Physicians' Practices in the Diagnosis, Management, and Prevention of Chemotherapy-Induced Peripheral Neuropathy at Khartoum Oncology Hospital, Sudan: A Cross-Sectional Study

Mona M. Taha[1], Riham M. Hamadouk[1,2], Mohamed Thabit Ahmed[3], Elmoiz Babekir[4,5], Mohammed Basendowah[6], Alaa Mousli[6], Mohammed Ahmed Zahrani[7], Sultan Almuallem[6], Khalid A. Ateyyah[8] and Bashir A. Yousef[9,10,*]

[1]*Department of Pharmacy Practice, Faculty of Pharmacy, University of Khartoum, Khartoum, Sudan*

[2]*Department of Clinical Pharmacy and Pharmacy Practice, Faculty of Pharmacy, Almughtaribeen University, Khartoum, Sudan*

[3]*Department of Pharmacology, Faculty of Pharmacy, Omdurman Islamic University, Khartoum, Sudan*

[4]*Department of Emergency Medicine, Faculty of Medicine, Mashreq University, Khartoum, Sudan*

[5]*Department of Medicine and Adult Critical Care Medicine, Ibn Sina College for Medical Studies, Jeddah, Saudi Arabia*

[6]*Department of Surgery, Faculty of Medicine, King Abdulaziz University, Jeddah, Saudi Arabia*

[7]*Department of Medicine, Faculty of Medicine, King Abdulaziz University, Jeddah, Saudi Arabia*

[8]*College of Medicine, Taibah University, Madinah, Saudi Arabia*

[9]*Department of Pharmacology, Faculty of Pharmacy, University of Khartoum, Khartoum, Sudan*

[10]*Department of Clinical Pharmacy and Pharmacology, Ibn Sina National College of Medical Studies, Jeddah, Saudi Arabia*

Abstract: Chemotherapy-induced peripheral neuropathy (CIPN) is a clinically important and potentially dose-limiting toxicity associated particularly with neurotoxic anticancer agents. This study assessed physicians' reported practices regarding CIPN assessment, management, and prevention at Khartoum Oncology Hospital, Sudan. A cross-sectional study was conducted from June to December 2025 among physicians involved in anticancer treatment at Khartoum Oncology Hospital. A total-coverage sampling approach was used, whereby all eligible physicians available during the study period were invited to participate. Data were collected using an expert-reviewed and pilot-tested structured questionnaire. Descriptive and inferential statistics were used according to the study objective to analyze the physicians' responses. A total of 42 physicians participated (response rate: 79.3%); 27 (64.3%) were female, and all were clinical oncologists. Clinical examination was the most frequently reported CIPN assessment approach, used by 32 physicians (76.2%), while 33 (78.6%) reported establishing a baseline assessment before neurotoxic chemotherapy. During chemotherapy, all 42 physicians reported assessing CIPN, and 36 (85.7%) reported assessment before each chemotherapy cycle. When functional nerve impairment developed, 38 (90.5%) reported therapeutic intervention, and 26 (61.9%) considered physical therapy for patients with physical dysfunction. Gabapentin and vitamin B12 were each reported by 38 physicians (90.5%), whereas duloxetine was reported by 4 (9.5%). Only 8 physicians (19.0%) reported using non-pharmacological approaches for prevention and 6 (14.3%) reported pharmacological preventive approaches. In conclusion, physicians reported several appropriate CIPN-related practices, including baseline assessment, monitoring during chemotherapy, and treatment modification when functional impairment developed. However, important evidence-practice gaps were identified in standardized assessment, pharmacological management, prevention, and safety-oriented supportive care. Development of a locally adapted CIPN assessment and management pathway, together with structured professional training, may improve consistency of care.

Keywords: Chemotherapy-induced peripheral neuropathy, CIPN, Duloxetine, Non-pharmacological management, Sudan.

INTRODUCTION

Chemotherapy-induced peripheral neuropathy (CIPN) represents a clinically important disorder of the peripheral nervous system as a consequence of chemotherapy with neurotoxic anti-cancer medications [1]. CIPN usually occurs because of using platinum-based drugs (oxaliplatin, cisplatin), taxanes (paclitaxel, docetaxel), vinca alkaloids (vincristine), proteasome inhibitors (bortezomib), epothilones (ixabepilone), and immunomodulatory drugs (thalidomide) [2]. The listed drugs are used as core treatment of common types of solid tumors and hematologic malignancies, such as

*Address correspondence to this author at the Department of Clinical Pharmacy and Pharmacology, Ibn Sina College for Medical Studies, Mahjar Street, Jeddah 22421, Saudi Arabia; Tel: +966541862525;
E-mail: bashiralsiddiq@ibnsina.edu.sa

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colorectal, lung, breast, and hematologic malignancies [3]. As cancer survivors' life expectancy increases, CIPN becomes one of the major issues among survivors. The incidence of CIPN varies from 19% to 85%, depending on the tumor type, neurotoxic drug, total dose, treatment time, and type of assessment [4-7].

