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PROGNOSTIC OUTCOMES AMONG YOUNG CANCER PATIENTS: A RETROSPECTIVE ANALYSIS

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Abstract: ***Objective:*** This study aimed to identify the clinical and prognostic characteristics of young can- cer patients who were admitted to our hospital over the past two years.
Patients and Methods: The clinical features of young cancer patients who aged 18-45 years and were diag- nosed in our hospital between January 2021 and December 2022, were retrospectively analyzed. The log-rank test was employed to compare the survival rates among different groups. The prognostic factors were assessed by the multivariate Cox regression model.
Results: A total of 620 cancer patients who aged 18-45 years were included. Notably, 260 (41.9%) patients were male and 360 (58.1%) were female. The median age was 38 (range, 18-45) years. The most common cancer types were thyroid cancer (182, 29.4%), non-small cell lung cancer (106, 17.1%), and soft tissue sarcoma (88, 14.2%). The median follow-up time was 18.5 (range, 3.4-29.4) months. The median overall survival was not achieved across different groups. The 2-year survival rate of all patients was 96.7%. Patients with distant metastases had worse survival than those without metastases (2-year survival rate, 84.0% vs. 99.4%, $p = 0.000$). Furthermore, multivariate analysis revealed that metastasis was an independent adverse prognostic factor for survival (hazard ratio 9.8, $p = 0.000$). A total of 17 cancer patients died, including nine patients with gastric cancer, three patients with colorectal cancer, three patients with hepatocellular carcinoma, one patient with pancreatic cancer, and one patient with glioma.
Conclusions: Metastasis was noted as an independent unfavorable prognostic factor for survival. Regular screening and timely diagnosis before metastasis are crucial to the therapy of young cancer patients.
Keywords: Young cancer patients, Survival outcomes, Prognostic factors.

INTRODUCTION

Young patients diagnosed with malignant tumors should be recognized as a unique age group due to their distinct biology, epidemiology, and clinical outcomes[1-3]. With advances in diagnosis and treatment, the overall survival (OS) of young cancer patients has prolonged, while some young cancer patients' prognosis has remained unchanged for decades[4,5]. In contrast to the older population, except for high- risk cases due to genetic or environmental factors, there is currently no effective screening method for young cases[6-8]. In addition, young cancer patients are inclined to overlook their symptoms, which may result in the delayed diagnosis and treatment[9]. In all cancer patients, types of cancer with the highest incidence rates include breast cancer, pros- tate cancer, lung cancer, and colorectal cancer[10]. Compared with the general population, young cancer patients have a unique and significantly different cancer spectrum. In the United States, thyroid cancer, breast cancer and melanoma are the most common tumors among young cancer patients[11]. However, little is known regarding the features of Chinese young cancer patients, including clinicopathological characteristics, OS, and prognostic factors. Therefore, the present study aimed to assess young cancer patients' clinicopathological features and prognosis.

PATIENTS AND METHODS

Patients

A retrospective study was conducted on young cancer patients who aged 18-45 years and were diag- nosed in our hospital between January 2021 and December 2022. All diagnoses of cancer patients were identified by histopathology. Patients with hematological malignancies were excluded. A total of 620 cancer patients with complete clinical and follow-up data were enrolled in this study.

Methods

The collected data on each patient included demographics, Eastern Cooperative Oncology Group per- formance status (ECOG PS), types of cancer, antitumor therapies, the presence of metastasis, and sur- vival time. This study was approved by the institutional review board of Chinese PLA General Hospital. Written informed consent was not required because of retrospective design and anonymous data. The research was conducted in accordance with the Declaration of Helsinki as revised in 2013.

Statistical analysis

Categorical variables were described as number with percentage, and continuous variables were summarized as median with range. The Kaplan-Meier method was utilized to OS and two-year surviv- al rate with the SPSS 24.0 software (IBM, Armonk, NY, USA). The log-rank test was used to compare the survival rate among different groups. OS was defined as the time from the date of cancer diag- nosis to the date of death or the last follow-up (May 2023). The multivariate Cox regression models were employed to identify the prognostic factors for OS. A p-value < 0.05 was considered statistically significant.

RESULTS

Patients' characteristics

A total of 620 cancer patients who aged 18-45 years were included in this study. Patients' demographic and clinical features are presented in Table 1. Notably, 260 (41.9%) patients were male and 360 (58.1%) were female. The median age was 38 (range, 18-45) years. The ECOG PS of all patients were < 2, with 0 in 359 (57.9%) patients and 1 in 261 (42.1%) patients, respectively. There were 97 patients with distant metastasis. As of May 2023, a total of 17 (2.7%) patients have passed away.

