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Incidence and Pattern of Childhood Leukaemia in Basrah, Iraq during 2003-2007

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Abstract

Background: Environment of Basrah is seriously contaminated with chemical leukomogens as a result of recent military conflicts. Many studies in the past few years have reported an increase in the incidence of leukemia in Basrah. This study was designed to study the risk and pattern of childhood leukemia in Basrah, Iraq, from 2003 to 2007.

Materials and Methods: This hospital-based cancer registry study was conducted on the hospital registry between June to December 2009. All children with leukemia, aged 1 to 14 years diagnosed from January 2003 to December 2007 in the Pediatrics' Oncology Word, Maternity and Children Hospital in Basrah, Iraq were included in the study. The records of all confirmed childhood leukemia were retrieved and studied. The specific incidence rates were calculated. The patterns of leukemia classified by age at diagnosis, gender, morphological subtypes and geographical distribution were also determined.

Results: From January 2003 to December 2007, the total number of the cases of childhood leukemia was 159. The overall age standardized incidence rate (ASIR) at this period was 5.45/100000. No temporal increase in incidence rates of childhood leukemia during this 5 year period was observed. The highest incidence rate was observed in the North of Basrah. The most common type of leukemia in this study was acute lymphoblastic leukemia (ALL), followed by acute myeloid leukemia (AML) and chronic myeloid leukemia (CML) respectively. All subtypes of leukemia were more common in males. The highest percentages of ALL and CML were observed at ages between 2 to 5 years. AML occurred more commonly at age of 6 to 14 years.

Conclusion: Leukemia was the most common childhood malignancy in Basrah. Although we observed no temporal increase in the incidence rates of childhood leukemia during the 5 year period from 2003 to 2007, leukemia incidence in children in Basrah was higher in comparison with other countries. There is a need for epidemiological studies to understand the etiology of childhood leukemia in Basrah.

Keywords: Child, Incidence, Leukemia, Basrah.

Introduction

Leukemia is the most common childhood cancer, accounting for 25% to 35% of all incident childhood cancers among most populations [1, 2].

The common type of childhood leukemia is acute lymphoblastic leukemia (ALL), which constitutes up approximately 80% of children leukemia cases, followed by acute myeloid leukemia (AML) and chronic myeloid leukemia (CML) and with relatively few leukemia cases in other categories [3].

The incidence of childhood leukemia incidence shows a trend for higher rates in resource rich countries, which ranges from 4.0 to 4.4 per 100000 per year [4], and lower in less-developed countries (e.g ., 0.9 per 100000 per year in Vietnam) [5]. These variations may reflect the lack of cancer registration in low income-countries [6]. Studies from different parts of the world have indicated an increase in the incidence of childhood leukemia in the recent decades[7, 8] while this incidence stayed largely stable

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in the United State [9] and Nordic countries [10]. In most countries, the incidence of childhood leukemia is higher in boys than girls [11, 12]. Although the etiology of most childhood leukemias is unknown [13], several factors have been associated with the disease, including socioeconomic status [14, 15], environmental exposures including ionizing radiation and benzene [16], infectious agents [17], and parental exposure risk factors [18, 19]. Basrah is the second largest city of Iraq with an estimated population of 2,426,607 in 2007. It is the country's main port and it is located along Shatt Al-Arab waterway, approximately 545 km southeast of Baghdad and adjacent to Iran and Kuwait borders. Basrah is composed of the flat alluvial plain formed by the combined flood plains and deltas of the Tigris, Euphrates, and Shatt Al-Arab rivers. The area surrounding Basrah has substantial petroleum resources with many oil wells. Basrah has been exposed to massive environmental pollution as a