Besides its impact on neurology, CIPN has important clinical implications. The disease is dose-dependent and can result in the necessity of dosage reductions or even cessation of the treatment because of neurotoxic effects, thus making it hard to balance between neurotoxicity prevention and efficacy of the treatment [8]. Sensory symptoms prevail as a consequence of increased sensitivity of large sensory neurons to damage during chemotherapy [8,9]. Sensory symptoms usually occur bilaterally in the form of stocking-and-glove syndrome in the hands and feet with numbness, tingling, burning pain, paresthesia, hypoesthesia and allodynia [8,10,11]. Motor problems like distal weakness and cramps are rarer but possible with platinum compounds and vinca alkaloids, whereas autonomic symptoms (dizziness, constipation, abdominal discomfort, bladder disturbance and orthostatic hypotension) indicate small-fiber injury with vinca alkaloids and thalidomide [5,8]. All these complications lead to impairment of physical activity, psychologic state, social interaction, work ability and quality of life, increased costs of health care and even inability to continue cancer treatment [3-5,9].

Early detection is crucial in the prevention of the progression to irreversible forms of CIPN. The precise baseline assessment before starting the treatment, systematic evaluation before each cycle, and follow-up after the treatment completion are required for proper detection, clinical documentation, and accurate estimation of the prevalence [5,8,12,13]. Consultation with the neurologist may be necessary in case of atypical, serious, progressing, or unclear symptoms [8,13]. Routine CIPN assessment is challenging due to the variety of different diagnostic tools available and the absence of a universally standardized instrument for clinical practice [11]. This diversity leads to poor detection, inconsistent grading, delayed management, and difficulty in comparing results of research and oncologic practice [8,10,12].

The management of CIPN is one of the most challenging areas in supportive oncology due to the lack of methods of prevention and management [4]. Numerous pharmacological drugs such as vitamin B12, anticonvulsants, nonsteroidal anti-inflammatory drugs, opioids, and duloxetine have been used in practice [8,14]. However, according to evidence-based guidelines, the only recommended pharmacologic agent for painful CIPN is duloxetine in the dosage of 60 mg daily [3,15]. Duloxetine works as a serotonin and norepinephrine reuptake inhibitor (SNRI) and presumably decreases pain by modulating descending pain inhibition and spinal dorsal horn mechanisms [14]. Besides pharmacological agents, such as exercise, massage, acupuncture, and nutrition support, can be beneficial for some patients, yet the quality and consistency of evidence base are varied [16,17]. It should be noted that there is no evidence base for the routine use of vitamin B6, vitamin E, alpha-lipoic acid, gabapentin, calcium, or magnesium in CIPN prevention [10,15]. Contemporary guidelines emphasize routine symptom assessment, knowledge about CIPN risk factors, patient education, assessment, and treatment of comorbid conditions, which can exacerbate neuropathy, and medication dosage adjustment if necessary [5,11].

Despite the increased prevalence of CIPN, the evident evidence-practice gap remains. The recent review stresses the existing challenges in the assessment, diagnosis, prevention, and management of CIPN, with the absence of universally standardized methods of diagnosis and limited options of evidence-based pharmacologic management besides duloxetine [11]. The survey of oncologists from France showed suboptimal prevention, diagnosis, and management of CIPN, which was not in line with American Society of Clinical Oncology and European Society for Medical Oncology recommendations, partially due to a lack of awareness about guidelines [18]. In general, the literature constantly highlights a lack of efficient preventive measures, absence of diagnostic standardization, and lack of real-world evidence about physicians' practice in CIPN management [13,19]. This evidence gap is particularly important in the oncologic setting with low resources, where guideline implementation, neurological assessment, supportive care, and survivorship services can be lacking.