The top five cancer types with the highest incidence rates among all patients are listed in Table 2. In all 620 patients, the most common cancer types were thyroid cancer (182, 29.4%), non-small cell lung cancer (NSCLC, 106, 17.1%), and soft tissue sarcoma (88, 14.2%). In 260 male cancer patients, the most frequent cancer types were soft tissue sarcoma (61, 23.5%), thyroid cancer (52, 20.0%), and NSCLC (38, 14.6%). In 360 female cancer patients, the most common cancer types were thyroid cancer (130, 36.1%), NSCLC (68, 18.9%), breast cancer (58, 16.1%).

Table 1. Clinical characteristics of young cancer patients.

Characteristic	Total (%)
All	620 (100)
Gender	
Male	260 (41.9)
Female	360 (58.1)
Age (years)	
Range	18-45
Median	38
ECOG	
0	359 (57.9)
1	261 (42.1)
Metastasis	
No	523 (84.4)
Yes	97 (15.6)
Survival state	
Alive	603 (97.3)
Dead	17 (2.7)

Abbreviation - ECOG: Eastern Cooperative Oncology Group.

Type of cancer	Total n=620 (%)	Types of cancer	Male n=260 (%)	Types of cancer	Female n=360 (%)
Thyroid cancer	182 (29.4)	Soft tissue sarcoma	61(23.5)	Thyroid cancer	130 (36.1)
Non-small cell lung cancer	106 (17.1)	Thyroid cancer	52 (20.0)	Non-small cell lung cancer	68 (18.9)
Soft tissue sarcoma	88 (14.2)	Non-small cell lung cancer	38 (14.6)	Breast cancer	58 (16.1)
Breast cancer	59 (9.5)	Colorectal cancer	23 (8.8)	Soft tissue sarcoma	27 (7.5)
Colorectal cancer	40 (6.5)	Hepatocellular carcinoma	20 (7.7)	Colorectal cancer	17 (4.7)

Survival and prognostic factors of OS

The median follow-up time was 18.5 (range, 3.4-29.4) months. The median OS was not achieved across different groups. The two-year survival rate of all patients was 96.7% (Figure 1A). There was no significant difference in survival rate between male and female patients (two-year survival rate, 95.2% *vs.* 97.7%, $p = 0.153$, Figure 1B). Patients with ECOG 0 had longer survival than patients with ECOG 1 (two-year survival rate, 100% *vs.* 92.6%, $p = 0.000$, Figure 1C). Patients with distant metastases had worse survival than those without metastases (two-year survival rate, 84.0% *vs*. 99.4%, $p = 0.000$, Figure 1D). Furthermore, multivariate analysis revealed that metastasis was an independent adverse prognostic factor for survival (hazard ratio 9.8, $p = 0.000$). A total of 17 can- cer patients have died, including nine patients with gastric cancer, three patients with colorectal cancer, three patients with hepatocellular carcinoma, one patient with pancreatic cancer, and one patient with glioma (Table 3). One gastric cancer patient died of immune-related pneumonia, one patient with hepatocellular carcinoma died of upper gastrointestinal hemorrhage, and the other patients died of the end-stage cancers.

