



## Research Article

### Pattern of Pediatric Tumors at Pediatric Department in South Egypt Cancer Institute: Thirteen Years Report

Amany Mohamed Ali<sup>1</sup>, Heba Abdel-Razik Sayed<sup>1\*</sup>, Douaa Mohammed Sayed<sup>2</sup> and Nabil Nazmy Mikhail<sup>3</sup>

<sup>1</sup>Department of Pediatric Oncology, South Egypt Cancer Institute, Assiut University, Egypt

<sup>2</sup>Department of Clinical Pathology, South Egypt Cancer Institute, Assiut University, Egypt

<sup>3</sup>Department of Biostatistics and Cancer Epidemiology, South Egypt Cancer Institute, Assiut University, Egypt

\*Corresponding Author: Dr. Heba A Sayed, Department of Pediatric Oncology, South Egypt Cancer Institute, Assiut University, Egypt; Tel: 002-01004246422; E-mail: [hebadina2007@yahoo.com](mailto:hebadina2007@yahoo.com)

Published: August 20, 2016

#### Abstract:

Background: Cancer, a common disease in adults, is rare in children and adolescents. Less than 1% of all malignancies occur in pediatric patients and only one case of cancer is encountered annually among 10,000 children aged 0 through 15 years.

Methods: A thirteen year retrospective study of pediatric malignancies in South Egypt Cancer Institute (SECI), Assiut University Egypt, was carried out based on data from the Department of Biostatistics and Cancer Epidemiology at the institute. The objective of this study was to determine the pattern of patients pediatric malignancies admitted at the Pediatric Oncology Department during the study period (January 2001 to December 2013) and compare it with previous reports from Egypt and worldwide. Data was categorized according to frequency of pediatric malignancies in different age groups, sex and types of tumors using International Classification of Childhood Cancer (ICCC). All the children below the age of 15 years with confirmed diagnosis of cancer by means of laboratory methods, pathological or cytological examinations were included in this study.

Results: 25347 patients were diagnosed as having malignancies in SECI out of which 2831 were pediatric cases. Overall frequency of pediatric tumor was 11.1% during the study period. The peak frequency of pediatric tumors (42.8%) occurred in children from 1<sup>st</sup> to 5<sup>th</sup> year of age. Males were affected more than females with ratio of 3:2. Hematological malignancies were the most common among our patients. The pattern of childhood tumors showed wide variation during the study.

**Abbreviations:** ALL: Acute Lymphoblastic Leukemia; AML: Acute Myeloid Leukemia; CNS: Central Nervous System; ICCC: International Classification of Childhood Cancer; NHL: Non-Hodgkin Lymphoma; SECI: South Egypt Cancer Institute

Childhood Cancer (ICCC), these diseases are classified into 12 main diagnostic groups, which are split further into 47 diagnostic subgroups and listed according to morphology rather than frequency, including non-malignant intracranial and intra-spinal tumors [3].

**Introduction:** Childhood cancers are histologically more diverse, differ in type, etiology and outcome from adult cancers. Childhood cancers are heavily influenced by genetic and environmental factors [1]. Unlike adults, where epithelial tumors predominate, the most common types of cancer in children include the leukaemias and lymphomas and the tumors of the central and sympathetic nervous systems, soft tissue, bone, and kidney. The overall incidence rate for childhood cancers has increased significantly by almost 33% during the period 1975 to 2001 [2]. According to the International Classification of

In 2005, the International Union Against Cancer reported that, worldwide, more than 160,000 children are diagnosed with cancer per year, and about 90,000 die from cancer because of late presentation due to parental ignorance and poverty, and poor health facilities [4,5]. It has also been estimated that more than 85% of childhood cancer cases occurred in resource-poor countries, and it is possible that this will increase to 90% in the next two decades as a result of an expected rapid increase in the youth population [4].

The occurrence of cancer during childhood represents one of the leading causes of death within the pediatric and adolescent age group [1] especially in economically developed nations of the world. More than 10% of all deaths in children below 15 years of age are caused by malignant diseases [6].

In the developing world, childhood cancers are yet to be recognized as a major pediatric illness due to several other competing causes of death like diarrheal illness and respiratory illness. However, due to considerable reduction in infant and child mortality rates experienced in a few developing countries, it is emerging as a distinct entity to be dealt upon [6].

