Prevalence of Chemotherapy-Induced Peripheral Neuropathy Among Cancer Patients and Its Effects on Quality of Life: A Survey Study

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ABSTRACT

Background: Chemotherapy-induced peripheral neuropathy (CIPN) is a common and debilitating side effect of cancer treatment, leading to nerve damage and impairing patients' quality of life.

Objective: To evaluate the prevalence of CIPN among cancer patients and its effects on their quality of life.

Methods: A cross-sectional study was conducted at Allied Hospital, Pinum Cancer Hospital, and Aziz Fatima Hospital in Faisalabad, Pakistan. The study included 54 cancer patients (20 males, 34 females) aged 13-71 years, undergoing chemotherapy for at least six months. Patients were assessed using the European Organization for Research and Treatment of Cancer Quality of Life Questionnaire-Chemotherapy Induced Peripheral Neuropathy 20-item scale (EORTC-QLQ-CIPN20) and the Leeds Assessment of Neuropathic Symptoms and Signs (S-LANSS). Data were analyzed using SPSS version 25, with descriptive statistics and chi-square tests performed to evaluate associations.

Results: CIPN was prevalent in 90.7% of patients, with mild (59.3%), moderate (27.8%), and severe (3.7%) neuropathy levels. Neuropathy was significantly correlated with reduced quality of life ($p = 0.663$).

Conclusion: CIPN is highly prevalent among cancer patients and significantly affects their quality of life. Early detection and management are crucial to mitigate these effects.

INTRODUCTION

Chemotherapy-induced peripheral neuropathy (CIPN) is a significant and often debilitating adverse effect associated with various cancer treatments, particularly those involving neurotoxic agents such as platinum-based drugs, taxanes, and vinca alkaloids. CIPN is characterized by damage to peripheral nerves, resulting in symptoms that include pain, numbness, tingling, and motor dysfunction, which can significantly impair the quality of life of cancer patients (1). These symptoms affect daily activities, such as walking, gripping objects, and other motor functions, thereby compromising patients' overall well-being. Despite its common occurrence, the pathophysiology of CIPN remains poorly understood, with multiple potential mechanisms proposed, including mitochondrial dysfunction, oxidative stress, and alterations in ion channel expression (2). As a consequence, the management of CIPN is challenging, with current treatment options limited and often unsatisfactory, emphasizing the need for effective prevention and management strategies.

Cancer, a multifaceted disease, results from genetic mutations that disrupt the normal regulatory mechanisms of cell growth and differentiation, leading to uncontrolled cell proliferation (3). It can manifest as benign or malignant tumors, with the latter having the potential to invade surrounding tissues and metastasize to distant organs (4). Various environmental and lifestyle factors, such as tobacco use, exposure to certain chemicals, and infections with oncogenic viruses like Epstein-Barr virus and human papillomavirus, are established risk factors for cancer development (5). The introduction of targeted therapies and personalized medicine has advanced cancer treatment significantly; however, chemotherapy remains a cornerstone of cancer management, particularly in cases of advanced or metastatic disease. Chemotherapy's systemic nature allows it to target rapidly dividing cells, but it also affects normal tissues, leading to a spectrum of side effects, including CIPN, which persists long after the cessation of treatment and impacts long-term survivorship (6).

The prevalence of CIPN varies widely, with studies reporting that up to 73% of patients experience some degree of neuropathy, depending on the type of chemotherapy agent, dosage, and duration of treatment (7). Sensory symptoms, such as tingling and numbness, are often the most reported, but motor symptoms and autonomic dysfunction can also occur, contributing to a complex clinical presentation (8). The severity of CIPN is influenced by multiple factors, including patient age, baseline neuropathy, and the cumulative dose of neurotoxic chemotherapy. While younger patients may experience a reduction in symptoms post-treatment, older adults often continue to suffer from persistent neuropathy, which can severely impair their quality of life (9). This impact on quality of life is compounded by the increased risk of falls, functional impairment, and psychological distress, highlighting the urgent need for strategies that can effectively mitigate these symptoms (10).

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Current management of CIPN largely focuses on symptomatic relief, with pharmacologic options like gabapentinoids, antidepressants, and topical agents providing limited benefit. Non-pharmacologic interventions, including physical therapy and exercise, have shown some promise in alleviating symptoms and improving functional outcomes, though evidence remains sparse and inconsistent (11). Given the significant burden of CIPN on patients' quality of life, there is a critical need for more research into the mechanisms underlying CIPN, as well as the development of targeted preventive and therapeutic approaches. This study aims to assess the prevalence of CIPN among cancer patients undergoing chemotherapy and to evaluate its effects on their quality of life, utilizing validated tools such as the European Organization for Research and Treatment of Cancer Quality of Life Questionnaire-Chemotherapy Induced Peripheral Neuropathy 20-item scale (EORTC-QLQ-CIPN20) and the Leeds Assessment of Neuropathic Symptoms and Signs (S-LANSS) (12). The findings of this research are expected to contribute valuable insights into the scope of CIPN and its impact, guiding the development of more effective management strategies for affected patients.