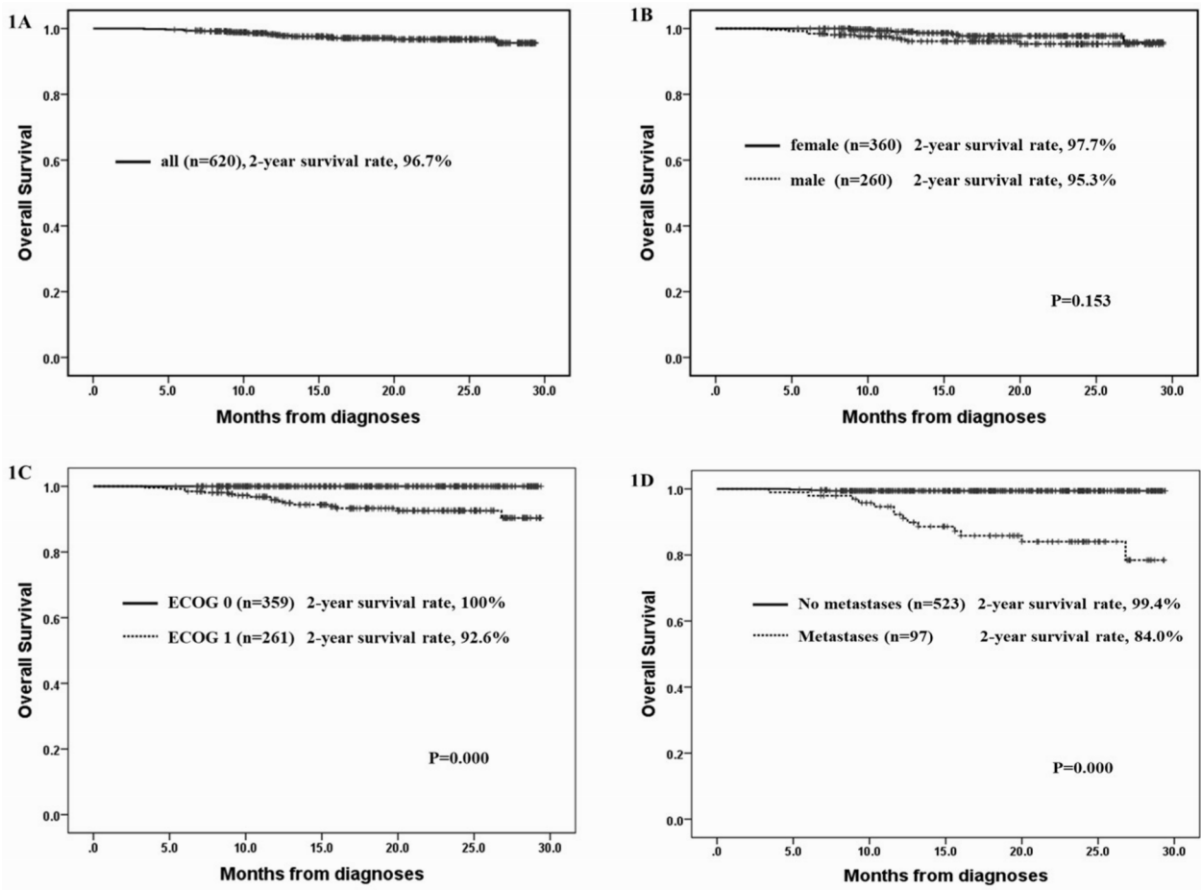

Figure 1. Overall survival: A, all 620 young cancer patients; B, female patients *vs.* male patients; C, pa- tients with ECOG PS 0 (Eastern Cooperative Oncology Group performance status) vs. patients with ECOG PS 1; D, non-metastatic patients vs. metastatic patients.

Table 3. Types of cancer in 17 dead patients.

Type of cancer	Total n=17 (%)
Gastric cancer	9 (52.9)
Colorectal cancer	3 (17.6)
Hepatocellular carcinoma	3 (17.6)
Pancreatic cancer	1 (5.9)
Glioma	1 (5.9)

DISCUSSION

In this retrospective, single-center study, the clinical characteristics, and outcomes of 620 young can- cer patients who aged 18-45 years were analyzed over the past two years. The most common types of cancer were thyroid cancer (29.4%), NSCLC (17.1%) and soft tissue sarcoma (14.2%). Univariate and multivariate analyses revealed that distant metastasis was an independent adverse prognostic factor for survival.

Zheng et al[12] reported the incidence and mortality rates of cancer in China in 2016. The most fre- quent cancer types were lung cancer, colorectal cancer, and gastric cancer. The leading causes of cancer death were lung cancer, liver cancer and stomach cancer. The new cancer cases and deaths in China in 2022 were also reported[13]. The results suggested that the three dominant cancer types and can- cer-related deaths remained the same as six years ago. Similar results were obtained when the clinical features of patients with multiple primary malignancies were retrospectively analyzed[14]. Regrettably, no study analyzed the data related to young cancer patients.

