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Original Article

The Effect of Chemotherapy on Nerve Conduction Velocity

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ABSTRACT

Introduction- An estimated 20 million new cancer cases were reported in 2025.The WHO predicts over 35 million new cancer cases by 2050, a 77% increase from 22 million cases in 2025. Chemotherapy has revolutionized cancer management by improving survival and offering hope for remission. Chemotherapy induced peripheral neuropathy (CIPN) is one of the most disabling and dose limiting complications, significantly affecting quality of life and treatment adherence.

Aim- The study aims to study the effect of chemotherapy on nerve conduction velocity with electrophysiological parameters. Objectives were to evaluate the nerve conduction velocity in patient receiving chemotherapy & to investigate motor and sensory peripheral nerve conduction abnormalities among patient receiving chemotherapy.

Materials and Methods-The study was conducted on 80 subjects (40 Cases and 40 control).

Results- Statistical comparison of nerve conduction velocity among different drug classes showed significant differences, reaffirming that neurotoxicity is drug-dependent, with platinum and taxanes being most harmful. p-value: 0.003, Statistically significant difference in conduction velocity across chemotherapy drugs.

Conclusion- The significant drop in nerve conduction velocity confirms the effectiveness of electrophysiological testing in early detection and grading of neuropathy. Such objective tools should be employed routinely alongside clinical evaluation to monitor nerve function, guide treatment adjustments and initiate timely intervention.

Keywords: Chemotherapy induced peripheral neuropathy, Nerve Conduction Velocity.

INTRODUCTION

Globally, an estimated 20 million new cancer cases and 9.7 million cancer related deaths were reported in 2022. This translates to about 1 in 5 people developing cancer in their lifetime, with approximately 1 in 9 men and 1 in 12 women dying from the disease. The World Health Organization (WHO) predicts over 35 million new cancer cases by 2050, a 77% increase from the 20 million cases in 2022. Lung cancer is the most diagnosed cancer and the leading cause of cancer death overall and in men worldwide. Cancer remains a major health burden globally and is a leading cause of mortality, with its incidence increasing steadily in countries like India. Chemotherapy has revolutionized cancer management by improving survival and offering hope for remission. Chemotherapy-Induced Peripheral Neuropathy (CIPN) is one of the most disabling and dose-limiting complications, significantly affecting quality of life and treatment adherence.

Sensory symptoms usually develop first in a “glove and stocking” pattern, presenting as numbness, tingling, impaired vibration sensibility, paresthesia and dysesthesias to light touch and warm or cool temperatures (i.e., hyperalgesia and mechanical or thermal allodynia), spontaneous burning, and shooting or electric shock-like pain.

Motor symptoms occur less frequently than sensory symptoms and present as gait and balance disturbances and decreased muscle strength and deep tendon reflexes. Autonomic symptoms occur infrequently, presenting as orthostatic hypotension, constipation, altered sexual and urinary function, Reduced amplitude suggests axonal loss, while slowed conduction indicates demyelination. NCS can detect neuropathy even before symptoms appear.

Despite being a common and disabling side effect, chemotherapy induced peripheral neuropathy remains underdiagnosed and undertreated, especially in regions with limited neurological services. Early detection using nerve conduction studies allow for timely management, which may include dose adjustments, pharmacologic intervention, or rehabilitation.

AIMS AND OBJECTIVES

The present study aims to study the effect of chemotherapy on nerve conduction velocity with electrophysiological parameters.

Objectives-

1. To evaluate the nerve conduction velocity in patients receiving chemotherapy.
2. To investigate motor and sensory peripheral nerve conduction abnormalities among patients receiving chemotherapy.

MATERIALS AND METHODS

The study was conducted on 80 subjects who were referred from Oncotherapy Department OPD of JLN Medical College and attached hospital to Neurophysiology lab at JLN Medical College and attached hospital, Ajmer.

Study Design: Prospective Cross-sectional study

Study Period: 1.5 years (From June 2023 to January 2025)

Place of Study: Neurophysiology Lab at JLN Medical College and Attached Hospital, Ajmer.

Ethical Approval- Prior to conduct the study, institutional Ethical Approval was taken vide Office Order No 2429/ Acad-III/ MCA / 2023

Inclusion Criteria-

1. Subject included-30 years of age or above 30 years of age.
2. Person who have a current or previous history of cancer chemotherapy.
3. Person having symptoms of chemotherapy induced peripheral neuropathy.

