

## Environmental Risk Factors for Acute Leukemia and Non-Hodgkin Lymphoma in Children

Mirmohammadi SJ<sup>1</sup>, Hashemi A<sup>2</sup>, Souzani A<sup>3</sup>, Dehghani KH<sup>4</sup>, Atefi A<sup>5</sup>, Zareian Yazdi Z<sup>3</sup>

1- Department of Occupational Medicine, Hematology, Oncology and Genetics Research Center, Shahid Sadoughi University of Medical Sciences and Health Services, Yazd, Iran

2- Department of Pediatrics, Hematology, Oncology and Genetics Research Center, Shahid Sadoughi University of Medical Sciences and Health Services, Yazd, Iran

3- General Practitioner, Yazd, Iran

4- MSc Nursing

5- Hematology, Oncology and Genetics Research Center, Shahid Sadoughi University of Medical Sciences and Health Services, Yazd, Iran

### Abstract

#### Objective

The incidence of childhood cancer has been increasing nearly one percent per year for the past two decades. Leukemia and lymphoma are the most common types of childhood cancers. This study assessed the relation between environmental factors (Hydrocarbon, agricultural toxin, insecticide) and leukemia/lymphoma in children, which was evaluated by the frequency of the parents' hazardous occupations, and their smoking, drug addiction, and alcoholism habits.

#### Methods

This was a case-control study on 86 children with leukemia and non-Hodgkin's lymphoma and 188 healthy controls from March 2007 till March 2010. They were matched in age and sex. Information was gathered via a questionnaire and analyzed by SPSS 15.

#### Result

There were 32 (37.2%) girls and 54 (62.8%) boys in the case group and the majority were 3-5 years old. In case group fathers' occupations were mostly farmers 50 (58.1%), followed by painter or exposed to hydrocarbons 14 (16.6%), but in the control group, farmers were 17 (19.7%), and painters or those exposed to hydrocarbons were 5 (5.8%). The frequency of fathers' various occupations was significantly different between cases and controls. In addition, smoking, drug addiction and alcoholism was significantly higher in cases fathers than controls fathers.

#### Conclusion

The frequency of leukemia and non-Hodgkin's lymphoma in children whose father were painters, exposed to hydrocarbons and farmers are higher than normal children. So people with these occupations should pay more attention and should be protected against these risk factors. The history of addiction and alcoholism was higher in their father.

#### Key words

Acute Leukemia, Non-Hodgkin Lymphoma, Environmental Factor

#### Corresponding Author:

Hashemi A MD. Hematology, Oncology and Genetics Research Center, Shahid Sadoughi University of Medical Sciences and Health Services, Yazd, Iran Email: Dr\_a\_hashemi@yahoo.com

## Introduction

The incidence of childhood cancer has been increased since the last two decades. Leukemia and lymphoma are common in children under 15 years old. Incidence of Acute Lymphoid Leukemia (ALL) has increased five fold from 1975 to 2002. The peak of incidence is in children between 2-6 years of age and frequency is a little more in male than female. Its incidence is more in white people and the high socioeconomic class. ALL occurs in Down syndrome, Bloom syndrome, ataxia telangectasia and Fanconi's anemia (2). Acute myeloid leukemia (AML) comprises 11% of all childhood leukemias (2). Lymphoma is the third common cancer in childhood (2) and comprises 16% of childhood cancers. The three main risk factors for leukemia and lymphoma are as follow; first, environmental factors, second, infectious factors, and last, genetic predisposition.

Lowengart RA in 1994 showed that the children of fathers exposed to diagnostic X-Ray are at increased risk of childhood leukemia. Exposure of fathers to hydrocarbons and insecticides is considered as a risk factor for childhood leukemia (6). Gasoline, trichloroethylene, colors used for painting, thinners and solvents are some of the industrial products that can cause leukemia. Benzene is used in plastics, color and as engine fuel (7), and Freidman and coworkers in a study in 2002 found a reasonable relationship between exposure to benzene and ALL in children (8). Savitz and Chen's investigation revealed that the most high-risk occupations of fathers include painters, mechanics and industrial workers (3). Long-term exposure of fathers to plastic is associated with an increased risk of leukemia (9). Exposure to insecticides present in surrounding environment and even occupation of parents is related to high incidence of leukemia in children, and exposure to agricultural toxins also increased risk of ALL.

## Methodology

In this case-control study, children with ALL, AML and Non-Hodgkin Lymphoma, who referred to the pediatrics department of Shahid Sadoughi hospital from 2007 to 2010, were studied. Control group were healthy children who were matched for age, gender and residence with cases. There were 86 cases and 188 controls. Information was gathered via a questionnaire and analyzed by SPSS software (version 15). The questionnaire includes age, gender, place of residence, age of diagnosis, father's occupation and so on.

