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Under the Patronage and Honoring of HRH Prince Saud bin Nayef bin Abdulaziz, Governor of the Eastern Province: Saudi Cancer Foundation Successfully Launches "AlSharqia Wardiyah 18"

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Original Article

Characteristics of hospital readmissions within 30 days among adult patients with cancer in Jordan

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Abstract

Background: Hospital readmissions are common among cancer patients, related to the complexity of their disease. This study aims to describe the characteristics of unplanned hospital readmission in cancer patients.

Methods: This prospective study was conducted at King Hussein Cancer Center from March 2023 to August 2023. The study included unplanned hospital readmission, defined as any admission through the emergency room within 30 days following the initial admission, excluding patients admitted to palliative care. Patients were followed to collect baseline characteristics, and data related to readmission.

Results: During the study period, a total of 2435 unplanned admissions were included. Of these, 769 (31.6%) patients had at least one readmission, accounting for a total number of 963 readmissions. The mean age of the readmitted patients was 55.9 years (± 14.6 SD), with 49.9% being male. The most common cancer types among these patients were gastrointestinal (22.4%), hematological (21.2%), and breast cancer (16.5%). Additionally, 80% had metastatic disease, and 54.4% were receiving active antineoplastic treatment. Infections were the leading cause of initial admission (28.3%) and first readmission (31.6%). Notably, 36.2% of the patients were readmitted for the same reason as their initial admission. The median time to first readmission was 11 days (range: 1–44 days). Among readmissions, 6.8% required intensive care unit service, while 89.2% were directed to the medical oncology service.

Conclusion: Unplanned readmissions within 30 days among patients with cancer were common, with infection being the leading cause. Further studies are needed to reduce preventable readmissions to optimize patient care.

Key words: Hospital admission, Hospital readmission, cancer, discharge.

Introduction

Cancer is a major clinical and economical challenge of the 21st century, accounting for approximately 22.8% of deaths from non–communicable diseases worldwide. [1] The natural history of the disease often necessitates frequent hospitalization, as the patients may present with critical conditions requiring immediate medical attention. [2] In addition, acute complications can occur at any point during anticancer treatment due to toxicity, refractory symptoms, or disease progression. Moreover, the diagnosis of certain types of cancer may require hospitalization. [3]

Cancer patients are at high risk for hospital readmissions due to the complexity of their disease and their treatment, and the presence of underlying comorbidities. [4] Hospital admissions place a significant burden on the healthcare system, with readmissions being particularly costly, often exceeding the expenses of the initial hospitalization. [5] Multiple factors contribute to readmissions, including disease progression with exacerbations of symptoms, treatments related toxicity, and the development of new health conditions. In some cases, readmissions may be directly related to the initial hospitalization, such as; persistent pain, unresolved infections, and ongoing gastrointestinal disorders. [4] Addressing these factors is essential for assessing the nature and preventability of the readmissions and reducing the healthcare burden associated with cancer care.

Several studies have evaluated hospital readmissions among patients with cancer. [6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16] However, most of these studies were retrospective in design, [6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16] and focused on specific

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patient characteristic and causes of readmissions. [9, 10, 12, 13, 15, 16] For instance, a study by Koubaity et al. explored readmissions specifically related to drug–related problems, reflecting a narrow focus on a particular aspect of cancer care. [13] To address this gap, we conducted a prospective study to assess the characteristics and causes of unplanned hospital readmissions within 30–days of the initial admissions at a comprehensive cancer center in Jordan.

Methods:

We conducted a prospective observational study at King Hussein Cancer Center (KHCC), a 350–bed, internationally accredited cancer center located in Amman, Jordan. KHCC provides comprehensive care to adult and pediatric patients with all types of cancer from Jordan and the Middle East region. The study was conducted in accordance with the principles of the Declaration of Helsinki. Ethics approval was obtained by the KHCC institutional review board (IRB) on March 8, 2023, under approval number 22 KHCC 176. A waiver of consent was granted due to the minimal risk posed by the collected data to the patients, and the waiver did not adversely affect the rights and welfare of the participants. Additionally, the research could not have been feasibly conducted without the waiver.

