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Research Article

Neutropenia in Cancer Care: Demographic and Clinical Characteristics at an Oncology and Hematology Center

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Abstract

Neutropenia, a prevalent and potentially lethal complication of cancer and its treatment, has been shown to markedly elevate the risk of infection and mortality in oncology patients. The objective of this study was to characterize the demographic and clinical profiles of neutropenic patients admitted to the Oncology Teaching Hospital, Alamal National Hospital for Cancer Treatment, and Hematology and Transplant Center (HTC). In this prospective cross-sectional study, data from 98 neutropenic patients were analyzed, focusing on demographic information, type of cancer, neutropenia severity, and the frequency of various clinical signs and symptoms. The analysis revealed a predominance of females (68.4%), patients over 50 years of age (75.5%), and individuals with hematological malignancies (81%). Moderate neutropenia was the most prevalent severity, with a prevalence of 68.4%. Mucositis, a common complication of chemotherapy, was the most frequently reported clinical sign, with a prevalence of 58% among patients. These findings contribute to a more nuanced understanding of the neutropenic patient population in this specific clinical setting, which can inform targeted management strategies and improve patient outcomes.

Keywords: *Neutropenia, Oncology, Hematology, Cancer, Clinical Characteristics, Infection, Chemotherapy.*

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Introduction

Neutropenia is defined as an abnormally low count of neutrophils (absolute neutrophil count [ANC] < 1,000 cells/μL, with severe neutropenia typically characterized by an ANC < 500 cells/μL) (Lustberg, 2012; Vercell et al., 2021). It represents a critical hematological abnormality frequently encountered in cancer patients (Shanafelt & Fonseca, 2024). This condition is frequently a direct consequence of myelosuppressive chemotherapy, radiation therapy, or the underlying malignancy itself, particularly in hematological cancers (Ma et al., 2022; Rasmy et al., 2016). The significance of neutropenia in the field of oncology is attributable to its profound impact on patient morbidity and mortality. A reduction in circulating neutrophils severely compromises the body's primary defense against bacterial and fungal infections, leading to a dramatically increased risk of severe and life-threatening infectious complications, most notably febrile neutropenia (FN) (Giri & Sahoo, 2023; Klastersky et al., 2016; Lustberg, 2012; Shanafelt & Fonseca, 2024).

Febrile neutropenia, defined as a fever in the presence of neutropenia, is classified as an oncologic emergency. This designation stems from the rapid progression of infection and the potential for septic shock and multi-organ failure if not managed promptly (Kim et al., 2022; Mangaloiu et al., 2023). The incidence of neutropenia and FN varies widely depending on the type of cancer, the intensity of chemotherapy regimens, patient comorbidities, and age (Hussain et al., 2022; Ludwig et al., 2019; Vercell et al., 2021). For instance, patients with hematological malignancies often experience higher rates of prolonged and profound neutropenia compared to those with solid tumors (Kecman et al., 2024; Ma et al., 2022). The clinical ramifications of neutropenia extend beyond the risk of direct infection; it can also result in delays or reductions in chemotherapy dosage, which may in turn compromise the efficacy of treatment and ultimately affect patient outcomes (Boccia et al., 2022; Ludwig et al., 2019).

Given the significant clinical implications, a thorough understanding of the demographic, clinical, and etiological factors associated with neutropenia in specific patient populations is crucial for effective risk assessment, prompt diagnosis, and appropriate management strategies (Kim et al., 2022; Shanafelt & Fonseca, 2024). The identification of shared presenting signs and symptoms can promote early recognition and the initiation of empirical antibiotic therapy, which is essential for enhancing prognosis (Mangaloiu et al., 2023; Vercell et al., 2021). Moreover, a comprehensive understanding of the prevalent cancer types contributing to neutropenia in a specific regional or institutional setting can facilitate the development of targeted prophylactic measures and optimize resource allocation.

The present study, a prospective cross-sectional analysis, seeks to describe the demographic characteristics, neutropenia severity, and common clinical manifestations among a cohort of neutropenic patients admitted to the Oncology Teaching Hospital, Alamal National Hospital for Cancer Treatment, and Hematology and Transplant Center (HTC). The objective of this study is to characterize the patient population under investigation, thereby providing data-driven insights that are pertinent to clinical practice. These insights will serve to guide targeted interventions and to identify areas for future research in this specialized medical environment.

