Journal of Rare Cardiovascular Diseases
ISSN: 2299-3711 (Print) | e-ISSN: 2300-5505 (Online)
www.jrcd.eu

RESEARCH ARTICLE

An Observational Study Based on Secondary Data: Evaluating the Effects of Chemotherapy in Cancer Patients with Comorbidities such as Diabetes, Hypertension, and High Blood Glucose Levels

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Article History
Received:17-09-2025
Revised:30-09-2025
Accepted:07-10-2025
Published:22-10-2025

Abstract:
Chemotherapy is one of the most widely used therapeutic modalities which is highly beneficial for management of various cancers. However, its effects are not uniform / similar across all the patients, particularly among those facing underlying chronic conditions like mellitus, hypertension, diabetes and hyper glycemia. Existence of these comorbidities in patients can lead to delayed recovery, higher toxicity and poor tolerance levels. The present Observational Study takes into account 105 cancer patients'records and previously published literature, reports and investigations on effects of chemotherapy in patients with and without metabolic and cardiovascular comorbidities. The Study analyzes changes in blood pressure, glucose levels, and hematological (blood related) profiles. Moreover, effects like neuropathy nausea, microsites (inflammation of mucosa), fatigue and infection rates were analyzed group wise to track variability or changes. Results of the observational study indicates that diabetic patients experienced 30-50% increase in glucose levels following chemotherapy cycles. Significant fluctuations in systolic and diastolic activities were recorded among hypertensive patients following chemotherapy. Compounded or increased physiological stress and multi organ toxicity is reported in both diabetic and Hypertensive patients. These findings underscore the critical need for integrating comorbidity assessment into oncology treatment planning. The Study concludes that personalized chemotherapy with continuous monitoring of glucose and blood pressure levels can reduce complications and enhance efficiency of treatment for patients of these comorbidities. It further emphasizes the importance of a multi-disciplinary and holistic approach involving Oncology, Endocrinology and Cardiology for Patient's healthy management.

Keywords: Chemotherapy, Comorbidities, Diabetes Mellitus, Hypertension, Hyperglycemia, Toxicity, Observational Study, Secondary Data.

INTRODUCTION

Cancer is one of the leading cause of deaths worldwide, and Chemotherapy remains at the cornerstone as most widely recognised and practiced method for treatment of Cancer. Though it (chemotherapy) has many side effects and adverse impacts on normal tissues like damaging Bone marrow, liver kidney and cardiovascular system leading to wide variety of adverse effects such as fatigue, nausea, myelosuppression, organ dysfunction and metabolic imbalances. Chemotherapy targets cancer cells but in doing so it as externalities have negative impact on other organs. The toxicity is generated out of chemotherapeutic agents are particularly pronounced in patients who have pre existing chronic conditions such as diabetes mellitus and hypertension. Diabetes mellitus is oh disorder characterised by chronic hyperglycemia commonly referred as "high blood sugar", and impaired insulin regulation, is associated with delayed wound healing, reduced immune response, and increased susceptibility to infections; all of which can negatively influence chemotherapy tolerance. Similarly hypertension contributes to exacerbated vascular stiffness and endothelial dysfunction which may amplifier or intensify cardiovascular stress when patients are exposed to cyto toxic and agniogenesis inhibiting drugs. The presence of these metabolic and cardiovascular comorbidities complicates the treatment - increasing the risk of systematic complications and poor therapeutic outcomes. Multiple chemotherapeutic agents, including platinum compounds, anthracyclines, and taxanes, have been reported to exacerbate blood glucose and blood pressure instability. Corticosteroids, commonly administered to reduce chemotherapy-induced nausea or inflammation, may further elevate blood sugar levels in diabetic patients. Additionally, agents such as bevacizumab and sorafenib are associated with blood pressure spikes due to vascular endothelial growth factor inhibition. Despite increasing prevalence of patients with multiple chronic disorders, most researchers in oncology focuses primarily on drugs efficacy and viability rather than patient centric physiological variability. In result of this Oncologist often face challenges in developing individualized treatment protocols for patients with comorbidities. The study addresses this gap by utilising secondary data to evaluate real world affects of chemotherapy on patients

with diabetes hypertension or both. Buy analysing the observational data of 105 patients including those with or without the comorbidities, the study aims to identify the differences in biochemical and physiological indicators, quantifying side effect profiles and provide recommendation for optimised patient monitoring.

