (inappropriate as per NCCN guidelines) were included in our study (Table 4). About 43.97% of the antiemetic regimen were found following NCCN guidelines.

DISCUSSION

Evidence-based recommendations for CINV have been developed during the past few decades. Many international guidelines have been in use for prevention of CINV.

The present study was conducted to evaluate the prescription pattern of prophylactic antiemetics in breast cancer patients. In our study, most common age group was 40–49 years (31.07%). Shah *et al*. studied drug utilization pattern and found highest breast cancer in similar age group [40].

Table 1: Chemotherapeutic agents according to level of emetic risk

Level of emetic risk	n (%)
High emetic risk (>90% frequency of emesis)	72 (51.06)
Moderate emetic risk (>30%–90% frequency of emesis)	3 (2.13)
Low emetic risk (10%–30% frequency of emesis)	61 (43.26)
Minimal emetic risk (<10% frequency of emesis)	5 (3.55)

Table 2: Pattern of chemotherapy regimen used in breast cancer patients

Chemotherapy drugs	n (%)
Paclitaxel	49 (34.75)
Anthracycline+cyclophosphamide	47 (33.33)
Trastuzumab+docetaxel+carboplatin	14 (9.93)
Docetaxel	10 (7.09)
Epirubicin+5-fluorouracil+cyclophosphamide	8 (5.67)
Pertuzumab+trastuzumab	4 (2.84)
Epirubicin+cyclophosphamide	3 (2.13)
Trastuzumab+docetaxel+carboplatin+pertuzumab	3 (2.13)
Trastuzumab	1 (0.71)
Trastuzumab+docetaxel	1 (0.71)
Pertuzumab+paclitaxel	1 (0.71)

Table 3: Appropriateness of antiemetic drugs used for chemotherapy regimens with different emetogenic potential

Chemotherapy prescription (n)	Appropriate antiemetic drugs, n (%)	Inappropriate antiemetic drugs, n (%)
High emetogenic potential regimen (72)	58 (80.56)	14 (19.44)
Moderate emetogenic potential regimen (3)	2 (66.67)	1 (33.33)
Low emetogenic potential regimen (61)	2 (3.28)	59 (96.72)

Most frequently prescribed regimen was paclitaxel 49 (34.75%) followed by AC regimen (anthracycline + cyclophosphamide combination) 47 (33.33%). AC regimen was one of the most common regimens for the treatment of breast cancer in similar studies [40-43].

In high emetogenic potential anticancer agents, three regimens were used. AC regimen was prescribed to 47 (65.28%) of 72, carboplatin-based regimen was prescribed to 17 (23.61%) of 72 patients, and 5-fluorouracil + epirubicin + cyclophosphamide was prescribed to 8 (11.11%) patients. Fifty-eight (80.56%) of 72 prophylactic antiemetic prescriptions were appropriate as per recommendation of NCCN guidelines 2022 [15]. It consists of combination of three drugs, one from NK1 RA (aprepitant, netupitant, and fosaprepitant), one from 5-HT3 RA (ondansetron and palonosetron), and dexamethasone. In all 58 (100%) prescriptions, dexamethasone was prescribed and other drugs were 28 (48.28%) fixed combination of netupitant 300 mg/palonosetron 0.5 mg, 25 (43.10%) ondansetron, 5 (8.62%) palonosetron, 17 (29.31%) aprepitant, and 13 (22.41%) fosaprepitant, respectively.

Five (6.94%) of 72 prescriptions were over antiemetic prophylaxis where two 5-HT3 RA were prescribed. Nine (12.5%) of 72 prescription were under antiemetic prophylaxis as dexamethasone was not prescribed and 5HT3RA was not included in one of them. Here, 80.56% of antiemetic prophylaxis was in consistent with NCCN guidelines. Guidelines consistency was highest for patients receiving high emetogenic potential anticancer agents.

In moderate emetogenic anticancer agents, 3 (100%) patients received Epirubicin+Cyclophosphamide. Antiemetic prophylaxis used in this group was consistent with NCCN guidelines in 66.67% prescriptions.

In low emetogenic anticancer agents, paclitaxel (49 [80.33%] of 61) was the most frequently prescribed chemotherapeutic agent followed by docetaxel (10 [16.39%] of 61). Two (3.28%) prescriptions were optimal regarding prophylactic antiemetic. In 55 (90.16%) of 61 LEC prescriptions, both serotonin receptor antagonist and dexamethasone were prescribed. Paclitaxel and docetaxel can produce hypersensitivity reaction as supported by many studies and use of dexamethasone in these treatment groups may be as a preventive measure against it [44]. In a similar single-center study, adherence to guidelines in the prescription of antiemetic prophylaxis in low emetogenic anticancer agent was only 11%, because rest of the patients received 5-HT3 RA in addition to corticosteroids [39].

