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Original Article

Potential Drug-Drug Interactions and Gender-Based Comparative Analysis of Chemotherapy-Related Side Effects in Oncology Patients: A Prospective, Comparative Study at a Tertiary Care Hospital in Urban India

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ABSTRACT

Background: Cancer patients often receive multiple medications, leading to Potential Drug-Drug Interactions (pDDIs) that may affect treatment outcomes. Chemotherapy-related side effects may also vary between genders, necessitating an understanding of these variations to improve patient care. **Materials and Methods:** This prospective, comparative study was conducted over 8 months (September 2023 to March 2024) at a tertiary care hospital in Urban India. A total of 273 patients were analysed for pDDIs and 213 patients were assessed for chemotherapy-related side effects. Patient data were collected using a structured data collection form. Drug interactions were assessed using Lexicomp® Solutions and data were analysed using SQL software. Statistical analysis, including chi-square tests, was performed using Microsoft Excel, with *p*-values < 0.05 considered statistically significant. **Results:** A total of 506 Potential Drug-Drug Interactions (pDDIs) were identified, with 88.2% of females and 90.3% of males experiencing at least one interaction. Pharmacodynamic interactions were more common (304 cases) compared to pharmacokinetic interactions (202 cases). The most frequent interaction was Aprecap-Dexa (11.06%), followed by Carboplatin-Paclitaxel (8.3%). Side effects were more prevalent in females, especially haematological side effects such as neutropenia (69% in females vs. 65.7% in males) and thrombocytopenia (24.6% in females vs. 23.28% in males). Non-haematological side effects, including indigestion and acidity, were also higher in females compared to males. **Conclusion:** This study highlights a high prevalence of pDDIs in oncology patients, emphasizing the need for proactive monitoring and clinical pharmacist involvement. Gender-specific differences in chemotherapy side effects suggest the need for personalized supportive care interventions to optimize treatment outcomes.

Keywords: Anti-Cancer Therapy, Drug-Drug Interactions (DDIs), Gender Differences, Side Effects.

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INTRODUCTION

Globally, cancer is the primary cause of illness and mortality for both men and women, as well as a global cost to public health. Cancer treatment medications are essential in managing the disease but are highly susceptible to Drug Interactions (DDIs). A drug interaction occurs when one drug alters the activity of another, potentially reducing its effectiveness or increasing toxicity. These interactions can be Pharmacokinetic (PK), which involves changes in drug absorption, distribution, metabolism, or excretion, or Pharmacodynamic (PD), where the drugs' effects are altered at their site of action. DDIs are particularly important in oncology, as many anticancer drugs have a narrow therapeutic index and are often used alongside other medications, raising the risk of adverse effects or diminished efficacy. Understanding these interactions is critical to optimizing treatment regimens and improving patient outcomes. The lack of comprehensive information on DDIs in cancer treatment led to the initiation of this project to address this knowledge gap and enhance patient care.[1-4]

Cancer treatment aims to improve the patient's quality of life and limit the disease's progression, making it one of the most complex and difficult diseases to treat. The creation of increasingly novel cancer therapies and combination regimens has emerged as a key priority in the ongoing search for more potent treatments as oncology progresses. Simultaneously, there has been a surge in the recognition of the significance of tailored patient care, emphasizing gender-based differences in treatment results and adverse effects. In order to treat their cancer and any coexisting

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disorders (non-communicable diseases), cancer patients frequently take multiple medications. They are quite susceptible to drug interactions as most anticancer drugs are potent, toxic drugs with a narrow therapeutic index. Drug-Drug Interactions (DDIs), which are avoidable medication errors linked to major or even fatal adverse effects, are the occurrence of a potentially hazardous combination of prescription drugs in a given patient. It may result from a combination of mechanisms, pharmacokinetics, or pharmacodynamics. Interference with a drug's absorption, distribution, metabolism and excretion is the primary cause of pharmacokinetic interactions. The P-glycoprotein pump, the cytochrome P450 enzyme system and the competitive protein-binding characteristics of anticancer drugs in oncology are the main causes of these. Pharmacodynamic interactions can have a substantial impact on the toxicity or efficacy of anticancer medications.[5] These interactions may arise from additive, potentiating, or antagonistic effects.[5] Since patients frequently use multiple medications in addition to their anticancer therapy, DDIs are a big concern in oncology. Furthermore, most anticancer medications have a narrow therapeutic index and are toxic and potent. When administering various medications as part of an anticancer drug therapy regimen, there is a risk of Drug-Drug Interactions (DDIs) that could reduce the effectiveness of the therapy or lead to adverse events. Chemotherapy treatments can interact with medications, herbs and foods, potentially impacting their effectiveness or causing adverse reactions.[6,7] Understanding and managing these interactions is crucial to ensuring the safety and efficacy of chemotherapy regimens for patients. The effectiveness and safety of anticancer medications are crucial for enhancing patient outcomes. However, a thorough investigation is necessary due to the complex terrain of drug interactions and patients' different susceptibilities to chemotherapy-related side effects, particularly by gender variations.[8-11] Chemotherapy side effects in females and males include fatigue, nausea, hair loss and increased infection risk.[12-14] Women may face more severe side effects due to chemotherapy.[15,16] Chemotherapy commonly results in non-haematological and Haematological side effects. These effects can significantly impact a patient's well-being and may require supportive care interventions to alleviate symptoms and ensure optimal management of treatment-related complications. The effects of DDIs in cancer therapy are not well understood enough. There isn't much research accessible in India that addresses this subject in recent years.[17-20] The goal of this study is to offer a comprehensive evaluation of possible DDI (DDI) in the oncology unit by utilizing a number of criteria, including reaction severity, risk classification and documenting of the observed interactions based on previously published research, along with a Gender-based comparative study between Males and Females undergoing Cancer chemotherapy.