Exclusion Criteria

1. Person with history of peripheral neuropathy apparently unrelated to chemotherapy.
2. Person with known risk factors for peripheral neuropathy, such as diabetes mellitus, severe renal failure, liver impairment, and alcoholism.
3. Patients having skin lesion such as leg deformities, leg infection, or leg injuries, which hamper the appropriate setting of the device.
4. Patient who have not given written consent.

Methodology

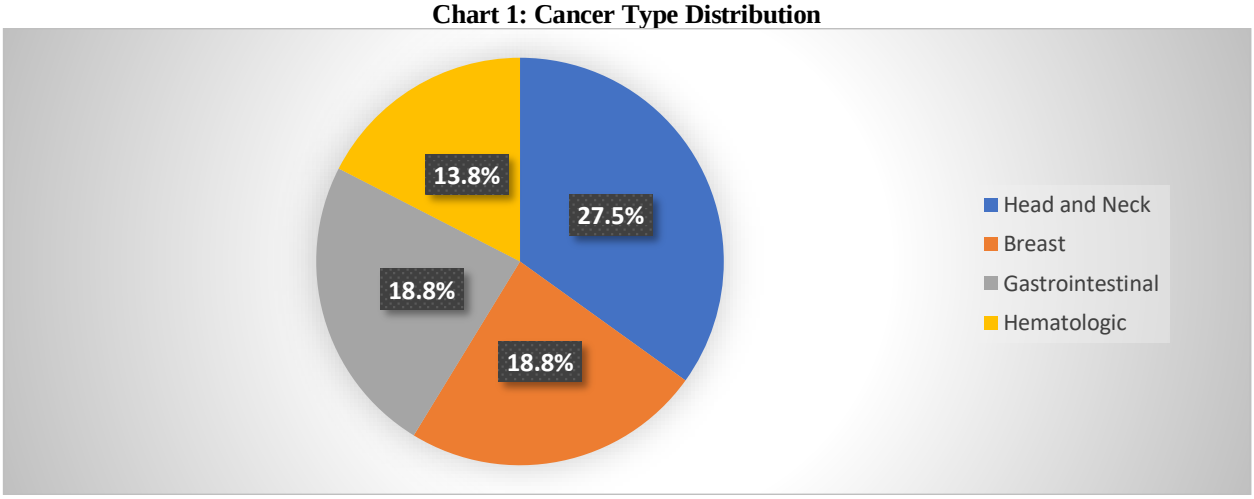
Nerve conduction study was performed on patient who received chemotherapy come from outdoor of JLN Medical College and attached Hospital and those who give consent for electrophysiological study and whole procedure was explained to patient. The Nerve conduction study was performed at room temperature, with normal body temperature on Nerve conduction velocity machine by Recorders and Medicare Systems, model RMS SALUS 4C and software used SPSS 24.

Statistical Analysis

The statistical test used were Chi-square test for association of various factors with respect to nerve conduction test interpretation; unpaired t-test for calculating mean latency, amplitude, and conduction velocity of various nerves; z-test for calculating the confidence interval of latency, amplitude and conduction velocity of various nerves. P-value equal to or less than 0.05 will be considered significant.