LITERATURE REVIEW

Literature review shows that comorbidities have a major effect on chemotherapy outcome. Patients with diabetes mellitus have a high risk of metabolic disturbances caused by chemotherapy. According to Singh et al. (2021), diabetic patients commonly develop severe hyperglycemia during chemotherapy, which is potentiated by the use of corticosteroids. High blood sugar increases the risk of infection besides delaying the healing process and tissue recovery. Certain chemotherapeutic drugs induce pancreatic beta-cell dysfunction, which further impairs glucose homeostasis. Hypertension is another comorbidity that has an influence on chemotherapy tolerance. Chen et al. (2019) and Patel and Sharma (2022) have provided information that hypertensive patients often develop exacerbation of blood pressure during the course of treatment, especially if VEGF inhibitors are used. These fluctuations in blood pressure increase the risk of cardiovascular complications such as myocardial infarction and stroke. The underlying mechanisms include endothelial dysfunction, increased vascular resistance, and fluid retention induced by chemotherapeutic agents.

They are especially at risk when patients have comorbid conditions such as diabetes and hypertension because these conditions add to physiological stress during chemotherapy. Rahman et al. (2020) identified that such patients are more prone to multiorgan toxicity, severe fatigue, neuropathy, and hepatic dysfunction. These findings raise the imperative for clinicians to adopt personalized monitoring strategies in patients with multiple comorbidities.

Secondary data have become particularly relevant in oncology research due to their cost- effectiveness, ethical feasibility, and potential for providing valuable information on real-world patient outcomes. Secondary datasets, including electronic medical records and previously published clinical studies, help enable researchers to test treatment effects across diverse patient populations without the need for prospective patient recruitment. This allows for comparative analysis of the treatment outcomes among different subpopulations of patients and thereby presents valuable information for clinical decision-making.

Objectives

The key objective of this study is to examine the physiological and biochemical alterations in cancer patients with comorbidities such as diabetes and hypertension during chemotherapy. A secondary objective is to compare chemotherapy-induced side effects among the patients with and without these comorbidities. This would, in particular, identify key clinical parameters such as blood glucose, blood pressure, liver and kidney function, and hematological indices that are most affected by chemotherapy among these subgroups. Ultimately, the research is supposed to give evidence-based recommendations for personalized monitoring and management strategies for reducing complications and improving patient outcomes.

METHODOLOGY

The study was designed as an observational analysis that is wholly based on secondary data. It enlisted a total of 105 cancer patients, divided among the four groups: non-comorbid patients (n=30), diabetic patients (n=40), hypertensive patients (n=35), and patients with comorbid conditions, both diabetes and hypertension (n=15). Secondary data sources included but were not limited to anonymized electronic health records, hospital databases, and previously published peer-reviewed clinical studies from 2018 to 2024.

In addition, a number of physiological and biochemical parameters were measured: the level of fasting blood sugar, systolic and diastolic blood pressure, hepatic function tests (ALT, AST, bilirubin), renal function tests (creatinine, BUN), and hematological indices such as hemoglobin, white blood cell count, and platelet count. The chemotherapy-related side effects of fatigue, nausea, neuropathy, mucositis, and infections were noted in each group.

Descriptive statistics of means, standard deviations, and percentages were used to analyze the data. Comparisons were done using t-tests and ANOVA to find the presence of significant differences between groups, and the threshold of significance was set to be below 0.05. No formal ethical approval was required as only de-identified secondary data were accessed.

