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## Research Article

# Measurement of the Severity of Pediatric Cancer in West Bengal, India

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### Abstract

**Background and Objective:** In children, cancer is the second commonest cause of death after accidents in developed countries. In the present study, the cancer incidence was recorded in the pediatric age group for the last 10 years (2011-2020). **Materials and Methods:** A total of 1945 cases were assessed from patients attending Barasat Cancer Research and Welfare Centre, a tertiary health centre of West Bengal and covering many districts of eastern India. **Results:** The most frequently affected carcinomas were acute lymphoblastic leukemia (ALL), acute myelocytic leukemia (AML), Hodgkin's Lymphoma and non-Hodgkin's Lymphoma (NHL), lymphoma, carcinoma of the brain (Ca-Brain), osteosarcoma and keratosarcoma. Results revealed that, below 10 years of age, among children, ALL was alarmingly high (31.05%), followed by AML (18.82%), Hodgkin's lymphoma (14.27%), NHL (14.14%), osteosarcoma (10.59%) and lymphoma (10.23%). The incidence of Ca-Brain and Kerato-sarcoma was negligible with only 0.57 and 0.31% frequency, respectively. The cancer frequency was high during 2011-2015 and reached the maximum in the year 2014. The frequency of these cancers was moderate during 2016-2018 but it rises drastically in 2019. But there was a sudden decrease in disease incidence was noted for the year 2020, which may be due to less number of patients attending the health care centre in the COVID-19 pandemic situation in the year 2020. **Conclusion:** The present demographic study indicates that pediatric cancer is prevalent in this population and results in morbidity and mortality in children with an increased rate.

**Key words:** Childhood cancer, acute myelocytic leukaemia, acute lymphoblastic leukaemia, Hodgkin's lymphoma, non-Hodgkin's lymphoma

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**Competing Interest:** The author has declared that no competing interest exists.

**Data Availability:** All relevant data are within the paper and its supporting information files.

## INTRODUCTION

All forms of cancers are posing threat worldwide and in the developed as well as developing countries causes over 6 M of deaths, over 10 M new cases including approximately 5.3 M men and 4.7 M women<sup>1-3</sup>. It is found that, in India, one million new cancer cases are detected annually. An average of one out of 10-13 people suffered from cancer during their lifetime as reported by ICMR in a study of the lifetime cumulative risk of cancer<sup>4</sup>.

In developed countries, less than 2% of the total cancer burden in childhood cancers. In developed countries, the second most commonest cause of death is cancer, in childhood, after accidents. The pattern of tumours is distinct in childhood as compared to adults, due to different etiological factors. Thus, childhood cancer is the major concern of public health problem<sup>2</sup>. The disease is not only fatal in patients but also proved to associate with a severe impact on children, their parents, immediate circle of relatives and also friends. In developing countries, the occurrence of premature delivery can cause the emergence of childhood cancer. Further, improvements in the management of communicable diseases may lead to the cancer emergence in children and cause a great impact on the public health problem more seriously as compared with the past<sup>2</sup>. In the year 1982-84, cancer ranked ninth for the cause of death of the boys and the tenth in girls, under the age of 15 years in Bombay.

Globally the incidence of childhood cancer reports 160,000 new cases and counts 90,000 deaths per year below the 15 years of age<sup>4</sup>. In the United States, the childhood cancer incidence is 14.9 per 100,000 below 15 years of age and 16.4 per 100,000 below 20 years of age. The commonest childhood cancers include brain cancer, leukaemia (acute myelocytic leukaemia and acute lymphoblastic leukaemia), lymphoma (Hodgkin lymphoma and non-Hodgkin lymphoma), neuroblastoma, sarcoma, (ewing sarcoma, osteosarcoma, soft tissue sarcoma and rhabdomyosarcoma), Wilms tumour and other childhood kidney tumours. In the peripheral healthcare infrastructure incorporating screening for cancers have a significant impact and effect for reducing the mortality by cancer<sup>5</sup>. In a defined region, a population-based cancer registry records all cancer cases and it is the important source of data for estimating the disease incidence and also mortality. A network has been initiated in different regions of the country by the Indian Council of Medical Research in 1982 to set up cancer registries. But the above study only covered 5% of the population covered, which is very limited, thus it gives the limited idea of the data, in India, for understanding the extent of cancer<sup>5</sup>.

In a country like India with wide socio-cultural diversity, a study on cancer epidemiology in childhood is earnest important. Keeping in view the scarcity of demographic data, the present investigation was aimed to understand the changing spectrum of malignancy profile in the pediatric age group of West Bengal, India.

## MATERIALS AND METHODS

**Study duration:** A total of 1945 cases were assessed from patients attending Barasat Cancer Research and Welfare Centre, a tertiary health care centre of West Bengal and it covers many neighbouring districts of Eastern India. In the present study, the cancer incidence was recorded in the pediatric age group for the last 10 years (2011-2020).