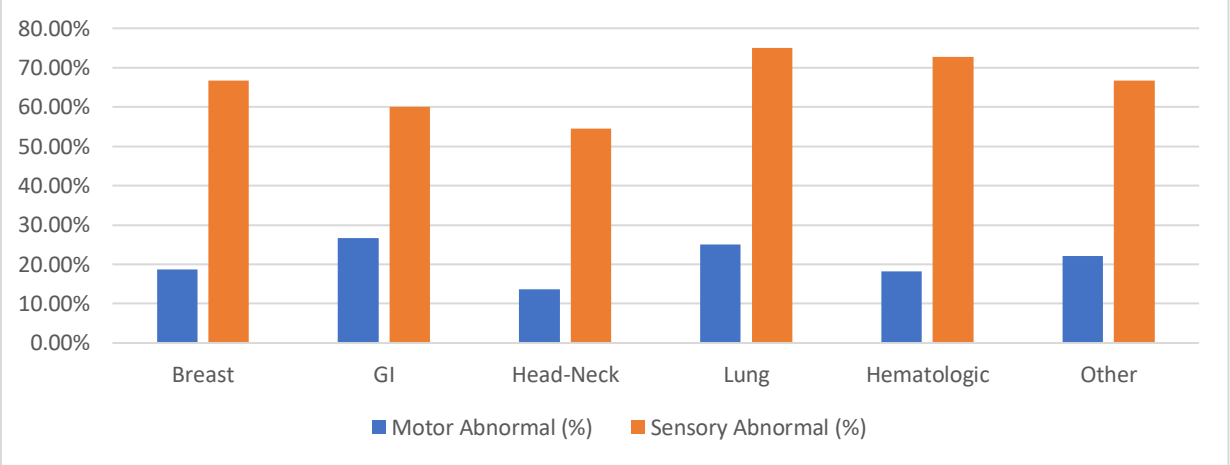
RESULTS

Chart 1: Cancer Type Distribution



This chart outlines cancer types, with head and neck and breast cancers being most common. The chemotherapy protocols for these cancers often include neurotoxic drugs, which correlates with the high CIPN prevalence observed.

Chart 2: Comparison of Motor and Sensory NCS Abnormalities by Cancer Type



Sensory abnormalities were more frequent across all cancer types, with hematologic and lung cancers showing the highest sensory involvement. This may be due to the aggressive regimens used for these malignancies.

Table 1: Chemotherapy Drug Class Distribution

Drug Class	Frequency (n)	Percentage (%)
Taxane	**28**	**35.0%**
Platinum	**22**	**27.5%**
Combination Therapy	**15**	**18.8%**
Proteasome Inhibitors	**8**	**10.0%**
Vinca Alkaloids	**7**	**8.8%**

Texans and platinum compounds were the most frequently used drugs. These agents are well known for their neurotoxic potential, explaining their significant association with nerve conduction abnormalities in the study. Statistically significant difference was observed in conduction velocity across chemotherapy drugs (P-**value**=0.003).

DISCUSSION

Chemotherapy-induced peripheral neuropathy (CIPN) represents a critical clinical challenge in oncology, significantly impacting patient quality of life and often necessitating chemotherapy dose reductions or discontinuation. This neurotoxic side effect arises due to damage caused by various chemotherapeutic agents to the peripheral nervous system, particularly sensory and motor nerve fibers. Our study, conducted on 80 cancer patients receiving chemotherapy at JLN Medical College and attached Hospital, Ajmer, provides an in-depth analysis of the demographic characteristics, clinical manifestations, electrophysiological parameters, and risk factors associated with chemotherapy induced peripheral neuropathy within the Indian population, correlating well with the international literature which resemble this study Nathan P Staff [1] Wolfgang Grisold [2]

The findings highlight that sensory nerve fibers, particularly those of the sural nerve, are most susceptible to chemotherapy-induced damage. Motor involvement, although less pronounced, was also evident in a proportion of patients. Contrary to widely held assumptions, demographic variables such as age, sex, and number of chemotherapy cycles did not show a significant association with neuropathy severity in our cohort. This indicates that genetic predisposition, metabolic factors, or drug-specific mechanisms may be more influential in determining neuropathy risk.

The significant drop in nerve conduction velocity among patients with abnormal nerve conduction studies confirms the effectiveness of electrophysiological testing in early detection and grading of neuropathy. Such objective tools should be employed routinely alongside clinical evaluation to monitor nerve function, guide treatment adjustments, and initiate timely interventions.

Therefore, it is imperative for clinicians, oncologists, and public health professionals to integrate routine screening, patient education, and neuroprotective strategies into cancer care protocols. Doing so will not only improve the quality of life of cancer patients but also ensure better adherence to therapeutic regimens, ultimately enhancing cancer outcomes in the Indian population.

CONCLUSION

The current study clearly establishes that chemotherapy-induced peripheral neuropathy is a common, under-recognized, and clinically significant complication among patients receiving chemotherapy in India. A substantial 62% of the study population demonstrated electrophysiological evidence of neuropathy, correlating well with clinical symptoms and existing literature from both Indian and global contexts.

Limitations

1. The period of study is minimal, huge data would have been collected if done for long time.
2. Study group is just adequate.
3. Serial estimation of the biochemical parameters during the course of hospital stay is not done.
4. Previously undiagnosed cancer patient is not ruled out in the study patients

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