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Original Article

Assessment of Chemotherapy-Induced Peripheral Neuropathy and its Impact on Health-Related Quality of Life among Various Cancer Patients

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ABSTRACT

Background: Cancer patients' Health-Related Quality of Life (HRQOL) could be substantially impaired by Chemotherapy-Induced Peripheral Neuropathy (CIPN). Hence, the present study is aimed to assess the prevalence of CIPN and its influence on HRQOL among various cancer patients. **Materials and Methods:** The study was a prospective observational cross-sectional study conducted in the Department of Medical Oncology, Sri Ramachandra Institute of Higher Education and Research (DU) from Jan 2023 to July 2023. A total of 125 patients treated with various chemotherapeutic drugs were included as per inclusion and exclusion criteria. Patients were evaluated for CIPN using a validated Self-Administered Leeds Assessment of Neuropathic Symptoms and Signs (SLANSS) questionnaire and the health-related quality of life was evaluated by using the European Organization for Research and Treatment of Cancer Chemotherapy-Induced Peripheral Neuropathy (EORTC-CIPN20) questionnaire. **Results:** The prevalence of chemotherapy-induced peripheral neuropathy was found to be 12%. Patients receiving chemotherapy experienced a significantly higher number of peripheral neuropathy-related complaints ($p<0.001$). Overall, the patients expressed that peripheral neuropathy had a detrimental impact on their quality of life, particularly with sensory and motor functions. **Conclusion:** Chemotherapeutic drug has the potential to cause the adverse effect of peripheral neuropathy. Particularly, antimetabolites and platinum derivative combination had reported a higher incidence of peripheral neuropathy (94.7%). Consequently, it has a detrimental impact on the health-related quality of life among cancer patients.

Keywords: CIPN, Platinum, Taxane, Cisplatin, Paclitaxel, Vincristine.

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INTRODUCTION

Chemotherapy-Induced Peripheral Neuropathy (CIPN) is a prevalent side effect often associated with chemotherapeutic drugs. A significant percentage of cancer patients receiving treatment with neurotoxic chemotherapeutic medicines, such as taxanes, platinum-based medications, vinca alkaloids and bortezomib, are at risk for developing CIPN after receiving chemotherapy.[1,2] Almost 71% to 96% of chemotherapy patients will acquire CIPN within one month.[3] CIPN prevalence depends on the chemotherapeutic agent, dosage and duration.[4] Cancer patients' Health-Related Quality of Life (HRQOL) could be substantially impaired by CIPN. Physical symptoms like pain, numbness, tingling and loss of sensation emerged from CIPN, compromising routine tasks and overall well-being. In addition, CIPN could interfere with psychological and social function of patient. To the best of our knowledge, this study could have been helpful for healthcare providers in identifying chemotherapy-induced peripheral neuropathy and enhancing patient outcomes.[5] This study aimed to assess the prevalence of CIPN and its influence on HRQOL among a diverse population of cancer patients.

MATERIALS AND METHODS

A prospective observational cross-sectional study was conducted in the Department of Medical Oncology at Sri Ramachandra Institute of Higher Education and Research (Deemed University). Ethical permission to conduct the study was obtained from the Institutional Ethics Committee, Sri Ramachandra Institute of Higher Education and Research (DU)-Ref.no: IEC CSP/22/DEC/119/604. Patients who visited the outpatient department

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for receiving chemotherapy between January 2023 and July 2023 and were treated with various chemotherapeutic drugs were included in the study. Patients with other comorbid conditions potentially causing CIPN such as diabetes, thyroid disease, or pre-existing neuropathy and alcoholics were excluded from the study. Patients gave informed consent before participating in the study. Demographic details were collected and evaluated for CIPN by using the validated questionnaire such as S-LANSS and physical examinations like primary sensory modalities and secondary sensory modalities (pinprick test, pain/temperature, joint position sense, vibration, graphesthesia, stereognosis, two-point discrimination, point localization) were done for the patients. EORTC-CIPN20 was used to evaluate the CIPN-health-related quality of life among various cancer patients.