MATERIALS AND METHODS

Study Design and Setting

This prospective, comparative study was conducted over eight months (September 2023 to March 2024) in the oncology unit of a tertiary care hospital in an urban region of India. Data were obtained from the medical records of patients admitted for cancer chemotherapy during the study period. Both male and female patients aged 18 years and above who received more than two drugs were included in the study. Patients from different age groups, including paediatric and geriatric populations, were also considered.

Sample Size and Sampling Method

The sample size was determined based on the feasibility of patient enrolment during the study period. A convenience sampling method was employed, including all eligible patients receiving chemotherapy, as illustrated in Figure 1. Figure 1 presents a flowchart outlining the patient selection process and study methodology.

Study Instrument

A structured data collection form was developed to record demographic details such as age, gender, diagnosis, cancer type and stage, duration of hospital stay, chemotherapy regimen, supportive drugs and medications for non-communicable diseases. Adverse effects reported by patients were also recorded. Potential Drug-Drug Interactions (pDDIs) were assessed using Lexicomp® Solutions. Data were entered and analysed using SQL software.

Classification and quantification of pDDIs were based on severity, risk rating and documentation quality as categorized in the Lexicomp® database. Interactions were classified as Major, Moderate, or Minor based on severity and as X, D, or C based on risk rating. Interactions were further categorized into pharmacokinetic, pharmacodynamic, or unknown mechanisms. Frequently observed pharmacological combinations involved in interactions were also analysed.

Ethical Approval

The study was approved by the Institutional Ethics Committee (IEC) of Abhinav College of Pharmacy. Informed consent was obtained from all patients. The study adhered to the principles outlined in the Declaration of Helsinki.

Statistical Analysis

Descriptive statistics were applied to summarize patient data and pDDI frequencies. Chi-square tests were performed using Microsoft Excel to compare gender-based side effects. A p-value < 0.05 was considered statistically significant.

RESULTS

Drug-drug interaction data analysis

The study included 273 patients, with 177 females and 96 males. The age distribution was as follows: 1 patient (0-18 years), 34 patients (19-35 years), 60 patients (36-50 years), 100 patients (51-65 years), 70 patients (66-80 years) and 8 patients (81-100 years). According to the data most patients are in 51-65 age group. And least patients are present in the 0-18 and 81-100 age group.

The presented data elucidates the distribution of various cancer diagnoses among the patient cohort, highlighting significant variances in incidence rates. The most prevalent diagnosis is carcinoma of the left breast (CA Left Breast), accounting for 37 cases, which constitutes 13.6% of the total cases. This is followed by carcinoma of the right breast (CA Right Breast) with 28 cases, representing 10.29%. Ovarian cancer (CA Ovary) is the third most common, with 14 cases (5.15%). This is shown in Table 1.

Non-Hodgkin's lymphoma, pancreatic cancer (CA Pancreas) and lung cancer (CA Lung) each have 8 cases, making up 2.94% of the total cases individually. Additionally, there are 7 cases each of carcinoma of the breast (CA Breast), metastatic breast cancer (Metastatic CA Breast) and gallbladder cancer (CA Gall Bladder), each accounting for 2.57%. Prostate cancer (CA Prostate) is the least common in this dataset, with 6 cases, representing 2.21%. This distribution indicates a notably higher occurrence of breast cancer, particularly in the left breast, compared to other types of cancer in this patient population.

The distribution of various cancer diagnoses is summarized in Table 1.

The data reveals a pronounced prevalence of breast cancer, particularly carcinoma of the left breast, among the patient population. This higher incidence underscores the importance of targeted screening and treatment strategies for breast cancer. Other notable diagnoses include ovarian cancer and various less common cancers such as non-Hodgkin's lymphoma, pancreatic cancer and lung cancer. The least common diagnosis in this cohort is prostate cancer. These findings highlight the need for tailored approaches in cancer management, taking into account the specific types and prevalence of cancers within the patient population.

During treatment, patients received both supportive medications and anti-cancer medications. The total number of drugs prescribed was 1961, with 586 being anti-cancer drugs and 1375 being supportive medications as illustrated in Figure 2. The maximum number of drugs used was 15 and the least number was 1. Most patients (55 patients, 20%) were given 7 medications and 216 patients showed polypharmacy. The average number of drugs prescribed was 7.13, with a standard deviation of 2.10. The maximum number of anti-cancer drugs given was 6 and the minimum was 1. Most patients (138 patients) were given 2 anti-cancer medications and the average number of anti-cancer drugs prescribed was 2.15, with a standard deviation of 0.84.

