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THE IMPACT OF PESTICIDES ON CANCER INCIDENCE AMONG CHILDREN IN UZBEKISTAN: A SURVEY STUDY

Abstract

Introduction: The spread of malignant diseases is a serious problem in Uzbekistan. Recent data suggest a possible link between pesticide exposure and an increase in cancer rates. Pesticides are used in the cultivation of a wide range of agricultural crops. In Uzbekistan, 249 different plant protection products are permitted. They contain various active ingredients, 59 of which are recognized as highly hazardous pesticides.

Research objective: To study the effect of pesticides on the development of malignant neoplasms in children.

Results: The survey shows that a significant number of patients (63 out of 93) live near agricultural fields, indicating a potential risk of pesticide exposure to health. Approximately 30% of respondents reported the use of pesticides in nearby fields. This may be an important environmental factor influencing the development of malignant neoplasms in children. Patients were diagnosed with 28 different types of cancer. Leukemia and brain cancer were the most commonly diagnosed types of cancer among the study participants, which is consistent with international studies that have established a link between pesticide exposure and these types of malignant neoplasms.

Conclusions: The results of this survey indicate a probable correlation between pesticide exposure and cancer incidence in children in Uzbekistan, highlighting the need for stricter control of pesticide use and more comprehensive clinical and epidemiological studies to confirm these results.

Keywords: malignant neoplasms (MN), cancer incidence, pesticides, childhood cancer, environmental exposure, agrochemicals, pediatric oncology.

Introduction

The spread of malignant neoplasms (MN) is a serious problem in Uzbekistan. In 2024, the number of newly diagnosed cases of malignant neoplasms in children aged 0 to 17 was 827. The incidence rate of MN in children was 6.4 per 100,000 of the child population. The leading types of cancer were: hemoblastoses (36.0%), brain and spinal cord tumors (19.7%), MN of bones and joints (8.1%), MN of connective and soft tissues (7.5%), kidney malignancies (4.7%), retinoblastoma (3.9%), and retroperitoneal malignancies (3.0%), which together accounted for 83.0% of all newly diagnosed malignancies in children.

Pesticides are used in the cultivation of a wide range of agricultural crops, including cotton and grains (the most common crops), as well as vegetables, fruits, berries, flowers, tobacco, fruit and ornamental trees and shrubs, and forest plantations. A total of 249 different products are approved for use as plant protection products in Uzbekistan. They contain various active ingredients, 59 of which are classified as highly hazardous pesticides and included in the list of particularly hazardous pesticides

(PAN). In addition, 34 of them are banned in other countries, according to the PAN summary report [3, 5, 7]. Uzbekistan has created a database of laws and regulations, governing the production, use, harm, and liability of individuals and legal entities, as well as the rational management of chemicals, including registration, licensing, and prevention of the accumulation of hazardous chemicals (primarily pesticides) in the country.

A meta-analysis published in 2019 on the impact of pesticides in the home and the risk of leukemia in children and adolescents showed a positive association between exposure to pesticides in the home and the development of leukemia in children [8].

Another study suggests that the risk of sarcoma was increased in some agricultural jobs involving pesticides, with differences depending on the histological subtype. Increased risks were observed among cattle farmers who had been working for more than 10 years, especially if they were involved in animal care and building disinfection, greenhouse production, and field vegetable growing [4, 6, 9].

The study aims to identify a possible link between pesticide exposure and cancer incidence among chil-

dren. The results of the study will allow for some changes in pesticide use, thereby reducing the risk of cancer in children.

Research objective

To study the effect of pesticides on the occurrence of malignant neoplasms in children.

Materials and methods:

The study was conducted in the form of a survey. Ninety-three out of 108 patients participated in the survey (15 patients did not consent to participate). All patients were treated at the Taskin hospice between 2022 and 2024. The survey was conducted by two coordinators during a telephone conversation. After obtaining verbal consent to use personal data and record the telephone conversation, the assistant began the survey. Recordings of all conversations related to the project were stored on the working group's personal computer.

