

Childhood Cancer in Basrah, Iraq During 2012-2016: Incidence and Mortality

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Abstract

Background: Worldwide, childhood cancer is rare. In addition, a distinct variation in both incidence and type distribution was reported between countries. **Aim:** To estimate the incidence and mortality rates of childhood cancer in Basrah, Iraq during 2012-2016. **Methods:** This registry based descriptive study included children aged 0-14 years with primary cancer who were newly diagnosed in Basrah during 2012-2016. The types of malignant tumors were classified according to International Classification of Childhood Cancer, Version 3 (ICCC-3). The overall and specific incidence and mortality rates by age and sex were calculated per 100,000 population. **Results:** A total of 723 new cases of childhood cancer were registered during the five- year study period, with a male to-female ratio of 1.2/1. Children aged <4 years accounted for 43.1% of patients. The overall incidence rate was 13.74/100,000, and the age standardized incidence rate (ASIR) was 13.87/100,000. Boys showed higher incidence rate than girls (14.78 vs. 12.66/100,000). Leukemia was the most common type of childhood cancer accounting for 35.4%, followed by lymphoma (17.8%), and central nervous system tumors 11.9%. The overall cancer-specific mortality rate was 6.04/100,000 and the ASMR was 6.08/100,000 children. **Conclusion:** The incidence rate of childhood cancer in Basrah as well as the cancer type distribution was comparable to that reported for developing countries.

Keywords: Cancer- childhood- incidence- mortality-Basrah

Asian Pac J Cancer Prev, **19** (8), 2337-2341

Introduction

Worldwide, cancer is a major health problem in terms of morbidity and mortality but is more in developing countries. In 2015, 8.8 million people died from cancer (about 16% of annual deaths worldwide) and 70% of these cancer-related deaths occur in developing countries (WHO, 2017).

In developed countries, although there is an improvement in the 5-year survival rate, cancer in children is the second leading cause of death after accidents (Murphy et al., 2013).

In developing countries, though significant success is achieved in combating the main causes of death in children like infection and malnutrition, cancer emerges as the third or fourth common cause of death among children (Pui and Ribeiro, 2003). Developing countries stand the greatest burden of childhood cancer. It is estimated that 80%-85% of pediatric cancer cases occur in the developing countries, where 90% of the world's children live in these countries (Ribeiro et al., 2008; Chirdan et al., 2009), and the 5-year survival could be less than 10% (Chirdan et al., 2009).

Cancer in children is usually rare and represents a small proportion of all cancers. According to Globocan 2012

estimates, it represents about 1% of all cancers. However, one out of two children with cancer will die (Ferlay et al., 2013). In Iraq, childhood cancer constitutes about 6.7% of all cancers (Iraqi Cancer Board, 2012). A part of other reasons, this could be attributed to the population structure. In Iraq, children less than 15 years of age represent 40% of the total population (Habib et al., 2016).

In most population of the world, the incidence of childhood cancer ranges from 50 to 200 per million children per year (Stefan, 2015).

Describing the epidemiology of childhood cancer in terms of estimating its incidence and outcome, and understanding the time trend, will allow for a crucial evaluation of current protocols for cancer prevention and control focusing on combating the common and modifiable risk factors using effective inexpensive strategies.

The aim of this study was to estimate the incidence and cancer-related mortality rates among children in Basrah, Iraq during 2012-2016.

Materials and Methods

Study design and setting

This was a descriptive retrospective study done for

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the period from February 2017 to September 2017 based on cancer registration in “Basrah specialized hospital for children, Oncology Centre at Al-Sadr teaching hospital, and Statistics department at Basrah General Health Directorate”. Therefore, it is expected that all cancers should be registered. However, a few of them may be missed particularly those treated abroad.

Study population

The study population was children aged less than 15 years of age from Basrah Governorate inhabitants who were diagnosed with histologically and haematologically verified cancer during the period from 1st of January 2012 up to 31st of December 2016 were included in this study. The primary sites of cancers were identified and coded according to the 3rd International Classification of Childhood Cancer (ICCC-3) coding system (Steliarova-Foucher et al., 2005).

Sampling and sample size

All children with cancer who were registered during the years 2012 and 2016 inclusive were included in this study. The total number of registered cases during this period was 723 (160 cases in 2012, 119 cases in 2013, 131 in 2014, 146 in 2015, and 167 in 2016) which represent the sample size of this study.