Childhood cancer is curable if diagnosed early; the cure rate in childhood cancer has increased tremendously [7]. The survival has improved dramatically over the last two decades due to aggressive combined modality management [8,9], however at least half of all South African children with cancer are never diagnosed, or present for treatment at too late a stage, as a combination of lack of knowledge on the part of parents and health care practitioners, and lack of access to medical care and appropriate treatment facilities [9].

The exact incidence of childhood tumors has been difficult to determine because of inadequate statistical data. Its impact on children's lives varies with its incidence, diagnosis, therapy, mortality and survival at different places and times. Geographical variation in the incidence of cancer in African countries, owing to genetic and environmental factors, has also been reported [4].

Good-quality population level statistics on the occurrence of cancer at young age have been more difficult to obtain than in adults and serious under reporting, even in western countries, has been documented [10]. Appropriate management of pediatric tumors requires complete epidemiological data of pediatric tumors in different geographical areas. As hospital registries are the only available source of information for assessing the disease pattern in community, this retrospective study was conducted to find out the pattern of childhood cancer

in South Egypt Cancer Institute that services the whole Upper Egypt based on our hospital records during the past thirteen years.

**Aim of the Study:** This study aimed to document general baseline data on the pattern of Pediatric tumors admitted at the Pediatric Oncology Department of South Egypt cancer Institute (SECI), Assiut University to have an idea about the disease pattern in our community.

**Patients and Methods:** This is a retrospective study included all children at age group 0-<15 years admitted to the Pediatric Oncology Department at SECI with confirmed diagnosis of cancer by means of hematological laboratory methods, pathological or cytological examinations during the study period (January 2001 to December 2013). The data was collected from patients' records and data from the Department of Biostatistics and Cancer Epidemiology of SECI.

Data was categorized according to frequency of pediatric malignancies in different age groups, sex and types of tumors using the International Classification of Childhood Cancer (ICCC), and compare it to similar data in adults during the same study period. Formal approval was obtained from SECI Institutional Review Board.

SECI is a tertiary university centre in South Egypt serving about 30 million populations. It includes 10 departments for diagnosing and managing all type of cancer patients and is located at Assiut governorate, Middle Egypt. The Pediatric Oncology Department offers both pediatric cancer management and intensive care services.

### **Results:**

During study period of thirteen years, 25347 patients were diagnosed as having malignancies at SECI, out of which 2831 cases belongs to pediatric age group. The pediatric malignant tumor comprises 11.2% of all malignancies, Table [1]. Males represented (60.2%) compared to females (39.8%) with male to female ratio of 3:2, Table [2].

Year	All patients	Paediatric patients	Percentage of paediatric patients
2001	1236	150	12.10%
2002	1477	211	14.30%
2003	1487	203	13.70%
2004	1516	242	16.00%
2005	1420	186	13.10%
2006	1621	172	10.60%
2007	1885	217	11.50%
2008	2018	197	9.80%
2009	2282	219	9.60%
2010	2598	251	9.70%
2011	2646	289	10.90%
2012	2630	256	9.70%
2013	2531	238	9.40%
Total	25347	2831	11.20%

**Table 1:** Frequency of pediatric Tumor versus Adult In SECI, 2001-2013

Year	Paediatric patients	Males	Females	Percentage of male paediatric patients
2001	150	91	59	60.70%
2002	211	133	78	63.00%
2003	203	115	88	56.70%
2004	242	149	93	61.60%
2005	186	124	62	66.70%
2006	172	98	74	57.00%
2007	217	135	82	62.20%
2008	197	118	79	59.90%
2009	219	133	86	60.70%
2010	251	145	106	57.80%
2011	289	175	114	60.60%
2012	256	145	111	56.60%
2013	238	141	97	59.20%
Total	2831	1702	1129	60.10%

**Table 2:** Frequency of pediatric Tumors in SECI (2001-2013) according to sex

Tumors were classified according to their frequency among different age groups. The frequencies were 42.8% in 1-<5 years, 30.1% in 5-<10 years and

27.1% in 10- <15years. The highest frequency was seen in 1-<5 years of age group and lowest incidence is seen in 10- <15years of age, Table [3].