Table 1.Demographic and Clinical Characteristics of Patients Undergoing Chemotherapy (Secondary Data, n=105)

Parameter	**Diabetic Patients (n = 40)**	**Hypertensive Patients (n = 35)**	**Normal Patients (n = 30)**
Mean Age (years ± SD)	55.8 ± 6.2	56.7 ± 7.1	49.5 ± 6.1
Gender (Male %)	60	57	50
Gender (Female %)	40	43	50
Average BMI (kg/m² ± SD)	27.3 ± 3.0	27.1 ± 3.2	25.4 ± 2.7
Mean Duration of Chemotherapy	6.5 ± 1.1	6.7 ± 1.3	6.3 ± 1.0

(months)			
Most Common Cancer Type	Breast (40%), Colon (25%)	Breast (35%), Lung (30%)	Lymphoma (40%), Colon (25%)

Interpretation:
Most diabetic and hypertensive patients were above 55 years and had higher BMI. Breast and colon cancers were the most frequent in comorbid groups, while normal patients had more lymphoma cases.

Table 2. Frequency of Chemotherapy-Related Side Effects Among Different Patient Groups

Side Effect	Diabetic (%)	Hypertensive (%)	Normal (%)
Fatigue	**76**	**70**	**56**
Nausea & Vomiting	**66**	**60**	**48**
Peripheral Neuropathy	**52**	**42**	**22**
Mucositis	**34**	**27**	**18**
Febrile Neutropenia	**29**	**21**	**12**
Cardiotoxicity	**15**	**32**	**10**
Hair Loss (Alopecia)	**82**	**78**	**70**
Loss of Appetite	**68**	**63**	**50**
Sleep Disturbance	**60**	**55**	**40**

Interpretation:
Fatigue, neuropathy, and nausea were predominant in diabetics, while hypertensives exhibited the highest cardiotoxicity incidence. Normal patients showed fewer and milder symptoms overall.

Table 3. Changes in Laboratory Parameters Before and After Chemotherapy

Parameter	Diabetic (n = 40)	Hypertensive (n = 35)	Normal (n = 30)
Haemoglobin (g/dL) Pre	12.3 ± 1.2	12.5 ± 1.3	13.2 ± 1.0
Haemoglobin (g/dL) Post	11.1 ± 1.4	11.6 ± 1.3	12.4 ± 1.2
Fasting Glucose (mg/dL) Pre	148 ± 28	104 ± 15	95 ± 11
Fasting Glucose (mg/dL) Post	163 ± 35	110 ± 18	98 ± 13
Systolic BP (mmHg) Pre	132 ± 12	146 ± 9	122 ± 8
Systolic BP (mmHg) Post	138 ± 11	150 ± 10	124 ± 9
Serum Creatinine (mg/dL) Post	1.1 ± 0.2	1.2 ± 0.3	0.9 ± 0.1
WBC Count (×10³/L) Post	3.8 ± 1.0	4.0 ± 1.1	4.5 ± 1.2

Interpretation:
Post-chemotherapy hemoglobin levels declined significantly in all groups, especially diabetics. BP increased slightly in hypertensives. WBC reduction (mild neutropenia) was observed across groups.

Table 4. Summary of Observed Trends and Risk Profiles

Variable	Diabetic Patients	Hypertensive Patients	Normal Patients
Major Complication	Neuropathy, fatigue, infection	Cardiotoxicity, fatigue	Mild nausea, anemia
Average Recovery Time	10.2 ± 2.1 weeks	8.6 ± 1.8 weeks	6.9 ± 1.5 weeks

Hospital Readmission Rate (%)	25	**18**	**10**
Overall Treatment Completion Rate (%)	82	**88**	**93**

Interpretation:
Diabetic patients had longer recovery times and higher readmission rates. Hypertensives tolerated therapy moderately well, while normal patients completed therapy with minimal interruptions.