The study was conducted to assess the characteristics and causes of unplanned hospital readmissions within 30–days of the initial admissions at a comprehensive cancer center in Jordan. It was conducted in the period between March 2023 and August 2023, and included cancer patients aged 18 years old and older, who were admitted to the hospital through the emergency department with an unplanned admission diagnosis. Patients were followed for 30 days following their discharge, to identify readmissions. Readmissions were defined as any unplanned admission occurring within 30 days of the discharge from the initial admission. [7] We excluded patients admitted for planned surgery, elective chemotherapy administration, or elective procedures. Additionally, adult cancer patients admitted to the hospice and palliative care, as well as patients aged 18 years old and older under the pediatric service were excluded from the study.

Patients were identified according to the inclusion and exclusion criteria through daily reviews of the hospital admission list. The Computerized Patient Record System (CPRS) was used to collect baseline patients' characteristics upon admission, including age, gender, type of malignancy, the metastatic status, whether the patient was receiving active antineoplastic treatment or radiotherapy, and the number of chronic medications taken (i.e., medications taken for any chronic illness other than cancer). Data related to reason of admission and readmission, discharge date, and days to readmission after discharge from the initial admission were collected. The causes of readmission were classified according to the admission diagnosis that was recorded in the admission note by the treating physicians in the CPRS. These included infections, cancer treatment complications (including treatment related vomiting, neutropenic fever, mucositis, and medication toxicity), neurological causes (including seizures, decreased level of consciousness, brain metastasis, and stroke), electrolytes disturbances (including hypercalcemia, hypokalemia, hypomagnesemia, and hyponatremia), renal failure, pain crisis, hematological causes (including non–gastrointestinal bleeding, anemia, and thrombocytopenia), gastrointestinal causes (including nausea, vomiting, acute pancreatitis, diarrhea, gastrointestinal obstruction, and gastrointestinal bleeding), cardiac causes (including heart failure, atrial fibrillation, and myocardial infarctions), respiratory causes (including asthma, pleural effusions, and chronic obstructive pulmonary disease exacerbation).

Statistical analysis

We used frequencies and percentages to describe categorical variables, and measures of central tendency (mean and median) and dispersion (standard deviation and range) to describe continuous variables. The relationship between categorical variables was assessed using the chi–square test or Fisher's exact test as an alternative. We used the Mann–Whitney U test (non–parametric) to examine the association between two groups of patients, and the Kruskal–Wallis H test (non–parametric) to examine the association between three or more groups. These tests were used according to the normality score of the data collected. Multivariate analysis was performed for significant factors using logistic regression for the binary outcome and multinomial logistic regression when the outcome had more than two categories. A P–value ≤ 0.05 was considered statistically significant. All analysis was performed using SAS version 9.4 (SAS Institute Inc., Cary, NC, USA).

Results

During the study period, 2435 hospital admissions were included. Of these, 769 (31.6%) had at least one readmission, with a total of 963 readmissions. The mean age of the readmitted patients was 55.9 years (SD ± 14.6), with 49.9% being male. The most common cancer types were gastrointestinal (22.4%), hematological (21.2%), and breast cancer (16.5%). The baseline characteristics of the patients who were readmitted to the hospital within 30 days of their discharge are summarized in table 1. Infections were

Variable	Frequency (%)
Gender	
Male	384 (49.9%)
Female	385 (50.1%)
Malignancy Type	
Gastrointestinal	172 (22.4%)
Hematological	21.2%))163
Breast	16.5%))127
Lung	91 (11.8%)
Genitourinary	62 (8.1%)
Melanoma	8 (1.0%)
Gynecological	54 (7.0%)
Head and neck	43 (5.6%)
Sarcoma	24 (3.1%)
Brain Tumors	3.0%))23
Unknown	2 (0.3%)
Metastatic	
Yes	616 (80.1%)
No	153 (19.9%)
On Active Treatment	
Yes	418 (54.4%)
No	351 (45.6%)
Treatment type :antineoplastic or radiotherapy (N=418)	
Antineoplastic	358 (85.6%)
Radiotherapy	21 (5.0%)
Concurrent chemo radiotherapy	39 (9.3%)
Chronic Medications	
None	215 (28.0%)
1–2	211 (27.4%)
3–5	219 (28.5%)
More than 5	124 (16.1%)
Comorbidities	
none one More than 1	197 (25.6%) 187 (24.3%) 385 (50.1%)
Readmission service	
Medical Service Surgical Service Bone marrow Transplantation Critical Care Service	686 (89.2%) 13 (1.7%) 18 (2.3%) 52 (6.8%)

