



CAUSES OF DEATH OF CANCER PATIENTS IN A REFERRAL HOSPITAL IN NORTHERN IRAN BETWEEN 2013 AND 2016

F. BOZORGI, A. HEDAYATIZADEH-OMRAN, R. ALIZADEH-NAVAEI, G. JANBABAEI, S. MORADI, N. SAMADAEI

Gastrointestinal Cancer Research Center, Mazandaran University of Medical Sciences, Sari, Iran

Abstract – Objective: Cancer is a major cause of death worldwide. The first step in planning to increase the survival rate of cancer patients is to know the cause of death of these patients. This study aimed to investigate the causes of death in cancer patients hospitalized in Imam Khomeini hospital of Sari, Iran (a referral hospital in northern Iran).

Patients and Methods: This cross-sectional study was conducted by collecting data on the causes of death in cancer patients who were hospitalized and passed away in Imam Khomeini hospital between 2013 and 2016 with a clinical diagnosis of cancer by an oncologist and confirmation of a pathologist. Data were collected using a questionnaire and were then analyzed by SPSS 21.

Results: The most prevalent cancers were gastric, lung, breast and colon cancers and the most frequent causes of death among patients were sepsis (45.3%), carcinomatosis (16.4%), IHD (10.8%), internal bleeding (9.6%), other infections (6%) and pneumonia (3.8%).

Conclusions: Infection is the most important cause of cancer deaths, while the importance of sepsis cannot be neglected. Bleeding, carcinomatosis and cardiovascular problems are also of particular importance in the deaths of cancer patients. Most of cancers were related to the digestive tract, blood, and respiratory tract. A majority of these patients died from curable causes, including infection and bleeding, meaning that a large proportion of the deaths can be avoided by taking technical clinical precautions.

KEYWORDS: Cancer, Death, Sepsis.

INTRODUCTION

Cancer is a leading cause of death worldwide, with a mortality rate of about 9.7 million people (accounting for 13% of all deaths) worldwide in 2007¹. The incidence of cancer in developed and developing countries is on the rise². Age over 50, family history, nutrition, obesity, smoking, and physical inactivity are among the risk factors for cancer³. However, cancer risk factors, except for a few, such as age, sex, and, to a lesser extent, genetic factors, can be avoided⁴. At the international level, numerous studies have been conducted to estimate the proportion of total cancer deaths that can be attributed to various risk factors. Two main

characteristics of the studies are that public awareness on each risk factor has been evaluated solely in the form of descriptive statistics, while other studies have focused on specific types of cancer⁵. In cancer studies, it is important to determine the survival rate of the patients⁶. Knowledge about the causes of death can help review the expenses and the effectiveness of the treatment of these patients and redesign health policies. Considering the paucity of research on the causes of cancer deaths in Iran and the high prevalence of cancer, this study aimed to investigate the causes of death in cancer patients hospitalized in Imam Khomeini Hospital in Sari (a large referral and educational hospital in the Mazandaran Province).



PATIENTS AND METHODS

This cross-sectional study aimed to investigate the causes of death in cancer patients hospitalized in Imam Khomeini hospital in Sari from between 2013 and 2016. The sample size was calculated as 397 using G Power software considering recent studies, with a confidence interval of 95%, and power of 90%. Data were collected by examining patients' records and lists of the causes of death in cancer patients admitted to Imam Khomeini Hospital in Sari during 2013-2016. Inclusion criteria included cancer patients who had been hospitalized in the hospital with a diagnosis of cancer by an oncologist and passed away. Since the present study aimed to investigate the causes of mortality based on the hospital's population, the sources of information used to collect data included the places with the where the information about the mortality of cancer patients was available. Cancer patients' information was recorded in the hospital's medical records unit. To complete the data and avoid missed data, the cancer registry data of the Comprehensive Cancer Center, which receives data from the Health Department, Mazandaran Provincial Registry Office, and Private and Public-Sector Pathology Center, were also used. The form used to collect data in this study was designed based on oncology, pathology, and epidemiology experts' comments. Data from completed forms were entered into Excel to be registered as a new case if they met the criteria and were not duplicate. Data were then analyzed using SPSS 21 (IBM SPSS Statistics for Windows, Version 21.0. Armonk, NY: USA); $p < 0.05$ was considered significant.

RESULTS

Table 1 shows the age and gender of the studied patients. According to the table, the mean age was 58.19 years with a standard deviation of 15.59 years. The minimum age was 7, and the maximum age was 90 years. The gender of the studied patients is listed in Table 2. According to the table, the frequency of cancer and cancer deaths were both higher in men than women. Tables 3, 4 and 5 list the frequency of cancer cases by type and their correlation with infection in cancer patients admitted to Imam Khomeini Hospital in Sari between 2013 and 2016. The most common cancers were lung cancer, gastric cancer, AML (leukemia), breast cancer and colon cancer, while the lowest frequency corresponded to plasma cell cancers and neuroblastoma. In terms of involved organs, the most

TABLE 1. Age of the cancer patients admitted to Imam Khomeini Hospital in Sari between 2013 and 2016.