In minimal emetogenic anticancer agents, most frequently prescribed regimen was pertuzumab and trastuzumab 4 (80%) followed by trastuzumab 1 (20%) of five prescriptions. The antiemetic prophylaxis prescribed with these regimens was not supported by NCCN guidelines.

The reasons of guidelines inconsistency varied across emetogenic risk group.

A study by Ayako Okuyama, found a substantial number of patients receiving chemotherapy with minimal or low emetic risk, were prescribed prophylactic antiemetic drugs [45].

CONCLUSION

Studies are needed to explore barriers of appropriate implementation of antiemetic guidelines. Education, training of all individuals involved in chemotherapy is needed to improve guidelines adherence. Institutional antiemetic guideline can be developed for better assessment and management of CINV.

ACKNOWLEDGMENT

We are thankful to authorities of State Cancer Institute (SCI), Gauhati Medical College(GMC), Guwahati, for their support to the research study. We are also thankful to staff of Medical Record Department of SCI for their help during data collection period.

Table 4: Pattern of antiemetic regimen used for chemotherapy regimen with different emetogenic potential

Emetogenic potential	Antiemetic agents used and number of patients
Highly emetogenic chemotherapy Number of patients (72) NCCN recommendations NK1RA+5HT3RA+dexamethasone	Combination of netupitant 300 mg/palonosetron 0.5 mg+dexamethasone (28) Ondansetron+aprepitant+dexamethasone (12) Ondansetron+fosaprepitant+dexamethason (13) Palonosetron+aprepitant+dexamethasone (5) Ondansetron+combination of netupitant 300 mg/palonosetron 0.5 mg+dexamethasone (5) Combination of netupitant 300 mg/palonosetron 0.5 mg (6) Ondansetron+fosaprepitant (2) Aprepitant (1)
Moderately emetogenic chemotherapy Number of patients (3) NCCN recommendations 5HT3RA+dexamethasone±NK1RA	Combination of netupitant 300 mg/palonosetron 0.5 mg (1) Combination of netupitant 300 mg/palonosetron 0.5 mg+dexamethasone (1) Aprepitant+palonosetron+dexamethasone (1)
Low emetogenic chemotherapy Number of patients (61) NCCN recommendations Dexamethasone or metoclopramide or prochlorperazine or 5HT3RA	Ondansetron+dexamethasone (48) Ondansetron (2) Aprepitant+ondansetron+dexamethasone (1) Fixed dose combination of netupitant 300 mg/palonosetron 0.5 mg (3) Palonosetron+dexamethasone (7)
Minimal emetogenic chemotherapy Number of patients (5) NCCN recommendations No routine prophylaxis	Ondansetron+fosaprepitant+dexamethasone (2) Ondansetron+dexamethasone (1) Ondansetron+fixed dose combination of netupitant 300 mg/palonosetron 0.5 mg+dexamethasone (1) Ondansetron+fixed dose combination of netupitant 300 mg/palonosetron 0.5 mg (1)

NCCN: National Comprehensive Cancer Network, NK1RA: Neurokinin-1 receptor antagonist

AUTHORS' CONTRIBUTIONS

Conception/design: Dr Dwipen Khanikar, Dr Indrani Bhagawati, Dr. Mitra Bhattacharyya, Dr Lakhimi Borah, Dr Kamal Ojha, Dr Neelakshi Mahanta, Dr Diptimayee Devi, Dr Partha Prasanna Singh, Dr Sukainnya Buragohain. Provision of study material: Dr Dwipen Khanikar, Dr Indrani Bhagawati, Dr. Mitra Bhattacharyya, Dr Lakhimi Borah, Dr Kamal Ojha, Dr Neelakshi Mahanta, Dr Diptimayee Devi, Dr Partha Prasanna Singh, Dr Sukainnya Buragohain. Collection of data: Dr Dwipen Khanikar, Dr Indrani Bhagawati, Dr. Mitra Bhattacharyya, Dr Lakhimi Borah, Dr Kamal Ojha, Dr Neelakshi Mahanta, Dr Diptimayee Devi, Dr Partha Prasanna Singh, Dr Sukainnya Buragohain. Data analysis and interpretation: Dr Dwipen Khanikar, Dr Indrani Bhagawati, Dr. Mitra Bhattacharyya, Dr Lakhimi Borah, Dr Kamal Ojha, Dr Neelakshi Mahanta, Dr Diptimayee Devi, Dr Partha Prasanna Singh, Dr Sukainnya Buragohain. Manuscript writing: Dr Dwipen Khanikar, Dr Indrani Bhagawati, Dr. Mitra Bhattacharyya, Dr Lakhimi Borah, Dr Kamal Ojha, Dr Neelakshi Mahanta, Dr Diptimayee Devi, Dr Partha Prasanna Singh, Dr Sukainnya Buragohain. Final approval of manuscript: Dr Dwipen Khanikar, Dr Indrani Bhagawati, Dr. Mitra Bhattacharyya, Dr Lakhimi Borah, Dr Kamal Ojha, Dr Neelakshi Mahanta, Dr Diptimayee Devi, Dr Partha Prasanna Singh, Dr Sukainnya Buragohain.