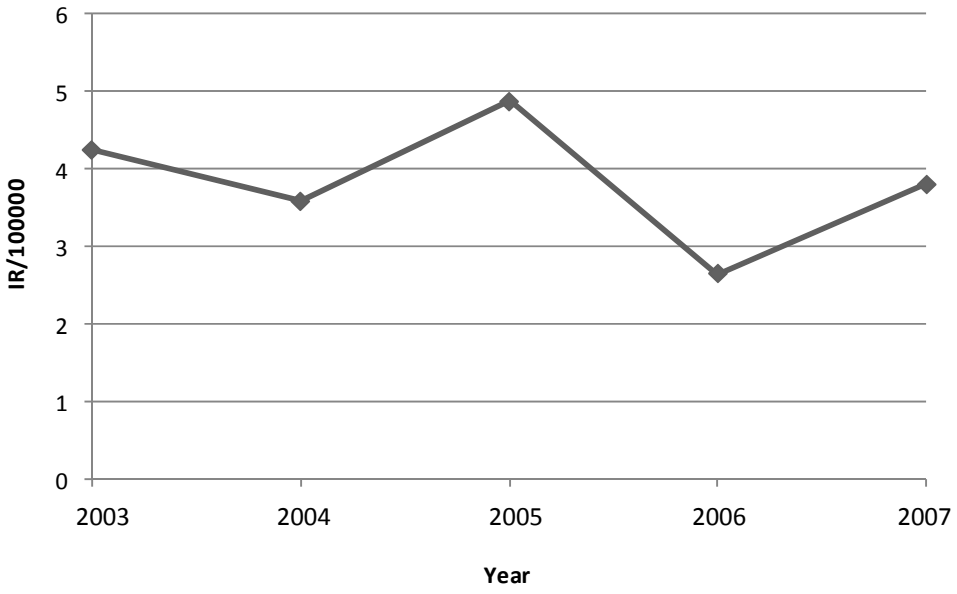


Figure 1. *Yearly incidence rate of pediatric leukemia per 100000 in Basrah, Iraq from 2003 to 2007.*

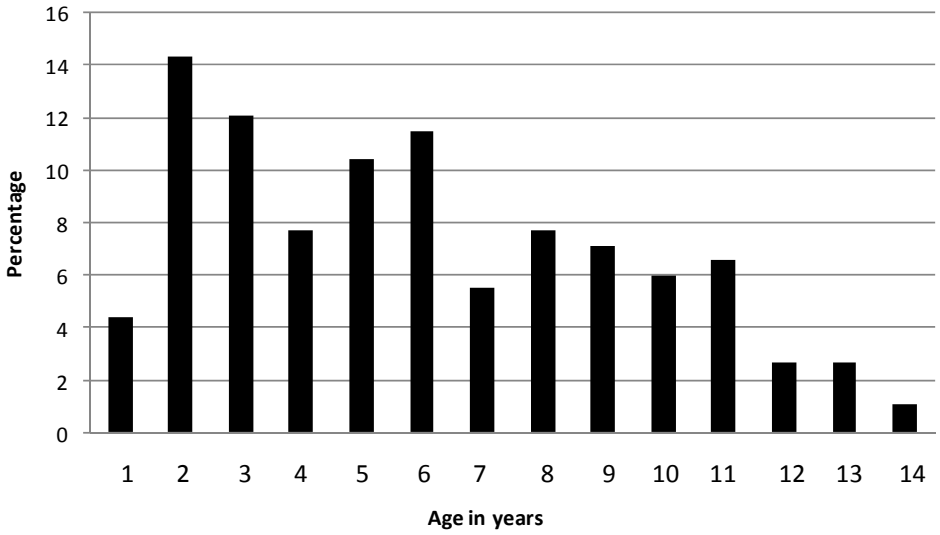


Figure 2. *Percentage distribution of leukemia by age among children below 15 years in Basrah, Iraq during 2003 – 2007.*

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consequence of military conflicts and lack of efficient protective policy from 1980 to 2003. Previous research work and growing impressions among physicians and lay people suggested that childhood leukemia is increasing in Basrah after the Persian Gulf war in 1991 [20-22].

However, these suggestions faced a lot of criticisms for being inadequate to prove a real increase in the risk of childhood leukemia simply because of incomplete case registration and/or inaccurate population denominators. In order to approach the reality, the Basrah Cancer Research Group (BCRG) was established and they initiated a project to improve registration, identify risk factors and improve care. This group (BCRG) achieved good results in registration of cancers including childhood leukemia [23].

The aim of this study was to describe the incidence rates of childhood leukemia and their variations in the population of Basrah, Iraq in the recent years. Data were available for this study from cancer registry at Pediatrics' Oncology Word in Maternal and Children Hospital in cooperation with the College of Medicine from the University of Basrah.

Materials and Methods

This hospital-based cancer registry study was based on all new cases of childhood leukemia which were registered in the Pediatrics' Oncology Ward in Basrah Maternity and Children Hospital. The pattern of medical referral in the Basrah governorate channels all childhood leukemia cases to the Pediatrics' Oncology Ward in Basrah Maternity and Children Hospital which is responsible for treatment and registration of childhood malignancies in Southern Iraq. Many of these children are treated outside Iraq but they were diagnosed and registered in Basrah before traveling. Diagnosis was based on histopathology of