Year	Pediatric patients	1 - <5 years	5 - <10 years	10 - <15 years
2001	150	65	43	42
2002	211	94	65	52
2003	203	77	71	55
2004	242	107	66	69
2005	186	85	55	46
2006	172	80	55	37
2007	217	89	59	69
2008	197	76	62	59
2009	219	94	71	54
2010	251	95	81	75
2011	289	119	73	97
2012	256	111	85	60
2013	238	119	67	52
Total	2831	1211	853	767
		-42.80%	-30.10%	-27.10%

**Table 3:** Frequency of pediatric Tumors in SECI (2001-2013) according to age group

In this study hematological malignancies represented (50.7%), non-hematological malignancies were (17.3%) and the tumors not classified by ICCC or in situ represented (32.7%).

Leukemias, myeloproliferative diseases and myelodysplastic diseases account for 33.4% of all tumors in the pediatric oncology department. Acute lymphoblastic leukemia (ALL) is the most common hematological malignancy. It accounts for 29.3% of total malignancies among patients admitted to the department and 87.8% of total leukemias, myeloproliferative diseases and myelodysplastic diseases and 58% of hematological malignancies during study period with peak incidence at the age group 1-<5 years.

The second hematological malignancies are Lymphomas and reticule endothelial system

neoplasms (17.3%), non-Hodgkins lymphoma NHL (10.5%) and Hodgkins lymphoma (6.8%). Most common non-hematological malignancy is neuroblastomas (6.5%) followed by renal tumors (4.1%) brain tumors (0.8%), hepatic tumors (0.8%), and retinoblastoma (0.3%) Table [4].

The male predominance was marked in leukemia, lymphoma, neuroblastoma retinoblastoma, central nervous system tumors and soft tissue sarcoma while female predominance was marked in bone tumors, hepatic tumors and germ cell tumor. Renal tumors were nearly equal in both sex, [Table 2, Table 5].

The most common embryonic tumors occurred between 1-5 years of age. They represented 90% of retinoblastomas, 80% of renal tumors, 86% of hepatic tumors, 81% of neuroblastomas, 45% of leukemias and 42% of lymphomas, Table [6].

ICCC Group	No.	%
Leukemias, myeloproliferative diseases & myelodysplastic diseases	945	33.40%
Lymphomas & reticulendothelial system neoplasms	490	17.30%
CNS & miscellaneous intracranial & intraspinal neoplasms	22	0.80%
Neuroblastoma and other peripheral nervous cell tumors	183	6.50%
Retinoblastoma	8	0.30%
Renal tumors	115	4.10%
Hepatic tumors	23	0.80%
Malignant bone tumors	40	1.40%
Soft tissue and other extraosseous sarcomas	43	1.50%
Germ cell tumors, trophoblastic tumors & neoplasms of gonads	26	0.90%
Other malignant epithelial neoplasms and malignant melanomas	9	0.30%
Other and unspecified malignant neoplasms	2	0.10%
Not Classified by ICCC or in situ	925	32.70%

**Table 4:** Frequency of pediatric Tumors in SECI (2001-2013) according to ICCC classification

ICCC Group	Males	%	Females	%
Leukemias, myeloproliferative diseases & myelodysplastic diseases	559	59	386	41
Lymphomas & reticulendothelial system neoplasms	351	71	139	29
CNS & miscellaneous intracranial & intraspinal neoplasms	13	59	9	41
Neuroblastoma and other peripheral nervous cell tumors	116	63	67	37
Retinoblastoma	5	62	3	38
Renal tumors	57	49	58	52
Hepatic tumors	9	39	14	61
Malignant bone tumors	18	45	22	55
Soft tissue and other extraosseous sarcomas	22	51	21	49
Germ cell tumors, trophoblastic tumors & neoplasms of gonads	5	19	21	81
Other malignant epithelial neoplasms and malignant melanomas	4	44	5	56
Other and unspecified malignant neoplasms	2	100	0	0
Not Classified by ICCC or in situ	541	58	384	42
Total	1702	60	1129	40

**Table 5:** Frequency of pediatric Tumors in SECI (2001-2013) according to ICCC and sex

ICCC Group	1-5 years	%	6-10 years	%	>10years	%
Leukemias, myeloproliferative diseases & myelodysplastic diseases	452	44.9	275	29	212	22
Lymphomas & reticulendothelial system neoplasms	219	42	176	34	95	19
CNS & miscellaneous intracranial & intraspinal neoplasms	12	54	4	19	6	27
Neuroblastoma and other peripheral nervous cell tumors	150	81	21	11	10	3
Retinoblastoma	7	90	0	0	1	10
Renal tumors	93	80	18	5	4	15
Hepatic tumors	20	86	2	10	1	4
Malignant bone tumors	3	8	16	40	21	52
Soft tissue and other extraosseous sarcomas	24	55	9	22	9	22
Germ cell tumors, trophoblastic tumors & neoplasms of gonads	13	57	2	7	7	26
Other malignant epithelial neoplasms and malignant melanomas	0	0	3	30	6	70
Other and unspecified malignant neoplasms	2	100	0	0	0	0
Not Classified by ICCC or in situ	443	47	243	26	227	37
Total	1438	50	769	27	599	21