In Sudan, there is no national guideline, which would standardize the diagnosis, prevention, or management of CIPN, and the real-world practice of physicians in this area remains unstudied. The absence of local evidence makes it impossible to identify the training needs, improve the services of supportive oncology, and make the practice more evidence-based. Therefore, this study aimed to assess

physicians' practices in the diagnosis, prevention, and management of chemotherapy-induced peripheral neuropathy in Sudan.

METHODS

Study Design and Settings

The study was a cross-sectional observational study using a questionnaire-based method to evaluate the practice of physicians for CIPN diagnosis, management, and prevention. The study was conducted at Khartoum Oncology Hospital, which is a Ministry of Health referral center for diagnosis and management of cancer in Sudan [20,21]. The study was conducted between June and December 2025.

Study Population and Sampling Procedure

The study population comprised registered physicians involved in prescribing, administering, or supervising anticancer therapy at Khartoum Oncology Hospital during the study period. A total-coverage sampling strategy was used because the number of physicians directly involved in anticancer treatment at the study center was limited. During the study period, 53 physicians met the eligibility criteria (registered, actively practicing at the hospital, and involved in oncology care). Of these, 42 agreed and completed the questionnaire, 6 declined participation, and 5 were unavailable during data collection. The final study sample comprised 42 physicians, corresponding to a response rate of 79.3%.

Data Collection Method

Data were collected using a structured questionnaire developed after reviewing previous studies of CIPN assessment and management practices [18,22–24]. Three experts—two professors of pharmacy practice from the Faculty of Pharmacy, University of Khartoum, and one consultant clinical oncologist from Khartoum Oncology Hospital — conducted a face and content review of the draft instrument. The reviewers assessed the relevance, clarity, comprehensiveness, wording, and contextual appropriateness of the items, and the authors made amendments accordingly. The revised questionnaire was subsequently pilot-tested among 10 physicians to assess comprehensibility, feasibility, completion time, and questionnaire administration procedures. Participants involved in pilot testing were excluded from the final study sample. Because the questionnaire contained heterogeneous clinical-practice items rather than a unidimensional psychometric construct, it was not treated as a validated summative scale.

The questionnaire consists of four sections, including 24 questions. The first section included sociodemographic data of the participants (e.g., age, gender, specialty, years of experience). The second section contained diagnosis strategies for CIPN, which consisted of five question items. Four scored practice items, namely: whether grade 3 CIPN was considered clinically significant, whether a baseline assessment for CIPN was determined before prescribing neurotoxic chemotherapy, whether patients were transferred to a neurologist when diagnostic uncertainty occurred, and whether CIPN was diagnosed when a patient developed new numbness or pain after starting chemotherapy. The fifth question, concerning the grading system used to classify CIPN severity, was in this section and was treated as a descriptive variable and was not included in the diagnosis practice score. The third section covered management of CIPN, it comprised five scored practice items to assess the management, which are recommendation of a therapeutic intervention when functional nerve impairment developed during chemotherapy, prescription of drugs to manage established CIPN, consideration of physical therapy for patients who developed physical dysfunction, assessment of CIPN during chemotherapy treatment; and assessment of CIPN before each chemotherapy cycle, based on the follow-up question concerning the timing of assessment. The fourth section included preventive strategies for CIPN; this part consisted of four scored practice items, namely: recommendation of therapeutic adjustment in the presence of neuropathy risk factors, use of pharmacological interventions to prevent CIPN, use of non-pharmacological approaches to prevent CIPN, and the recommended type of non-pharmacological approach. Additional follow-up responses describing the specific type of chemotherapy adjustment, preventive medication, or non-pharmacological intervention were considered descriptive details rather than additional independent practice items. The data were collected through self-administered questionnaires. A total of 42 questionnaires were obtained by the end of the study period.

Data Analysis

The analysis was conducted using the Statistical Package for Social Sciences software, version 26.0

(IBM SPSS Inc., Chicago, IL.). Descriptive statistics were applied to analyze continuous and categorical variables, and the results were represented as percentages and frequency tables. Only the predefined practice items were included in the practice scores, resulting in four scored items for diagnosis, five for management, and four for prevention. Each practice item was coded dichotomously according to whether the physician's response represented the recommended practice; 1 for recommended practice and 0 for non-recommended practice. The appropriateness of each response was determined based on the recommendation of ASCO [10]. All practice items were equally weighted. The minimum and maximum possible scores varied across the practice domine ranged from 0 to 4 for diagnosis, 0 to 5 for management, 0 to 4 for prevention. A cutoff 75% of the maximum possible scores was used to classify the practice as good or poor. Accordingly, scores meeting or exceeding 75% of the maximum possible scores were considered good, while scores below this threshold were considered poor. This cutoff 75% was selected as a study-defined criterion to indicate that the majority of the recommended practice components were met. Because of the relatively small sample size and sparse cell frequencies in several subgroup comparisons, Fisher's exact test was used for 2 × 2 tables and an exact test was applied to larger contingency tables when expected cell counts were insufficient for Pearson's chi-square test. All tests were two-sided, and a p-value <0.05 was considered statistically significant.