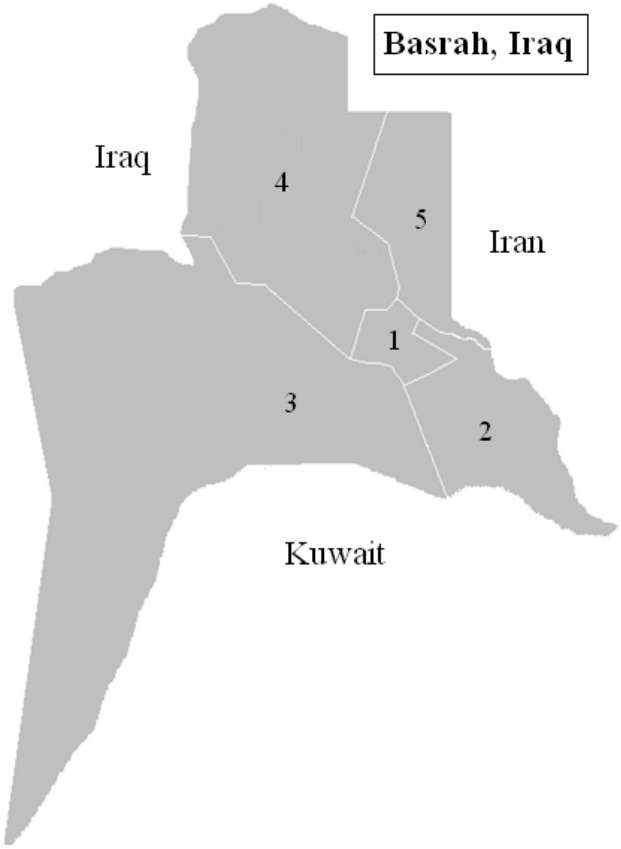


Figure 3. *Average rates of childhood leukemia in different areas in Basrah during 2003 – 2007.*
(1) Basrah city center, (2) South of Basrah, (3) West of Basrah, (4) North of Basrah, (5) East of Basrah.

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Table 1. *Distribution of the subtypes of childhood leukemias in Basrah during 2003 – 2007.*

Type of leukemia	N (%)
ALL	134 (84)
AML	17 (11)
CML	8 (5)
Total	159 (100)

Table 2. *Age distribution and subtypes of childhood leukemia in Basrah during 2003 – 2007.*

Age (years)	Type of leukemia		
	ALL	AML	CML
	N (%)	N (%)	N (%)
0 – 1	4 (3)	2(12)	1 (13)
2 – 5	66 (49)	3 (18)	4 (50)
6 – 14	64 (48)	12 (70)	3 (37)
Total	134 (100)	17 (100)	8 (100)

Table 3. *Sex distribution and subtypes of childhood leukemia in Basrah during 2003 – 2007.*

Sex	Type of leukemia		
	ALL	AML	CML
	N (%)	N (%)	N (%)
Male	78 (58)	11 (65)	5 (63)
Female	56 (52)	6 (35)	3 (37)
Total	134 (100)	17 (100)	8 (100)

bone marrow aspirate and complete blood counts. Two hematologists agreed on all diagnoses and no change in diagnostic techniques occurred over the study period. Standard criteria were used to diagnose leukemia, which for the purpose of this analysis have been divided into acute lymphoblastic leukemia, acute myeloblastic leukemia, chronic myeloid leukemia and chronic lymphocytic leukemia.

Information related to population of Basrah was based on data available with Basrah Health Authorities, from the electronic lists and the Statistical Office in Basrah.

According to the modified system used by the health authorities, Basrah governorate was divided into five areas or health sectors. These areas are: Basrah city center, South of Basrah (including Abualkaseeb and Alfao), West of Basrah (including Alzubair), North of Basrah (including Alhartha, Alqurna, and Almudaina) and East of Basrah (including Shatalarab) (see map, Figure 3).

Statistical analysis was carried out with the SPSS software ver. 15.0 (Chicago, IL). Some of figures were constructed with Excel (Office 2007) program. Incidence rate for each year was calculated by dividing incident cases in that year by the population of children aged 0-14 years in that year and then multiplying the result by 100000. Age standardized incidence was derived using the world standard population by the direct method [24].

Results

Between January 2003 and December 2007, the total number of the cases of childhood leukemia was 159. This represented 47.2 % of the total number of cancer cases among children in Basrah. The overall crude annual incidence rate among children between January 2003 and December 2007 was 3.98 per 1000000. The overall age standardized incidence rate (ASIR) in this period was 5.45/100000. The yearly incidence rates of leukemia from 2003 to 2007 were 4.25/100000, 3.58/100000, 4.88/100000, 2.64/100000 and 3.80/100000 respectively (Figure 1).

The total reported incidents cases showed that leukemia was predominant in boys (55.3) than in girls (44.7), with a male to female ratio of 124:100. The percentage distribution of leukemia by age is

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presented in Figure 2. A clear peak in incidence is observed at ages of 2-6 years.

The subtype of leukemia in Basrah is presented in Table 1. The most common type of leukemia in this study is ALL, followed by AML and CML respectively.