**Table 6:** Frequency of pediatric Tumors in SECI (2001-2013) according to ICCC and age

### Discussion:

The National Cancer Registry Program (NCRP) was established in 2008 and became the only source for cancer incidence in our country. For registration purposes, Egypt was stratified into 3 geographical strata (regions), namely, Lower Egypt (north of Cairo), Middle Egypt (south of Cairo), and Upper Egypt (further south, reaching the southern frontier of the country) which only publish the cancer incidence in adults in these areas [11] so in this study we aimed to present the pattern of pediatric tumors admitted at the Pediatric Oncology Department of South Egypt cancer Institute (SECI), Assiut University to give an idea about the disease pattern in our community.

In the present study, 2831 cases of pediatric tumor were enrolled, which constituted 11.1% of the total cancer cases admitted to SECI during the study period, which is comparable to the findings of National Cancer Institute (NCI) Egypt during the period from 2002 to 2005 (10.2%) [12] and higher than other studies reported 5% in Aswan [11], 4.8% in India [13], and 2% in the United States [14-16]. Cancer, a common disease in adults, is rare in children and adolescents, less than 1% of all malignancies occur in pediatric patients and only one case of cancer is encountered annually among 10,000 children aged 0 through 15 years [9].

The international comparison of the cancer frequency and the incidence varies due to a variability in the diagnosis, classification and the differential access to the medical care and due to incomplete registration of the cases [17]. Good- quality population level statistics on the occurrence of cancer at young age have been more difficult to obtain than in adults [18].

Childhood cancer incidence by gender in the United States for children younger than 15 years reported that male predominance was most apparent for NHL, with males having incidence rates more than twice those of females., other cancer diagnoses that showed a 1.2-fold or higher male predominance were ALL, CNS tumors, neuroblastoma, hepatoblastoma, Ewing's sarcoma, and rhabdomyosarcoma [19] in the present study a male predominance (60%) [Table 2] is marked in leukemia lymphoma, neuroblastoma retinoblastoma and soft tissue sarcoma and the female predominance is marked in bone tumors, hepatic tumors and germ cell tumors which is comparable with the results reported [9], NCI Egypt [12], Aswan, Egypt [11] and Iran [20].

The maximum number of pediatric malignancy cases in our report was observed between the first and the fifth age groups (42.8%), 30.1% of cases were in the age group 5-10 years and 27.1% was older than 9 years which is comparable with the findings of other studies [11,12,16,17,20]. In Aswan, Egypt, the highest frequency was in the age group 1-4 years (44.4% for males, 52.2% for females and 47.5% for both sexes together) [11].

In India age-adjusted cancer incidence rates ranged from 18.6 per million to 159.6 per million for boys and 11.3 to 112.4 for girls. The highest incidence was observed for males (159.6) in Southern region of the country and the lowest in North-east in both boys (18.6) and girls (11.3). Leukemia and lymphoma were the commonest malignancies in boys whereas leukemia and brain tumors were commonest in girls [21].

For children 0 to 14 years, ALL was the most common cancer, accounting for 23.6% of all cancer diagnoses. Acute myeloid leukemia (AML) was the next most common type of leukemia in this age group, occurring at a rate of one-fifth that for ALL. Central nervous system cancers, primarily occurring in the brain, accounted for 22.1% of cancer diagnoses and together with ALL and AML made up one half of cancer diagnoses among children younger than 15 years. The most common non-CNS solid tumor in the 0- to 14-year age group was neuroblastoma (7.7%), followed by Wilms' tumor (5.9%) and NHL (5.9%). Other diagnoses that individually represented 2% to 4% of cancer diagnoses in this age group included Hodgkin's disease, rhabdomyosarcoma, non-rhabdomyosarcoma soft tissue sarcomas, germ cell

tumors, retinoblastoma, and osteosarcoma [9].