Nakata et al[15] concentrated on the epidemiology and survival of cancer in adolescents and young adults in Japan. In male patients, testicular cancer and gastrointestinal cancer were the most common cancer types in cases who aged 25-29 and 30-39 years, respectively. In female patients who aged 20- 24, 25-29, 30-34 and 35-39 years, the most common cancer types were thyroid cancer, ovarian cancer, breast cancer and cervical cancer, respectively. The 5-year OS of all cancer patients diagnosed between 2007 and 2011 was 80% for those who aged 15-29 years, and 79% for those who aged 30-39 years. Miller et al[11] reported the cancer statistics for young patients in the United States in 2020. The most di- agnosed cancer types were thyroid cancer, female breast cancer and melanoma of the skin. The 5-year survival rate was 86% and 83% in patients who aged 20-29 and 30-39 years, respectively. The three leading causes of cancer death among patients who aged 15-39 years were nervous system tumors, leukemia, and colorectal cancer for men, and breast cancer, cervical cancer, and nervous system tu- mors in women. In the present study, the most common cancer types were thyroid cancer, NSCLC, and soft tissue sarcoma, which was different from the two Chinese studies [12,13]. However, the two Chinese studies included all age groups, which was different from our young cases. In young cancer patients from Japan[15] and America[11], thyroid cancer was identified as the most frequent cancer type. Owing to the advancements in detection methods, a growing number of thyroid cancer cases could be diagnosed at an early stage. Additionally, in the present study, all thyroid cancer patients had papillary carcinoma, which was associated with a very favorable prognosis.

The 2-year survival rate of all young cancer patients was 96.7%, which was remarkably higher than the 5-year survival rate reported in studies from Japan and America, ranging from 79% to 86%[11,15]. How- ever, the follow-up time in the present study was significantly shorter, and hematological malignancies with poor outcomes were also excluded from this study, thus, the survival rates need to be further con- firmed with the extension of follow-up time in the future research.

Good ECOG PS of cancer patients are associated with favorable prognostic outcomes[16, 17]. In the present study, patients with ECOG 0 had a better survival than those with ECOG 1. However, the survival advantage was not preserved after multivariate analysis. Patient with ECOG ≤ 1 mainly receive the treat- ment of the same intensity, which may explain the result.

Distant metastases frequently indicate unfavorable outcomes in cancer patients[18-20]. This was also confirmed in the present research. Metastasis was found as the only independent adverse prognostic factor for survival. Therefore, early diagnosis and timely treatment before cancer metastases are of vital importance for the survival of the disease. In the US, the greatest number of cancer-related deaths were attributed to lung cancer, colorectal cancer, and pancreatic cancer among patients of all ages. In patients who aged 20-39 years, the three leading causes of cancer death were breast cancer, colorectal cancer and nervous system tumors[10]. Although thyroid cancer, NSCLC, soft tissue sarcoma and breast cancer were found as the most common cancer types in the present study, these cancer types can be detected in early-stages through self-examination or regular physical examination. In addition, for NS- CLC and breast cancer, there are multiple and rapidly advancing treatment options. Therefore, none of these patients died in the current study. On the contrary, among the 17 deceased patients, 16 were di- agnosed as gastrointestinal cancer, particularly gastric cancer. Young individuals often neglect digestive symptoms, and effective screening, such as gastroscopy, are not routinely employed in this population. Consequently, they are frequently diagnosed at an advanced stage, posing challenges for effective treat- ment, leading to rapid progression due to a lack of sustained and effective intervention[21,22].

The present study included two limitations. Firstly, the therapeutic outcomes and prognosis vary among different cancer types. In this study, the survival data were not specific to a certain cancer, and the outcome of a specific young-onset cancer remained to be clarified. Secondly, data from young can- cer patients were collected over the recent two years. Despite prioritizing timely results, the relatively short follow-up time might lead to deviation in survival rates.

CONCLUSIONS

In young cancer patients, thyroid cancer, NSCLC, and soft tissue sarcoma were found as the most com- mon cancer types. In contrast, the top fatal cancer types were mainly digestive cancers, such as gastric cancer and colorectal cancer. Metastasis was noted as an independent unfavorable prognostic factor for survival. Therefore, regular screening and timely diagnosis before metastasis are crucial to the ther- apy of young cancer patients.

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AUTHORS' CONTRIBUTIONS:

Wang XK collected the data and drafted the manuscript; Wu Y analyzed the data, and drafted the manuscript; Zhou MH per- formed the study design, analyzed the data and revised the manuscript. All the authors read and approved the final manuscript.

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CONFLICTS OF INTEREST:

The authors declare that there is no conflict of interest.

ETHICS APPROVAL AND INFORMED CONSENT STATEMENT:

This study was approved by the institutional review board of Chinese PLA General Hospital. Written informed consent was not required because of retrospective method and anonymous data.

DATA AVAILABILITY STATEMENT:

The data used to support the findings of this study are available from the corresponding author upon reasonable request.

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