Materials and Methods

Study Design and Setting

This prospective cross-sectional descriptive study was conducted at the Oncology Teaching Hospital, Alamal National Hospital for Cancer Treatment, and Hematology and Transplant Center (HTC). The HTC is a specialized medical facility that provides comprehensive care for cancer patients, including those undergoing intensive chemotherapy and hematopoietic stem cell transplantation. The objective of the study was to obtain data on a cohort of neutropenic patients at a specified point in time, with the aim of characterizing their demographic and clinical profiles.

Study Population and Sampling

The study population comprised 98 neutropenic patients admitted to the Oncology Teaching Hospital, Alamal National Hospital for Cancer Treatment and Hematology and Transplant Center (HTC). All consecutive neutropenic patients who met the inclusion criteria during the study period were included in the analysis. No specific sampling method was employed beyond the inclusion of all eligible patients within the defined timeframe. Patients were eligible for inclusion irrespective of the underlying cause of neutropenia, whether due to chemotherapy, the malignancy itself, or concurrent infections, provided that they met the ANC threshold criteria for neutropenia.

Data Collection

The data were collected using a data collection form derived from the patient's medical records. The following data were retrieved:

Demographic Information

The demographic variables of gender (male/female), age group (≤50 years, >50 years), and ethnicity (Arabs, Kurds, Others) were also considered.

Clinical Characteristics

- **Type of Cancer:** Categorized as either solid cancer or hematological cancer, with further breakdown into specific diagnoses (e.g., Hodgkin lymphoma, non-Hodgkin lymphoma, acute lymphoblastic leukemia, acute myeloid leukemia for hematological cancers; breast cancer, nasopharyngeal cancer, lung cancer, ovarian cancer for solid cancers).
- **Neutropenia Severity:** The classification of these conditions is determined by the absolute neutrophil count (ANC) thresholds established by Lustberg (2012) and Vercell et al. (2021), with the condition being classified as mild, moderate, or severe based on these thresholds.
- **Clinical Signs and Symptoms:** The frequency of reported symptoms, including mucositis, chest infection, kidney infection, diarrhea, urinary tract infection, and hypotension, is also examined.

Ethical Considerations

The study protocol was reviewed and approved by the Iraqi Ministry of Health (Approval No. 19000). The research was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki. To ensure the confidentiality of patient data, all information that could lead to the identification of the patients was anonymized. Consequently, no patient data was included in the analysis or reporting.

Data Analysis

The collected data was then subjected to descriptive statistics analysis. Frequencies and percentages were calculated for categorical variables such as gender, ethnicity, age group, type of cancer, and neutropenia severity. The frequency of each clinical sign and symptom was also tabulated. All data analysis was performed using standard statistical software (e.g., SPSS, R, or similar, though not explicitly stated in the provided data).

Results

Demographic Characteristics of Neutropenic Patients

The study's sample population comprised 98 neutropenic patients. The patient cohort exhibited a significant gender disparity, with females constituting 68.4% (n=67) of the cases and males accounting for 31.6% (n=31). With respect to age distribution, the majority of patients were over 50 years of age, constituting 75.5% (n=74) of the cohort, while patients aged 50 years or younger constituted 24.5% (n=24). The ethnic composition of the sample is noteworthy. The largest ethnic group, comprising 74.4% of the sample (n=73), was identified as Arab. The second-largest group, representing 17.3% of the sample (n=17), was identified as Kurdish. The third-largest group, comprising 8% of the sample (n=8), was identified as belonging to other ethnicities (**Table 1**).

Cancer Types Among Neutropenic Patients

The predominant diagnosis among the neutropenic patients was hematological cancer, constituting 81% (n=79) of the cases, while solid cancers accounted for 19% (n=19). A further breakdown of cancer types revealed that within hematological cancers (sub-total=67, 68.4%), Hodgkin Lymphoma (HL) was the most frequent at 32.8% (n=22), followed by Non-Hodgkin Lymphoma (Non-HL) at 26.9% (n=18), Acute Lymphoblastic Leukemia (ALL) at 23.9% (n=16), and Acute Myeloid Leukemia (AML) at 16.4% (n=11). Among solid cancers, breast cancer (32.2%, n = 10) was the most prevalent, followed by nasopharyngeal cancer (29%, n = 9), lung cancer (25.8%, n = 8), and ovarian cancer (13%, n = 4) (**Table 2**).

