

Pediatric cancers that need radiotherapy in Iran: 30 years of one hospital data analysis

Khodabakhshi R¹, Yahyazadeh SH¹, Shahidi J¹, Mortazavi SH², Alidoosti A³, Mosavi-Jarrahi A⁴, Shahradi B³

Abstract

Objective: Several studies have been published on the epidemiology of childhood malignancies worldwide. The primary objective of this study is to determine the relative frequency of pediatric cancers in Iran.

Methods: Using a retrospective approach, all confirmed cases of malignancies aged 14 years old or less at the time of first referral to the department of radiation oncology of Jorjani hospital entered to the study. Registered pediatric cancers from 1972 to 2001 were classified into 12 groups according to the International Classification of Childhood Cancer (ICCC).

Results: Among 1881 registered malignancies, leukemia was the most common form (36.8%). Thereafter, in descending order of frequency were lymphoma (16.6%), CNS (14.2%), kidney (7.1%), soft tissue (5.8%), bone (5.2%), retinoblastoma (4.9%), sympathetic nervous system (3.5%), epithelial (2.3%), and germ cell tumors (2.1%). Only five patients (0.3%) had liver cancer.

Conclusion: Like other similar studies worldwide, leukemia, lymphoma, and CNS tumors were the most common types of childhood cancers in our study. Since relative frequency of cancers in referred patients to a radiation oncology department cannot give a precise estimation about cancer prevalence in the country, establishing a national cancer registry can lead to achieve more accurate cancer prevalence and incidence rate.

Keywords: cancer epidemiology, pediatric cancers, relative frequency

1. Department of radiation oncology, Fayazbakhsh hospital, Tehran, Iran.
2. Department of radiation oncology, Madaen hospital, Tehran, Iran.
3. Department of radiation oncology, Imam Hossein hospital, Tehran, Iran.
4. Department of epidemiology, Shahid Beheshti University, M.C.

Corresponding author:
Dr. Khodabakhshi R
E-mail: rokh17@yahoo.com

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Introduction

Malignant neoplasms are one of the major causes of mortality in children under the age of fourteen [1]. Epidemiological studies provide useful measures of the health burden and potential impact on health care delivery because of childhood cancer, which can aid the planning of cancer care services. In addition, they may guide investigations of disease etiology [2].

Numerous studies have been done to show the relative prevalence and incidence of childhood cancers worldwide [2-12]. Although the pattern of relative prevalence of pediatric malignancies has similarities in the majority of these reports, there are significant and considerable differences that confirm the importance of regional epidemiological studies. Whilst in many countries leukemia is the most common childhood neoplasm following by central nervous system tumors and lymphoma [2-12], reports from other countries show diversities. For example, in Nigeria the most common childhood malignancy is

lymphoma, while leukemia is in the fourth place [7]. Besides, the percentage of cases of each cancer and its pathological subtypes vary from one region to another [2-12].

There are a few regional reports on cancer incidence in Iran that mainly focused on adult malignancies [13-15]. Besides, the majority of previous studies in the field of pediatric oncology in Iran only included specific childhood malignancies especially leukemia and lymphoma [16]. To our knowledge, there is no large epidemiological study on relative prevalence and incidence of childhood cancers, which contains both hematological malignancies and solid tumors in last 30 years in Iran.

The aim of this study is to present the relative frequency of malignant neoplasms in Iranian children using the data of the patients' documents referred to the department of radiation oncology of Jorjani hospital (now known as Imam Hossein hospital). Department of radiation oncology at Jorjani hospital is one of the oldest and busiest radiation oncology centers in Iran which has been providing services to

Table 1: Number and percentage of cases in three age groups (0-4, 5-9, and 10-14 years) together with sex ratio for 12 major ICCC diagnostic categories and selected subgroups (Jorjani, 1972-2001).