Ethical Considerations

This study was conducted in agreement with the recommendations of the Declaration of Helsinki. The ethical approval to conduct the study was obtained from the Ethical Committee of the Faculty of Pharmacy, University of Khartoum (Approval No.: FPEC-24-2025). Additional approval was obtained from the Training and Research Department at the Ministry of Health. Written informed consent was obtained from each participant before filling out the questionnaire, and confidentiality was maintained throughout the study.

RESULTS

Sociodemographic Characteristics of the Participants

In total, 42 physicians completed the questionnaire (response rate: 79.3%). The majority of the participants were females, representing 64.3% (n= 27). Among the participants, the most common age category was less than 40 years old, which represented 57.1% (n= 24). All participants 100%) had a specialty in clinical oncology, and 19 (45.2%) had experience of 5 to 10 years (Table **1**).

Table 1: Sociodemographic Characteristics of the Physician (N=42)

Variable	Category	Frequency (%)
Age (Years)	< 40	24 (57.1)
	40-49	14 (33.3)
	> 50	4 (9.5)
Gender	Male	15 (35.7)
	Female	27 (64.3)
Category	Registrar	20 (47.6)
	Consultant	22 (52.4)
Specialty	Clinical oncology	42 (100)
Years of experience	Less than 5	18 (42.9)
	5-10	19 (45.2)
	More than 10	5 (11.9)

Physicians' Practice in Diagnosing CIPN

Regarding CIPN, 32 physicians (76.2%) used clinical examination to assess CIPN (Figure **1**). Of the participating physicians, 40 (95.2%) used the 1979 WHO neurotoxicity grading scale to classify CIPN severity [25], and all of them 100%) considered grade 3 clinically significant. Among the physicians, 33 (78.6%) said they determined the baseline for CIPN before neurotoxic chemotherapy prescription, and 32 (76.2%) of them said they transferred some patients to a neurologist if uncertainty occurred (Table **2**).

Physicians' Practice in the Management of CIPN

Regarding the management of CIPN, 38 (90.5%) of physicians recommended therapeutic intervention when a patient developed functional nerve impairment during chemotherapy, and 30 of them (71.4%) changed the protocol for the management of CIPN. All physicians 100% assessed CIPN during chemotherapy treatment. Most physicians (n= 26, 61.9%) considered a physical therapy approach for patients who develop physical dysfunction. More details in Table **3**. Furthermore, among the drugs prescribed to manage CIPN, gabapentin and vitamin B were the most common (Figure **2**).

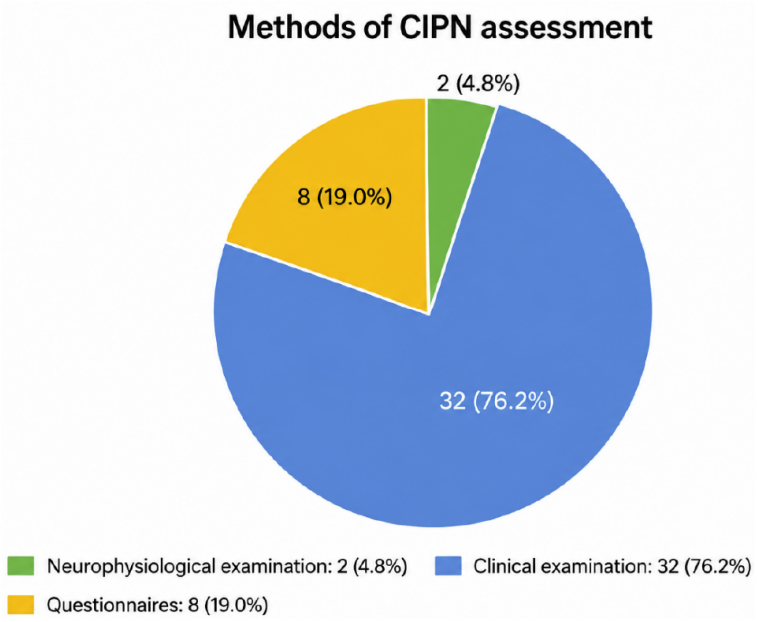


Figure 1: Distribution of physicians according to methods used in assessing CIPN.