S-LANSS (The Self-Administered Leeds Assessment of Neuropathic Symptoms and Signs)

SLANSS questionnaire is a validated tool for assessing neuropathic pain, particularly in cases of Chemotherapy-Induced Peripheral Neuropathy (CIPN). It consists of 7 items that evaluate symptoms such as burning pain, abnormal sensations like tingling or numbness (paresthesia), pain triggered by non-painful stimuli (allodynia), increased pain sensitivity (hyperalgesia) and pain induced by mild contact or brushing. Patients can self-report these symptoms using the above questionnaire.[6]

EORTC-CIPN 20 (European Organization for Research and Treatment of Cancer Chemotherapy-Induced Peripheral Neuropathy 20-item)

The EORTC-CIPN20 is a validated tool designed for evaluating Chemotherapy-Induced Peripheral Neuropathy (CIPN) and its impact on cancer patients' quality of life. It consists of 20 items that address both the sensory and motor CIPN symptoms. These items assess various aspects of peripheral neuropathy, including sensory symptoms like tingling, discomfort and numbness, as well as motor symptoms like muscular weakness and balance issues.[7]

Each item in the questionnaire is scored on a Likert scale ranging from 1 (not at all) to 4 (very much). The scores are then converted to a scale of 0 to 100, where higher scores indicate more severe symptoms or a greater impact on the patient's quality of life.

Statistical analysis

Data was analyzed using IBM SPSS Statistics for Windows, version 29.0 (Armonk, NY: IBM Corp). Descriptive data were represented as numbers and percentages. The significance between chemotherapeutic drugs, peripheral neuropathy and HRQOL was determined using chi square test and Levene's test, p-value <0.05 were considered as a statistically significant value.

RESULTS

This study was carried out to assess the prevalence of chemotherapy-induced peripheral neuropathy and its impact on health-related quality of life among various cancer patients. In this study, 125 patients who visited the medical oncology department to receive chemotherapy therapy were included. Out of 125 patients, 94 patients had experienced chemotherapy-induced peripheral neuropathy.

Out of 125 participants, 32% of participants were between the age group of 51-60 years, 70% of study participants were female and 98% of participants were married. Nearly 35 % of participants had a familial history of cancer and 70% of participants had no comorbid conditions. Nearly, 81% of study participants belonged to the middle-class category. Table 1 represents the baseline characteristics of patients.

In this study, the majority of the participants (26%) had a diagnosis of breast cancer. Table 2 represents the types of cancer of participants. Stage-wise distribution of cancer of the patients were assessed. Almost 2% of patients had stage 1 cancer, 12% of the patients had stage 2 cancer, 4% of the patients had stage 2a cancer, 8% of the patients had stage 2c cancer, 19% of the patients had stage 3 cancer, 21% of the patients had stage 3c cancer, 26% of the patients had stage 4 cancer, 8% of the patients had stage 4c cancer. The majority of the patients (38%) were diagnosed with stage 3 cancer.

Physical examinations of the patients were done. It was observed that 34% of patients had reduced light touch, 60% of patients had reduced pain/temperature, 28% of patients had reduced joint position sense, 62% of patients had reduced vibration sense, 46% of patients had reduced graphathesia, 13% of patients had reduced sterognosis, 32% of patients had reduced two-point discrimination sense, 29% of patients had reduced point localization sense. Conversely, sensory Health-Related Quality of Life (HRQOL) worsened in 66% of the participants, while motor HRQOL worsened in 98% of the study participants. Additionally, 49% of the study participants experienced a worsened autonomic HRQOL. The frequency and percentage distribution of S-LANSS Score for various chemotherapeutic drug regimens were depicted in Table 3. Table 3 shows the association between chemotherapy and SLANSS score. The highest percentage of association between chemotherapy and SLANSS score was observed for "Antimetabolites+Platinum derivatives" (94.7%). The chi-square test showed a significant result (p=0.0001). The frequency, mean and standard deviation of S-LANSS Score and EORTC-CIPN20 Score were depicted in Table 4 and it shows the association of S-LANSS and EORTC-CIPN20.