| | 0-4 | years | 5-9 | years | 10-14 | years | 0-14 | years | |
|-----------------------------------|-----|-------|-----|-------|-------|-------|------|-------|-----------|
| | No. | % | No. | % | No. | % | No. | % | M/F ratio |
| Leukemia | 252 | 41.5 | 294 | 39.6 | 146 | 27.4 | 692 | 36.8 | 1.7 |
| ALL | 245 | 40.4 | 284 | 38.3 | 139 | 26.1 | 668 | 35.5 | |
| Other and unspecified | 7 | 1.1 | 10 | 1.3 | 7 | 1.3 | 24 | 1.3 | |
| Lymphoma | 47 | 7.8 | 152 | 2.5 | 112 | 21.0 | 311 | 16.6 | 2.1 |
| Non-Hodgkin's Lymphoma | 37 | 6.1 | 92 | 12.4 | 52 | 9.8 | 181 | 9.7 | |
| Hodgkin's Disease | 10 | 1.7 | 60 | 8.1 | 60 | 11.2 | 130 | 6.9 | |
| CNS tumors | 42 | 6.9 | 127 | 17.1 | 98 | 18.4 | 267 | 14.2 | 1.5 |
| Astrocytoma | 16 | 2.6 | 58 | 7.8 | 53 | 10.0 | 127 | 6.8 | |
| Medulloblastoma | 16 | 2.6 | 40 | 5.4 | 26 | 4.9 | 82 | 4.3 | |
| Ependymoma | 6 | 1.0 | 11 | 1.5 | 7 | 1.3 | 24 | 1.3 | |
| Other and unspecified | 4 | 0.7 | 18 | 2.4 | 12 | 2.2 | 34 | 1.8 | |
| Renal tumors | 87 | 14.3 | 36 | 4.9 | 10 | 1.9 | 133 | 7.1 | 1.3 |
| Soft tissue sarcomas | 37 | 6.1 | 33 | 4.5 | 42 | 7.9 | 112 | 5.8 | 1.6 |
| Bone tumors | 13 | 2.1 | 26 | 3.5 | 58 | 10.9 | 97 | 5.2 | 1.3 |
| Ewing's Sarcoma | 7 | 1.1 | 18 | 2.4 | 32 | 6.0 | 57 | 3.0 | |
| Osteosarcoma | 0 | 0 | 5 | 0.7 | 24 | 4.5 | 29 | 1.6 | |
| Other and unspecified | 6 | 1.0 | 3 | 0.4 | 2 | 0.4 | 11 | 0.6 | |
| Retinoblastoma | 73 | 12.0 | 18 | 2.4 | 1 | 0.2 | 92 | 4.9 | 1.2 |
| Sympathetic nervous system tumors | 35 | 5.8 | 24 | 3.2 | 7 | 1.3 | 66 | 3.5 | 1.5 |
| Carcinomas | 4 | 0.7 | 14 | 1.9 | 26 | 4.9 | 44 | 2.3 | 1.1 |
| Germ Cell tumors | 13 | 2.1 | 5 | 0.7 | 22 | 4.2 | 40 | 2.1 | 0.8 |
| Hepatic tumors | 3 | 0.5 | 1 | 0.1 | 1 | 0.2 | 5 | 0.3 | 0.7 |
| Other and unspecified tumors | 1 | 0.2 | 12 | 1.6 | 9 | 1.7 | 22 | 1.2 | 1.2 |
| Total | 607 | 100 | 742 | 100 | 532 | 100 | 1881 | 100 | 1.6 |

cancer patients since 1972. The department is located in the central part of Tehran and is in charge of cancer treatment including radiotherapy and chemotherapy. Therefore, it can present a perspective on the epidemiology of childhood cancers in Iran.

Methods

This retrospective study covered all patients referred to the department of radiation oncology of Jorjani hospital from 1972 to 2001 who at the time of referral were 14 year-old or less. The required data was obtained from patients' written documents, It included document number, patient's name, sex, age, cancer type, pathology, etc. Patients with benign diseases were excluded from the study.

