Assessment of Some Risk Factors of Leukemia in Children Attending Baghdad Hospitals

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Abstract:

Background: The term leukemia refers to cancers of the white blood cells (also called leukocytes or WBCs). When a child has leukemia, large number of abnormal white blood cells is produced in the bone marrow. These abnormal white cells crowd the bone marrow and flood the bloodstream, but they cannot perform their proper role of protecting the body against disease because they are defective.

Objective: The aim of the present study is to assess the possible risk factors of leukemia in children less than 15 years of age in Baghdad hospitals.

Methods: This study was a hospital-based case-control study (AL-Kadhmiya teaching hospital, Children welfare teaching hospital and Central teaching hospital of pediatric) by collecting the data by a direct interview with patient parents and medical records during the period from 3rd November 2011 to the 7th May 2012, a total of 612 children were studied, 204 children (cases) less than 15 years of age with hematological and histological confirmed diagnosis of leukemia compared with 408 children (controls) who were free from cancer at the time of the study on clinical basis. Cases and controls were matched for age, gender and place of residence at level of administrative units.

Results: The results showed significant association between leukemia and probable exposure to history of malignancy in third degree relative and pesticides while no significant association between leukemia and oil refineries and high power voltage lines.

Conclusions: In the current study, males were more affected than females. Based on exposure to chemicals, only the percentage of exposed cases to the pesticides was greater than the percentage of controls. Based on electromagnetic field exposure, only the percentage of exposed cases to the high power voltage lines was greater than the percentage of controls.

Key Words: Leukemia, Risk factors, Baghdad hospitals

Introduction:

The term leukemia refers to cancers of the white blood cells (also called leukocytes or WBCs). When a child has leukemia, large number of abnormal white blood cells is produced in the bone marrow. These abnormal white cells crowd the bone marrow and flood the bloodstream, but they cannot perform their proper role of protecting the body against disease because they are defective [1].

Risk Factors for Childhood Leukemia:

- Parental occupational exposure
- Tobacco smoke
- Alcohol drinking
- Genetic risk factors
- Exposure to electromagnetic field
- Chemical exposure
- Dietary factors
- Reproductive history
- Birth weight
- Infection and allergy [2].

Objective of Study:

The aim of the present study is to assess the possible risk factors of leukemia in children less than 15 years of age in Baghdad hospitals.

Patients and Methods:

This study was a hospital-based case-control study (AL-Kadhmiya teaching hospital, Children welfare teaching hospital and Central teaching hospital of pediatric) by collecting the data by a direct interview with patient parents and medical records during the period from 3rd November 2011 to the 7th May 2012, a total of 612 children were studied, 204 children (cases) less than 15 years of age with hematological and histological confirmed diagnosis of leukemia compared with 408 children (controls) who were free from cancer at the time of the study on clinical basis. Cases and controls were matched for age, gender and place of residence at level of administrative units.

Statistical Analysis:-

The information regarding each case was transferred into code sheets and data entry was done using computer Pentium IV and statistical analysis was done using the SPSS (statistical package of the social science) package version 17. The approach to data was consisted of two steps (descriptive and analytic statistic).

1. Chi-square (χ^2) test for contingency tables to find the statistical difference between cases and controls about the risk factors.
2. Odds ratios (OR) and their confidence intervals (CI) were calculated.
3. P - Values of less than 0.05 were considered significant.

Ethical Issues:

There was no ethical issues occur by keeping the names of patients.

Results of the Study:

Table (1): The results showed distribution of these variables among cases and controls and there were no statistical significant difference between the two groups (P>0.05). This reflects the successful matching process during the data collection phase of the study. Most of the cases and controls were 41.7% in the age group of 5 - 9 years; predominantly males were 60.8% of cases and controls.

