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Chief Complaints, Clinical Characteristics, and Outcomes of Emergency Department Visit among Pediatric Cancer Patients: A Single-Center Experience

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ABSTRACT

OBJECTIVE: The aim of this study was to examine the chief complaints and clinical characteristics, outcomes, and associated factors of pediatric cancer patients who present at the emergency department (ED).

METHODS: A retrospective, single-center study was conducted on children less than 18 years old with active cancer treatment at the Department of Pediatrics, Faculty of Medicine Vajira Hospital, Navamindradhiraj University, Bangkok, Thailand from January 2017 to September 2023. The chief complaints, and clinical characteristics of ED encounter were captured. The outcomes of the patients were categorized into those from admitted patients and those from the discharged group, before the potential risk factors were analyzed.

RESULTS: A total of 91 ED encounters were documented among fifty cancer patients, representing 0.2% of total pediatric ED visits. Sixty-three (69.2%) ED visits met the inclusion criteria. The most common cancer was acute lymphoblastic leukemia. The common ED chief complaints were fever, gastrointestinal complaints, and respiratory complaints. Our results show that most pediatric cancer patients presenting at the ED were hospitalized (84.1%). There were no deaths at ED, and no patient died within 48 hours of ED visits. Seventy-seven percent of patients sought care within one day of developing emergency conditions. Fever as a chief complaint ($p = 0.016$), and levels 1 and 2 of emergency severity index (ESI) were the risk factors associated with cancer ED visits resulting in hospitalization (odds ratio = 5.64; 95% confidence intervals 1.09-29.14).

CONCLUSION: ED visits were common among children with cancer. The most frequent chief complaints were fever, gastrointestinal complaints, and respiratory complaints. Approximately 80% of ED visits resulted in hospitalization. Having fever as the chief compliant, especially in patients with high body temperature, and levels 1 and 2 of ESI, were associated with an increased likelihood of admission. This study provides valuable baseline information to enhanced the quality of emergency care for pediatric cancer patients.

KEYWORDS: cancer, chief complaint, emergency, fever, pediatric

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INTRODUCTION

The incidence of childhood cancer has increased over the past decade[1,2]. Despite improvements in cancer treatments, childhood cancer is one of the major causes of death among children and adolescents worldwide[3]. Cancer patients can develop emergency conditions related to diseases, treatment-associated adverse effects, general acute illnesses, or end-of-life care[4-6]. These emergency situations significantly impact use of healthcare and mortality[7-9]. Recently, Christodoulou et al.[10] reported a higher frequency of emergency department (ED) visits and mortality rate among children with cancer than that in the pediatric population without cancer.

A chief complaint represents a patient's concise statement of symptom or reason for seeking medical care[11,12]. Previous studies reported a chief compliant leading ED visit among cancer patients[6,8,13]. The common chief complaints among patients visiting the ED include the following: pain (such as chest pain, back pain, and extremity pain), gastrointestinal symptoms (such as bloating, loss of appetite, diarrhea, nausea, vomiting, and abdominal pain), respiratory complaints (such as dyspnea, shortness of breath, and coughing), neurologic complaints (such as alteration of conscious, dizziness, and seizures), fever, injuries, bleeding, fatigue or malaise, seeking for medication refill, dehydration, abnormal blood test, and hypertension. The management approach and outcomes varied across studies. Focusing on pediatric cancer population, admission rate ranged from 44% to 62.5% in the USA[5,8,10,14]. Prior hospitalization within four weeks, and the chief complaint of fever were the risk factors associated with high admission rate[8]. However, there is much less data on ED visits among pediatric populations in low-income and middle-income countries than in high-income countries[15]. No such data for the pediatric population in Thailand. Therefore, this study aimed to retrospectively explore the chief complaints related to ED visits, outcomes, and associated clinical features among children and adolescent with cancer in Thailand. Findings of this study were envisaged to assist in planning the optimum emergency services and providing better care for pediatric cancer patients at ED.