Sources of data and data collection

Data about socio-demographic characteristics such as age, sex, age at diagnosis, residence, and type of cancer were extracted from records of the aforementioned sources of data according to a special form designed for the purpose of the study. Recorded data were summarized in a data sheet excel program. To ensure completeness and accuracy, the data were checked and reviewed several times both manually and electronically. In case of incompleteness or doubt about medical records, additional data were searched for using cancer registration reports of Ministry of Health.

Duplication of data was avoided by using the patient’s full four names (patient, father, grandfather and family name), in addition to mother’s name. The data were typed first on an excel sheets. Then were transformed into an SPSS (Statistical Package for Social Sciences) program version 23 (IBM, Chicago, Illinois, USA) for statistical analysis. Information about death was sought from Basrah cancer registry and was ascertained by linkage with the death registry from the Statistics Department in Basrah General Health Directorate.

Information related to population of Basrah governorate including the (age and sex) structure and residence for the period 2012- 2016 were based on data available with the Ministry of Planning/ Basrah Statistical Office.

Data analysis

Statistical analysis was performed with the statistical package for social sciences (SPSS) version 23. Children were classified by age at time of cancer diagnosis as 0-14 years (0-4, 5-9 and 10-14 years). Age standardized incidence (ASIR) and age standardized mortality rates (ASMR) per 100,000 were calculated using the world

standard population (Doll and Cook, 1967).

Incidence and mortality rates were calculated based on the estimated mid-period population reported by the Central Department of Statistics and Information, Ministry of planning.

Results

The total number of children with cancer that were newly diagnosed and registered during the years 2012-2016 was 723 (Males= 395, Females= 328, Male: Female ratio= 1.2:1). The mean age was 6.2±4.1 years, 43.1% of them were aged 0-4 years, 31.5% aged 5-9 years, and 25.4% were 10-14 years of age.

The overall incidence rate was 13.74/100,000, and the ASIR was 13.87/100,000. The peak of incidence and age standardized incidence rates of childhood cancer in Basrah were in the year 2012 (15.74/100,000 population and 15.87/100,000 population respectively). Then they decreased to (11.50/100,000 population and 11.59/100000 population respectively) in the year 2013 to rise again steadily in the following years to reach (14.53/100,000 population and 14.54/100,000 population respectively) in the year 2016 (Table 1).

The age and sex specific incidence and mortality rates are shown in table 2. Boys showed higher incidence rate than girls (14.78 vs. 12.66/100,000). Similarly, the mortality rate was also higher among boys than girls (6.51 vs. 5.59/100,000). The highest age specific incidence and mortality rates were observed among children aged 0-4 years, then decreased gradually.

The most common cancers were leukemia (35.4%), lymphomas (17.8%), and central nervous system (CNS) cancers (11.9%). The least common type of cancer was hepatic tumors (1.5%).

Table 1. Crude and Age Standardized Incidence Rates of Cancer During 2012-2016

Year	Population	No. of cases	IR/ 100,000	ASIR/ 100,000
2012	1,015,945	160	15.74	15.87
2013	1,034,246	119	11.5	11.59
2014	1,052,672	131	12.44	12.63
2015	1,115,983	146	13.08	13.15
2016	1,149,574	167	14.53	14.54
Mid-period pop	1,052,672	723	13.74	13.87

IR, Incidence rate; ASIR, Age standardized incidence rate

Table 2. Age and Sex Specific Incidence and Mortality Rates

Age group (years)	Incidence rate (Per100,000)			Mortality rate (Per 100,000)		
	Boys	Girls	Total	Boys	Girls	Total
0 - 4	17.65	15.14	16.4	7.29	6.83	7.06
5-9	15	11.42	13.25	7.16	4.17	5.69
10-14	11.33	11	11.18	4.96	5.5	5.22
Total	14.78	12.66	13.74	6.51	5.59	6.04