Table 1. Baseline characteristics of patients who were readmitted within 30 days of the discharge date (N = 769)

the most common cause of the initial hospital admission (28.3%). Similarly, infections were the most common cause of first readmission, which accounted for 31.6% (n= 243), followed by gastrointestinal causes at 10.0% (n= 77). Table 2 demonstrates the distribution of readmission diagnoses. Notably, 36.2% (n=278) of the patients were readmitted to the hospital primarily for the same reason as the initial hospital admission. The mean age of these patients was 55.5 (± 14.4 SD), with 50.7% being male. Among these patients, 80.6% (n=224) had solid tumors, while 19.4% (n=54) had hematologic malignancies. Moreover, 78.1% (n=217) had metastatic disease, and 55.4% (n=154) were receiving active treatment.

The median time to readmission for any reason was 11 days (range: 1–44), with 3.6% of readmissions

Variable	Frequency (%)
Infections	243 (31.6%)
Gastrointestinal causes	77 (10.0%)
Hematological causes	63 (8.2%)
Renal causes	63 (8.2%)
Neurological causes	60 (7.8%)
Electrolytes disturbances	59 (7.6%)
Cancer treatment complications	57 (7.4%)
Pain crisis	54 (7.0%)
Respiratory Causes	48 (6.2%)
Cardiovascular causes	31 (4.0%)
Others	14 (1.8%)
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Cancer treatment complications	57 (7.4%)
Pain crisis	54 (7.0%)
Respiratory Causes	48 (6.2%)
Cardiovascular causes	31 (4.0%)
Others	14 (1.8%)

Table 2. Causes of unplanned hospital readmissions **(N = 769)**.

occurring within 2 days from their hospital discharge. The median time to readmission for the same reason as the initial hospital admission was 12 days (range: 1–32). The median length of stay of the initial hospital admission among patients who were readmitted within 30 days of their discharge was 6 days (range: 1–56). Hospital readmissions to the critical care service accounted for 6.8% of the cases, while 89.2% were directed to the medical oncology service.

Multivariate logistic regression analysis showed that patients with metastatic disease were significantly associated with hospital readmissions following their original admission (Odds Ratio [OR]: 1.85, 95% Confidence Interval (CI) 1.5– 2.3, P<0.0001), and longer length of stay of the initial hospital admission was associated with an increased like– hood of readmissions (OR: 1.03, 95% CI 1.01–1.05, P <0.0001).

Discussion:

In this study, we evaluated the demographic and clinical characteristics of unplanned hospital readmissions among cancer patients. Our findings provide valuable insights into these readmissions, highlighting potential areas for improvement in clinical practice. The mean age of readmitted patients was about 56 years old, with nearly equal distribution between genders. This contrasts findings from other studies, for example, a study by Saunders et al that was conducted in the United States, showed higher admission rates among female patients and a median age of 69 years. [6]

In the present study, gastrointestinal, hematological, and breast cancers were the predominant malignancies among readmitted patients. This reflects the complexities of these diseases, their treatment, and their incidence rate in Jordan. Interestingly, breast cancer is the most prevalent cancer in Jordan and ranks as the third leading cause of cancer–related deaths after lung and colorectal cancer. [17] These findings align with previous studies. For example, a study conducted by Johnson et al, which followed 200 patients for one year after their initial admission, identified gastrointestinal tumors as the most common.[15] Similarly, a retrospective study on unplanned readmissions over one year reported hematological and gastrointestinal tumors as the most frequent types of cancer. [18] In contrast, a systematic review conducted by Bell et al, reported bladder, pancreatic, ovarian, and liver cancers as the highest tumors with hospital readmissions.[14]

Our study demonstrated that majority of patients who were readmitted had metastatic disease. This aligns with the nature of advanced disease with metastasis where patients are more prone to complications related the tumor progression at the metastatic site. Furthermore, our multivariate analysis revealed proportional relationship between having a metastatic disease and readmissions. Additionally, half of the patients with readmissions had more than one comorbidity, which can be attributed to complications from the cancer itself, or their comorbidities. Notably, more than half of the readmitted patients were receiving active antineoplastic treatment, as this often leads to complications that necessitate readmissions. These findings are consistent with a systematic review conducted in the United States, [14] which identified the presence of comorbidities, and advanced disease as significant predictors of readmissions.