METHODS

We conducted a retrospective chart review using the electronic hospital information system of ED encounters. We included children and adolescent with cancer aged less than 18 years who received active cancer treatment at the Department of Pediatrics, Faculty of Medicine Vajira Hospital, Bangkok, Thailand from January 1, 2017 to September 30, 2023. Pediatric patients with cancer were identified based on information from clinical records of pediatric cancer care maintained by the Division of Pediatric Hematology and Oncology, Department of Pediatrics, and inpatient encounters that included an International Classification of Diseases, Ninth Edition, Clinical Modification (ICD-9-CM) code for cancer (140.x-209.x, 235.x-239.x), as described previously[10,16].

The ED at Vajira Hospital is an urban level 1 trauma center that provides services for about 30,000 children who accounted for 53,396 ED visits during the study period. We excluded ED visits of a new diagnosis of cancer or before cancer diagnosis, referral visits, and scheduled visits for appointments related to a treatment plan. In this cohort, the primary outcomes focused on ED complaints, and clinical characteristics of ED visits. The secondary outcomes included the outcomes of ED visits, including mortality and, ED disposition status; admission rate, and factors related to hospitalization.

The study was approved by the Ethical Clearance Committee on Human Rights Related to Research Involving Human Subjects, Faculty of Medicine Vajira Hospital, Navamindradhiraj University, Thailand. (COA 022/2567)

The cohort included 50 consecutive pediatric patients with cancer who had been treated during study periods. Data was extracted from the electronic medical record database. For eligible patients, we collected demographic data, including age, gender, comorbidity and cancer diagnosis, and number of ED visits. The treatment-related data regarding treatment protocol, and disease status were recorded. For all the identified ED visits, we collected data on ED chief complaints and characteristics, including emergency severity index (ESI) acuity measured at five levels (level 1 = crisis condition, immediate life-saving intervention required, level 2 = emergency condition, level 3 = urgent condition, multiple resources needed to stabilize the patient, level 4 = less urgent condition, and level 5 = non-urgent illness)[17], vital signs, sepsis based on 2020 surviving sepsis campaign international guidelines for the management of septic shock and sepsis-associated organ dysfunction in children[18], febrile neutropenia[19], unplanned revisit within 48 hours, and clinical outcomes.

Data analyses were performed using the PASW statistical software version 28 (SPSS, Chicago, IL, USA). Descriptive statistics were expressed as mean, standard deviation (SD), median, interquartile range, frequency and percentages. Statistical comparisons were performed using the independent t-test, Chi-square test. A p-value of less than 0.05 was considered statistically significant.

RESULTS

During the six-year study period, we identified 50 pediatric cancer patients who were involved in 91 episodes of ED visits, which accounted for 0.17% of all pediatric ED visits. Sixty-three (69.2%) ED visits met the inclusion criteria, whereas 22 (24.2%) of the ED visits were new diagnoses for cancer, and 6 (6.6%) of them were referral visits. Patient characteristics are summarized in Table 1. There were almost equal proportions of males and females in the cohort. The most common cancers were acute lymphoblastic leukemia (21%), solid tumor (18%)-including osteosarcoma (n = 3), rhabdomyosarcoma (n = 2), hepatoblastoma (n = 2), Ewing sarcoma (n = 1), and germ cell tumor (n = 1)-lymphoma (12%), and brain tumor (12%), such as medulloblastoma (n = 4), central nervous system (CNS) germ cell tumor (n = 2). The median age was 7.94 years (range, 0.3-13.7 years). Most of the cancer patients had at least one ED visit (80%).