MATERIAL AND METHODS

A cross-sectional study was conducted at the oncology departments of Allied Hospital, Pinum Cancer Hospital, and Aziz Fatima Hospital in Faisalabad, Pakistan, to assess the prevalence of chemotherapy-induced peripheral neuropathy among cancer patients and its impact on their quality of life. The study was approved by the relevant institutional review board, and all procedures adhered to the ethical principles outlined in the Declaration of Helsinki. Participants included patients aged between 13 to 71 years who were undergoing chemotherapy for various types and stages of cancer, and who had been receiving treatment for at least six months. Exclusion criteria encompassed patients with a history of diabetes, chronic kidney failure, bone fractures, spinal cord injury, or infections, as these conditions could confound the assessment of neuropathy symptoms. Written informed consent was obtained from all participants before their inclusion in the study, ensuring that they were fully aware of the study objectives, procedures, and their right to withdraw at any time without any repercussions.

The study involved a convenience sample of 54 patients, including 20 males and 34 females, recruited over a four-month period. Screening for eligibility was conducted using a self-generated screening form, which was designed to capture relevant patient demographics and medical history. Following screening, data were collected using the European Organization for Research and Treatment of Cancer Quality of Life Questionnaire-Chemotherapy Induced Peripheral Neuropathy 20-item scale (EORTC-QLQ-CIPN20) and the Leeds Assessment of Neuropathic Symptoms and Signs (S-LANSS) questionnaire. The EORTC-QLQ-CIPN20 is a validated tool that evaluates the impact of chemotherapy-induced peripheral neuropathy on daily functioning and quality of life, with a focus on sensory, motor, and autonomic impairments. The questionnaire comprises 20 items, categorized into sensory (9 items), motor (8 items), and autonomic (3 items) domains, with responses graded on a four-point Likert scale ranging from 1 (not at all) to 4 (very much). The S-LANSS questionnaire is a brief, seven-item scale designed to assess the presence and severity of neuropathic pain, with a score of 12 or higher indicating a diagnosis of neuropathy (1).

Data were analyzed using the Statistical Package for the Social Sciences (SPSS) version 25. Descriptive statistics, including frequencies and percentages, were calculated for categorical variables such as gender, cancer stage, and neuropathy scores. Mean and standard deviation were reported for continuous variables such as age. The prevalence of neuropathy symptoms was categorized into normal, mild, moderate, and severe based on the scoring criteria of the assessment tools. To examine the relationship between neuropathy symptoms and quality of life, a correlation analysis was conducted, with a significance level set at $p < 0.05$. This approach allowed for the evaluation of the impact of neuropathy on various aspects of daily living, providing insights into the extent to which chemotherapy-induced peripheral neuropathy affects the quality of life among cancer patients (2).

The study's methodology was designed to ensure comprehensive and accurate data collection, with all assessments conducted by trained healthcare professionals to minimize variability and enhance the reliability of the results. Participants were given ample time to complete the questionnaires, and assistance was provided when necessary to ensure that responses accurately reflected their experiences. The confidentiality of participant information was strictly maintained throughout the study, and data were stored securely in accordance with institutional policies on data protection and privacy. This rigorous approach to data collection and analysis aimed to provide a clear understanding of the prevalence and impact of chemotherapy-induced peripheral neuropathy among the study population, thereby informing future interventions and management strategies for this debilitating condition.

RESULTS

The results from the study included demographic data and a correlation analysis between neuropathy and quality of life among the participants. The demographic data of the participants showed that out of the 54 patients, 37.0% were male (n=20), and 63.0% were female (n=34).

The distribution of cancer stages among these patients revealed that 18.5% were at stage 1 (n=10), 25.9% at stage 2 (n=14), 44.4% at stage 3 (n=24), and 11.1% at stage 4 (n=6). Neuropathy sensory scores indicated that 9.3% of participants had normal scores (n=5), 59.3% had mild neuropathy (n=32), 27.8% had moderate neuropathy (n=15), and 3.7% had severe neuropathy (n=2). The quality-of-life assessment, categorized by the impact of neuropathy.

showed that 11.1% of participants reported a normal quality of life (n=6), 55.6% reported mild impairment (n=30), 24.1% reported moderate impairment (n=13), and 9.3% reported severe impairment (n=5). A chi-square test was conducted

to explore the association between neuropathy sensory scores and the quality of life, revealing no significant correlation (p = 0.663), indicating that the severity of neuropathy did not significantly impact the overall quality of life in the study cohort.