Table 1: Baseline characteristics of patient.

Variables	No. of Participants (*N*=125)	Percentage of participants (%)
Age in years		
21-30 years	5	4
31-40 years	13	10
41-50 years	32	26
51-60 years	40	32
61-70 years	21	17
71-80 years	13	10
80-90 years	1	1
Gender		
Male	38	30
Female	87	70
Marital Status		
Married	123	98
Unmarried	2	2
Family History		
Mother	25	16
Father	10	8
Grandparents	7	6
Nil	1	70
Comorbid Condition		
HTN	28	22
CVA	1	1
Hypothyroidism	14	11
Multinodular goiter	2	2
S.HTN	5	4
Migraine	2	2
CAD	4	3
HbsAg Positive	2	2
Nil	67	61
Income status		
Upper middle class	24	19
Lower middle class	101	81
Cycle of chemotherapy		
Cycle 2-4	84	67
Cycle 5-7	28	22
Cycle 8-11	13	10

DISCUSSION

In this study, the maximum participants were in the age group of 51-60 (32%). The results were in accordance with the study conducted by Bonhof CS *et al.*, which included 100 patients and the author revealed that the maximum number was in the age group of 50-60 years.[8]

In this study, the maximum participants were females (70%) when compared to male participants. The results were in similar to the study conducted by Driessen CM *et al.*, which included

Table 2: Types of cancer of participants.

Sl. No.	Types of cancer	No. of Participants (*n*=125)	Percentage of participants (%)
1.	Breast cancer	33	26
2.	Buccal cancer	5	4
3.	Colon cancer	21	16
4.	DLBCL (Non Hodgkin lymphoma)	5	4
5.	Endometrial cancer	14	11
6.	Ewing sacrum sarcoma	3	2
7.	Gall bladder cancer	3	2
8.	Gastric cancer	10	8
9.	Germ cell	4	3
10.	Hodgkin lymphoma	2	2
11.	Laryngeal cancer	1	1
12.	Lung cancer	19	15
13.	Multiple myeloma	2	2
14.	Nasopharyngeal cancer	1	1
15.	Oropharyngeal cancer	2	2
16.	Oro esophageal cancer	3	2
17.	Ovarian cancer	9	7
18.	Pancreatic cancer	3	2
19.	Rectal cancer	4	3
20.	Renal cancer	2	2
21.	Urinary bladder cancer	3	2

Table 3: Association between chemotherapy Protocol and SLANSS score

Sl. No.	Chemotherapeutic Drug	S-LANSS		*p*-Value Significant (<0.05)
		Yes	No	
1.	Antibiotics	16.7%	83.3%	0.20
2.	Antibiotics+Alkylatingagent.	71.4%	28.6%	0.003
3.	Antimetabolites	60.0%	40.0%	0.001
4.	Antimetabolites+Platinum derivatives.	94.7%	5.3%	0.0001
5.	Monoclonal antibodies.	34.8%	65.2%	0.05
6.	Platinum derivatives.	90.9%	9.1%	0.0001
7.	Taxane+Platinum derivatives.	91.7%	8.3%	0.0001
8.	Taxane+Alkylating agents.	60.0%	40.0%	0.001
9.	Taxane derivative.	82.6%	18.8%	0.0001
Total average		75.2%	24.8%	

143 patients and the author revealed that the majority of the participants were female participants 50%.[9] According to this study, the majority of the study participants were married (98%). The results were in accordance with the study conducted by Hung HW *et al*, which included 93 patients were participated. Out of which 70% were married.[10]

In this study, the maximum participants were literate and degree holders (65%). The results were in accordance with the study conducted by Bonhof CS, *et al.* which included 500 colorectal cancer patients, which included and the author revealed that the majority of the participants had a higher education qualification of 62%.[8] According to this study, the majority of the participants

Table 4: Association of S-LANSS and EORTC-CIPN.