Table 3. Frequency and Incidence Rates (IR) of Different Types of Cancers

Type of cancer	No. (%)	Boys			Girls		
		No. of cases	%	IR	No. of cases	%	IR
Leukemias	256 (35.4)	143	36.2	5.35	113	34.5	4.36
Lymphomas	129 (17.8)	77	19.5	2.88	52	15.8	2.00
CNS and miscellaneous intracranial intraspinal neoplasms	86 (11.9)	34	8.6	1.27	52	15.8	2.00
Neuroblastoma and other peripheral nervous cell tumors	51 (7.1)	34	8.6	1.27	17	5.2	0.66
Retinoblastoma	21 (2.9)	8	2.0	0.3	13	4.0	0.5
Wilms tumor/Other renal tumors	33 (4.6)	17	4.3	0.64	16	4.9	0.62
Hepatic tumors	11 (1.5)	5	1.3	0.19	6	1.8	0.23
Malignant bone tumors	37 (5.1)	19	4.8	0.71	18	5.5	0.69
Soft tissue and other extra osseous sarcomas	35 (4.8)	19	4.8	0.71	16	4.9	0.62
Germ cell tumors, trophoblastic tumours, and neoplasms of gonads	18 (2.5)	8	2.0	0.3	10	3.0	0.39
Other malignant epithelial neoplasms & malignant melanomas	28 (3.9)	17	4.3	0.64	11	3.4	0.42
Other and unspecified malignant neoplasms/ not well defined	18 (2.5)	14	3.6	0.52	4	1.2	0.15
Total	723 (100)	395	100	14.47	328	100	12.43

Based on gender, the incidence rates of leukemia and lymphoma were more among boys than girls. While, the incidence rate of CNS was more among girls than boys (2.00 vs. 1.27/100,000) (Table 3).

Discussion

Childhood cancer is rare everywhere in the world, with great variation between countries for some specific tumors. Some of these geographical variations are attributed to environmental factors while others seem to be related to genetic predisposition (Jin et al., 2016).

The overall incidence rate of childhood cancer in this study (13.74/100,000) was higher than that reported previously for Basrah during the period 2004-2011 (11.23/100,000) (Habib et al., 2016). Such increment in incidence rate of childhood cancer in the recent years could be attributed to many factors such as improvement of diagnostic capacities, good cancer registration practices, and possibly the control of communicable diseases (Ibrahim et al., 2008; Feraly et al., 2010; Jemal et al., 2010). Probable exposure to other specific risk factors such as radiation (medical or accidental), pesticides and chemicals related to automobiles and other sources cannot be excluded (Obaid et al., 2008). Habib et al., (2016) recommended an extensive research, not only in terms of the extent of childhood cancer in Basrah but also in terms of important locally operating determinants.

The overall incidence in Basrah for the years 2012-2016 was comparable to that reported for some Asian countries such as China, Shanghai for the years 2009-2011 where the crude incidence rate was 12.90/100,000 and the ASIR was 12.96/100,000 population (Bao et al., 2016), and Korea (1993-2011), the ASIR was 13.49/100,000 children (Park et al., 2016).

In Turkey, the incidence rate of cancer ranges between 11/100,000 and 15/100,000 population in children under the age of 15 years (Kutluk, 2004; Kutluk, 2009). In Taiwan, the overall ASIR for the 1996-2010 was 12.5/100,000 (Liu et al., 2015).

In Jordan, the average annual incidence rate of cancer

in children for the period 1996-1998 was 11.3/100,000 children (Al-Sheyyab et al., 2003). In Saudi Arabia, the incidence rate of cancer in children increased from 8.8/100,000 in 1999 to 9.8/100,000 in 2008 (Al-Mutlaq et al., 2015).

In agreement with many previous studies (Wiangnon et al., 2014; Al-Mutlaq et al., 2015; Fathi et al., 2015), higher frequency (43.1%) of cancer cases in this study were found in those aged 0-4 years. This high proportion of cancer in this age group could be explained by that a peak incidence of embryonic tumor occurs in infancy. In addition, delayed exposure to infections in this age group leads to immature immune system and consequently unregulated immune response resulting in cancer development particularly in the presence of predisposed cells (Orchica et al., 2012).

Regarding gender distribution, childhood cancer is more common among males than females. In this study, males constituted 54.6% of the study population with a male to female ratio 1.2:1. Similarly in Shanghai, China (Bao et al., 2016), the male to female ratio was 1.2:1 and in Saudi Arabia (Al-Mutlaq et al., 2015), it was 1.3:1. While in Northwest Iran (Fathi et al., 2015), the male to female ratio was reported to be 1.6:1.