Table 1 Patient characteristics and clinical features of emergency department visits

Characteristics	n = 50
Median of age at baseline, years (range)	7.94 (0.34-13.75)
Male: Female	25: 25
Cancer diagnosis, n (%)	
Acute lymphoblastic leukemia	21 (42)
Solid tumor	9 (18)
Lymphoma	6 (12)
Brain tumor	6 (12)
Acute myeloid leukemia	4 (8)
Chronic myeloid leukemia	2 (4)
Histiocytic disease	2 (4)
Patients with any ED visits, n (%)	40 (80)
Frequency of ED visits per individual, n (%)	
1-2	25 (50)
3-4	12 (24)
≥ 5	3 (6)

Table 1 Patient characteristics and clinical features of emergency department visits (continued)

Characteristics			n = 50
Comorbid, n (%)			
Invasive pulmonary aspergillosis			2 (4)
Epilepsy			1 (2)
Renal tubular acidosis			1 (2)
Deep vein thrombosis			1 (2)
Total number of ED visits by cancer patients			n = 63
Number of chief complaints per visit		1	37 (58.7)
		2	20 (31.7)
		3	3 (4.8)
		4	3 (4.8)
Duration of symptoms before ED visit		≤ 1 day	49 (77.8)
		> 1 day	14 (22.2)
ED chief complaints	Fever		41 (65.1)
	Gastrointestinal complaints		12 (19.0)
	Respiratory		12 (19.0)
	Pain		11 (17.5)
	Bleeding		6 (9.5)
	Fatigue/ malaise		3 (4.7)
	Dehydration/ poor intake		3 (4.7)
	Rash		3 (4.7)
	Injury		2 (3.2)
	Cardiovascular complaints		2 (3.2)
	Neurological complaints		1 (1.6)
	Abnormal lab		1 (1.6)
ESI status	1 (crisis)		2 (3.2)
	2 (emergency)		31 (49.2)
	3 (urgent)		28 (44.4)
	4 (less urgent)		2 (3.2)
Sepsis			9 (14.3)
Disease status	Newly cancer diagnosis on therapy		53 (84.1)
	Relapsed disease on therapy		6 (9.5)
	Palliative		3 (4.8)
	Off therapy for less than 6 months		1 (1.6)
Recent admission in prior 4 weeks			57 (90.5)
Unplanned revisit (within 48 hours)			20 (31.7)
Inpatient			15 (23.8)
Outpatient			5 (7.9)
Diagnosis before time to ED visit		< 6 months	28 (44.4)
		6-12 months	23 (36.5)
		> 12 months	12 (19.0)
Status	Discharged		10 (15.9)
	Admission		53 (84.1)
	Ward		48 (76.2)
	ICU		5 (7.9)

Abbreviations: ED, emergency department; ESI, emergency severity index; ICU, intensive care unit; n, number

The clinical features of the ED visits are summarized in Table 1. Most of the visits occurred within the first six months of cancer diagnosis (44.4%), followed by 6 to 12 months (36.5%), and more than 12 months (19%) after cancer diagnosis. Overall, 58.7% of ED visits had only one chief complaint, whereas 31.7% of ED visits had two chief complaints. More than 75% of the ED cancer visits were by patients who had the presenting symptom or chief complaint for less than one day. Fever was the most common (65.1%) ED chief complaint; followed by gastrointestinal complaints (19%), respiratory complaints (19%), and pain (17.5%). Fever was the most common ED chief complaint of all cancer types except in patients with brain tumors, whose most frequent ED complaint was bleeding (Figure 1). Absolute neutrophil count was evaluated in 97.5% of fever visits (40/41). Only 17 (41.5%) visits had febrile neutropenia, whereas 23 (56.1%) febrile episodes occurred in patients with absolute neutrophil count of more than 1,000 cells/mm^3. The most common triage status was ESI level 2 (49.2%), followed by level 3 (44.4%), level 1 (3.2%), and level 4 (3.2%). Regarding the time of ED visits, over half of the patients (58.7%) visited during the night (from 6:00 PM to 6:00 AM), and the remaining patients came during daytime (from 6:00 AM to 6:00 PM). Twenty ED encounters (31.7%) were unplanned revisits, including visits by patients who had recently been discharged from wards or outpatient departments for less than 48 hours. Approximate 90% of ED visited had a history of admission with the past 4 weeks. The mean body temperature was 38.0°C (SD = 0.14). Severe sepsis was observed in 14.3% of the cancer patients.