S-LANSS		N	Mean±Std. Deviation	*p*-Value Significant (<0.05)
EORTC -SS	Worsen HRQOL	94	10.04±3.61	0.002
	Better HRQOL	31	7.87±1.76	0.100
EORTC-MS	Worsen HRQOL	94	18.04±3.50	0.0001
	Better HRQOL	31	12.71±5.17	0.100
EORTC -AS	Worsen HRQOL	94	4.73±1.93	0.210
	Better HRQOL	31	3.19±0.91	0.0001

were diagnosed with breast cancer (26%). The results were in accordance with the study conducted by, Muller J *et al.*, which included 170 participants. Out of which 74% of the study participants were diagnosed with breast cancer.[11]

In this study, most of the participants had worsened sensory peripheral neuropathy (66%) and motor peripheral neuropathy (98%) when compared to autonomic peripheral neuropathy. The results were in accordance with the study conducted by Bonhof CS, *et al.*, which included 143 patients and the author revealed that the majority of the participants had worsened sensory and motor peripheral neuropathy after receiving chemotherapy.[8] According to this study, most of the study participants had received chemotherapy cycles 2-4(67%). The results were in accordance with the study conducted by Prieto-Callejero B and *et al*, which includes 110 breast cancer patients and the author revealed that most of the participants had completed their chemotherapy cycle-1, cycle-2 and cycle-4.[12]

In this study, the health-related quality of life of cancer patients was significantly impaired due to chemotherapy-induced peripheral neuropathy. The results were in accordance with the study conducted by Shimozuma K *et al.*, which included 300 patients and the author revealed that the severity of patient-reported Chemotherapy-Induced Peripheral Neuropathy (CIPN) was significantly higher in those receiving single-agent adjuvant taxane treatment compared to those who underwent Adriamycin and Cyclophosphamide followed by taxane treatment.[13] In this research, out of 125 participants, 60% of the study participants had reduced vibration and pain sense. The results were similar to the study conducted by Kneis S *et al.*, which included 37 patients. Out of which 28 participants had reduced vibration sense.[14]

This study provides important information about the prevalence of CIPN, which can help raise awareness among healthcare professionals and patients and guide better management strategies. The study identified a significant correlation between the severity of CIPN and reduced Health-Related Quality of Life (HRQOL), which highlights the potential impact of CIPN on patients' well-being.

Recall bias, as patient-reported data on CIPN symptoms and Health-Related Quality of Life (HRQOL) can be influenced by their ability to recall past experiences accurately. As the study is cross-sectional design, it lacks follow-up data, preventing the assessment of changes in CIPN severity and Health-Related Quality of Life (HRQOL) over time. Further research and intervention strategies should be explored to address this distressing side effect and enhance the patient's quality of life.

CONCLUSION

In conclusion, the prevalence of Chemotherapy-Induced Peripheral Neuropathy (CIPN) was found to be 12% among a diverse group of cancer patients. There was a notably higher occurrence of peripheral neuropathy among the patients who received a combinatorial therapy of antimetabolite and platinum derivatives (94%). Additionally, a significant correlation was observed between the severity of CIPN and a decline in Health-Related Quality of Life (HRQOL). These findings emphasize the importance of early detection and management of CIPN to improve the overall well-being and quality of life of cancer patients undergoing chemotherapy.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

ABBREVIATIONS

HRQOL: Health-Related Quality of Life; **CIPN:** Chemotherapy-Induced Peripheral Neuropathy; **SLANSS:** Self-Administered Leeds Assessment of Neuropathic Symptoms and Signs; **EORTC-CIPN20:** European Organization for Research and Treatment of Cancer Chemotherapy-Induced Peripheral Neuropathy.

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