CONFLICTS OF INTEREST

None

FUNDING

Nil.

REFERENCES

1. Bloechl-Daum B, Deuson RR, Mavros P, Hansen M, Herrstedt J. Delayed nausea and vomiting continue to reduce patients' quality of life after highly and moderately emetogenic chemotherapy despite antiemetic treatment. J Clin Oncol 2006;24:4472-8. doi: 10.1200/JCO.2006.05.6382, PMID 16983116
2. Warr D. Standard treatment of chemotherapy-induced emesis. Support Care Cancer 1997;5:12-6. doi: 10.1007/BF01681956, PMID 9010984.
3. Ryckeghem FV, Belle SV. Management of chemotherapy-induced nausea and vomiting. Belg J Med Oncol 2009;3:212-7.
4. Dodd MJ, Onishi K, Dibble SL, Larson PJ. Differences in nausea, vomiting and retching between younger and older outpatients receiving cancer chemotherapy. Cancer Nurs 1996;19:155-61. doi: 10.1097/00002820-199606000-00001, PMID 8674023
5. Goodman M. Risk factors and antiemetic management of chemotherapy-induced nausea and vomiting. Oncol Nurs Forum 1997;24 7 Suppl:20-32. PMID 9282378
6. Ouwerkerk J. Cancer therapy-induced emesis: The nurse's perspective. Eur J Cancer Care (Engl) 1994;3:18-25. doi: 10.1111/j.1365-2354.1994.tb00005.x, PMID 7804562
7. Osoba D, Zee B, Pater J, Warr D, Latreille J, Kaizer L. Determinants of postchemotherapy nausea and vomiting in patients with cancer. Quality of Life and Symptom Control committees of the National Cancer Institute of Canada Clinical Trials Group. J Clin Oncol 1997;15:116-23. doi: 10.1200/JCO.1997.15.1.116, PMID 8996132
8. Molassiotis A, Yam BM, Yung H, Chan FY, Mok TS. Pretreatment factors predicting the development of postchemotherapy nausea and vomiting in Chinese breast cancer patients. Support Care Cancer 2002;10:139-45. doi: 10.1007/s00520-001-0321-4, PMID 11862503
9. Klein J, Tran W, Watkins E, Vesprini D, Wright FC, Hong NJ, *et al*. Locally advanced breast cancer treated with neoadjuvant chemotherapy and adjuvant radiotherapy: A retrospective cohort analysis. BMC Cancer 2019;19:306. doi: 10.1186/s12885-019-5499-2, PMID 30943923
10. Rao KV, Faso A. Chemotherapy-induced nausea and vomiting: Optimizing prevention and management. Am Health Drug Benefits 2012;5:232-40. PMID 24991322
11. Dipiro J, Burns M, Scwinghammer T, Wells B, Malone P, Kolesar J. Pharmacotherapy Principles and Practice. 4th ed. New York: McGraw-Hill Companies; 2016.
12. Aapro M. CINV: Still troubling patients after all these years. Support Care Cancer 2018;26:5-9. doi: 10.1007/s00520-018-4131-3
13. Roila F, Herrstedt J, Aapro M, Gra RJ, Einhorn LH, Ballatori E, *et al*. Guideline update for MASCC and ESMO in the prevention of chemotherapy- and radiotherapy-induced nausea and vomiting: Results of the Perugia consensus conference. Ann Oncol 2010;21 Suppl 5:v232-43. doi: 10.1093/annonc/mdq194, PMID 20555089
14. Basch E, Prestrud AA, Hesketh PJ, Kris MG, Feyer PC, Somerfield MR, *et al*. Antiemetics: American Society of Clinical Oncology clinical practice guideline update. J Clin Oncol 2011;29:4189-98. doi: 10.1200/JCO.2010.34.4614, PMID 21947834
15. NCCN Clinical Practice Guidelines. Available from: http://www.nccn.org/professionals/physician_gls/pdfbreast.pdf [Last accessed on 2022 Aug 11].
16. Kawazoe H, Murakami A, Yamashita M, Nishiyama K, Kobayashi-Taguchi K, Komatsu S, *et al*. Patient-related risk factors for nausea and vomiting with standard antiemetics in patients with breast cancer receiving anthracycline-based chemotherapy: A retrospective observational study. Clin Ther 2018;40:2170-9. doi: 10.1016/j.clinthera.2018.10.004, PMID 30392814