A total of 506 pDDIs were observed, with 329 females (88.2%) and 177 males (90.3%) showing DDIs. There were 304

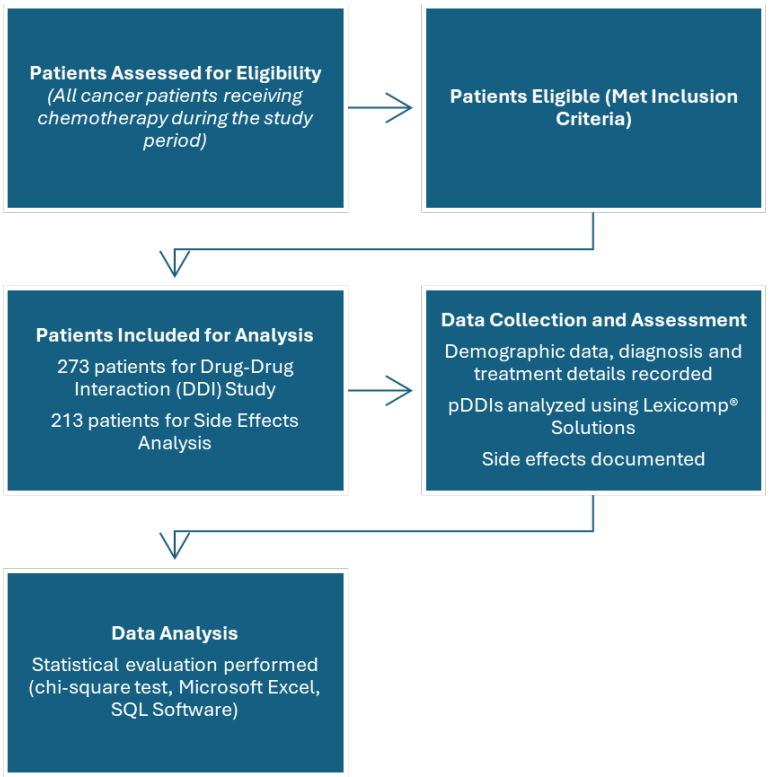

Figure 1: Flowchart Representing Patient Selection and Study Process.

pharmacodynamic interactions and 202 pharmacokinetic interactions. Documentation quality was fair in 294 cases (58.1%), good in 211 cases (41.6%) and excellent in 1 case (0.1%). The information demonstrates how frequent anti-cancer medications are in oncology treatment. With 85 cases (14.731%), carboplatin tops the list, demonstrating its broad application and potency against a variety of cancer types. The drug paclitaxel follows closely with 64 instances (11.09%), demonstrating its utility in the treatment of lung, ovarian and breast malignancies, among other cancers. With 28 cases (4.85%), cisplatin is mostly used to treat bladder, ovarian and testicular cancer. Bevacizumab and Gemcitabine, with 27 (4.67%) and 26 (4.506%) cases, respectively, are essential constituents in cancer treatment, employed in combination therapies for pancreatic, ovarian, lung and colorectal cancers. These patterns of use highlight how essential these medications are to oncology, helping to direct treatment plans and improve patient outcomes.

Out of all the recorded interactions, "Aprecap-dexa" is the most common interaction, occurring 56 times, (11.06%) of all the times. Because interactions are more likely when patients are prescribed Aprecap and Dexa at the same time, this research emphasizes how important it is to monitor patients. Later "Carboplatin-paclitaxel" interaction is seen with 42 cases (8.30%), emphasizing the necessity for cautious evaluation in cancer treatment plans where these drugs are routinely taken concurrently as depicted in Figure 3. Furthermore, "Dexa-Nykron" with 40 occurrences (7.905%), highlighting the significance of careful observation for any possible interactions between Dexa and Nykron. Even though they are less common, interactions like "5fu-Leucovorin" and "Atropine-Avil" each has 15 occurrences (2.96%), thus they should be carefully examined. Furthermore, "Aprecap-Irinotecan" and "Paclitaxel-Trastuzumab" show comparatively lower frequencies of 13 (2.56%) and 12 cases (2.37%), respectively, but require caution in clinical practice. In summary, this analysis emphasizes how important it is to monitor and control possible DDIs proactively to maximize patient safety and treatment effectiveness in medical settings.

The study identified the prevalence and severity of drug-drug interactions (DDIs) in cancer patients undergoing chemotherapy. Among 506 interactions analysed, 89.02% of patients experiencing at least one potential DDI, with an average of 3.94 pDDIs per patient. The interactions were categorized as major (30.43%), moderate (36.76%) and minor (32.81%). Notably, 67.14% of these interactions were clinically relevant, significantly higher than the 20% reported in previous studies. This discrepancy may be due to a high rate of polypharmacy (93%) and the use of different drug interaction databases, highlighting the need for careful monitoring of DDIs in cancer patients.

The dataset delineates various management actions and their prevalence within a specific context. As illustrated in Figure 4, Management actions included "Monitor Therapy" (37.5%), "Consider Therapy Modifications" (37.7%) which emerge as the dominant strategies, "No Action Needed" (21.9%) suggesting scenarios where immediate intervention might not be necessary,"Avoid Combination" actions are less frequent (3.36%) of reported cases. This analysis underscores the prominence of proactive management approaches while also highlighting the importance of recognizing instances where intervention may not be warranted.

Out of the 506 pDDI cases, 154 cases (30.43%) were major events, indicating serious problems requiring prompt action. In contrast, minor events comprise 166 cases (32.81%) and are considered less serious issues that need to be taken into account. Moderate incidents 186 cases (36.76%), indicate problems that fall between large and small in terms of impact and urgency. This research emphasizes the necessity for comprehensive management techniques that address issues across the severity range by highlighting a balanced distribution of severity levels.

Statistical Insight

Chi-square analysis showed no statistically significant difference between males and females in the overall occurrence of pDDIs (p=0.64).