Table (1): Distribution of Study Population according to the Age and Gender

Variables	Leukemia (Cases) (n=204)		P-value
Child age (years)	**No.**	**%**	
< 5	63	30.9	1.000
5 – 9	85	41.7	
10 – 14	56	27.5	
Total	204	100.0	
Gender			
Male	124	60.8	1.000
Female	80	39.2	
Total	204	100.0	

Table (2): The highest percentage of malignant history of for first degree from relative of other cancer were 1.5% and 2.0% of the cases and controls respectively (OR= 0.74; 95%CI: 0.19 – 2.84). The highest percentages of malignant history for second degree from relative of other cancer were 14.2% and 19.9% of the cases and controls respectively (OR= 0.67; 95%CI: 0.42 – 1.07). The percentages of leukemia for second degree of relative were 2.9% and 1.7% of the cases and controls respectively (OR= 1.62; 95%CI: 0.53 – 4.90). The highest percentages of malignant history for third degree of relative of other cancer were 9.8% and 4.7% of the cases and controls respectively (OR= 2.31; 95%CI: 1.20 – 4.44). The percentages of leukemia for third degree of relative were 4.4% and 1.0% of the cases and controls respectively. The risk of malignant history for third degree of relative from cases highly significantly increased 4.95 times of the relative with leukemia.

Table (2): Distribution of Cases and Controls according to History of Malignancy for First, Second and Third Degree of Relative

History of malignancy	Leukemia (Cases) (n=204)		Controls (n=408)		Total	OR	95%CI	P- value
First degree relative	**No.**	**%**	**No.**	**%**				
Leukemia	0	0.0	0	0.0	0	-	-	0.667
Other cancer	3	1.5	8	2.0	11	0.74	0.19 - 2.84	
None	201	98.5	400	98.0	601			
Total	204	100.0	408	100.0	612			
Second degree relative								
Leukemia	6	2.9	7	1.7	13	1.623	0.53 - 4.90	0.157
Other cancer	29	14.2	81	19.9	110	0.677	0.42 - 1.07	
None	169	82.8	320	78.4	489			
Total	204	100.0	408	100.0	612			
Third degree relative								
Leukemia	9	4.4	4	1.0	13	4.95	1.5 - 16.29*	**0.001***
Other cancer	20	9.8	19	4.7	39	2.31	1.20 - 4.44*	
None	175	85.8	385	94.4	560			
Total	204	100.0	408	100.0	612			

* As compared with none. Statistically significant

Table (3): The highest percentages of exposure history to pesticide were 48.5% and 37.0% of the cases and controls respectively. The risk of cases were highly significantly increased 1.60 times in the children with positive exposure than children with negative exposure ($p<0.05$). The highest percentages of exposure history to petrol station were 49.0% and 62.7% of the cases and controls respectively. The risk of cases were highly significantly decreased 0.57 times (protective effect) in the children with positive exposure than children with negative exposure ($p<0.05$). The highest percentage of exposure history to cars repairing garage were 35.3% and 55.6% of the cases and controls respectively. The risk of cases were very highly significantly decreased 0.43 times (protective effect) in the children with positive exposure than children with negative exposure ($p<0.0001$). The highest percentages of exposure history to oil refineries were 4.9% and 5.1% of the cases and controls respectively (OR= 0.95; 95%CI: 0.43 – 2.05). The highest percentage of exposure history to heavy traffic roads were 19.6% and 28.4% of the cases and controls respectively. The risk of cases were significantly decreased 0.61 times (protective effect) in the children with positive exposure than children with negative exposure ($p<0.05$)

Table (3): Distribution of Cases and Controls according to Chemical Exposure

Chemical exposure	Leukemia (Cases) (n=204)		Controls (n=408)		Total	OR	95%CI	P- value
Pesticide	**No.**	**%**	**No.**	**%**				
+ve	99	48.5	151	37.0	250	1.605	1.14 - 2.25*	0.006*
- ve	105	51.5	257	63.0	362			
Total	204	100.0	408	100.0	612			
Petrol station								
+ve	100	49.0	256	62.7	356	0.571	0.40 - 0.80*	0.001*
- ve	104	51.0	152	37.3	256			
Total	204	100.0	408	100.0	612			
Cars repairing garage								
+ve	72	35.3	227	55.6	299	0.435	0.30 – 0.61*	<0.0001*
- ve	132	64.7	181	44.4	313			
Total	204	100.0	408	100.0	612			
Oil refineries								
+ve	10	4.9	21	5.1	31	0.95	0.43 – 2.05	0.896
- ve	194	95.1	387	94.9	581			
Total	204	100.0	408	100.0	612			
Heavy traffic roads								
+ve	40	19.6	116	28.4	156	0.614	0.40 - 0.92*	0.018*
- ve	164	80.4	292	71.6	456			
Total	204	100.0	408	100.0	612			