17. Hesketh PJ, Kris MG, Basch E, Bohlke K, Barbour SY, Clark-Snow RA, *et al*. Antiemetics: American Society of Clinical Oncology clinical practice guideline update. J Clin Oncol 2017;35:3240-61. doi: 10.1200/JCO.2017.74.4789
18. Jordan K, Warr DG, Hinke A, Sun L, Hesketh PJ. Defining the efficacy of neurokinin-1 receptor antagonists in controlling chemotherapy-induced nausea and vomiting in different emetogenic settings-A meta-analysis. Support Care Cancer 2016;24:1941-54. doi: 10.1007/s00520-015-2990-4. PMID 26476625
19. Zaidan M, Soufi L, Hafeez M, Abdelwahid M, Rasul KI. Assessing prescribing patterns for the prevention of chemotherapy-induced nausea and vomiting in the national center for cancer care and research. Saudi Pharm J 2015;23:381-7. doi: 10.1016/j.jsps.2015.01.003, PMID 27134539
20. Pluzanski A, Kalinka E, Lacko A, Rubach M. Prevention of chemotherapy-induced nausea and vomiting-standards versus clinical practice. Oncol Clin Pract 2016;12:153-7. doi: 10.5603/OCP.201 6.0002
21. Tageja N, Groninger H. Chemotherapy-induced nausea and vomiting #285. J Palliat Med 2014;17:1400-2. doi: 10.1089/jpm.2014.9392, PMID 25401213
22. Roila F, Molassiotis A, Herrstedt J, Aapro M, Gralla RJ, Bruera E, *et al*. MASCC and ESMO guideline update for the prevention of chemotherapy- and radiotherapy induced nausea and vomiting and of nausea and vomiting in advanced cancer patients. Ann Oncol 2016;27 Suppl 5:v119-33. doi: 10.1093/annonc/mdw270, PMID 27664248
23. Multinational Association of Supportive Care in Cancer. MASCC/ESMO Antiemetic Guidelines; 2019. Available from: https://www.mascc.org/antiemetic-guidelines [Last accessed on 2020 May 12].
24. National Comprehensive Cancer Network. NCCN Clinical Practice Guidelines in Oncology. Antiemesis. Version 2 [NCCN guidelines]; 2020. Available from: https://www.nccn.org/professionals/physiciangls/PDF/antiemesis.pdf [Last accessed on 2020 May 12].
25. AKYNZEO. (Netupitant and Palonosetron) Capsules. Akynzeo (Fosnetupitant and Palonosetron) for Injection [Prescribing Information]. Dublin, Ireland: HelsinnBirex Pharmaceuticals Ltd.; 2020.
26. Cinvanti (aprepitant) Injectable Emulsion [Prescribing Information]. San Diego: HeronTherapeutics, Inc.; 2019.
27. Varubi (rolapitant) injectable emulsion. 2018. Available at https://www.fda.gov/drugs/postmarket-drug-safety-information-patients-and-providers/varubi-rolapitant-injectable-emulsion
28. Jordan K. New formulation, new drug? The importance of assessing the safety of new supportive care formulations in oncology. Ann Oncol 2018;29:1494-6. doi: 10.1093/annonc/mdy187, PMID 29790903
29. European Medicines Agency. Summary of Opinion (Post Authorisation). Akynzeo (Fosnetupitant/Palonosetron). EMA/CHMP/670824/2019. Netherlands: European Medicines Agency. Available from: https://www.ema.europa.eu/en/documents/smop-initial/chmp-summary-positive-opinionakynzeo_en.pdf [Last accessed on 2020 May 12].
30. Tesaro, Inc. Anaphylaxis, Anaphylactic Shock and other Serious Hypersensitivity Reactions Associated with Use of VARUBI (Rolapitant) Injectable Emulsion. United States: Tesaro, Inc.; 2018. Available from: https://www.fda.gov/media/110258/download [Last accessed on 2020 May 12].
31. ASD Healthcare. Varubi IV Distribution Suspension; 2018. Available from: https://www.asdhealthcare.com/asdhealthcare/media/asdlibrary/pdfs/news/varubi-final-web-notice.pdf [Last accessed on 2020 May 12].
