Patterns of Childhood Cancer

Introduction: Cancers form one of the major causes of death in children between the ages of one and 15 years. They differ markedly from adult cancers in their nature, distribution and prognosis. The patterns of childhood cancers in America and Europe are almost the same, with leukemia and central nervous system tumors accounting for over one-half of the new cases. In contrast, lymphoma is the most common prevailing cancer of this age group in Africa.

Objective: The objective of this study is to determine the patterns of childhood cancers in Gezira State, Central Sudan. It is a retrospective study using hospital records. All children with cancer, aged 1 – 15 years diagnosed by means of histological or cytological examination admitted to the Institute of Nuclear Medicine, Molecular Biology and Oncology from May 1999 – December 2004 were included in the study.

Results: The results showed a pattern of childhood lymphoma as the most common cancer (42.8%) followed by acute lymphoblastic leukemia (19.8%) and kidney tumor (12.8%). The prevalence of cancer was found to be higher among boys (64.7%) than girls (35.3%) with a rate of 1.8:1. Most of the children admitted with cancer were from rural areas (66.1%) compared to 33.9% from urban areas.

Conclusion: Lymphoma, acute lymphoblastic leukemia and bone tumor commonly occurred in children above 5 years in contradistinction to kidney tumor and retinoblastoma which was prevalent in children less than 5 years of age.

Key Words: Leukemia, Lymphoma, Pattern, Prevalence, Cancer.

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INTRODUCTION
Cancer remains one of the major causes of death in children between the ages of 1 –15 years.\textsuperscript{1} Pediatric cancers differ markedly from adult cancers in their nature, distribution and prognosis. Pediatric oncologists face unique challenges because treatment with irradiation, surgery and chemotherapy can adversely affect the children's growth and development. The incidence of childhood cancer and type vary greatly throughout the world. Though lower compared with the incidence of some adult cancers, it comes next to accidents as the leading cause of death among children in the developed world.\textsuperscript{1}

The patterns of childhood cancer in America and Europe are almost the same, with leukemia and tumors of the central nervous system accounting for over one-half of the new cases. However, there is a dearth of data on the incidence and patterns of childhood cancer in Africa. Although many papers have been published on this in some African countries,\textsuperscript{2-9} reports on the patterns and incidence of childhood cancer in Sudan are very few.

The objective of this study is to determine the patterns of childhood cancer in Gezira State, Central Sudan.

DESIGN AND METHOD
This is a retrospective study using hospital records. The patterns of cancer were studied focusing on the prevalence of tumors according to age, sex, geographic and ethnic distribution and relating the cancer to environmental and genetic causative factors.

All children with cancer, aged one to 15 years diagnosed by means of histological or cytological examination and admitted to the Institute of Nuclear Medicine and Molecular Biology and Oncology from May 1999 – December 2004, were included in the study.

Gezira is the second largest state in Sudan, with an estimated population of 3,962,000 with a 50:50 male to female ratio (49.3:50.7) according to the last population census (1993). It has 13 secondary hospitals, 36 rural hospitals and 150 health centers. Gezira state was considered the richest state in the country before the discovery and extraction of oil. The Institute of Nuclear Medicine, Molecular Biology and Oncology (INMO) which was founded in 1993, has a new department established in 1997 to manage and care for cancer patients in a multidisciplinary approach. This is the second oncology centre in Sudan and it caters for patients with cancer from Gezira state and the surrounding states in the central region of Sudan.

RESULTS
The results of this study showed a pattern of childhood cancer in patients admitted to INMO during the period (May 1999 – Dec. 2004). Lymphoma was the most prevalent (42.8%) followed by acute lymphoblastic leukemia (19.8%) and kidney tumors (12.8%).

| Cancer                          | No. (%)   |
|--------------------------------|-----------|
| Lymphoma                       | 80 (42.8) |
| Kidney tumor                   | 24 (12.8) |
| Bone tumor                     | 11 (5.9)  |
| Acute lymphoblastic leukemia    | 37 (19.8) |
| Acute myeloid leukemia          | 8 (4.3)   |
| Nasopharyngeal carcinoma        | 5 (2.7)   |
| Brain tumor                    | 2 (1.1)   |
| Retinoblastoma                  | 2 (1.1)   |
| Liver tumor                     | 13 (7.0)  |
| Soft tissue tumor               |           |
| **Total**                      | 187 (100) |

| Sex       | Urban No. (%) | Rural No. (%) | Total |
|-----------|---------------|---------------|-------|
| Male      | 45 (36.6)     | 78 (63.4)     | 123 (100) |
| Female    | 19 (28.8)     | 47 (71.2)     | 66 (100)  |
| **Total** | 64 (33.9)     | 125 (66.1)    | 189 (100) |

| Tribe                  | No. (%) |
|------------------------|---------|
| Kordofan tribes        | 37 (20.3) |
| Central Sudan tribes   | 76 (41.8) |
| Darfur tribes          | 27 (14.8) |
| Northern Sudan tribes  | 37 (20.3) |
| Eastern Sudan tribes   | 5 (2.7)   |
| **Total**              | 182 (100) |