Table 1: Distribution of various cancer diagnoses among patients.

Cancer Diagnosis	Number of Cases	Percentage of Total Cases
Carcinoma of the Left Breast (CA Left Breast)	37	13.6%
Carcinoma of the Right Breast (CA Right Breast)	28	10.29%
Ovarian Cancer (CA Ovary)	14	5.15%
Non-Hodgkin's Lymphoma	8	2.94%
Pancreatic Cancer (CA Pancreas)	8	2.94%
Lung Cancer (CA Lung)	8	2.94%
Carcinoma of the Breast (CA Breast)	7	2.57%
Metastatic Breast Cancer (Metastatic CA Breast)	7	2.57%
Gallbladder Cancer (CA Gall Bladder)	7	2.57%
Prostate Cancer (CA Prostate)	6	2.21%

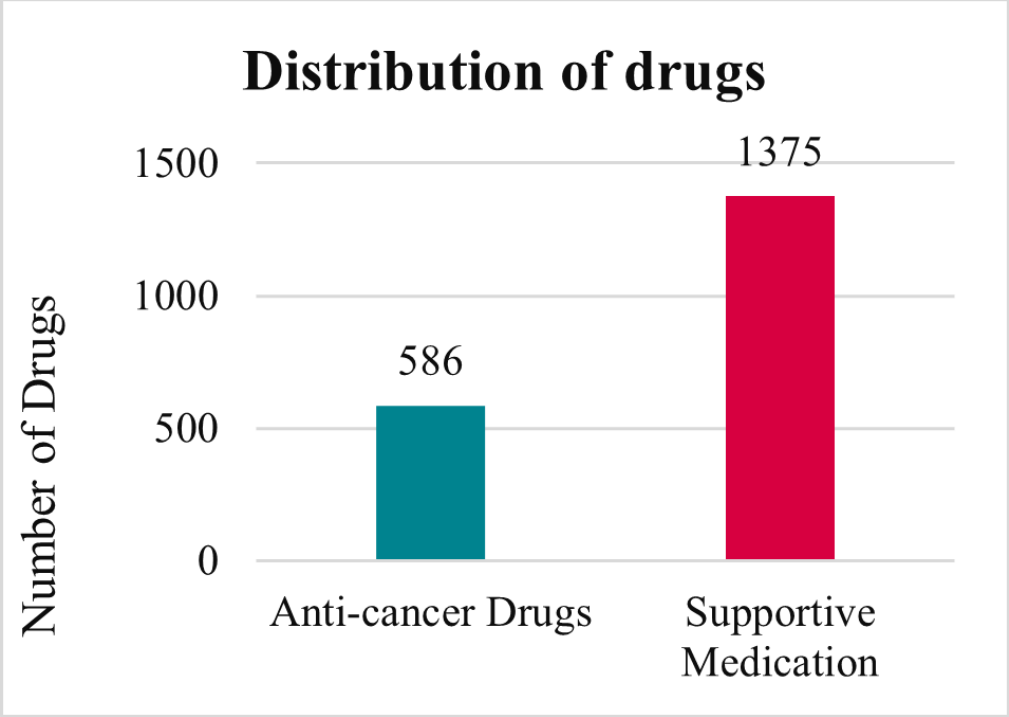

Figure 2: Distribution of Drugs.

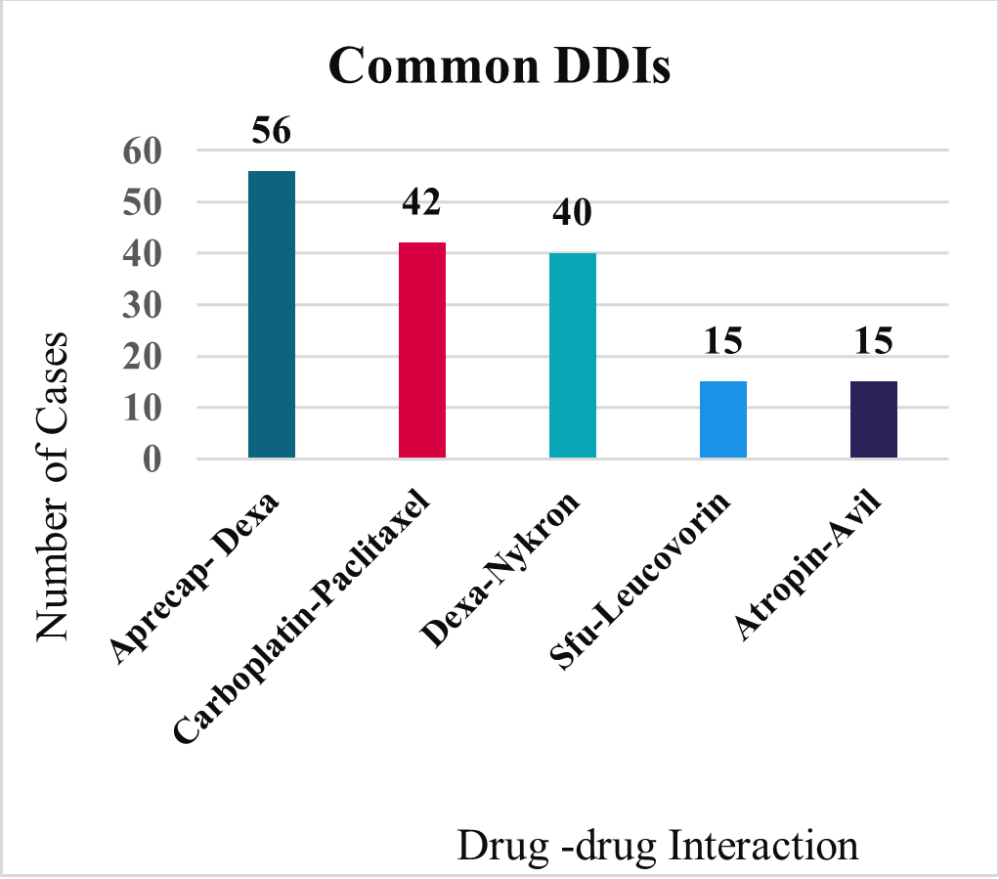

Figure 3: Most Common Drug-Drug Interactions Observed.