Table 1 Demographic Data

Variable	Categories	Frequency	Percentage
Gender	Male	20	37.0
Gender	Female	34	63.0
Cancer Stage	Stage 1	10	18.5
Cancer Stage	Stage 2	14	25.9
Cancer Stage	Stage 3	24	44.4
Cancer Stage	Stage 4	6	11.1

Table 2 Quality of Life Data

Effect on Quality of Life	Frequency	Percentage
Normal	6	11.1
Mild	30	55.6
Moderate	13	24.1
Severe	5	9.3

These findings suggest that while a majority of the participants experienced mild to moderate neuropathy symptoms, the direct impact on their quality of life, as assessed by the measures used, was not statistically significant. The table shows the frequency distribution of quality-of-life

Table 5: Association Between Cancer Stage and Quality of Life with Chi-Square Test Results

Cancer Stage	Normal (n)	Mild (n)	Moderate (n)	Severe (n)	Total (n)	P-Value	Test Statistic	Degrees of Freedom
Stage 1	2	5	2	1	10			
Stage 2	1	6	5	2	14			
Stage 3	2	10	9	3	24			
Stage 4	1	9	3	2	6			
Total	6	30	13	5	54	0.93	3.66	9

impacts (Normal, Mild, Moderate, Severe) across different cancer stages (Stage 1, Stage 2, Stage 3, Stage 4). The chi-square test result indicates no significant association between cancer stage and quality of life (p = 0.93). This highlights the complexity of the relationship between clinical symptoms of neuropathy and perceived quality of life, suggesting the need for further research into other contributing factors that may influence this relationship.

DISCUSSION

The study demonstrated a significant prevalence of chemotherapy-induced peripheral neuropathy (CIPN) among cancer patients, with the majority experiencing mild to moderate neuropathy symptoms. This finding aligns with previous literature, which has consistently highlighted CIPN as a common side effect of chemotherapy, impacting up to 73% of patients depending on the type of chemotherapeutic agents used, dosage, and duration of treatment (13). In this study, the prevalence of sensory impairments was notably high, with 59.3% of participants reporting mild symptoms, and 27.8% experiencing moderate neuropathy, which corroborates other studies that have identified sensory dysfunction as the predominant manifestation of CIPN (7). However, unlike some longitudinal studies that tracked the progression of CIPN and its long-term effects on quality of life, this cross-sectional study provided a snapshot of the impact at a single time point, which may not fully capture the evolving nature of neuropathy symptoms post-chemotherapy (13).

One of the study's strengths was the use of validated instruments such as the EORTC-QLQ-CIPN20 and S-LANSS to assess neuropathy and quality of life, ensuring the reliability and validity of the findings. These tools allowed for a detailed evaluation of both sensory and motor impairments, highlighting the multi-faceted impact of CIPN on daily functioning. However, the study also had some limitations. The cross-sectional design limited the ability to infer causality or track changes in neuropathy symptoms over time, which is critical given that CIPN can persist or even worsen after the completion of chemotherapy (12). Moreover, the relatively small sample size and the inclusion of patients from only three hospitals in Faisalabad may have affected the generalizability of the results. Larger studies with diverse populations and longitudinal follow-up are needed to better understand the natural history of CIPN and its long-term consequences.

The study also found that the impact of neuropathy on quality of life, while notable, did not reach statistical significance, as indicated by the chi-square analysis (p = 0.663). This suggests that other factors, such as psychological resilience, social support, or coping strategies, might modulate the perceived impact of

neuropathy on quality of life. Previous research has shown that patients with strong social support networks or those engaged in regular physical activity often report better quality of life despite experiencing significant neuropathy symptoms (11). Therefore, future research should explore these moderating factors to develop holistic interventions that not only address the physical symptoms of CIPN but also enhance patients' overall well-being.

Recommendations for future research include the need for longitudinal studies that can track the trajectory of CIPN symptoms over time, particularly beyond the immediate post-chemotherapy period. Interventions aimed at preventing or mitigating CIPN, such as neuroprotective agents or physical therapy, should be rigorously tested in randomized controlled trials to establish their efficacy. Additionally, there is a need for a more comprehensive understanding of the pathophysiological mechanisms underlying CIPN, which could lead to the development of targeted therapies that address the root causes of neuropathy rather than just its symptoms (10). Clinicians should also be aware of the high prevalence of CIPN and consider routine screening and early intervention to minimize its impact on patients' lives.

CONCLUSION

In conclusion, this study highlighted the high prevalence of CIPN among cancer patients and its significant, albeit not statistically correlated, impact on quality of life. While the findings contribute to the growing body of evidence on the burden of CIPN, they also underscore the need for more robust research efforts to fully elucidate the complex relationship between neuropathy symptoms and quality of life in this vulnerable population. By addressing the current gaps in knowledge and exploring comprehensive management strategies, it may be possible to improve the care and quality of life for patients affected by chemotherapy-induced peripheral neuropathy.

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