Variable	Mean	Standard deviation
Patients' age	58.19	15.59

TABLE 2. Gender of cancer patients hospitalized in Imam Khomeini Hospital in Sari between 2013 and 2016.

Gender	Frequency	Percentage (%)
Male	228	57.4
Female	169	42.6

TABLE 3. Frequency of cancer cases by type in cancer patients hospitalized in Imam Khomeini Hospital in Sari between 2013 and 2016.

Cancer type	Frequency	Percentage (%)
Lung	56	14.1
AML	43	10.8
Stomach	43	10.8
Breast	37	9.3
Colon	36	9.1
Esophagus	25	6.3
Pancreas	16	4
ALL	16	4
Brain	15	3.8
Lymphoma	14	3.5
Liver	14	3.5
Hodgkin's lymphoma	12	3
Bladder	10	3.5
Prostate	9	2.3
Cervix	8	2
MM	8	2
Sarcoma	5	1.3
Ovary	5	1.3
Thyroid	3	0.8
Pritonium	3	0.8
Nasopharynx	3	0.8
Kidney	3	0.8
Rectum	3	0.8
Cholangiocarcinoma	3	0.8
Small intestine	3	0.8
Neuroblastoma	2	0.8
Plasma cell	1	0.3
Tongue	1	0.3i

TABLE 4. Frequency of cancer cases by type and by body organ in cancer patients hospitalized in Imam Khomeini Hospital in Sari between 2013 and 2016.

Cancer type	Frequency	Percentage (%)
Gastrointestinal cancers	140	35.3
Blood cancers	94	23.7
Lung Cancers	56	14.1
Breast Cancers	37	9.3
Other cancers	70	17.6

TABLE 5. Distribution of various types of cancers in different organs of the body by being infectious and noninfectious in cancer patients admitted to Imam Khomeini Hospital in Sari during 2013-2016.

Cancer type	Infectious		Noninfectious		p-value
	Frequency	Percentage (%)	Frequency	Percentage (%)	
Gastrointestinal cancers	62	26.1	76	50	0.000
Blood cancers	76	31	18	8.11	
Breast Cancers	23	4.9	14	2.9	
Lung Cancers	35	3.14	21	8.13	
Other cancers	67	2.19	23	1.15	

TABLE 6. Frequency of metastasis to various organs of the body in cancer patients hospitalized in Imam Khomeini Hospital in Sari during 2013-2016.

Metastatic organ	Frequency	Percentage (%)
Lumbar vertebrae	4	1
Brain	16	4
Stomach	7	1.8
Esophagus	2	0.5
Liver	59	14.9
Free of metastases	295	73.4
Lung	9	2.3
Breast	1	0.5
Pancreas	1	0.3
Adrenal	2	0.5

common cancer was involved the gastrointestinal tract, followed by blood, respiratory tract. According to Table 5, the number of patients who had died due to infection was significantly higher in blood cancers, and cancer in those who died in the non-infectious group was significantly related to gastrointestinal cancers ($p < 0.05$). Tables 6 and 7 show the statistics of the metastasis of cancer to other organs of the body, as well as the correlation with deaths from infectious and noninfectious causes. The lowest frequency corresponds to metastasis to the pancreas and breast. In the infectious group, the number of people with metastatic cancer mass was significantly less than the non-metastatic patients. However, in the non-infectious group, the number of metastatic cases was higher, and a significant correlation was observed ($p < 0.05$). Tables 8, 9 and 10 show the frequency of causes of cancer deaths and their relationship with gender and infection. The most frequent cause

of death was sepsis, followed by heart disease or IHD, carcinoma and internal bleeding. Infectious diseases are also responsible for over 60% of deaths in cancer patients. Regarding gender distribution by infectious and non-infectious deaths, although the number of infectious and non-infectious deaths is higher in men than women, no significant relationship was found ($p > 0.05$).

DISCUSSION

Considering the increasing number of cancer cases in the world and especially in Iran, this study was conducted to determine the frequency of various causes of mortality in cancer patients who were hospitalized and passed away in Imam Khomeini Hospital in Sari between 2013 and 2016. In the present study, the mean age was 58.19 years. In the study by Fateh and Amini[3], the mean age of patients was 56.22 years. Other researchers reported a mean age of over 65 in 53.5% of patients⁷. Salari and Dehghan's findings⁸ indicated a high incidence of cancer (67%) over the age of 60 years. According to Yazdanband et al⁹ the mean age of cancer patients was 64.8 years. The mean age was reported as 51.2 years in the study by Jalali et al¹⁰. Abedini et al¹¹ reported that the highest incidence rate of cancers belonged to stomach, breast and cancer cases of unknown origin. In the United States, the most common cancers are prostate and lung cancers¹², while in Europe the most common cancers are lung, colon, and stomach cancers¹³. In Lebanon, the most common cases of cancers are in the bladder, prostate, and

TABLE 7. Relationship between metastasis and deaths caused by infectious and non-infectious factors in cancer patients hospitalized in Imam Khomeini Hospital in Sari during 2013-2016.