Neutropenia Severity

The severity of neutropenia among the 98 patients varied. The most prevalent type of neutropenia was moderate, affecting 68.4% (n=44) of patients, while mild neutropenia was observed in 31.6% (n=35). Severe neutropenia was observed in 19.4% (n=19) of the cohort (**Table 3**).

Frequency of Clinical Signs and Symptoms

A wide spectrum of clinical manifestations was observed among the neutropenic patients. Mucositis was the most frequently observed symptom, with a frequency of 57. Subsequent to this, the most prevalent ailments were chest infections (frequency: 41), kidney infections (frequency: 36), diarrhea (frequency: 35), and urinary tract infections (frequency: 33). Hypotension was reported in 26 patients. The total frequency of reported signs and symptoms was 229 (**Table 4**).

Discussion

The findings of this study offer valuable insights into the characteristics of neutropenic patients within a specialized oncology and hematology setting. The observed female predominance (68.4%) necessitates further investigation, as demographic variations in neutropenia incidence can be influenced by underlying cancer types, treatment protocols, and regional patient demographics. Additionally, the predominance of patients over 50 years of age (75.5%) is consistent with the general epidemiology of cancer, where incidence typically increases with age (Klastersky et al., 2016). The observed age distribution of cancer-related neutropenia cases aligns with global patterns, indicating that the majority of these cases occur in older adults. For instance, data from GLOBOCAN 2020 reveal a marked increase in cancer incidence after the age of 50 across

most regions. This observation is consistent with the 75.5% representation of patients over the age of 50 in the study cohort. The ethnic distribution of the region largely reflects the local population demographics.

Table 1. Data of neutropenic patients admitted to Oncology Teaching Hospital, Alamal National Hospital for Cancer Treatment, and Hematology and Transplant Center (HTC) (n=98)

Data	Number	Percentage
Gender		
Male	31	31.6
Female	67	68.4
Total	**98**	**100**
Age Group		
≤50	24	24.5
>50	74	75.5
Total	**98**	**100**
Ethical		
Arabs	73	74.4
Kurds	17	17.3
Others	8	8
Total	**98**	**100**
Type of Cancer		
Solid	19	19
Hematological	79	81
Total	**98**	**100**

Table 2. Types of Cancer Diagnosed Among Neutropenic Patients Studied (n=98)

Cancer Type	Number	Percentage
Hematological cancer	***Sub-total= 67***	***Sub-total= 68.4***
HL	22	32.8
Non-HL	18	26.9
ALL	16	23.9
AML	11	16.4
Solid cancer	***Sub-total= 31***	***Sub-total= 31.6***
Breast cancer	10	32.2
Nasopharyngeal cancer	9	29
Lung cancer	8	25.8
Ovarian cancer	4	13
Total	**98**	**100**

Table 3. Neutropenia Severity Among Neutropenic Patients Included (n=98)

Data	Number	Percentage
Mild	35	31.6
Moderate	44	68.4
Severe	19	19.4
Total	**98**	**100**

Table 4. Frequency of the Clinical Signs and Symptoms Among Neutropenic Patients Included (n=98)

Signs and Symptoms	Frequency	Percentage
Mucositis	57	25
Chest infection	41	18
Kidney infection	36	16
Diarrhea	35	15.3
Urinary tract infection	33	14.4
Hypotension	26	11.3
Total	**229**	**100**

The preponderance of hematological malignancies within the neutropenic cohort, constituting 81% of the total cases, is a pivotal observation. This finding aligns with the established literature on the subject, as numerous studies have demonstrated that hematological cancers and their intensive chemotherapy regimens are known to be highly myelosuppressive (Islas-Muñoz et al., 2024; Ludwig et al., 2019; Ma et al., 2022). This characteristic has been shown to result in a higher incidence and severity of neutropenia compared to many solid tumors. The specific breakdown of hematological cancers, with HL, Non-HL, ALL, and AML being prominent, highlights the significant burden of these diseases in contributing to neutropenic

complications. While solid cancers constituted a smaller proportion of the total, the presence of breast, nasopharyngeal, lung, and ovarian cancers underscores that neutropenia is a risk across various cancer types, albeit often with lower rates of febrile neutropenia compared to hematological malignancies (Ma et al., 2022; Yapici et al., 2016).