Chemotherapy side effects data analysis

A gender-based study of side effects was conducted on 213 patients, with 112 females and 101 males. A detailed description of the adverse effects that both males and females suffered is provided by the data, along with the proportion of each gender group who experienced these symptoms. The age distribution was as follows: 9 patients in the 0-29 age group, 118 patients in the 30-59 age group and 86 patients in the 60-89 age group. Nine (9) Side effects were appeared 66 times out of 213 instances, making up nearly 31% of the dataset. Conversely, only one (1)side effect was observed 3 times, constituting about 1.4% of the total. The average number of side effects per patient was 6.13, with a standard deviation of 2.79. Overall, this analysis offers valuable insights into the prevalence of various side effects within the studied population.

Most Common Side Effects (Non-Haematological)

Nausea: Females 78% vs. Males 79% (p=0.86).
Vomiting: Females 74% vs. Males 82% (p=0.18).
Indigestion: Females 31% vs. Males 12% (p=0.001) → Statistically significant.
Hair Loss: Females 28% vs. Males 28% (p=1.00).
Constipation: Females 75% vs. Males 74% (p=0.87).
Acidity: Females 53% vs. Males 35% (p=0.006) → Statistically significant.Indigestion (p=0.001) and acidity (p=0.006) were significantly more common in females. The distribution is illustrated in Figure 5.

The results about the Patient's Haematological side effects were also obtained. A total of 199 patients showed objective side effects like Neutropenia & Thrombocytopenia. Out of 199 patients, 126 were females and 73 were males.

Among those who exhibited neutropenia, there were 135 cases, with 87 being female and 48 males. Neutropenia was most commonly observed in the 30-59 age group, with 70 cases, while it was least prevalent in the 0-29 age group, with only 2 cases. In total, 48 patients experienced thrombocytopenia, with 31 female and 17 male. Thrombocytopenia was predominantly observed in the 30-59 age group, with 30 cases and there were no reported cases in the 0-29 age group. The results regarding haematological side effects are presented in Figure 6.

Key Statistical Observations

Indigestion and Acidity were significantly more common in females (p<0.05). Other side effects did not show significant gender differences.

DISCUSSION

The complex treatment regimen of chemotherapy, along with changes in Pharmacokinetics (PK) and Pharmacodynamics (PD), contributes significantly to Drug-Drug Interactions (DDIs) in cancer patients. This study highlights the significant prevalence of Potential Drug-Drug Interactions (pDDIs) and gender-based differences in chemotherapy-related side effects among oncology patients. The identification of 506 pDDIs across 273 patients, with 88.2% of females and 90.3% of males experiencing at least one interaction, demonstrates the high burden of DDIs in oncology practice. This prevalence is higher than previous studies, such as the study by K.M. Venkatesh *et al.*, which reported a

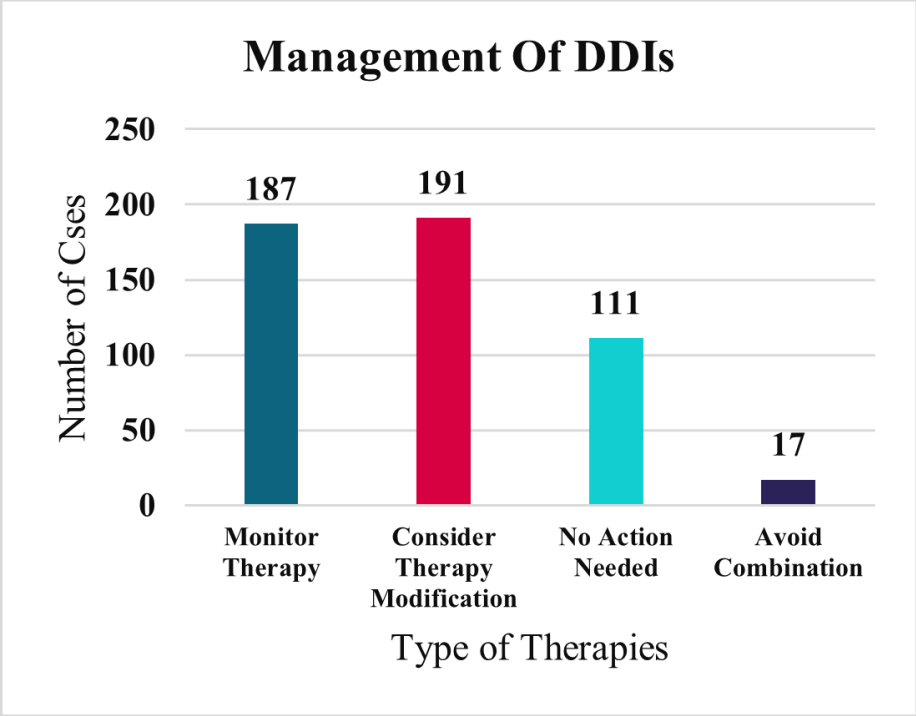

Figure 4: Management Distribution of Potential Drug-Drug Interactions.