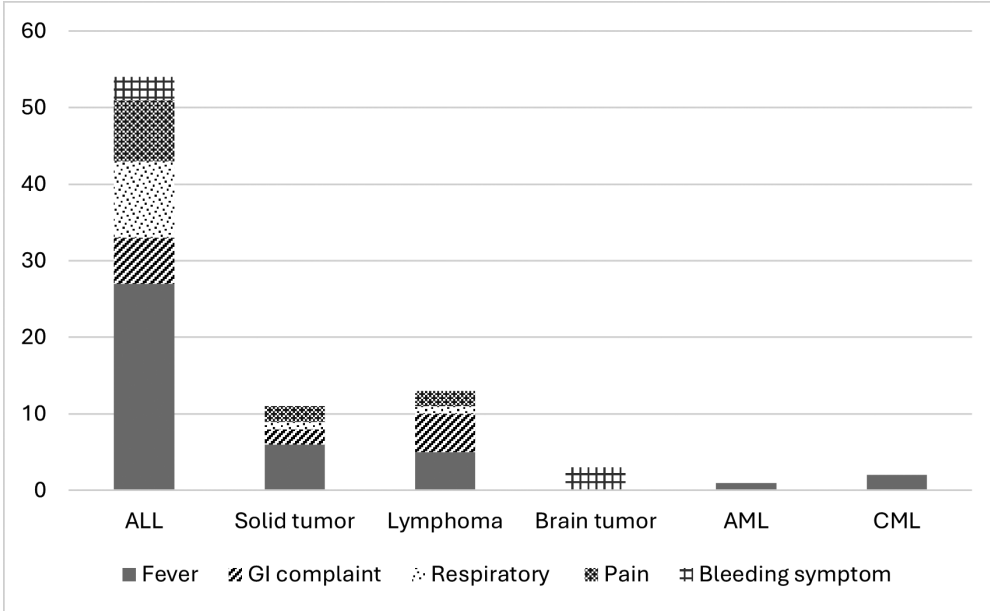

Figure 1 The most common chief complaints at ED by cancer diagnosis
Abbreviations: ALL, acute lymphoblastic leukemia; AML, acute myeloid leukemia; CML, chronic myeloid leukemia; ED, emergency department; GI, gastrointestinal

Among the patients who visited the ED, 53 (84.1%) patients were admitted to the ward (48; 76.2%) and pediatric intensive care unit (ICU) (5; 7.9%), and 10 (15.9%) patients were discharged without any unplanned ED revisit within 48 hours. There were no deaths at ED, and no patient died within 48 hours of ED visits. A comparison of the clinical characteristics between patients admitted from the ED and outpatients are shown in Table 2.

There were significant demographic differences between the hospitalized group and the discharged group; the former had fever as a presenting chief complaint, and had higher body temperature and level 1 and 2 of ESI. ED visits with fever as the chief complaint had higher odds of admission (odds ratio (OR) = 5.91; 95% confidence intervals (CI) 1.35-25.93). High likelihood of being admitted was associated with levels 1 and 2 of ESI (OR = 5.64; 95%CI 1.09-29.14). The mean temperature was higher in hospitalized patients (38.2°C ± 1.1°C) than in patients who were treated under outpatient settings (37.1°C ± 0.8°C); the differences between the two groups were significant (p = 0.005). Discharged patients were older (7.5 ± 3.9 vs 8.8 ± 3.4 years old, p = 0.33) than those who were admitted. We also observed no significant difference in median duration between the time of diagnosis and the ED visit, as well as prior admission within the previous 4 weeks. The median duration from cancer diagnosis to the ED visit was 7.1 months (range, 0.26-30.6 months) in the admitted group, compared to 10.8 months (range, 0.79-40.9 months) in the discharged group (p = 0.075).