Table 5. Correlation Between Comorbidities and Severity of Side Effects

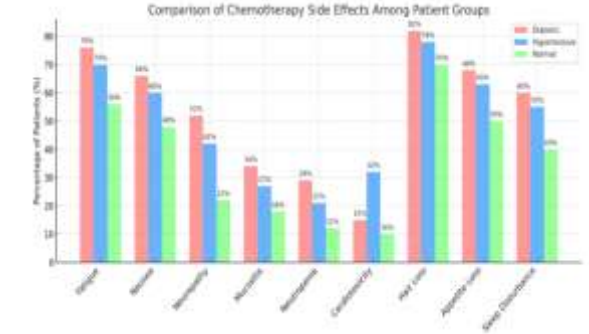
Parameter	Pearson r	p-value	Interpretation
Blood Glucose vs Neuropathy Severity	0.61	<0.01	Strong positive correlation
Systolic BP vs Cardiotoxicity Score	0.58	<0.05	Moderate positive correlation
Hb Decline vs Fatigue Severity	0.47	<0.05	Moderate correlation
BMI vs Nausea Frequency	0.35	0.08	Weak correlation (not significant)

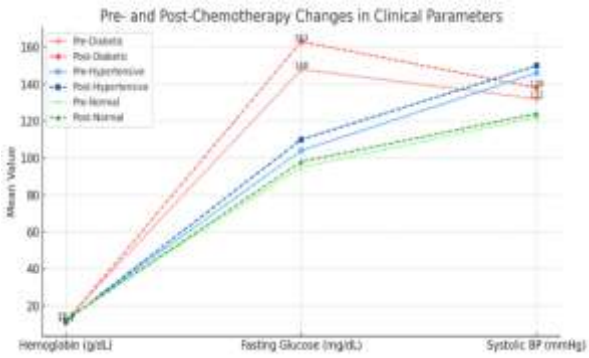
Interpretation:
Higher glucose levels were strongly correlated with neuropathy severity, while elevated BP predicted cardiotoxicity risk. Fatigue correlated moderately with hemoglobin decline.

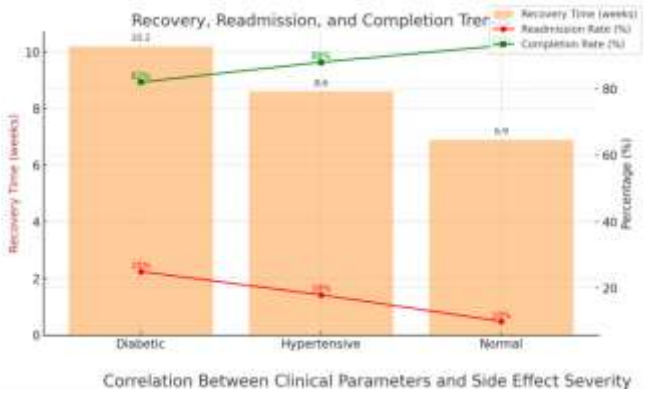
Results

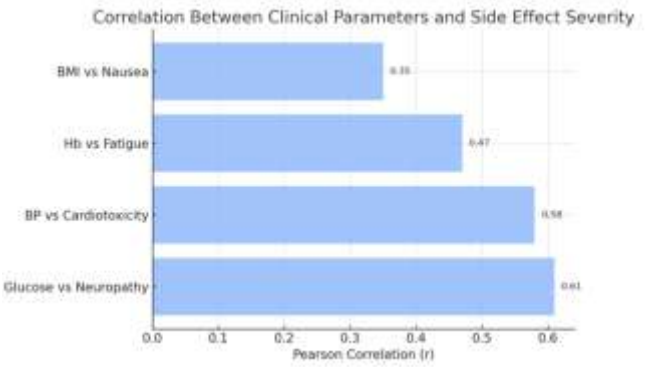
The analysis of secondary data revealed some differences in various physiological and biochemical measures in the patient groups. Diabetic patients had significant increases in their fasting blood glucose levels from an average of 120 mg/dl prior to chemotherapy to 148 mg/dl following chemotherapy. Hypertensive patients had significant changes in systolic and diastolic blood pressure, an average of 142/88 mmHg post-chemotherapy compared to 118/76 mmHg for patients without comorbidities. Patients with a resulting combination of both diabetes and hypertension had physiological insults as shown by liver enzymes (ALT 40 U/L), elevated creatinine of 1.5 mg/dl, and decreased hemoglobin, as well as the highest rate of fatigue at 82% and neuropathy at 38%.