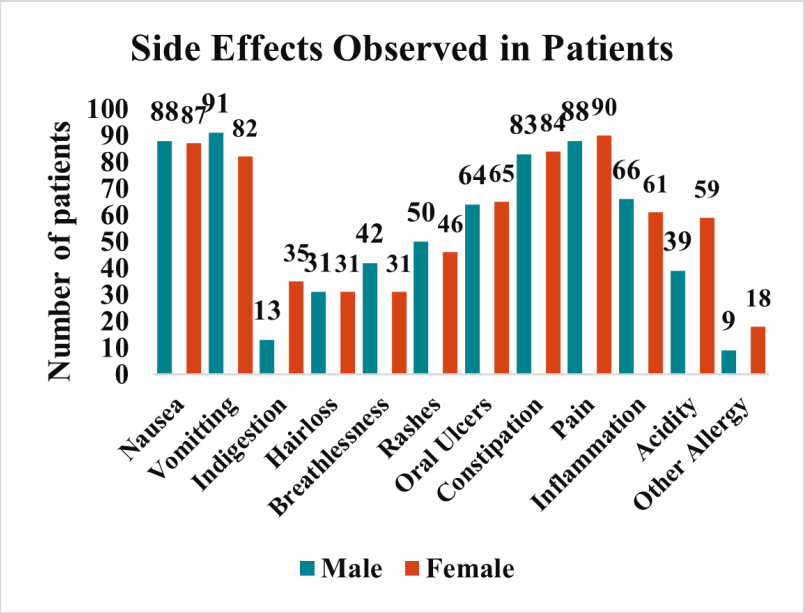

Figure 5: Gender-Based Distribution of Non-Haematological Side Effects.

lower percentage of clinically relevant interactions (20%). The polypharmacy observed in 216 patients (79.1%), with an average of 7.18 drugs per patient, is a likely contributing factor to this increased incidence, highlighting the need for vigilant medication review during chemotherapy.

The classification of DDIs based on severity revealed that 30.43% were major, 36.76% moderate and 32.81% minor, which is comparable to other Indian studies assessing DDIs in oncology patients. This emphasizes that even moderate interactions can lead to clinically significant adverse events due to the narrow therapeutic index of anticancer drugs. Based on risk ratings, 3.35% of interactions were contraindicated (X), 37.7% required therapy modifications (D) and 37.5% required monitoring. According to documentation levels, 58.1% had fair documentation, 41.6% had good documentation and 0.1% had excellent documentation. These findings suggest that while most DDIs were moderately severe, they still require diligent monitoring.

Analyzing the mechanisms of these interactions, approximately 60% were pharmacodynamic and 39.9% were pharmacokinetic, similar to findings by Van Leeuwen RW *et al*., who reported that pharmacodynamic interactions were more common in oncology practice. Pharmacodynamic interactions might be more common because many drugs influence similar physiological pathways and individual variations in response increase their likelihood.

The most common DDI observed was Aprecap-Dexa (11.06%), followed by Carboplatin-Paclitaxel (8.3%). Aprecap-Dexa involves an increase in dexamethasone concentration when co-administered with Aprepitant, requiring dose adjustments to prevent corticosteroid-related side effects, as highlighted by Sood *et al*. Similarly, Carboplatin-Paclitaxel, a well-known combination for ovarian and lung cancer, is associated with myelosuppression and neuropathy, emphasizing the need for careful monitoring. Netupitant-Dexamethasone (Dexa-Nykron), another notable combination, can increase Dexa levels due to CYP3A4 inhibition, necessitating dose adjustments. These findings align with those reported by Baker *et al*., who emphasized the importance of monitoring taxane-based regimens for interactions.

Other frequently observed DDIs requiring careful management include 5-Fluorouracil (5-FU) and Leucovorin, which enhance anticancer efficacy but increase toxicity risk, requiring dose adjustments and monitoring for myelosuppression and gastrointestinal toxicity. The Adriamycin-Endoxan (Doxorubicin-Cyclophosphamide) combination, often used in breast cancer, poses a cardiotoxicity risk, necessitating cardiac monitoring. The Atropine-Avil (Pheniramine) combination can lead to additive anticholinergic effects, particularly in elderly patients, requiring dose adjustments and monitoring. Bevacizumab-Doxorubicin is another combination to avoid due to the potential for enhanced cardiotoxic effects.

Regarding gender-based differences in chemotherapy-related side effects, this study found that females experienced more haematological side effects, including neutropenia (69%) and thrombocytopenia (24.6%), compared to males (65.7% and 23.28%, respectively). Although these differences were not statistically significant, they are clinically relevant, especially considering that hormonal and genetic factors may predispose females to greater haematological toxicity, as supported by Unger *et al*. Additionally, non-haematological side effects such as indigestion and acidity were significantly more common in females (p = 0.001 and p = 0.006, respectively). Hormonal influences and slower gastric emptying in females may explain these observations, consistent with findings from Coates *et al*.