In this cohort, five patients with severe features requiring ICU admission presented to the ED with fever along with others chief complaints. All patients were diagnosed with febrile neutropenia accompanied by septic shock. The clinical data of patients requiring ICU admission are summarized in Table 3. Notably, patient with severe conditions tended to present to the ED with multiple complaints, and 60% of severe case visits requiring ICU admission occurred in the patient who sought ED care more than one day after the onset of an emergency condition (p = 0.074).

Table 2 Clinical characteristics of patients presenting to ED by admission status (Independent t-test and Chi-squared test)

Characteristics	Admitted (n = 53)	Discharged (n = 10)	P-value
Duration of symptoms before ED visit less than 1 day	39 (73.6)	10 (100.0)	0.100
ED chief complaints			
Fever	38 (71.7)	3 (30.0)	0.016
Gastrointestinal complaints	11 (20.8)	1 (10.0)	0.671
Respiratory complaints	10 (18.9)	2 (20.0)	1.000
Pain	8 (15.1)	3 (30.0)	0.360
ESI 1-2	31 (58.5)	2 (20.0)	0.038
Mean age (years old ± SD)	7.5 ± 3.9	8.8 ± 3.4	0.329
Mean body temperature (°C ± SD)	38.2 ± 1.1	37.1 ± 0.8	0.005
Median duration from cancer diagnosis (months, min-max)	7.1 (0.26-30.6)	10.8 (0.79-40.9)	0.075
Sepsis	9 (17.0)	0	0.332
Unplanned re-visit (within 48 hours)	16 (30.2)	4 (40.0)	0.713
Recent admission in prior 4 weeks	49 (92.5)	8 (80.0)	0.240

Abbreviations: °C, celsius; ED, emergency department; ESI, emergency severity index; n, number; SD, standard deviation

Table 3 Clinical courses of ED cases with severe feature requiring intensive care

	Case 1	Case 2	Case 3	Case 4	Case 5
Age (year)	10.8	12.3	1	13.7	8.3
Sex	Male	Male	Female	Female	Female
Diagnosis	ALL	Diffuse large B lymphoma	AML	Ewing sarcoma	ALL
Treatment protocol/ phase of treatment	TPOG ALL1303/ augmented consolidation	TPOG BL-13HR/ maintenance	TPOG AML-1302/ consolidation	TPOG-EWS-13SR	TPOG ALL1303/ maintenance
Comorbid	None	None	None	None	None
Number of chief complaints; details	4; fever, GI, fatigue, pain	4; fever, GI, pain, fainting	1; fever	3; fever, pain, dehydration	2; fever, GI
Duration from cancer diagnosis (days)	91	224	86	137	499
Onset >1 day	Yes	No	Yes	Yes	No
Sepsis	Yes	Yes	Yes	Yes	Yes
Diagnosis	Febrile neutropenia, SARS-CoV-2 infection	Febrile neutropenia	Febrile neutropenia	Febrile neutropenia	Febrile neutropenia, relapsed disease
Reason for ICU	Septic shock	Septic shock, severe dehydration	Septic shock	Septic shock	Septic shock
Outcome	Discharge, recovery	Discharge, recovery	Discharge, recovery	Discharge, recovery	Discharge, palliative care

Abbreviations: ALL, acute lymphoblastic leukemia; AML, acute myeloid leukemia; BL, B-cell non-Hodgkin lymphoma; ED, emergency department; EWS, Ewing sarcoma; GI, gastrointestinal; HR, high risk; ICU, intensive care unit; SR, standard risk; TPOG, Thai Pediatric Oncology group

DISCUSSION

In this retrospective cohort study, the proportion of pediatric cancer patients visiting ED averaged 0.17% of the total pediatric patient ED visits. These patients may present to the ED for the management of symptomatic cancer, treatment-related complications, acute conditions, or palliative care needs. This study reported that fever was the most common ED chief compliant, followed by gastrointestinal complaints, and respiratory symptoms. Additionally, the vast majority of pediatric cancer patients presenting to the ED were subsequently hospitalized.