**Research methodology:** Various investigations were employed by physicians to diagnose the malignancy, like cytology, radio-imaging and histopathological examinations.

Different types of carcinoma were investigated and the common eight types of malignancy encountered by the children of West Bengal including, acute myelocytic leukemia (AML), acute lymphoblastic leukemia (ALL), non-Hodgkin's Lymphoma (NHL), Hodgkin's lymphoma, lymphoma, carcinoma of the brain (Ca-Brain), osteosarcoma, kerato-sarcoma, were studied.

The data of the pathological status of cancer patients, age and sex were collected for successive 10 years (2011-2020). Demographic data and also environmental data were taken into consideration. The socioeconomic status of the families under study was determined. For this study, permission from the ethical committee was taken. Written consent was taken with information from all the patient parties as per the guidelines of the hospital centre ethical committee and review board.

## RESULTS

The present investigation revealed that among the children in the studied population cancer rate was alarmingly high. In rural areas, the incidence was slightly low as compared to the urban counterparts which are more polluted. The carcinomas, which were most frequently affected, were ALL, AML, NHL, Hodgkin's lymphoma, lymphoma, Ca-Brain, osteosarcoma and kerato-sarcoma in Table 1. The site-wise distribution showed variation within the studied population.

Trend analysis study on the cancer incidence for the period of 2011-2020 showed that cancer incidence is overall increasing. Among the pediatric age group, this prevalence is with greater increase. The cancer frequency was high during

Table 1: Year-wise distribution and frequency of different types of childhood cancer

Years	ALL	AML	NHL	Hodgkin's lymphoma	Lymphoma	Ca-Brain	Osteo-sarcoma	Kerato-sarcoma	Total
2011	51	44	38	25	19	3	37	1	218 (11.21)
2012	53	41	30	29	21	1	28	1	204 (10.49)
2013	64	45	31	26	25	1	29	0	221 (11.36)
2014	73	49	38	33	28	2	20	1	244 (12.54)
2015	71	33	28	38	18	1	21	1	211 (10.84)
2016	74	28	29	24	11	0	12	0	178 (9.15)
2017	66	26	27	28	16	1	16	1	181 (9.31)
2018	62	31	19	22	20	0	19	1	174 (8.95)
2019	53	40	24	35	26	2	16	0	196 (10.08)
2020	37	29	11	18	15	0	8	0	118 (6.07)
Total	604 (31.05)	366 (18.82)	275 (14.14)	278 (14.27)	199 (10.23)	11 (0.57)	206 (10.59)	6 (0.31)	1945

\*Digit in parenthesis represents the frequency, AML: Acute myelocytic leukemia, ALL: Acute lymphoblastic leukemia and NHL: Non-Hodgkin's lymphoma

2011-2015 (above 10.8%) and reached the maximum (12.54%) in the year 2014 (Table 1). It was then moderate during 2016-2018 (below 10%) but it rises drastically in 2019 (10.08%). But there was a sudden decrease in disease incidence was noted for the year 2020. It may be due to less number of patients attending the health care centre in the COVID-19 pandemic situation in the year 2020.

Results revealed that, below 10 years of age-group of children, ALL was alarmingly high (31.05%), followed by AML (18.82%), Hodgkin's lymphoma (14.27%), NHL (14.14%), osteosarcoma (10.59%) and lymphoma (10.23%). The incidence of Ca-Brain and Kerato-sarcoma was negligible with only 0.57 and 0.31% frequency, respectively. After 2012, these cancer frequencies was drastically increased and finally, they reached the peak in 2014 showing 73 cases (3.75%) for ALL, 49 cases (2.52%) for AML, 38 cases (1.95%) for NHL, 33 cases (1.70%) for Hodgkin's lymphoma, 28 cases (1.44%) for lymphoma and 20 cases (1.03%) for osteosarcoma (Table 1).

## DISCUSSION

The present epidemiological study indicates that pediatric malignancy is responsible for morbidity and increase in mortality in children. This observation supports the early investigations that in the past decade cancer especially in children has risen 10.8% overall. In the United States, cancer is the second most common cause of death among children in the ages of 1-14 years, after only accidents. In comparison with high-income to low-income countries, the greatest variation is observed in pediatric cancer incidence. It may be due to incomplete ascertainment of cancer occurrence in pediatric ages. Different risk factors are also associated, for example, in Sub-Saharan Africa pediatric Burkett lymphoma is associated with Epstein-Barr virus infection in conjunction with malaria. But in industrialized countries, Burkett lymphoma is not associated with these infectious conditions. Other factors contribute to risk in different ethnic groups or different racial population subgroups in differential patterns<sup>6</sup>.