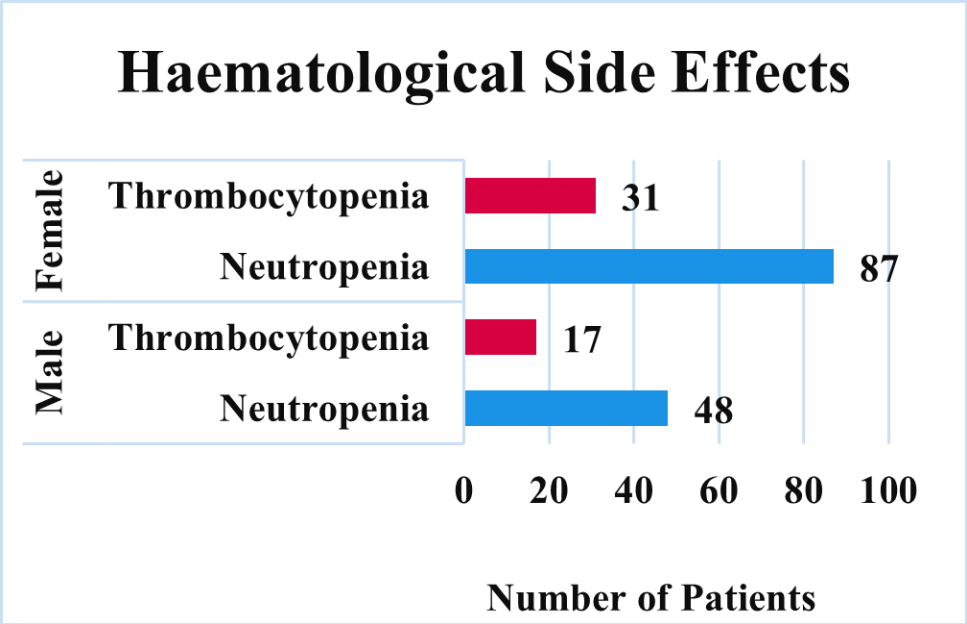

Figure 6: Gender-Based Distribution of Haematological Side Effects.

The lack of significant differences in other side effects like nausea, vomiting and hair loss suggests that both genders experience a comparable burden of these common chemotherapy toxicities. This finding aligns with studies by Devlin *et al.*, which emphasized that patient expectations and psychological factors also contribute significantly to the perception of chemotherapy side effects.

This study reinforces the critical role of clinical pharmacists in oncology units, who can identify and manage DDIs, educate patients and suggest dose modifications. Implementing routine DDI screening tools like Lexicomp during chemotherapy prescription reviews can improve patient safety. Additionally, gender-specific supportive care strategies should be considered, such as closer haematological monitoring in females and more aggressive management of gastrointestinal side effects.

However, this study has some limitations. The sample size was limited to a single hospital and the pDDIs were identified based on Lexicomp alone, without cross-verifying with other databases. Moreover, the clinical impact of these pDDIs was not assessed and the study lacked long-term follow-up data on side effects. Future research should focus on multi-center studies, clinical validation of DDIs and exploration of genetic markers influencing chemotherapy toxicity.

In conclusion, this study contributes to the growing body of evidence on DDIs and chemotherapy side effects in oncology patients. It underlines the need for proactive DDI management and personalized, gender-sensitive supportive care to enhance patient outcomes. Vigilant monitoring and appropriate dosage adjustments can mitigate serious risks such as cardiotoxicity, myelosuppression, nephrotoxicity and other adverse effects. Tailoring treatment plans to individual patient needs, particularly considering gender differences, can ultimately improve the safety and effectiveness of chemotherapy regimens.

CONCLUSION

In conclusion, this study highlights the importance of managing Drug-Drug Interactions (DDIs) in cancer patients undergoing chemotherapy. The high prevalence of DDIs observed, with 506 interactions identified across 273 patients, underscores the need for proactive monitoring and clinical pharmacist involvement. Polypharmacy and the concurrent use of supportive medications were key contributors to the increased risk of DDIs. The most frequently observed interactions involved Aprecap-Dexa and Carboplatin-Paclitaxel combinations, necessitating vigilant dose adjustments and patient monitoring to prevent adverse effects.

Furthermore, this study identified notable gender-based differences in chemotherapy-related side effects. Females experienced a higher incidence of both haematological and non-haematological toxicities, with indigestion and acidity being significantly more prevalent among female patients. These findings suggest that females may be more susceptible to chemotherapy-induced adverse effects due to physiological, hormonal and genetic factors. Personalized treatment strategies, such as individualized dosing and gender-specific supportive care, are vital to reducing these risks and optimizing patient outcomes.

Preventing and managing DDIs require a multifaceted approach, including developing institutional protocols, fostering collaborative communication between oncologists and pharmacists and leveraging clinical decision support tools like Lexicomp. The implementation of Computerized Provider Order Entry (CPOE) systems and routine pharmacist-led medication

reviews can further enhance medication safety. Educating healthcare professionals on clinically significant DDIs and promoting patient awareness regarding self-medication practices are also essential for minimizing DDI-related risks.

Collaboration among oncologists, pharmacologists and clinical pharmacists is paramount to ensuring patient safety and achieving better therapeutic outcomes. Healthcare providers must maintain thorough documentation of prescribed drugs and ensure vigilant monitoring for signs of toxicity or adverse reactions. By adopting a systematic approach to DDI management and integrating gender-specific considerations into supportive care, healthcare teams can significantly enhance treatment efficacy and patient quality of life.