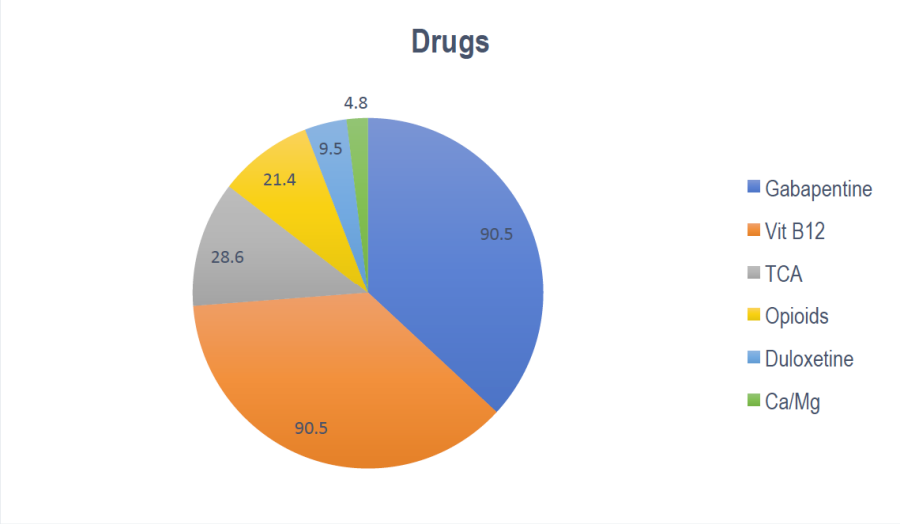
Table 2: Distribution of Physicians According to Variables Related to the Diagnosis of CIPN (n=42)

Variable	Responses	Frequency (%)
Which grading system do you use to classify the severity of CIPN?	NCI-CTCAE	2 (4.8)
	WHO	40 (95.2)
Do you consider grade 3 clinically significant?	Yes	42 (100)
	No	0
Do you determine the baseline for CIPN before neurotoxic chemotherapy prescription?	Yes	33 (78.6)
	No	9 (21.4)
Do you transfer some patients to a neurologist if uncertainness occur?	Yes	32 (76.2)
	No	10 (23.8)
If a patient complains of new numbness or pain after starting chemotherapy, so CIPN diagnosed is made?	Yes	42 (100)
	No	0

Table 3: Distribution of Physicians According to Variables Related to the Management of CIPN (n=42)

Variable	Responses	Frequency (%)
In case a patient develops functional nerve impairment during chemotherapy, do you recommend any therapeutic intervention?	No	4 (9.5%)
	Yes	38 (90.5%)
Do you prescribe any drugs to manage CIPN?	No	0
	Yes	42 (100%)
Do you consider a physical therapy approach for patients who develop physical dysfunction?	No	16 (38.1%)
	Yes	26 (61.9%)
Do you assess CIPN during chemotherapy treatment?	No	0
	Yes	42 (100%)
If yes, when do you assess?	At a patient's demand	6 (14.3%)
	Before each CT cycle	36 (85.7%)

*CT = chemotherapy.



*TCA = Tricyclic antidepressant

Figure 2: Types of drugs used to manage CIPN.

Table 4: Distribution of Physicians According to Variables Related to the Prevention of CIPN (n=42)

Variable	Response	Frequency (%)
In the presence of neuropathy risk factors, do you recommend therapeutic adjustment?	No	7 (16.7%)
	Yes	35 (83.3%)
If yes, which type of intervention do you recommend?	Reducing dose of CT*	20 (47.6%)
	protocol change	15 (35.7%)
Do you use any drugs to prevent CIPN?	No	36 (85.7 %)
	Yes	6 (14.3%)
If yes, the main drugs used for the prevention of CIPN	Vit B12	6 (14.3%)
Do you use any non–pharmacological approach to prevent CIPN?	No	34 (81%)
	Yes	8 (19%)
If yes, which type of non-pharmacological approach do you recommend?	Physical exercise	8 (19%)

*CT = chemotherapy.