* Statistically significant

Table (4): The highest percentage of exposure history to high power voltage lines were 15.2% and 13.2% of the cases and controls respectively (OR= 1.17; 95%CI: 0.72 – 1.89). The highest percentages of exposure history to devices and mobiles transmission stations were 30.4% and 62.5% of the cases and controls respectively. The risk of cases were highly significantly decreased 0.26 times (protective effect) in the children with positive exposure than children with negative exposure (p<0.0001). The highest percentage of exposure history to radio and TV transmitter were 2.0% and 14.2% of the cases and controls respectively. The risk of cases were highly significantly decreased 0.12 times (protective effect) in the children with positive exposure than children with negative exposure (p<0.0001).

Table (4): Distribution of Cases and Controls according to Electromagnetic Field Exposure

Electromagnetic field exposure	Leukemia (Cases) (n=204)		Controls (n=408)		Total	OR	95%CI	P- value
High power voltage lines	**No.**	**%**	**No.**	**%**				
+ve	31	15.2	54	13.2	85	1.175	0.72-1.89	0.508
- ve	173	84.8	354	86.8	527			
Total	204	100.0	408	100.0	612			
Devices &mobiles transmission stations								
+ve	62	30.4	255	62.5	317	0.262	0.18-0.37*	**<0.0001***
- ve	142	69.6	153	37.5	295			
Total	204	100.0	408	100.0	612			
Radio &TV transmitter								
+ve	4	2.0	58	14.2	62	0.121	0.04-0.33*	**<0.0001***
- ve	200	98.0	350	85.8	550			
Total	204	100.0	408	100.0	612			

* Statistically significant

Discussion:

Regarding the age, the results in this study showed that the higher percentage of age group between 5 – 9 years old were less than half but it was not reached a significant association which agreed with other studies done in Iraq [1]; while Meinert *et al*. disagree with that were 54.4% and 43.5% among age group between 1-4 years in the leukemia cases and controls respectively [3]. Regarding the gender, this study showed that there was higher percentage of males were affected with leukemia but it was not reached a significant association which agreed with other

studies done in Iraq [1]; Meinert *et al*. 2000 in Germany who found that most of the study samples were 58.9% and 58.1% among males in the leukemia cases and controls respectively, which agree with this study [3]. Schuz *et al*. reported similar finding [4], they agree with study and found that the highest percentages of males were 59.0% and 57.4% among cases and controls respectively. Age as a strong confounder was removed by the process of matching in this study cases and controls were matched for age, gender and place of residence.

The higher percentage of malignant history of leukemia in third degree relative were 4.4% and 1.0% for cases and controls respectively (OR= 4.95; 95%CI: 1.5 – 16.29), and the higher percentage of malignant history of other cancer in second degree relative were 14.2% and 19.9% for case and controls respectively (OR= 0.67; 95%CI: 0.42 – 1.07). Abdulla [5] found that 62.0% of cases had family history of malignancy compared to 39.0% of controls. Cases with positive family history of malignancy had statistically significant higher risk of leukemia (OR= 1.77; 95%CI: 1.19 – 2.63), which agree with this study but without determination of degree of relative. Deley *et al*. [6], who found that most of the study samples were in malignant history 11.0% and 17.0% in the cases and controls respectively (OR= 0.46; 95%CI: 0.14 – 1.3), which disagree with this study but without determination of degree of relative.