Future research should focus on large-scale, multi-center studies to validate these findings and explore genetic factors influencing chemotherapy toxicity. Long-term follow-up studies are also needed to evaluate the persistence and evolution of gender-specific side effects and assess the clinical impact of DDIs on treatment outcomes. Incorporating genetic analysis and investigating sex-based variations in drug metabolism will further aid in developing precision oncology approaches tailored to individual patient needs.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

SUMMARY OF STUDY FINDINGS

This study investigated potential drug-drug interactions (pDDIs) and gender-based differences in chemotherapy-related side effects among oncology patients at a tertiary care hospital. A total of 506 potential DDIs were identified among 273 patients, with 88.2% of females and 90.3% of males experiencing at least one interaction. Pharmacodynamic interactions (304 cases) were more common than pharmacokinetic interactions (202 cases). The most common interaction was Aprecap-Dexa (11.06%), followed by Carboplatin-Paclitaxel (8.3%). Among 213 patients assessed for side effects, females experienced more haematological side effects, including neutropenia (69%) and thrombocytopenia (24.6%), compared to males (65.7% and 23.28%, respectively). Non-haematological side effects such as indigestion (31%) and acidity (53%) were also more common in females. These findings underscore the importance of clinical pharmacist interventions to mitigate DDIs and address gender-specific adverse effects in oncology patients.

REFERENCES

1. Van Leeuwen RW, Swart EL, Boven E, Boom FA, Schuitenmaker MG, Hugtenburg JG. Potential drug interactions in cancer therapy: a prevalence study using an advanced screening method. Ann Oncol. 2011;22(10):2334-41.
2. Ismail M, Khan S, Khan F, Noor S, Sajid H, Yar S, *et al.* Prevalence and significance of potential drug-drug interactions among cancer patients receiving chemotherapy. BMC Cancer. 2020;20:1-9.
3. Stoll P, Kopittke L. Potential drug-drug interactions in hospitalized patients undergoing systemic chemotherapy: a prospective cohort study. Int J Clin Pharm. 2015;37:475-84.
4. Turossi-Amorim ED, Camargo B, Schuelter-Trevisol F. Prevalence of potential pharmacological interactions in patients undergoing systemic chemotherapy in a tertiary hospital. Hosp Pharm. 2022;57(5):646-53.
5. Niu J, Straubinger RM, Mager DE. Pharmacodynamic drug-drug interactions. Clin Pharmacol Ther. 2019;105(6):1395-406.
6. Alsanad SM, Williamson EM, Howard RL. Cancer patients at risk of herb/food supplement–drug interactions: a systematic review. Phytother Res. 2014;28(12):1749-55.
7. Meijerman I, Beijnen JH, Schellens JH. Herb-drug interactions in oncology: focus on mechanisms of induction. Oncologist. 2006;11(7):742-52.
8. Riechelmann R, Girardi D. Drug interactions in cancer patients: a hidden risk? J Res Pharm Pract. 2016;5(2):77-8.
9. Venkatesh KM, Acharya S, Holla R. Assessment of potential drug-drug interaction among the patients receiving cancer chemotherapy: a cross-sectional study. J Pharmacol Pharmacother. 2021;12(2):79-85.
10. Riechelmann RP, Del Giglio A. Drug interactions in oncology: how common are they? Ann Oncol. 2009;20(12):1907-12.
11. Beavers CJ, Rodgers JE, Bagnola AJ, Beckie TM, Campia U, Di Palo KE, *et al.* Cardio-oncology drug interactions: a scientific statement from the American Heart Association. Circulation. 2022;145(15):e811-e38.
12. Devlin EJ, Denson LA, Whitford HS. Cancer treatment side effects: a meta-analysis of the relationship between response expectancies and experience. J Pain Symptom Manage. 2017;54(2):245-58.
13. Coates A, Abraham S, Kaye SB, Sowerbutts T, Frewin C, Fox RM, *et al.* On the receiving end-patient perception of the side-effects of cancer chemotherapy. Eur J Cancer Clin Oncol. 1983;19(2):203-8.
14. Pearce A, Haas M, Viney R, Pearson SA, Haywood P, Brown C, *et al.* Incidence and severity of self-reported chemotherapy side effects in routine care: a prospective cohort study. PLoS One. 2017;12(10):e0184360.
15. Unger JM, Vaidya R, Albain KS, LeBlanc M, Minasian LM, Gotay CC, *et al.* Sex differences in risk of severe adverse events in patients receiving immunotherapy, targeted therapy, or chemotherapy in cancer clinical trials. J Clin Oncol. 2022;40(13):1474-86.
16. Rakshith HT, Lohita S, Rebello AP, Goudanavar PS, Naveen NR. Sex differences in drug effects and/or toxicity in oncology. Curr Res Pharmacol Drug Discov. 2023;4:100152.
17. Sood M, Kaushal S, Chopra SC. Aprepitant in PONV. J Anaesthesiol Clin Pharmacol. 2007;23(4):395-8.
18. Baker AF, Dorr RT. Drug interactions with the taxanes: clinical implications. Cancer Treat Rev. 2001;27(4):221-33.
19. Edition P. Drug interactions between fluorouracil and multivitamin. Balis FM. Pharmacokinetic drug interactions of commonly used anticancer drugs. Clin Pharmacokinet. 1986;11(3):223-35.
20. Lexicomp Drug Interactions. Lexicomp Online. Wolters Kluwer Health, Inc. Available from: http://online.lexi.com

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