hand, despite the non-statistically significant difference among patients with contrasting cancer types and/or stages, it is always important to consider the type of anticancer intervention used. Females and elderly patients were recognized as potential risk factors for the increased severity of CINP among cancer patients in the present study. Similar findings have also been identified by several studies in addition to a number of other factors, particularly older age [18], chemotherapy cycles [19], African descent [20], diabetes mellites [21], and obesity [22]. However, other studies have failed to demonstrate such an association with CINP [23, 24].

Currently, there is no standard treatment for CINP in cancer patients, which can be most challenging as there is no one-size-fits-all approach. The most effective treatment that helps manage CINP symptoms depends on the individual patient, the severity of symptoms, and the specific chemotherapy drugs they are receiving [25]. Various pain relievers such as acetaminophen, nonsteroidal anti-inflammatory drugs, and opioids can help manage the pain associated with CINP. However, long-term use of analgesics may lead to deleterious adverse effects and complications. Other treatments can also be used in managing symptoms associated with CINP, which may involve certain antidepressants such as duloxetine and amitriptyline in addition to anticonvulsant medications such as gabapentin and pregabalin that can alter pain perception signalling [26]. Therefore, cancer patients need to communicate well with their healthcare providers to develop a safe and potentially effective management plan. Alternative therapies, such as capsaicin topical treatments and physical therapy, including exercise, massage, and acupuncture were also utilized by some patients, alone or in combination with other treatments, to reduce pain and other symptoms of CINP [27, 28].

Even with these treatments, neuropathic symptoms might continue to persist beyond the cessation of chemotherapy [29]. Hence, the EORTC QLQ-CIPN20 instrument is a valuable tool for clinicians assessing CIPN symptoms that might help in optimizing an effective treatment plan with analgesics and other palliative treatments to reduce cancer patient complaints. Finally, although currently there is no effective cure for CINP, management of CINP symptoms, and pain in particular, with the available treatments, should be initiated early to avoid any interruption of the primary cancer therapy that can compromise the therapeutic outcome and eventually can deteriorate their quality of life.

CONCLUSION

A substantial number of participants were found to have moderate to severe CIPN. The mean scores of both motor and autonomic subscales of EORTC QLQ-CIPN20 were significantly higher (worse) in females and elderly patients than in the corresponding patient groups. Moreover, significantly higher (worse) scores on all three subscales (sensory, motor, and autonomic) were revealed in patients with metastatic cancer who received chemotherapy. Identifying risk factors associated with CIPN may help recognize at-risk patients, which could ultimately reduce their suffering and improve their quality of life if treated.

DECLARATIONS

Ethical Statement

This study did not receive any funding, but it was approved by the Institutional Review Board (IRB) of King Abdullah international medical research centre, Riyadh, Saudi Arabia (IRB number: 0463/22). Written informed consent was obtained from all participants prior to their participation.

Author Contributions

- Conceived and designed the analysis: Wesam S. Abdel-Razaq, Shmeylan A. Alharbi
- Collected the data: Afnan M. Ibn Khamis, Amal H. Alnahdi, Amirah S. Alghanim, Areej M. Almutairi, Hessa H. Alqahtani
- Performed the analysis: Wesam S. Abdel-Razaq
- Wrote the paper: Wesam S. Abdel-Razaq, Afnan M. Ibn Khamis, Amal H. Alnahdi, Amirah S. Alghanim, Areej M. Almutairi, Hessa H. Alqahtani
- Writing-review and editing: Wesam S. Abdel-Razaq, Shmeylan A. Alharbi

Conflicts of Interest

The authors declared no potential conflicts of interest concerning the research, authorship, and/or publication of this article.

ACKNOWLEDGMENTS

The authors would like to thank the whole team in the Oncology Department at KAMC and KASCH for their indispensable assistance during data collection.

REFERENCES

[1] Selvy, Marie, et al. "Prevention, diagnosis and management of chemotherapy-induced peripheral neuropathy: a cross-sectional study of French oncologists' professional practices." *Supportive Care in Cancer*, Vol. 29, 2021, pp. 4033-43.

[2] Bonhof, C. S., et al. "Painful and non-painful chemotherapy-induced peripheral neuropathy and quality of life in colorectal cancer survivors: results from the population-based PROFILES registry." *Supportive Care in Cancer,* Vol. 28, 2020, pp. 5933-41.

[3] Rivera, Donna R., et al. "Chemotherapy-associated peripheral neuropathy in patients with early-stage breast cancer: a systematic review." *JNCI: Journal of the National Cancer Institute,* Vol. 110, No. 2, 2018, p. 140.

[4] Staff, Nathan P., et al. "Chemotherapy-induced peripheral neuropathy: a current review." *Annals of neurology,* Vol. 81, No. 6, 2017, pp. 772-81.

[5] Zajączkowska, Renata, et al. "Mechanisms of chemotherapy-induced peripheral neuropathy." *International journal of molecular sciences*, Vol. 20, No. 6, 2019, p. 1451.

[6] Hu, Lang-Yue, et al. "Prevention and treatment for chemotherapy-induced peripheral neuropathy: therapies based on CIPN mechanisms." *Current neuropharmacology*, Vol. 17, No. 2, 2019, pp. 184-96.

[7] Kamgar, Mandana, et al. "Prevalence and predictors of peripheral neuropathy after breast cancer treatment." *Cancer medicine*, Vol. 10, No. 19, 2021, pp. 6666-76.