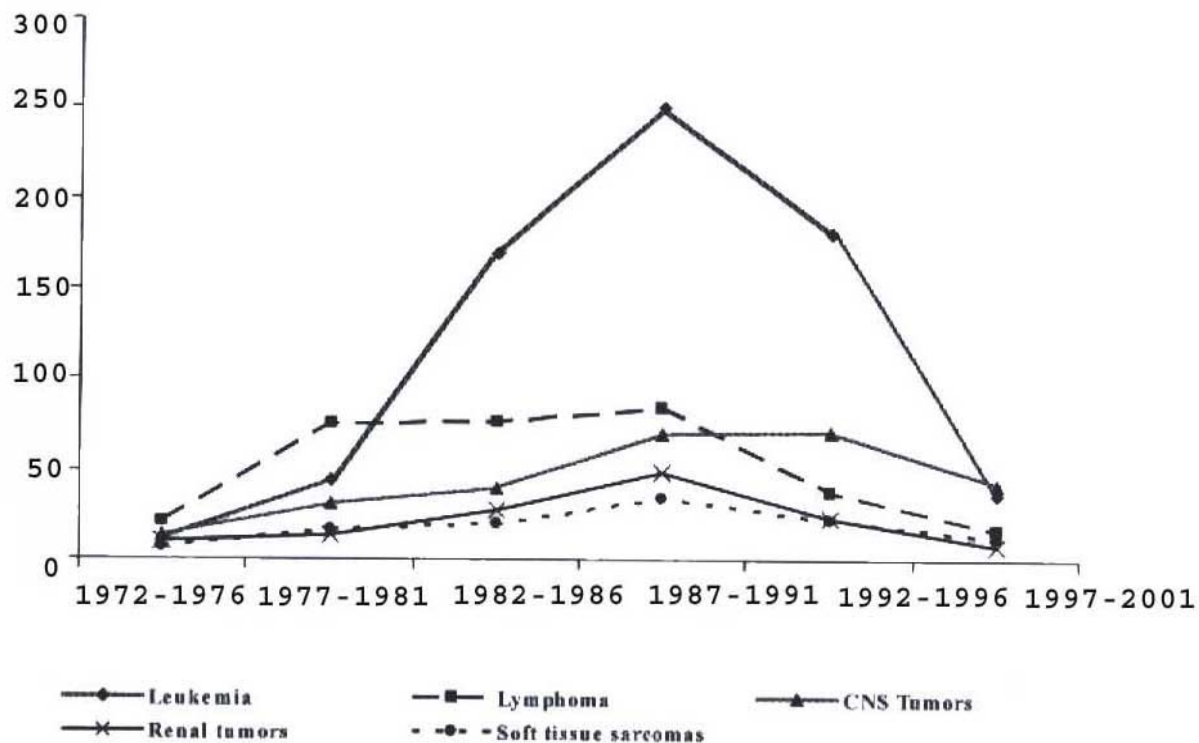
The International Classification of Diseases for Oncology M-code was determined for all cases. The types of cancer were classified into 12 groups according to the International Classification of Childhood Cancer (ICCC) [17]. These 12 groups are

leukemia, lymphoma, central nervous system tumors, sympathetic nervous system tumors, retinoblastoma, renal tumors (including Wilm's tumor), hepatic tumors, bone tumors, soft tissue sarcomas, germ cell tumors, epithelial neoplasms (carcinomas), and other neoplasms. Each group divided into subgroups based on the pathologic diagnosis. The collected information then entered into computer and was analyzed using Microsoft Access and Microsoft Excel 2003.

Patients were also classified into three age groups (0-4, 5-9, 10-14 years) according to their age at the time of first referral to the department, Number of male and female cases and Male/Female ratio was determined in all types of cancer.