A questionnaire was developed that included 12 questions:

- Full name
 - Date of birth
 - Place of residence
 - Diagnosis
 - Stage of disease
 - Date of diagnosis
 - Medical facility
 - Presence of agricultural fields near place of residence
 - Occupation of guardians
 - Direct involvement in field work
 - Use of pesticides in the fields
 - Condition of the patient at the time of the survey
- Personalized information was collected, including: data on the diagnosis according to the Inter-

national Classification of Diseases, 10th Revision (ICD-10), age, gender, date of diagnosis, clinical stage of the disease according to the international classification, as well as the current condition of the patient according to the rules for registering malignant tumors. Relevant criteria for the impact of pesticides on patients with malignant neoplasms were also collected, such as: the presence of agricultural fields near the patient's place of residence, the occupation of caregivers, the patient's participation in field work, and the use of pesticides on agricultural fields, if any.

Research results:

Based on the study material, 37 patients (39.8%) were women and 56 (60.2%) were men. When studying the place of residence of the patients, it was found that most of them, 72 (77.4%), were rural residents, and 19 (20.4%) were urban residents.

The age distribution of patients was as follows: most patients in the study group were 2 years old (10.8%), 4 years old (8.6%), and 11 years old (7.5%). The average age of patients was $9.23 \pm 2.3.16.1\%$ of patients had brain tumors, 12.9% had hemoblastoses, and 10.8% had malignant neoplasms of bones and joints. It should be noted that the structure of morbidity in the study group is similar to the national structure.

After studying the distribution of the above diseases by stage, it was noted that 57.0% of patients were in stages III-IV, 9.7% were in stage I, and 33.3% were in stage II

The study included patients who were diagnosed between 2017 and 2024. Most of the patients in the study were diagnosed in 2023 (47.3%) and 2022 (26.9%). It is worth noting that a total of 39.8% of patients died. At the same time, 100% mortality was recorded in patients diagnosed in 2019 and 2020 (Table 1).

Table 1 – Distribution of study patients by date of diagnosis and mortality

Date of diagnosis	Number of patients		Mortality	
	Absolute number	%	abs. number	%
2017	2	2.2	0	0
2018	2	2.2	1	50
2019	1	1.1	1	100.0
2020	1	1.1	1	100.0
2021	9	9.7	5	55.6
2022	25	26.9	13	52.0

Continuation of the table

Date of diagnosis	Number of patients		Mortality	
	Absolute number	%	abs. number	%
2023	44	47.3	13	29.5
2024	9	9.7	3	33.3
Total:	93	100.0	37	39.8

Most patients (67.7% – 63 patients) lived near agricultural fields, while 30 patients (32.3%) did not have fields near their homes. It is worth noting that, of the 63 subjects, 24 (38.1%) were agricultural workers and were directly involved in this activity (Table 2). It should also be noted that 30 (30.1%) of the subjects responded that they themselves use various types of pesticides in their work.

Table 2 – Distribution of patients by the presence of agricultural fields near their place of residence and their parents' occupation

No agricultural fields near the patient's place of residence		There are agricultural fields near the patient's place of residence	
30	32.3	63	67.7
Of these, agricultural workers are employed:		Of these, agricultural workers:	
Mother	1 (3.3%)	All family members	11 (17.5%)
		Father	9 (14.3%)
		Mother	4 (4.8%)
		Brother	1 (1.6%)

Conclusions:

The survey involved 93 patients, mainly from rural areas where agricultural practices, including the use of various pesticides, are widespread. The data show that 67.7% of respondents lived near agricultural fields, and 26.9% had family members working in these fields. The study revealed that the vast majority of patients were from rural areas (77.4%). This is another direct link between cancer incidence and pesticide exposure. Approximately 30% of the study participants (30 out of 93) reported using pesticides while working in agricultural fields. This may be an important environmental factor affecting health.

The survey results show that 28 different types of cancer were recorded among the patients. Leukemia and brain cancer were the most commonly diagnosed types of cancer among the subjects, which is consistent with international studies that have established a link between pesticide exposure and these types of malignant neoplasms.

The results of this survey indicate a probable correlation between pesticide exposure and cancer incidence in children, highlighting the need for stricter control of pesticide use, more comprehensive clinical and epidemiological studies to confirm these results, and the development of effective cancer prevention strategies in Uzbekistan.

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