## Results

The mean age of cases was  $6.7 \pm 0.5$  years old, which were 32 (37.2%) girls and 54 (62.8%) boys. They were mostly 3-5 years old (29.6%) followed by 6-8 years old (26.9%). Most of the referred patients (37.2%) lived in Yazd city. Their fathers' occupations were as follow; 50 farmers (58.1%), 14 painters or those exposed to hydrocarbons (16.6%), 7 clerk (8.1%) and 15 other jobs (17.4%). In the control group, the fathers' occupations were as follow; 17 farmers (19.7%), 22 clerks (25.6%), 5 painters or those exposed to hydrocarbons (5.8%), and 42 with other jobs (48.8%). Significant difference was found between the fathers' occupations in cases and controls ( $PV \approx 0.000$ ).

Between fathers of case group, 37(43%) were smokers, 5(5.8%) were alcoholics and 16 (18.6%) person were drug addicts, while fathers in control group were 19 (22.3%) smokers, and 4(5%) drug addicts, which significantly were lower than fathers of the cases ( $PV \approx 0.003$ ).

## Discussion

This study revealed that there is a significant difference between the cases and controls fathers' occupation and frequency of malignancy in their children ( $PV \approx 0.00$ ). These results were the same as previous study, which showed that exposure of fathers to hydrocarbons and insecticides is considered as a risk factor for childhood leukemia (6-8). Those studies showed that the chemical exposure to hydrocarbons and pesticides are most commonly associated with childhood leukemia, which present study showed the same results. They examined the relationship between childhood leukemia and direct exposure to these chemicals (e.g., use of pesticides in the home) as well as indirect exposure, such as to parents' clothing worn in an occupational setting where hydrocarbons are used and brought home to launder (6, 9). Other study believed that occupational or residential exposure to pesticides by either parents or children could increase risk of childhood cancer (10).

In conclusion, Leukemia and lymphoma are the most common malignancies of childhood. Despite many advances in the treatment of childhood leukemia, the causes of leukemia and lymphoma remain unclear. Farmers should use agricultural toxins with more caution and pay more attention to the use of protection covers (gloves, uniforms, or masks) against risk factors. This study should be repeated in a larger population and even in adults.

## References

1. Colt JS, Blair A. Parental occupational exposures and risk of childhood cancer. *Environ Health Perspect.* 1998;106 Suppl 3:909-25.
2. Lichtman MA, Beutler E, Kipps TJ, Seligsohn U, Kaushansk K, Prchal JT. *Williams's hematology*, seventh edition 2006; pp:1017-1163.
3. Belson M, Kingsley B, Holmes A. Risk factors for acute leukemia in children: a review. *Environ Health Perspect.* 2007;115(1):138-45.
4. Mahoney MC, Moysich KB, McCarthy PL Jr, McDonald RC, Stepanenko VF, Day RW, et al. The Chernobyl childhood leukemia study: background & lessons learned. *Environ Health.* 2004; 3(1):12.
5. Shu XO, Reaman GH, Lampkin B, Sather HN, Pendergrass TW, Robison LL. Association of paternal diagnostic X-ray exposure with risk of infant leukemia. Investigators of the Childrens Cancer Group. *Cancer Epidemiol Biomarkers Prev.* 1994; 3(8):645-53.
6. Lowengart RA, Peters JM, Cicioni C, Buckley J, Bernstein L, Preston-Martin S, et al. Childhood leukemia and parents' occupational and home exposures. *J Natl Cancer Inst.* 1987 ;79(1):39-46.
7. Glass DC, Gray CN, Jolley DJ, Gibbons C, Sim MR, Fritschi L, et al. Leukemia risk associated with low-level benzene exposure. *Epidemiology.* 2003 ;14(5):569-77
8. Freedman MD, Stewart P, Kleinerman RA, Wacholder S, Hatch EE, Tarone RE, et al. Household solvent exposures and childhood acute lymphoblastic leukemia. *Am J Public Health.* 2001; 91: 564-567.
9. Shu XO, Stewart P, Wen WQ, Han D, Potter JD, Buckley JD, et al. Parental occupational exposure to hydrocarbons and risk of acute lymphocytic leukemia in offspring. *Cancer Epidemiol Biomarkers Prev.* 1999 ;8(9):783-91.
10. Daniels JL, Olshan AF, Savitz DA. Pesticides and childhood cancers. *Environ Health Perspect.* 1997 ;105(10):1068-77.