Time trend analysis was based on the number of cases referred between 1972 and 2001. The period of study divided into 5-year intervals and the date of first referral was determined to be used for this purpose.

Figure 1: Number of registered patients according to year of referral for the five most common childhood malignancies (Iorjani, 1972-2001).



Results

Between 1972 and 2001, 1924 patients under the age of fifteen were registered from which 43 cases were diagnosed as benign diseases. Therefore, a total of 1881 childhood cancer cases referred to the department over this 30-year period.

Table 1 shows the number and percentage of each type of cancer according to the International Classification of Childhood Cancers and the selected subtypes in three age groups (0-4, 5-9, 10-14). Leukemia was the most common type of cancer, constituting 36.8% of all cases. It was also the most frequent malignancy in all three age groups. Acute lymphoblast leukemia was the most common pathologic type of cancers (668 patients, 35.5%). Other common malignancies in descending order of frequency were lymphoma, central nervous system tumors, renal tumors, and soft tissue sarcomas.

Non-Hodgkin's lymphoma and Hodgkin's disease consisted 58% and 42% of lymphomas respectively. Whilst lymphoma was the second most common malignancy under the age of 15 in our study, it ranked fourth after leukemia, renal tumors, and retinoblastoma among patients under the age of five.

Considering central nervous system tumors, astrocytoma, medulloblastoma, and ependymoma formed the three most common subtypes with a percentage of 47.6, 30.7, and 9.0 respectively. Ten cases of craniopharyngioma registered during the period of study. Similar to lymphoma, central nervous system tumors tend to appear in 5-9 and 10-14 age groups.

All renal tumors have been diagnosed pathologically as Wilm's tumor. No other pathology (such as renal cell carcinoma) has been reported. Wilm's tumor was the second most common malignancy under the age of five (14.3%).

Discussion

Soft tissue sarcomas ranked fifth among childhood malignancies in our study. Rhabdomyosarcoma was the most frequent pathologic subtype among soft tissue sarcomas (58%).

Ewing's sarcoma and osteosarcoma were the two common pathologies among bone tumors. The former consisted 58.8% and the latter formed 29.9% of bone tumors in our report. Approximately 60 percent of patients who registered as a case of bone tumor

Table 2: Relative frequency of pediatric malignancies in referred patients to the department of radiation oncology at Jorjani hospital in comparison with similar reports from Hong Kong, Italy, and the US.

| | Iran | | Hong Kong [3] | | Italy [4] | | US[5] | |
|-----------------------------------|------|------|---------------|------|-----------|------|-------|------|
| | % | rank | % | rank | % | rank | % | rank |
| Leukemia | 36.8 | 1 | 40.0 | 1 | 33.4 | 1 | 31.4 | 1 |
| Lymphoma | 16.6 | 2 | 10.8 | 3 | 11.8 | 3 | 12.4 | 3 |
| CNS tumors | 14.2 | 3 | 16.3 | 2 | 22.4 | 2 | 17.6 | 2 |
| Renal tumors | 7.1 | 4 | 3.5 | 6 | 4.8 | 7 | 6.3 | 6 |
| Soft tissue sarcomas | 5.8 | 5 | 2.9 | 8 | 5.8 | 5 | 7.1 | 5 |
| Bone tumors | 5.2 | 6 | 4.2 | 4 | 5.3 | 6 | 5.0 | 7 |
| Retinoblastoma | 4.9 | 7 | 2.5 | 10 | 2.5 | 9 | 2.9 | 10 |
| Sympathetic nervous system tumors | 3.5 | 8 | 2.4 | 11 | 7.6 | 4 | 8.1 | 4 |
| Carcinomas | 2.3 | 9 | 3.3 | 7 | 2.3 | 10 | 4.0 | 8 |
| Germ cell tumors | 2.1 | 10 | 4.1 | 5 | 2.6 | 8 | 3.2 | 9 |
| Hepatic tumors | 0.3 | 11 | 2.5 | 9 | 1.0 | 11 | 1.3 | 11 |

were between 10 and 14 years old at the time of first referral.