The distribution of neutropenia severity, with moderate neutropenia being the most prevalent (68.4%), suggests that a considerable number of patients require vigilant monitoring and prophylactic measures. While severe neutropenia (19.4%) poses the highest risk for severe infections, even moderate neutropenia necessitates careful clinical attention (Kim et al., 2022; Vercell et al., 2021).

The high frequency of mucositis (57 cases) as a presenting symptom underscores the necessity for comprehensive oral care and pain management strategies in neutropenic patients (Lustberg, 2012). The prevalence of various infections, including but not limited to chest infections, kidney infections, diarrhea, and urinary tract infections, underscores the heightened infectious risks associated with neutropenia. These findings underscore the importance of prompt antimicrobial therapy, infection control measures, and patient education on recognizing early signs of infection. Early intervention for suspected neutropenic sepsis has been proven to optimize outcomes (Keck et al., 2022; Kim et al., 2022; Lustberg, 2012). Hypotension can serve as an indication of sepsis in neutropenic patients, necessitating a swift assessment and intervention (Islas-Muñoz et al., 2024; Lustberg, 2012). Supportive care interventions have been demonstrated to play a vital role in reducing neutropenia-related complications. The utilization of granulocyte-colony stimulating factors (G-CSFs) has been demonstrated to reduce the duration of neutropenia, while structured oral hygiene protocols have been shown to contribute to the prevention and management of chemotherapy-induced mucositis.

Limitations

The study's limitations stem from its descriptive nature and cross-sectional design, which provide a snapshot in time and do not allow for the establishment of cause-and-effect relationships or tracking of patient outcomes over time. The exclusive reliance on data from a single center imposes additional limitations on the generalizability of the findings. The dearth of specific treatment regimens, infection rates, or outcome data precludes a more profound analysis of risk factors and the efficacy of interventions. It is recommended that further prospective studies be conducted with larger cohorts and detailed clinical outcomes. Furthermore, although symptoms related to infection were documented, this study did not include specific data regarding febrile neutropenia episodes or the severity of infections. As febrile neutropenia is a critical clinical entity with direct implications for morbidity and mortality, future studies should incorporate detailed documentation of fever patterns, microbiological findings, and infection severity scores to enable more comprehensive clinical risk stratification.

Conclusion

This study offers a thorough examination of the demographic and clinical characteristics of patients diagnosed with neutropenia who were admitted to the following institutions: an oncology teaching hospital, Alamal National Hospital for Cancer Treatment, and Hematology and Transplant Center. The findings indicate a patient population predominantly composed of older females with hematological malignancies, experiencing moderate to severe neutropenia, and frequently presenting with mucositis and various infections. These insights are of paramount importance for healthcare professionals, particularly oncology nurses, hematologists, infectious disease specialists, and pharmacists, as they facilitate proactive management strategies and potentially enhance outcomes for this vulnerable patient population.

Declarations

Ethics approval and consent to participate

The study protocol was reviewed and approved by the Iraqi Ministry of Health (Approval No. 19000). The research was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki. To ensure the confidentiality of patient data, all information that could lead to the identification of the patients was anonymized. Consequently, no patient data was included in the analysis or reporting.

Consent for Publication

Not applicable.

Availability of Data and Material

The data that supports the findings of this study are available from the corresponding author upon reasonable request.

Conflicts of Interest / Competing Interests

The authors declare that there are no conflicts of interest.

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Author Contributions

A.A.O: Methodology, Visualization, Writing of the original draft.

M.K.AQ: Investigation, Resources, Writing of the original draft.

M.K.A: Investigation, Writing of the original draft, Visualization.

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Use of Generative AI and AI-Assisted Technologies

The authors declare that no generative AI or AI-assisted technologies were used in the preparation of this work.

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