Physicians Practice in the Prevention of CIPN

Concerning the prevention of CIPN, when asked how they responded to the presence of neuropathy risk factors, 35 physicians (83.3%) reported considering a therapeutic adjustment; 20 (47.6%) reported chemotherapy dose reduction and 15 (35.7%) reported protocol modification (Table **4**). Because the questionnaire item did not specify that neuropathy or functional impairment had already developed, these responses are presented descriptively and are not interpreted as guideline-concordant preventive interventions. Furthermore, only 8 of physicians (19%) used a non–pharmacological approach to prevent CIPN, which was mainly physical exercise. The results showed that 6 of physicians (14.3%) used drugs to prevent CIPN, and vitamin B was the only drug used (Table **4**).

The Association between Demographic Characteristics of Physicians and their Practice in Diagnosis, Management, and Prevention

The results of this study revealed that 85.7% of the physicians had good practice in diagnosing CIPN, 88.1% had good practice in CIPN management, and 73.8% of the physicians had good practice in the prevention of CIPN. Statistically, no significant association was found between physicians' demographic variables, including age, gender, and years of experience, and their practice in diagnosis, management, and prevention. However, professional category was significantly associated with both

Table 5: Association of Physicians' Characteristics with their Practice in Diagnosis, Management, and Prevention Regarding CIPN

Variable	Category	Diagnosis		df	P-value	Management		df	P-value	Prevention		df	P-value
		Good	Poor			Good	Poor			Good	Poor		
Age	< 40 Y	18	6	2	.085	19	5	2	.239	17	7	2	.756
	40-49	14	0			14	0			10	4		
	> 50	4	0			4	0			4	0		
Gender	Male	14	1	1	.395	14	1	1	.639	11	4	1	1
	Female	22	5			23	4			20	7		
Professional category	Registrar	14	6	1	.007*	15	5	1	.018*	12	8	1	.081
	Consultant	22	0			22	0			19	3		
Years of experiences	< 5	13	5	2	.117	14	4	2	.232	10	8	2	.067
	5-10	18	1			18	1			16	3		
	> 10	5	0			5	0			5	0		

*P-value < .05 is considered statistically significant.

diagnostic and management practice. Among registrars, 14 of 20 had good diagnostic practice, and 6 had poor diagnostic practice, whereas all 22 consultants were classified as having good diagnostic practice (p = 0.007). Similarly, 15 registrars had good management practice, and 5 had poor management practice, whereas all 22 consultants had good management practice (exact p = 0.018). The association between professional category and preventive practice was not statistically significant (p = 0.081) (Table **5**).

DISCUSSION

Chemotherapy-induced peripheral neuropathy (CIPN) remains an important toxicity of neurotoxic anticancer therapy because symptoms may persist after treatment and can impair physical function, psychological well-being, social participation, and quality of life [3,9,12,26,27]. The clinical consequences of CIPN also extend to cancer treatment itself, as progressive neurotoxicity may require treatment interruption or modification. These features make early recognition, serial assessment, and timely management central components of supportive oncology care [8,15].

The present findings indicate that CIPN assessment at Khartoum Oncology Hospital relies predominantly on clinical evaluation, with fewer physicians reporting questionnaire-based or neurophysiological approaches. This pattern is consistent with the broader challenge of CIPN assessment: no single universally accepted gold-standard diagnostic instrument exists, and available approaches vary in feasibility, psychometric performance, domains assessed, and resource requirements [8,28]. Clinician grading scales are practical but may underestimate patient-reported symptom burden, whereas patient-reported outcome measures can capture symptoms and functional effects that are not always apparent during routine examination [8,28,29]. Neurophysiological testing can provide objective information but is generally more resource intensive and is not required for every typical case [1,15]. Importantly, the present study did not measure local availability, cost, or routine access to nerve-conduction studies, validated patient-reported tools, or other diagnostic resources; therefore, the predominance of clinical examination cannot be attributed directly to resource limitations. Nevertheless, these factors should be evaluated in future implementation work because they may influence whether standardized assessment can be incorporated into routine care.