Acute leukemia, solid tumors, and lymphoma, being the most prevalent cancers in the study population and accounted for the majority of ED encounters. Our study found that fever was the most common chief complaint among cancer-related ED visits. These findings are similar to previous studies conducted in USA and Ethiopia, which also identified fever as the most common ED chief complaint among pediatric and adolescent patients with cancer[6,8,20]. However, some previous studies report that in adult cancer population, the most common ED chief complaints are pain, gastrointestinal symptoms, respiratory system symptoms, and fever[6,13]. The reasons for this discrepancy might be differences in primary cancer type and treatment between the population groups. Cancer ED visits tended to be from patients within the first six months of cancer diagnosis (44.4%). Most ED visits could be associated with aggressive nature of cancers and treatment-related toxicities of intensive chemotherapy during the initial period of their treatment[21].

In a previous study with a large study population, Christodoulou et al.[10] reported a mortality of 1.2% among pediatric patients with cancer presenting to the ED. Our study demonstrated favorable outcomes, with no deaths

reported in the ED, or within 48 hours of presentation. This observation may be attributed to the tendency of patients in this cohort to seek medical care promptly, typically within less than one day of experiencing an emergency or urgent conditions. However, due to the limited sample size in this study, we could not identify a significant association between delayed ED encounter and severe clinical conditions necessitating intensive care. Notably, a high admission rate was observed. Our findings revealed that 84.1% of pediatric cancer patients presenting to the ED were admitted, which is higher than in previous reports. In the US, hospitalization rates have ranged from 44% to 62.5% depending on the study population[5,8,10,14]. This difference might be attributed to variations in the emergency care system between developing and developed countries, including the lack of specific risk-stratified approach to the management of fever and follow-up systems, particularly for non-neutropenic fever[22], which constituted a significant proportion of fever episodes in this study.

A previous study reported that factors associated with hospitalization following ED presentation included prior hospitalization within 4 weeks, and a chief complaint of fever[8]. In the current study, we also identified significant variability in hospitalization, particularly regarding fever as the chief complaint, especially in patients with high body temperature, and levels 1 and 2 of ESI. However, in contrast to that previous study, prior hospitalization within 4 weeks was not identified as a significant factor for hospitalization. This may be attributed to differences in chemotherapy management and health care system in Thailand, as most patients tended to be admitted for chemotherapy.

This study provides a better understanding of the emergency conditions of pediatric cancer patients in the ED settings. It emphasizes the need for medical providers, pediatricians, and oncologists to be adequately prepared to address common emergency chief complaints and improve the quality of emergency management. Future research should focus on developing risk-stratified treatment guidelines for fever management, and enhancing multidisciplinary care systems, particularly by improving the ability of patients or caregivers to promptly detect emergency conditions, as well as strengthening follow-up systems, and referral services in resource-limited settings to reduce unnecessary hospitalization and mortality.

This study had some limitations. First, the retrospective analysis may lead to lack of document more specific ED chief compliant. Second, data in hospital databases might exclude patients who died at home before documentation of the ED revisit episodes. Third, with a small sample size, single-center patients might not be representing the diversity of patients in other institutions in terms of volume and spectrum of cancer diagnosis. Therefore, further prospective studies incorporating multiple centers should be considered.

CONCLUSION

ED visits were common among children with cancer. The most common chief complaints were fever, gastrointestinal complaints, and respiratory complaints. No deaths were observed in the ED or within 48 hours after the visit. The majority of patient tended to visit ED within one day of developing emergency conditions. Most of the pediatric cancer patients who visited the ED were hospitalized. Having a chief compliant of fever, especially in patients with high body temperature, and levels 1 and 2 of ESI were associated with high chances of admission. This study enhanced the understanding of emergency conditions in pediatric cancer patients in the ED, which may assist healthcare providers in preparing for the management of common emergency complaints, and improve quality of ED care in the future.

CONFLICT OF INTEREST

None

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This study was approved by the ethics committee on human rights related to research to research involving human subjects, Faculty of Medicine Vajira Hospital, Navamindradhiraj University, Thailand.

DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article, further inquiries can be directed to the corresponding author.

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