The age distribution according to the subtype of leukemia is present in Table 2. The highest percentages of ALL and CML were observed at ages between 2 to 5 years. AML occurred more commonly at ages between 6 to 14 years. Table 3 shows the sex distribution and the subtypes of leukemia. In the present study, all subtypes of leukemia were more common in males.

The five years crude incidence rates of childhood leukemia in each region in Basrah were presented in Figure 3. The highest incidence rate was observed in the North of Basrah (5.63/100000), followed by the West of Basrah (3.34/100000), Basrah city center (3.27/100000), the South of Basrah (2.37/100000) and the East of Basrah respectively.

Discussion

This paper presents data on the incidence, time trends and regional variations of childhood leukemia in Basrah. Leukemias made up about 47% of pediatric cancers in Basrah whereas international percentages ranged from 27% of pediatric cancers in the United States, 30% in Ireland and France [25], 33% in Germany [26] and 35% in China (Shanghai)[27] and India [28]. The high percentage of leukemia in the present study may suggest a relatively higher risk of leukemia in Basrah as a result of exposure to many environmental risk factors.

Although, we observed no temporal increase in the incidence rates for childhood leukemia during the 5 year period from 2003 to 2007, leukemia incidence in children in Basrah was higher in comparison with other countries. The rate of leukemia for children <15 years old has been estimated to be 4 per 100000 per year in the developed world and 2.5 per 100000 per year in the developing world [29]. The percentage distribution of age for childhood leukemia in Basrah has a clear peak between the ages of two and six, with the highest rates at ages of two and three. This is similar to the united State and Great Britain where the peak incidence occurs between ages of 2-5 years and may be downward. The peak is less marked in less developed countries [30, 31]. However, it is not certain what specific causes account for the high rate of leukemia and what is the etiology of this age pattern in childhood leukemia in Basrah. This may be attributed to the changes in the life style of the population and/or may be linked to the extensive environmental pollution in Basrah in the recent decades.

Basrah is confronted with a range of environmental problems that are both immediate and severe. Some can be directly linked with the effects of the recent military conflicts. Others have been triggered by internal Iraqi policies and actions and exacerbated by factors such as the impact of economic sanctions [32].

In the Persian Gulf War of 1991 and 2003, the US and UK Governments acknowledged that known depleted uranium munitions have been used in Iraq. Many tons of this radioactive substance targeted the Basrah governorate [20, 33].

Also, in the Persian Gulf war of 2003, there were reports of oil wells that were deliberately set on fire in the Rumeila oilfield in Basrah where a thick haze of dark smoke could be seen from Kuwait City on the following day. The broad categories of contaminants are volatile hydrocarbons, hydrogen sulfide and naturally occurring radioactivity. Since aromatic hydrocarbons (like benzene), which are known leukemogens, are the most volatile forms of hydrocarbons, exposure even at low levels can be very harmful [34].

Studying the leukomogenic nature of war – time exposures is difficult in the welter situation that characterizes warfare. It is known that Basrah region was exposed to environmental insults including pyrophoric depleted uranium [35] and leukemogen benzene [36], as well as ongoing undifferentiated water and air pollution, but no data are available on the doses of these exposures to the leukemia patients in our study.

The occurrence patterns of the subtypes of leukemia were also analyzed in this study: the most common type of leukemia was ALL. This distribution was similar to that reported in other countries [37, 38]. The ratio of boys to girls diagnosed with leukemia in our study is 124:100 which is similar to the gender distribution in North America including the United State where the ratio is 120:100. It has also been reported that in many developing countries, the reported number of childhood cancer in boys is

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substantially higher than the girls. The ratio of boys to girls registered with childhood cancer, increased with decreasing gross domestic products and with increasing infant mortality, suggesting that boys are increasingly more likely to be affected than girls with increasing economic disadvantages [12]. In the present study, childhood leukemia incidence disclosed higher rates in the North of Basrah, an area of low socioeconomic status in comparison with the center of Basrah city. Earlier studies [1, 31] indicated a geographic place correlation between socioeconomic status and childhood leukemia incidence. These studies have indicated that this characteristic incidence peak emerges with socioeconomic development [39], but there is at least one exception [40]. These observations are consistent with the hypothesis that the risk of childhood acute lymphoblastic leukemia can be modified by exogenous factors [41].

Conclusion

Clear increase in the incidence of childhood leukemias in Basrah have been noted recently in comparison with other countries, which cannot be easily explained. It would be interesting to explore whether exposure to environmental pollution and different lifestyle patterns across Iraqi population might be responsible for the observed excess leukemia incidence in governorate such as Basrah, and therefore highlight the need for more research into the etiology of childhood leukemia.

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