In the present study, approximately one–third of the readmissions were related to infections, highlighting the significant burden of infections among cancer patients and the need for effective infection control and preventive strategies. Gastrointestinal causes were the second most common reasons of readmission. Notably, about one third of readmissions were due to a reason similar to the original admission, this could suggest an area of further assessment to evaluate these recurrent admissions and provide suggestive preventive measures. Our findings are consistent with previous literature. [4, 15] For example, a retrospective study of 200 patients with readmissions identified infections and gastrointestinal complaints as among the most common reasons of readmissions. Furthermore, the study found that about one–third of readmissions were potentially avoidable as they were due to the same reason as the original admission. [15]

Our study found that patients were readmitted after a median of 11 days' from discharge. This duration is longer than what has been reported in the literature. For example, a patient–centered study conducted in the United States, which interviewed patients with readmissions, found a median time to readmission of 7 days. [4] Similarly, a retrospective study over a six–month period reported a median of 8.5 days. [6] We reported a high readmission rate of 31.6%, which may be explained by our inclusion of all types of cancer, including both solid and hematological tumors. This high readmission rate can be related to the complexity of hematological malignancies and the associated sever and frequent complications that warrant hospital readmissions. We found several studies reporting similar readmission rates. For example, a retrospective study of patients with metastatic solid tumors reported readmission rate of 24.5%. [12] In contrast, a retrospective study of adult and pediatric patients with acute lymphoblastic leukemia found a readmission rate ranging from 18.5% to 33.3%. [16] The high readmission rate reported in our study may also be explained by the advanced stage of malignancies of the included patients, which may cause deterioration in patients' clinical status and result in frequent readmissions. In addition,

almost half of the patients had comorbidities. These comorbidities can interfere and complicate patients' malignancy treatment and cause hospital readmissions for the treatment of these conditions.

Interestingly, the multivariate logistic regression analysis showed that longer length of stay during the original admission was proportionally associated with a higher like–hood of readmission. This could be explained by the fact that sicker patients who spent more time in the hospital were more likely to experience frequent readmissions compared to those with shorter hospital stay. This finding is supported by a retrospective study on unplanned 30–day readmissions conducted in the United States. [6]

The strength of our study included its prospective design, which minimized the risk of missing data and the inclusion of a relatively large number of patients with a diverse types of tumors compared to previous studies. However, we acknowledge several limitations. First, the study was conducted at a single cancer center, which may limit the generalizability of our findings. Second, we did not investigate the preventability of these readmissions, which is an important aspect in this research and could provide actionable insights to improve clinical practice. Though preventability was not evaluated, our findings should not be interpreted as these readmissions were avoidable. Lastly, we relied solely on diagnosis recorded in patient's computerized records, lacking objective method to assess the readmission diagnosis and this can introduce misclassification bias. Future prospective studies should include standardized assessments of readmission preventability, including assessment of patients, treatments, and healthcare system related factors, to better evaluate preventable from non–preventable readmissions and to assess appropriate interventions accordingly.

Conclusion

In this study, unplanned readmissions were more prevalent among patients with metastatic disease, and in those with gastrointestinal, hematological, and breast cancer. Among the causes of unplanned readmissions, infections were the most frequent, highlighting the importance of enhancing infection management practices. Our study revealed that one–third of the readmissions were due to the same reason as the original admission. Further investigation is warranted to assess the preventability of these readmissions, and evaluate their cost implications on the health care system, with the aim of optimizing resource allocation and cost–saving measures while enhancing clinical practice, untimely improving patients' outcomes.

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Conflict of Interests:

The authors have no relevant conflict of interests to disclose.

Ethical statement:

This study was performed in line with the principles of the Declaration of Helsinki. Ethics approval was granted by the institutional review board on March 8, 2023, under approval number 22 KHCC 176.

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