32. Schwartzberg L, Szabo S, Gilmore J, Haislip S, Jackson J, Jain G, *et al*. Likelihood of a subsequent chemotherapy-induced nausea and vomiting (CINV) event in patients receiving low, moderately or highly emetogenic chemotherapy (LEC/MEC/HEC). Curr Med Res Opin 2011;27:837-45. doi: 10.1185/03007995.2011.556603, PMID 21309647
33. Molassiotis A, Aapro M, Dicato M, Gascon P, Novoa SA, Isambert N, *et al*. Evaluation of risk factors predicting chemotherapy-related nausea and vomiting: Results from a European prospective observational study. J Pain Symptom Manage 2014;47:839-48.e4. doi: 10.1016/j.jpainsymman.2013.06.012, PMID 24075401
34. Navari RM, Aapro M. Antiemetic prophylaxis for chemotherapy-induced nausea andvomiting. N Engl J Med 2016;374:1356-67. doi: 10.1056/NEJMra1515442, PMID 27050207
35. Bosnjak SM, Gralla RJ, Schwartzberg L. Prevention of chemotherapy-induced nausea: The role of neurokinin-1 (NK1) receptor antagonists. Support Care Cancer 2017;25:1661-71.
36. Aapro M, Molassiotis A, Dicato M, Peláez I, Rodríguez-Lescure Á, Pastorelli D, *et al*. The effect of guideline-consistent antiemetic therapy on chemotherapy-induced nausea and vomiting (CINV): The Pan European Emesis Registry (PEER). Ann Oncol 2012;23:1986-92. doi: 10.1093/annonc/mds021, PMID 22396444
37. Gilmore JW, Peacock NW, Gu A, Szabo S, Rammage M, Sharpe J, *et al*. Antiemetic guideline consistency and incidence of chemotherapy-induced nausea and vomiting in US community oncology practice: INSPIRE study. J Oncol Pract 2014;10:68-74. doi: 10.1200/JOP.2012.000816, PMID 24065402
38. Molassiotis A, Saunders MP, Valle J, Wilson G, Lorigan P, Wardley A, *et al*. A prospective observational study of chemotherapy-related nausea and vomiting in routine practice in a UK cancer centre. Support Care Cancer 2008;16:201-8. doi: 10.1007/s00520-007-0343-7, PMID 17926070
39. Burmeister H, Aebi S, Studer C, Fey MF, Gautschi O. Adherence to ESMO clinical recommendations for prophylaxis of chemotherapy-induced nausea and vomiting. Support Care Cancer 2012;20:141-7. doi: 10.1007/s00520-010-1079-3, PMID 21234609
40. Shah S, Singh A, Mundhava S. A study of drug utilization in patients of carcinoma breast receiving systemic chemotherapy in tertiary care hospitals. Asian J Pharm Clin Res 2021;14:116-9. doi: 10.22159/ajpcr.2021.v14i4.40826
41. Roila F, Hesketh PJ, Herrstedt J, Antiemetic Subcommitte of the Multinational Association of Supportive Care in Cancer. Prevention of chemotherapy- and radiotherapy-induced emesis: Results of the 2004 Perugia International Antiemetic Consensus Conference. Ann Oncol 2006;17:20-8. doi: 10.1093/annonc/mdj078, PMID 16314401
42. Chan VT, Yeo W. Antiemetic therapy options for chemotherapy-induced nausea and vomiting in breast cancer patients. Breast Cancer (Dove Med Press) 2011;3:151-60. doi: 10.2147/BCTT.S12955, PMID 24367184
43. Lokkur PP, Mahanta N, Kalita NK, Deka H, Kutum N, Ray A. Prevalence of breakthrough chemotherapy-induced nausea vomiting in patients on highly emetogenic chemotherapy: A single-center observational study. Oncol J India 2021;5:92-6. doi: 10.4103/oji.oji_22_21
44. Satyasrinivas TR. Management of infusion reactions to taxane Based Chemotherapy: review Article. IOSR J Dent Med Sci 2016;15:22-6.
45. Okuyama A, Nakamura F, Higashi T. Prescription of prophylactic antiemetic drugs for patients receiving chemotherapy with minimal and low emetic risk. JAMA Oncol 2017;3:344-50. doi: 10.1001/jamaoncol.2016.4096, PMID 27812688