The present investigation revealed that among children ALL was most threatening. Among other childhood cancer AML, NHL, Hodgkin's lymphoma, lymphoma, osteosarcoma were prevalent in the studied populations. This observation was at per with the fact that ALL is the commonest childhood cancer. It has its peak incidence at the age group of 4-12 years. But 85% cure rate is observed in the case of ALL in children<sup>7</sup>. Previous studies on the incidence of ALL and NHL among children during the last 15 years period revealed that the increase of ALL was 10.7% and the increase of NHL was 19.2%<sup>6</sup>. Cancer causes more deaths in children ages 1-14 years in the United States in comparison with any other diseases. In the industrialized world, for children less than 15 years of age, childhood cancer is the 4th most common cause of death. Because of concerns of the rise of incidence of common childhood cancers, the trend patterns have been evaluated.

The incidence of childhood leukaemia increased abruptly between 1983-1984 and then declined between 1989 and 1995. There was a modest increase in the incidence of brain and CNS cancers from 1983-1986 and the rates stabilized between 1986-1995. Statistically significant and satisfactory increases were observed in the mid 80's. The increase may be due to the improvement of diagnostic. In the case of rare skin cancers such as dermato-fibrosarcomas, an increase of 40% was observed between 1975 and 1995. In the United States, data revealed that the incidence rate of cutaneous malignant melanoma (CMM) increased 2.6% per year in 15-19 years old between 1973-1995, for a total increase of 85%<sup>8</sup>.

The present study also showed a slight decrease in pediatric cancer from the year 2016 to 2019 (below 10%). But in the year 2020, there was a sudden fall in disease incidence was noted (6.07%). It may be due to the COVID-19 pandemic situation, when the number of cases attended to the health care centre was low, for lockdown and other social distance maintaining issues. This is common for all the govt, non-govt and private health care sectors in West Bengal and other places.

In this population, the cancer rate is climbing at epidemic proportions. The climax may be partially attributed to

ignorance. Though try to ignore the fact that the cancer rates are spiralling out of control in many areas, specifically for particular cancers<sup>9-11</sup>. In the country, the epidemiological transition is contributed by urbanization, industrialization, population growth, changes in lifestyles and ageing. The absolute number of new cancer cases is increasing rapidly due to the population size growth<sup>5</sup>. Exposure to various pollutants viz., asbestos specks of dust, industrial wastages, coloured agricultural products, coloured food products, environmental toxicants incredibly elevate the risks of malignancy<sup>11</sup>. Besides this, newer types of malignant burst and cancer emergence are also prevalent throughout the world and this situation is more threatening in polluted sites.

This may be due to genetic causes or the use of different carcinogenic products in their daily life, knowingly or unknowingly. In modern days, the increased environmental pollution also contributed to it. In the case of childhood cancers, a small percentage of the risk to predispose children to cancer is familial or genetic factors. Further, the environmental link has also been identified for definite childhood cancer, even in a smaller percentage. The genetic factors have a minor effect on childhood cancer as investigated earlier<sup>12</sup>. The causes of the majority of childhood cancers remain poorly understood or unknown. It can be held that a combination of factors act concurrently and also sequentially to contribute to childhood cancer.

Exposures to agricultural chemicals are associated with cancers, like Hodgkin's disease, non-Hodgkin's lymphoma and soft tissue sarcoma as was reported in a previous study<sup>5</sup>. This cancer scenario with its devastating effect can be drawn into a positive direction with regular screening. Training of personnel with the prevention measures of cancer susceptibility and also lifestyle modification for betterment in a proper way can control the disease epidemic on a wide scale. If the malignancy is diagnosed in its advanced stage, then very few options were left for the cure and thus lead to high morbidity. Further, the under-report of cancer mortality due to poor recording of death causes is also the main issue in India<sup>13</sup>. Thus, it can be concluded that the implementation of an effective screening program is a challenge, which can only be done by using new cancer markers and these affairs can only be regulated by modern techniques.

### **CONCLUSION**

In the present study, the cancer incidence was recorded in the pediatric age group for the last 10 years (2011-2020). Results showed that the cancer rate was alarmingly high among the children in the studied population. In rural areas,

the incidence was slightly low as compared to the more polluted urban counterparts. The site-wise distribution showed variation within the studied population. The most frequently affected carcinomas were ALL, AML, NHL, Hodgkin's lymphoma, lymphoma, Ca-Brain, osteosarcoma and kerato-sarcoma. The present investigation revealed that among children ALL was most threatening. Among other childhood cancer AML, NHL, Hodgkin's lymphoma and lymphoma, osteosarcoma were prevalent in the studied populations. After 2012, these cancer frequencies increased drastically and finally, they reached a peak in 2014. The present epidemiological study indicates that pediatric malignancy is responsible for cancer morbidity and also an increased rate of mortality in children.

### **SIGNIFICANCE STATEMENT**

This study discovered the severity of pediatric cancer in West Bengal that can be beneficial for the understanding of the incidence profile of different malignancies in the pediatric age group and its vulnerability in this population. This study will help the researchers to uncover the critical areas of effect of pollution and the site-wise variation in cancer incidence that many researchers were not able to explore. Thus, a new theory on the demographic distribution of pediatric cancer may have arrived at a critical analysis of the studied data.

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