Pharmacological management showed an important divergence between commonly reported practice and the limited evidence base for CIPN management. Gabapentin and vitamin B12 were the most frequently reported pharmacological approaches, each reported by 38 physicians (90.5%). Their interpretation should distinguish routine empirical treatment of CIPN from treatment of other causes of neuropathy. Current ASCO guidance does not provide a recommendation supporting gabapentin or pregabalin for established CIPN because available evidence is insufficient [15]. Similarly, routine empirical vitamin B12 supplementation has not been established as a CIPN treatment; however, vitamin B12 replacement remains clinically appropriate when a documented vitamin B12 deficiency represents a potentially reversible

contributor to neuropathic symptoms. Therefore, clinicians should evaluate alternative or coexisting causes of peripheral neuropathy rather than assuming that all neuropathic symptoms occurring during chemotherapy are attributable exclusively to CIPN. This pattern is also consistent with recent clinician-practice research showing that evidence-practice gaps remain and that oncology clinicians may desire additional information and practical resources for CIPN prevention and management [22].

A range of agents has been used in clinical practice for neuropathic symptoms associated with chemotherapy, although the strength of evidence differs considerably among agents [8,14,30]. Only 4 physicians (9.5%) reported using duloxetine for CIPN management. This finding requires cautious interpretation because the questionnaire asked about CIPN management in general and did not distinguish established painful CIPN from non-painful sensory symptoms or motor dysfunction. The 2020 ASCO guideline specifically states that duloxetine may be offered for established painful CIPN and notes that its magnitude of benefit is limited [15]. Accordingly, the present study cannot determine the proportion of physicians who appropriately used duloxetine among patients who specifically had painful CIPN. Nevertheless, its low overall reported use suggests that future studies should investigate scenario-specific prescribing and potential implementation barriers. Potential explanations for low duloxetine use may include limited familiarity with CIPN-specific recommendations, medicine availability or cost, concerns about adverse effects or drug interactions, and differences in the clinical phenotype of neuropathy encountered [31,32]. However, none of these factors were measured in this study, and they should therefore be regarded as hypotheses rather than established explanations. A focused local evaluation of formulary availability, affordability, prescriber familiarity with guideline recommendations, and barriers to initiating duloxetine for established painful CIPN would help distinguish knowledge-related from system-related causes of the observed practice pattern.

Chemotherapy modification and rehabilitation should also be interpreted according to the clinical context. ASCO and ESMO-EONS-EANO guidance supports consideration of dose delay, dose reduction, substitution, or discontinuation when patients develop intolerable neuropathy and/or functional impairment during neurotoxic therapy, rather than routine dose reduction solely because risk factors are present [8,15]. In the present study, most physicians reported therapeutic intervention when functional nerve impairment developed, and physical therapy was considered by many respondents when physical dysfunction was present. This is clinically relevant because rehabilitation may address balance, strength, gait, functional limitations, and fall risk. Evidence for exercise has also become more supportive: a 2025 systematic review and meta-analysis reported improvement in CIPN symptoms with structured exercise, although intervention types and study designs remain heterogeneous [33]. Thus, exercise and physiotherapy are reasonable components of multidisciplinary supportive care, while the specific program should be individualized to functional status and available rehabilitation expertise.

Prevention remains the area with the greatest evidence limitations. Current ASCO guidance does not recommend a pharmacological agent for routine prevention of CIPN, and several agents historically used for this purpose have not shown sufficient benefit [15]. The reported use of vitamin B12 as a preventive intervention should therefore not be interpreted as evidence-based CIPN prophylaxis in the absence of a documented deficiency. Non-pharmacological strategies such as cryotherapy and compression remain areas of active investigation, with guideline recommendations constrained by the quality and consistency of available evidence [8,16]. More recent randomized evidence further emphasizes the need to separate treatment from prevention; the trials found that prophylactic duloxetine was not more promising than placebo for preventing oxaliplatin-induced sensory neuropathy [34,35]. These findings reinforce the importance of avoiding extrapolation from evidence supporting duloxetine for established painful CIPN to its use as a preventive agent.

The current survey did not directly assess whether Khartoum Oncology Hospital has a formal CIPN-specific clinical pathway, standardized screening form, recurring training program, or routine audit-and-feedback process. It also did not measure access to neurologists, physiotherapists, oncology pharmacists, pain or supportive-care services, or the local availability and affordability of recommended medicines and diagnostic tools. Consequently, the observed differences between reported practice and guideline recommendations cannot be causally attributed to any one barrier. In other oncology settings, clinicians have described uncertainty regarding evidence, limited practical resources, and competing clinical priorities as

factors affecting CIPN management [22]. In Sudan, a dedicated implementation study should therefore assess these system-level determinants directly, including workforce availability, referral pathways, medicine access, workload, guideline awareness, and training needs.