The crude incidence rate was higher in males than females (14.78 vs. 12.66/ 100,000), and more in children aged 0-4 years than the other two groups (5-9 and 10-14 years) with an incidence rates of 16.40, 13.25, and 11.18/100,000 children respectively. Such age and sex specific incidence rates are in agreement with that reported in many countries (Orchica et al., 2012; Al-Mutlaq et al., 2015). Genetic differences in immune function or behavioral related factors might be responsible for such difference between boys and girls (Fathi et al., 2015).

The observed distribution of paediatric cancer types in this study resembles that noticed in developing countries, but differs from that reported for developed countries. Leukemia was the most common type and ranks first as the top childhood cancer followed by lymphoma and central nervous system (CNS) cancers. This pattern of cancer types' distribution is similar to that reported in Saudi Arabia (Al-Mutlaq et al., 2015), Turkey (Kebudi, 2006),

Tunisia (Missaoui et al., 2011), Iran (Moradi et al., 2010), Indonesia (Wahidin et al., 2012), and Pakistan (Jamal et al., 2006). While in other parts of the world, particularly developed countries, such as France (Lacour and Clavel, 2014), Germany (Spallek et al., 2008), and China (Bao et al., 2016), leukemia is the commonest type followed by CNS tumors and lymphoma ranked as the third common cancer type. Different environments, life styles, dietary habits, hygienic conditions, and genetic predisposition are the main reasons for those differences (Yaris et al., 2004). Another explanation for this difference is under-reporting of CNS tumors in developing countries because of difficulties in diagnosis (Yang and Fujimoto, 2015).

In Africa, lymphomas, nephroblastoma, and Kaposi sarcoma were the most frequent childhood cancers (Stefan, 2015). This pattern of cancer's type distribution could be due to an increase incidence of Epstein Bar Virus (EBV) infection, which is associated with high risk of lymphoma development, and congenital HIV infection that associated with Kaposi sarcoma (Yaris et al., 2004).

In low-income developing countries, due to inadequate facilities for diagnosis of cancers and access to treatment at early stage as well as unaffordable treatment, and malnutrition that makes children vulnerable to chemotherapy. It is expected for mortality rate to be high (Terracini, 2011; Sullivan et al., 2013; Stones et al., 2014). However, the promising treatment outcomes of paediatric malignancies indicate that they have reached cure rates up to 80% (Al Sudairy, 2010).

In this study, the crude cancer specific mortality rate during 2012-2016 was 6.04/100,000 (6.51/100,000 for boys and 5.59/100,000 for girls), and the age standardized mortality rate (ASMR) was 6.08/100,000 children.

It is higher than that reported in Japan during 2010-2013, which was 1.99 per 100,000 population for boys and 1.75 for girls (Yang and Fujimoto, 2015). In India, the childhood cancer mortality rate was 3.7 (95% CI, 3.1 to 4.2) per 100,000 population per year and the ASMR was 3.9/100,000 (95% CI, 3.3 to 4.4) (Gupta et al., 2016).

The crude cancer mortality rate showed a decrement with time. It decreased from 7.78/100,000 population in the year 2012 to 5.13/100,000 population in 2016. Such decrement in childhood cancer mortality could be attributed to improved treatment of some types of cancer particularly leukemia (Bosetti et al., 2010; Chatenoud et al., 2010).

Some limitations have to be considered in this study. This study intended to identify all new cases of childhood cancer in Basrah governorate registered during the period 2012-2016 seeking information from all sources concerned with cancer registry. However, some cases may be diagnosed in other places and not registered. Another limitation is that; determination of cancer incidence requires an accurate estimate of the population of interest (children less than 15 years). Population estimates depend on the accuracy and frequency of censuses. Age-specific population estimates are calculated interpolation. However, this approach does not provide valid estimates if the most recent census is poor or when there is a migration. In such instances, the age-specific population may be over

or under estimated. Furthermore, incompleteness in death registries cannot be completely excluded. However, death is a recognizable event and the fact of death is usually ascertained in Islamic countries for legal, religious, and social issues such as a proof for burial or inheritance claims. (Essa et al., 2007). Some inaccuracy may occur about the cause of death.

In Conclusion, the overall incidence rate of childhood cancer in Basrah was in agreement with that reported for most neighboring and developing countries. Incidence of childhood cancer, nevertheless, is increasing with time, while mortality is decreasing. The observed distribution of childhood cancer types in Basrah was similar to that reported for developing countries. Cancer specific mortality rates were comparable to that in developing countries but were higher than that in developed countries.

Funding

No funding was received for this study.

Conflict of interest

The author declares no conflicts of interest.

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