Nearly 80 percent of retinoblastomas were under 5 years old at first referral. Whilst retinoblastoma was not among five most common childhood malignancies, it consisted 12 percent of cases under the age of five that made it appear in the third place in this age group. Only one patient with the diagnosis of retinoblastoma was older than 10.

Sympathetic nervous system tumors, carcinomas, and germ cell tumors were not common with less than 70 patients each. Hepatic tumors were very rare with just 0.3 percent of total cases.

Number of male and female patients were 1146 and 735, respectively that leads to M/F ratio of approximately 1.6 in total. The highest M/F ratio is seen in Lymphoma (2.1). Only in two malignancies (germ cell and hepatic tumors), the number of female patients was more than male ones.

Figure 1 illustrates the number of patients registered at the department of radiation oncology of Jorjani hospital by period of referral for the five most common malignancies. Leukemia peaked remarkably between 1987 and 1991 with a maximum of 250 registered cases.

This study uses the data of registered patients at the department of radiation oncology of Jorjani hospital over a period of 30 years. We designed the study in a way to be comparable to the same studies worldwide. Lack of similar studies in Iran, high number and variety of referred patients to the department, long period of study and precise data analysis make the results of this report relatively reliable.

Table 2 shows the relative frequency of pediatric malignancies in our study in comparison with three selected similar studies from three different regions [3-5]. Like the majority of reports, leukemia is the most common malignancy under the age of 15 in all

presented studies. Acute lymphoblastic leukemia consists 96 percent of leukemias in Jorjani data which is remarkably higher than reports from other cancer registries. It can be because other pathologic subtypes of leukemia were not referred to the department as much as ALL. As Figure 1 shows, the number of patients with the diagnosis of leukemia started to decline dramatically in the early 90's. It is mainly because of the introducing of curative chemotherapy in other centres, which led to a decrease in the number of patients who needed radiotherapy.

Unlike the selected studies, in our data lymphoma is more common than central nervous system tumors (16.6% vs. 14.2%). The ratio of NHL to Hodgkin's disease shows various patterns in different studies. For instance, while the frequency of NHL is apparently higher than Hodgkin's disease in Hong Kong [3], Hodgkin's disease is more common than NHL in Italy [4]. In our study, NHL is more frequent than Hodgkin's disease with a ratio of 1.4:1. Male/Female ratio among lymphoma cases is more than two which is similar to that of Italy [4].

Astrocytoma, medulloblastoma, and ependymoma are the three major subtypes of CNS tumors in our study. This data mimics the data resulted from Piedmont cancer registry in Italy [5]. It may refute the hypothesis which suggests that there may be a different pattern of CNS tumors distribution in the Middle East [18].

Hepatic earcinoma was rare among the referred patients to the department of radiation oncology of Jorjani hospital. Although the incidence of liver tumors in children is low in developed countries for the vaccination against hepatitis B virus, it seems that very low number of hepatic tumor cases in our study is partly because radiation does not have an important role in the treatment of these patients.

Thus, these patients are not usually referred to a radiation oncology department.

We are aware of our limitations in this study, most importantly our data source. Since there is no national cancer registry in Iran and even regional cancer registries have fundamental flaws, we had to use the information obtained from a large cancer treatment centre to reach the relative frequency of pediatric malignancies in Iran. Obviously, it cannot give an accurate estimation of relative frequency in that there are factors which actively influence the results such as changes in treatment of pediatric malignancy over the time (like preference of chemotherapy to radiotherapy in ALL in recent years). In addition, we cannot calculate the incidence rate of pediatric cancers using the current data.

In conclusion, the relative frequency of childhood malignancies in Iran is similar to that of western countries. Improving the method of data collection including the establishment of a national cancer registry can help to reach more accurate results on the prevalence and incidence of childhood cancers.

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