A practical implication of these findings is the development of a hospital-based CIPN pathway that is feasible within the resources of Khartoum Oncology Hospital. Such a pathway could include: baseline identification of neuropathy and relevant comorbidities before neurotoxic chemotherapy; use of a brief standardized clinician assessment together with a patient-reported symptom measure at baseline and before treatment cycles; documentation of sensory, motor, autonomic, pain, and functional effects; explicit criteria for neurology referral when symptoms are atypical, progressive, severe, or diagnostically uncertain; evaluation of potentially reversible contributors to neuropathy; consideration of duloxetine for established painful CIPN; early physiotherapy or rehabilitation referral for functional impairment; and structured criteria for chemotherapy dose delay, reduction, substitution, or discontinuation when neuropathy becomes intolerable or functionally significant [8,15]. Oncology pharmacists could support medication review, identification of alternative neuropathy causes, assessment of medicine access and interactions, and evidence-based counselling. Importantly, previous research has shown that a structured CIPN decision-support algorithm can be incorporated into clinical practice, supporting the feasibility of pathway-based approaches [13]. Local implementation should be accompanied by clinician education, periodic audit, and feedback so that the pathway is adapted to workflow and resource constraints.

This study has several limitations that should be considered when interpreting the findings. As a major national referral center, Khartoum Oncology Hospital may differ from regional facilities in patient volume, specialist expertise, training, diagnostic capacity, and supportive-care resources. Therefore, the findings primarily reflect practice at this center and may not be generalizable to all oncology physicians in Sudan. The study also relied on self-reported practice, which may be affected by recall and social-desirability bias and may not fully reflect actual clinical behavior. The questionnaire did not distinguish painful CIPN from non-painful sensory or motor neuropathy when asking about pharmacological treatment, limiting interpretation of duloxetine prescribing in relation to guideline recommendations for established painful CIPN. In addition, the item concerning therapeutic adjustment in the presence of neuropathy risk factors did not specify that clinically significant neuropathy or functional impairment had developed, and therefore should not be interpreted as a direct measure of guideline-concordant dose modification. Finally, the study did not evaluate several implementation determinants specifically highlighted by the reviewer, including institutional protocols, formal training, access to neurologists, physiotherapists and oncology pharmacists, diagnostic-tool availability, medication cost and availability, and workload. These gaps identify important priorities for subsequent multicenter and mixed-methods research.

Overall, the study identifies a mixed pattern of appropriate reported practices and clinically important evidence-practice gaps. Baseline and ongoing assessment, treatment modification for functional impairment, and consideration of rehabilitation were encouraging features, whereas non-standardized assessment, frequent use of therapies with limited evidence for CIPN, low reported use of duloxetine in the overall CIPN population and use of unproven preventive approaches indicate opportunities for improvement. Rather than interpreting these findings solely as individual clinician deficits, the results support a systems-oriented response that combines a locally adapted CIPN pathway, access to concise evidence-based guidance, multidisciplinary referral mechanisms, and continuing professional development. Such an approach would provide a practical framework for improving consistency of CIPN care while generating measurable targets for future quality-improvement research.

CONCLUSION

Physicians at Khartoum Oncology Hospital reported several appropriate practices related to CIPN care, including baseline assessment, monitoring during neurotoxic chemotherapy, therapeutic intervention when functional impairment develops, and consideration of physical therapy for patients with physical dysfunction. Nevertheless, important evidence-practice gaps remain, particularly in the use of standardized assessment approaches, pharmacological management, differentiation of painful from non-painful CIPN, and evidence-based prevention. The findings support development of a locally adapted clinical algorithm incorporating a brief standardized CIPN screening tool, clear criteria for

chemotherapy modification and specialist referral, and guidance for management of established painful CIPN. Structured continuing professional development and multidisciplinary collaboration among oncologists, neurologists, pharmacists, nurses, and physiotherapists may further improve consistency of supportive oncology care.

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CONFLICT OF INTEREST

None.

AUTHORS' CONTRIBUTION

Conceptualization: MMT, RMH, MTA, and BAY; Methodology: MMT, RMH, EB, KAA, and BAY; Investigation and Data collection: MMT, RMH, and MTA; Formal analysis: EB, MB, AM, MAZ, SA, KAA and BAY; Writing - original draft preparation: MMT, RMH, MTA, EB and MB; Writing-review and editing: MB, AM, MAZ, SA, KAA, and BAY; Resources: EB, MB, KAA, and BAY; Supervision: BAY.

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The publication of this study was confirmed by all authors.

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