Cancer type	Infectious		Noninfectious		p-value
	Frequency	Percentage (%)	Frequency	Percentage (%)	
Yes	97	22	104	68.4	0.044
No	191	78	48	6.31	



TABLE 8. Frequency of causes of cancer deaths in cancer patients hospitalized in Imam Khomeini Hospital in Sari between 2013 and 2016.

Cause of death	Frequency	Percentage (%)
Sepsis	180	45.3
Carcinomatosis	65	16.3
IHD	43	10.8
Internal bleeding	38	9.5
Other infections	24	6
Pneumonia	15	3.8
Embolism	9	2.3
Unknown	9	2.3
Meningitis	7	1.8
Hypoglycemia	6	1.5
Opium	1	0.3
Total	397	100

lungs¹⁴, and in Canada, cervix, breast, prostate, and skin cancers are the most prevalent, and only 10% of the cancers are reported in the stomach¹⁵. Mais-inneuve and Lowenfels¹⁶ reported a high incidence of cancer in the lungs and stomach, respectively. Some of these findings are consistent with the current study; however, there are differences that can be attributed to differences in lifestyle, diet habits, genetic differences and geographical place of residence¹⁷⁻²⁰. In the present study, AML cancers showed a high incidence. Considering the findings of a study in Mazandaran Province indicating that this cancer has a growing prevalence, especially in the capital, this issue needs the attention of relevant experts and authorities¹². In this study, the mortality rate in men was more than that of women, which was consistent with the study of Abedini et al¹¹. In the United States, the prevalence of cancer has been higher in men¹². In the study by Chattar-Cora et al²² 55.9% of cancer cases were reported in men, showing a high incidence of cancer in men. According to Jalali et al¹⁰ 58% of cancer patients are male and the rest are female. The higher incidence of cancer in men in these studies may be due to men's exposure to environmental and occupational risks and economic and social stresses outside the home, which necessitates careful planning for this group. According to a study by Jiro et al²³ the most commonly-reported malignancy corresponded to the genitourinary system, followed by the gastrointestinal tract, lung, neck,

TABLE 9. Frequency of causes of cancer deaths by being infectious or noninfectious in patients hospitalized in Imam Khomeini Hospital in Sari between 2013 and 2016.

Type	Frequency	Percentage (%)
Infectious	245	61.7
Non-infectious	152	38.3

and head and chest. In the study by Gohari et al²⁴ the most commonly-reported metastasized cancer cases were in the brain, lung, bone, and liver, followed by lymph nodes, eyes and head. In the study by Ambrus et al²⁵ the main cause of death was infection (36%), followed by hemorrhagic and thromboembolic causes (18%), involvement of internal organs (10%), which includes hepatic failure, cachexia (1%), pulmonary failure for any reason, such as aspiration (19%), and heart failure (7%). In the study by Torno et al²⁶ 34% of deaths were due to infection, 11% due to metastasis, 9% due to hemorrhage, 28% due to the disease itself and 10% due to other causes of death. According to Jiro et al²³, the most important causes of death in cancer patients are infection and sepsis, which are consistent with the present work. These findings indicate that infection is common in cancer patients and significantly affects their mortality rate. In the study by Kefford et al²⁷ the cause of death in cancer patients was internal organ failure (42%), infection (23%), and carcinomatosis (18%). In a study by Khorana et al²⁸ of 141 patients, 100 died due to cancer progression, 13 due to embolism, 13 due to infection, 5 due to respiratory failure, 2 due to internal bleeding, 2 due to pneumonia aspiration, 9 due to other reasons, and 5 died of unknown causes. In this study, the most common cause of death in cancer patients was sepsis, which accounts for nearly half of the deaths. Carcinomatosis, ischemic heart disease, internal bleeding, other infections, and pneumonia, are other causes of cancer deaths. These relatively different figures can be due to the specific outbreak of a type of cancer in different regions and different types of metastases in the affected population; however, the remarkable problem in all of these studies is death due to infection, which should be taken into consideration by health specialists, authorities, and policy makers.

TABLE 10. Relationship between gender and infection in cancer patients hospitalized in Imam Khomeini Hospital in Sari between 2013 and 2016

Cancer type	Infectious		Noninfectious		p-value
	Frequency	Percentage (%)	Frequency	Percentage (%)	
Male	148	60.4	80	52.6	0.144
Female	97	39.6	72	47.4	

CONCLUSIONS

According to the literature and the findings of this study, cancer is more prevalent in older patients and in men. The most prevalent cancers in this study were reported in lung, AML, stomach, breast, colon, esophagus, and pancreas. Infection is an important cause of cancer deaths, while sepsis is also very important. Bleeding, carcinomatosis and cardiovascular problems are also of particular importance in the deaths of cancer patients. Cancers in the digestive tract, blood, and respiratory tract are most prevalent. Most patients die from curable causes, including infection and bleeding, which can be avoided by observing technical and therapeutic principles.

CONFLICT OF INTEREST:

The authors declare that there is no conflict of interests regarding the publication of this paper.

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