| Cancer                                    | < 5 No. (%) | > 5 No. (%) |
|-------------------------------------------|-------------|-------------|
| Lymphoma                                  | 21 (35.0)   | 59 (46.5)   |
| Kidney tumor                              | 18 (30.0)   | 6 (4.7)     |
| Bone tumor                                | 1 (1.7)     | 10 (7.9)    |
| Acute lymphoblastic leukemia              | 11 (13.8)   | 26 (20.5)   |
| Acute myeloid leukemia                    | 0           | 8 (6.3)     |
| Nasopharyngeal carcinoma                  | 0           | 5 (3.9)     |
| Brain tumor                               | 1 (1.7)     | 1 (0.8)     |
| Retinoblastoma                            | 5 (8.3)     | 0           |
| Liver tumor                               | 0           | 2 (1.6)     |
| Soft tissue tumor                         | 3 (5.0)     | 10 (7.9)    |
| **Total**                                 | 60 (100)    | 127 (100)   |
### Table 5: Association between common types of cancers and child tribes

| Types of cancers | Kordofan tribes | Central Sudan tribes | Darfur tribes | Northern Sudan tribes | Eastern Sudan tribes | Total |
|-----------------|-----------------|---------------------|--------------|----------------------|---------------------|-------|
| Lymphoma        | 22              | 29                  | 13           | 13                   | -                   | 77    |
| Kidney tumor    | 1               | 13                  | 6            | 2                    | 1                   | 23    |
| Lymphatic       | 6               | 16                  | 2            | 7                    | 2                   | 33    |
| Leukemia        | -               | -                   | -            | -                    | -                   | -     |
| **Total**       | **29**          | **58**              | **21**       | **22**               | **3**               | **133**|

Chi square=15.893, p-value=0.04, significance at 5%

The prevalence of tumor in children in our study was higher among boys (64.7%) than girls (35.3%).

Most of the children admitted with cancer came from the rural areas (66.1%) compared to 33.9% from urban areas. The distribution of children according to their tribes showed that the majority of them belonged to central Sudan tribes (41.8%), followed by Kordofan and northern Sudan tribes, (both of them recorded 20.3%). Children from the Darfur tribes constituted 14.8%, while those from Eastern Sudan tribes were only 2.7%.

The results showed that lymphoma, acute lymphoblastic leukemia and bone tumor commonly occurred in children above five years of age in contradistinction to kidney tumor and retinoblastoma which commonly occurred in children younger than 5 years. The prevalence of non-Hodgkin lymphoma in males were found to be 65% while it was 35% in females. Male prevalence in Hodgkin lymphoma was 83% while it was 17% in females. There was also a significant association between the children's tribes and the types of cancers at a level of 5%.

**DISCUSSION:**

Although the causes of childhood cancers are largely unknown, a few conditions can be explained with specific chromosomal and genetic abnormalities, and ionizing radiation exposure. Environmental causes have long been suspected by many scientists but have been difficult to determine because it is difficult to identify past exposure levels in children particularly during potentially important periods such as pregnancy or even the time prior to conception. In addition, each of the distinctive types of childhood cancers develops unique clinical course in terms of age, race, gender and many other factors.1

It has been shown that in many developing countries, the reported prevalence of childhood cancer in boys is substantially higher than in girls. The ratio of boys to girls registered with childhood cancer, increased with decreasing gross domestic product and with increasing infant mortality, suggesting that boys are increasingly more likely to be affected than girls with increasing economic disadvantages.10 The ratio of boys to girls in our study is 1.8:1 which agrees with the African trend but differs from the trend in western countries where the female to male ratio is 1:1.10-12

The pattern of the cancer in Gezira - Sudan is like other African countries, with lymphoma as the commonest followed by acute lymphoblastic leukemia and kidney tumor. This was also the pattern found in a study conducted in Khartoum in the early nineties.13-16

The distribution of the most common three cancers according to age and gender in our study, is in consonance with international trends for lymphoma as a common cancer in children aged more than five years, with non-Hodgkin lymphoma being twice more common in males than in females, while Hodgkin is five times more common in males than in females.

In this study, acute lymphoblastic leukemia differed from the international trend in that it was more common among the children aged more than five years. However, the gender distribution was similar to the international pattern which has females and males equally affected.

The prevalence of kidney tumors as evident in our study is in accord with the international pattern which shows that the tumor is prevalent in children less than 5 years of age with slight difference in male to female ratio 1.7: 1.

There was a significant relationship of the prevalence of different cancers in relation to the different Sudan tribes.

**CONCLUSION**

In this study it was evident that the:
1. Patterns of cancer in Gezira State is like other African patterns but different from those of western countries.
2. Lymphoma is the most common cancer in Gezira State, with males three times more affected than females. Children above five years of age were shown to be the most commonly affected.

3. In contrast to western countries leukemia is more prevalent in children above five years of age.

**RECOMMENDATIONS**

1. There is a need for research to determine the annual incidence of different cancers in children in Gezira and determine mortality and five year survival rates.

2. A detailed study of environmental risk factors is necessary since Gezira state has the largest agricultural scheme in Africa and Middle East.

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