[8] Janahi, Noor M., et al. "Diabetic peripheral neuropathy, is it an autoimmune disease?." *Immunology letters,* Vol. 168, No. 1, 2015, pp. 73-79.

[9] Brizzi, Kate T., and Jennifer L. Lyons. "Peripheral nervous system manifestations of infectious diseases." *The neurohospitalist*, Vol. 4, No. 4, 2014, pp. 230-40.

[10] Postma, Tjeerd J., et al. "The development of an EORTC quality of life questionnaire to assess chemotherapy-induced peripheral neuropathy: the QLQ-CIPN20." *European journal of cancer*, Vol. 41, No. 8, 2005, pp. 1135-9.

[11] Kerckhove, Nicolas, et al. "Long-term effects, pathophysiological mechanisms, and risk factors of chemotherapy-induced peripheral neuropathies: a comprehensive literature review." *Frontiers in pharmacology*, Vol. 8, 2017, p. 86.

[12] Trotti, Andy, et al. "CTCAE v3. 0: development of a comprehensive grading system for the adverse effects of cancer treatment." *Seminars in Radiation Oncology*, Vol. 13, No. 3, 2003.

[13] Mystakidou, Kyriaki, et al. "The EORTC core quality of life questionnaire (QLQ-C30, version 3.0) in terminally ill cancer patients under palliative care: Validity and reliability in a Hellenic sample." *International journal of cancer*, Vol. 94, No. 1, 2001, pp. 135-9.

[14] Tan, Aaron C., et al. "Chemotherapy-induced peripheral neuropathy—patient-reported outcomes compared with NCI-CTCAE grade." *Supportive Care in Cancer*, Vol. 27, 2019, pp. 4771-7.

[15] Jones, Desiree, et al. "Neuropathic symptoms, quality of life, and clinician perception of patient care in medical oncology outpatients with colorectal, breast, lung, and prostate cancer." *Journal of Cancer Survivorship*, Vol. 9, 2015, pp. 1-10.

[16] Beijers, A. J. M., et al. "Chemotherapy-induced neuropathy in multiple myeloma: influence on quality of life and development of a questionnaire to compose common toxicity criteria grading for use in daily clinical practice." *Supportive Care in Cancer*, Vol. 24, 2016, pp. 2411-20.

[17] Boyette-Davis, Jessica A., et al. "Subclinical peripheral neuropathy is a common finding in colorectal cancer patients prior to chemotherapy." *Clinical Cancer Research*, Vol. 18, No. 11, 2012, pp. 3180-7.

[18] Raphael, Michael J., et al. "Neurotoxicity outcomes in a population-based cohort of elderly patients treated with adjuvant oxaliplatin for colorectal cancer." *Clinical Colorectal Cancer*, Vol. 16, No. 4, 2017, pp. 397-404.

[19] Johnson, Cassandra, et al. "Candidate pathway-based genetic association study of platinum and platinum–taxane related toxicity in a cohort of primary lung cancer patients." *Journal of the neurological sciences*, Vol. 349, No. 1-2, 2015, pp. 124-8.

[20] Schneider, Bryan P., et al. "Genome-wide association studies for taxane-induced peripheral neuropathy in ECOG-5103 and ECOG-1199." *Clinical Cancer Research*, Vol. 21, No. 22, 2015, pp. 5082-91.

[21] Kus, Tulay, et al. "Taxane-induced peripheral sensorial neuropathy in cancer patients is associated with duration of diabetes mellitus: a single-center retrospective study." *Supportive Care in Cancer*, Vol. 24, 2016, pp. 1175-9.

[22] Ottaiano, Alessandro, et al. "Diabetes and body mass index are associated with neuropathy and prognosis in colon cancer patients treated with capecitabine and oxaliplatin adjuvant chemotherapy." *Oncology*, Vol. 90, No. 1, 2016, pp. 36-42.

[23] Schneider, Bryan P., et al. "Neuropathy is not associated with clinical outcomes in patients receiving adjuvant taxane-containing therapy for operable breast cancer." *Journal of clinical oncology*, Vol. 30, No. 25, 2012, p. 3051.

[24] Shah, Arya, et al. "Incidence and disease burden of chemotherapy-induced peripheral neuropathy in a population-based cohort." *Journal of Neurology, Neurosurgery & Psychiatry*, Vol. 89, No. 6, 2018, pp. 636-41.

[25] Cleeland, Charles S., John T. Farrar, and Frederick H. Hausheer. "Assessment of cancer-related neuropathy and neuropathic pain." *The Oncologist*, Vol. 15, No. 2, 2010, pp. 13-18.

[26] Hou, Saiyun, et al. "Treatment of chemotherapy-induced peripheral neuropathy: systematic review and recommendations." *Pain Physician*, Vol. 21, No. 6, 2018, p. 571.

[27] Kleckner, Ian R., et al. "Effects of exercise during chemotherapy on chemotherapy-induced peripheral neuropathy: a multicenter, randomized controlled trial." *Supportive Care in Cancer*, Vol. 26, 2018, pp. 1019-28.

[28] Hao, Jie, Xiaoshu Zhu, and Alan Bensoussan. "Effects of nonpharmacological interventions in chemotherapy-induced peripheral neuropathy: an overview of systematic reviews and meta-analyses." *Integrative cancer therapies*, Vol. 19, 2020.

[29] Ibrahim, Eiman Y., and Barbara E. Ehrlich. "Prevention of chemotherapy-induced peripheral neuropathy: a review of recent findings." *Critical reviews in oncology/hematology*, Vol. 145, 2020.