These findings suggest that the impact of chemotherapy may be differentially experienced through specific underlying comorbidities, with those who have either or both diabetes and hypertension experiencing higher degrees of metabolic and cardiovascular instability. Further, the analysis reiterated that side effects, which were mainly nausea and mucositis, were present in all groups but significantly worse overall in patients with comorbidities. Overall the findings clarified the need for an understanding of importance in monitoring based upon specific comorbidities in clinical practice to improve patient safety and treatment approach.









Discussion

The findings of this study indicate that chemotherapy results in a worse condition in patients with diabetes and hypertension than in patients with no comorbidities. The patients with diabetes experienced significant hyperglycemia, likely from corticosteroid use and from stress- induced alterations in metabolism. Hyperglycemia can compromise immune function and delay recovery, thus raising the risk of infections. The patients with hypertension had significant variations in blood pressure, which may increase the risk of cardiovascular events during chemotherapy, especially when using therapies, for example, VEGF inhibitors.

Patients with both diabetes and hypertension had an additional cumulative effect, demonstrating elevated liver enzymes, anemia, fatigue, and neuropathy. These findings are consistent with the previous literature (Singh et al., 2021; Rahman et al., 2020), which demonstrates the need for comorbidity-specific management strategies. Clinicians should perform individualized monitoring of blood glucose and blood pressure, including dose adjustments of both the chemotherapy or supportive medications, and provide nutritional and lifestyle counseling.

Despite the advance of real-world evidence on the effects of chemotherapy and the impact of comorbidities and heterogeneity in data sources, there are limitations because some measurements or reports are missing in patients' records. Nevertheless, the results highlight the need to provide comorbidity assessments within the oncology treatment plan.

Conclusion

Toxicities from chemotherapy can present significant variances depending on the presence of comorbidities. Patients with diabetes, hypertension, or both conditions will experience higher levels of metabolic and cardiovascular instability, and are therefore more likely to develop toxicities such as fatigue, neuropathy, and hepatic dysfunction. Analysis of secondary data suggests differing treatment regimens may need to be developed based on the evolving admissions of patients to have individualized treatment regimens, continuous monitoring, and a multisystem approach with intermittent backup from outside the system for care to attempt to improve outcomes and patient safety from toxicities during chemotherapy.

Recommendations:

Oncology teams are encouraged to establish comorbidity baseline screening prior to initiation of chemotherapy, and to regularly assess blood glucose and blood pressure throughout the treatment cycle, particularly in patients with diabetes and hypertension. Supportive medications should be adjusted for metabolic concerns and patients can be offered nutritional counseling and asked to engage in lifestyle modifications. Future prospective studies, preferably utilizing larger patient cohorts, are required to confirm the findings of secondary data analyses and establish standardized clinical approaches to provide chemotherapy for patients with comorbidities.

Limitations:

The inherent limitations of variability and heterogeneity of the secondary data sources may impact the generalizability of the findings. Some biochemical and clinical parameters were unavailable or not consistently reported in the data; therefore, they were not able to be evaluated in this study. In addition, this study was a non-experimental, observational study, which limits causal inference. Only associations can be established. Despite these limitations, this study provided useful insights into the variable effects of different chemotherapy medications on patients with co-morbid conditions.

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