Several Studies have linked leukemia to pesticides. Use of insecticides in the home and garden was associated with increased risk of ALL [7,8]. In the present study it was found that the percentage of cases with probable exposure to pesticides was more than the percentage of controls (OR= 1.6; 95%CI: 1.14 – 2.25) and this was comparable to the results of studies carried out in Abed, 2007 in Basrah (OR= 2.01; 95%CI: 1.22 – 3.33) [38], Denver, USA [9,10], and France [11]. The higher percentage of exposure history to petrol station were 49.0% and 62.7% for cases and controls respectively (OR= 0.57; 95%CI: 0.40 – 0.80). Steffen *et al*. [12], who found there was an association between dwellings neighboring a petrol station which are benzene emitting sources and the risk of childhood leukemia, which disagree with this study (OR= 4.0; 95%CI: 1.5 – 10.3). This disagreement may be due to increase of houses nearest of petrol station between Iraq and other countries. The higher percentage of exposure history to cars repairing garage were 35.3% and 55.6% for cases and controls respectively (OR= 0.43; 95%CI: 0.30 – 0.61). Steffen *et al*. [12], who found there was an association between dwellings neighboring cars repairing garage which are benzene emitting sources and the risk of childhood leukemia, which disagree with this study (OR= 4.0; 95%CI: 1.5 – 10.3). This disagreement may be due to increase of dwellings vicinity of cars repairing garage between Iraq and other countries. The higher percentage of exposure history to oil refineries were 4.9% and 5.1% for cases and controls respectively (OR= 0.95; 95%CI: 0.43 – 2.05). Wilkinson *et al.* [13], who found there was no association between dwellings neighboring oil refineries which are benzene emitting sources and the risk of childhood leukemia, which agree with this study (OR= 0.94; 95%CI: 0.79 – 1.11).

The higher percentage of exposure history to heavy traffic roads were 19.6% and 28.4% for cases and controls respectively (OR= 0.61; 95%CI: 0.40 – 0.92). Steffen *et al*. 2004 in France [12], who found there was no association between dwellings neighboring heavy traffic roads which are benzene emitting sources and the risk of childhood leukemia, which disagree with this study (OR= 1.1; 95%CI: 0.8 – 1.6). This disagreement may be due to increase of dwellings vicinity of heavy traffic roads between Iraq and other countries.

The higher percentage of exposure history to high power voltage lines were 15.2% and 13.2% for cases and controls respectively (OR= 1.17; 95%CI: 0.72 – 1.89). This study supported by the UK childhood cancer study. They concluded that there was no evidence that exposure increased the risk of leukemia, or any other type of childhood cancer [14]. Draper *et al*. [15], who found that children who lived close to high voltage power lines at the time of their birth (within 200 m) had a significantly higher (1.69 times higher) chance of developing leukemia than those who lived further away (beyond 600 m) which disagree with this study. This disagreement may be due to increase of dwellings vicinity of high power voltage lines between Iraq and other countries. The higher percentage of exposure history to devices and mobiles transmission stations were 30.4% and 62.5% for cases and controls respectively (OR= 0.26; 95%CI: 0.18 – 0.37; p<0.0001). This result was disagreeing with Elliott *et al*. They found no conclusive evidence of a link between cell phone tower proximity and increased incidence of early childhood cancers (P>0.05) [16]. The higher percentage of exposure history to radio and TV transmitter were 2.0% and 14.2% for cases and controls respectively (OR= 0.12; 95%CI: 0.04 – 0.33). This result was supported by Michelozzi *et al*. The study has limitations because of the small number of cases and the lack of exposure data. Although the study adds evidence of an excess of leukemia in a population living near high-power radio transmitters, no causal implication can be drawn. There is still insufficient scientific knowledge, and new epidemiologic studies are needed to clarify a possible leukemogenic effect of residential exposure to radio frequency radiation [17] and disagree with Dolk *et al*. [18].

Conclusions:

1. There was a higher percent of leukemias in the age group between 5 – 9 years more than other

age groups and males were more affected than females.

2. Based on exposure to chemicals, only the percentage of exposed cases to the pesticides was greater than the percentage of controls.
3. Based on electromagnetic field exposure, only the percentage of exposed cases to the high power voltage lines was greater than the percentage of controls.
4. In current study, significant association between chemical exposure (petrol station, cars repairing garage and heavy traffic roads) and electromagnetic field exposure (devices and mobiles transmission stations & radio and TV transmitter) with leukemia whereas OR< 1 (protective effect).
5. In current study, no significant association between malignant history for second degree relative for leukemia and electromagnetic field exposure for high power voltage lines with leukemia in spite of OR>1.
6. In current study, significant association between malignant history for third degree relative and pesticide with leukemia (OR>1).

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