In this study the hematological malignancies were more common (50.7%) than the non-hematological malignancies (17.3%) which is comparable with the data in the literature and many studies [9,16] and [17] and this can be explained by that our pediatric oncology department, SECI is a referral centre mainly for hematological malignancies that requires good supportive care and unique diagnosis in our hematology lab as immune-phenotyping and cytogenetic studies. Tumors of the brain and nervous system represented small percent, about 0.8%, which less than reported in the literature [9,22] (10% to 20%) which can explained by the lack of neurosurgery in SECI and that these cases are managed in the health insurance organization hospitals. Also, bone tumors (1.4%) and liver tumors (0.8%) constituted small percent.

In this study we faced several limitations in registering of pediatric tumors, the most important was that the pattern of different tumors reported at pediatric oncology department, SECI Assiut University is not the exact reflection of the disease spectrum of the population but it only can gave a rough estimation of the pattern of malignancies among pediatric patients as there are other centres belongs to health insurance manage these cases. Also, the lower number of cases observed for most of the non-hematological malignancies in this study may be related to the same reason. Other limitations included the retrospective nature of the study and exclusion of patients older than 15 years who treated at medical oncology department from the study which make us lost a group of patients (adolescents) who are actually in the range of pediatric age (15- $\leq$ 18 years).

**Conclusion:** The distribution of the various pediatric tumors in this study was similar to that seen in NCI Egypt and Aswan and the age and sex incidence observed correlated with other studies within and outside Egypt.

These data are important in planning and in evaluation of health strategies. Population based statistical data on childhood cancer will help in assessing the magnitude of the cancer problem in our country. So we recommend union of all pediatric centres all over Egypt for management and registration of whole pediatric oncology patients to ensure accurate registering of this group of patients and improve their survival and quality of life.

#### References:

1. Patte C (2006) Childhood Cancer 3th ed Arnold: London, UK. Pediatric Oncology 254-266.

2. Ibrahim AS, Khaled HM, Mikhail NNH, Baraka H, Kamel H (2014) Cancer Incidence in Egypt: Results of the National Population-Based Cancer Registry Program. *J Cancer Epidemiol* 437971.
3. Steliarova-Foucher E, Stiller C, Lacour B, Kaatsch P (2005) International Classification of Childhood Cancer, third edition. *Cancer* 103: 1457-1467.
4. Kanavos P (2006) The rising burden of cancer in the developing world. *Ann Oncol* 17: 15-23.
5. Yaris N, Mandiracioglu A, Büyükpamukcu M (2004) Childhood cancer in developing countries. *Pediatr Hematol Oncol* 21: 237-253.
6. Parkin DM, Whelan SL, Ferlay J, Teppo L, Thomas DB (1995) Cancer incidence in five continents. Lyon IARC.
7. Arya LS (2003) Childhood cancer-challenges and opportunities. *Indian J Pediatrics* 70: 159-162.
8. Stiller CA, Parkin DM (1996) Geographic and ethnic variations in the incidence of childhood cancer. *Br Med Bull* 52: 682-703.
9. Pizzo PA, Poplack DG (2006) Malignancy in children. In *Principles and Practice of Pediatric Oncology* J.B. Lippincott Co.: Philadelphia, PA, USA 537-575.
10. Wagner HP, Antic V (1997) The problem of pediatric malignancies in the developing world. *Ann N Y Acad Sci* 824: 193-204.
11. Amal S, Nabil M, Hussein K (2010) Egypt National Cancer Registry: Aswan Profile-2008, Publication Number RR1, National Cancer Registry Program of Egypt.
12. El-Attar I (2004) Cancer statistics, NCI, 2004. Cairo, Egypt: Department of Biostatistics and Epidemiology, NCI; 2005.
13. Arora RS, Eden TO, Kapoor G (2009) Epidemiology of childhood cancer in India. *Indian J Cancer* 46: 264-273.
14. Ross JA, Severson RK, Pollock BH, Robison LL (1996) Childhood cancer in the United States. A geographical analysis of cases from the Pediatric Cooperative Clinical Trials groups. *Cancer* 77: 201-207.
15. Ross JA, Olshan AF (2004) Pediatric Cancer in the United States: The Children's Oncology Group Epidemiology Research Program. *Cancer Epidemiol Biomarkers Prev* 13: 1552-1554.
16. Ries LAG, Smith MA, Gurney JG, Linct M (1975) Cancer incidence and survival among children and adolescents: the United States SEER Programme 1975-99, Nat Cancer Institute, SEER Program NIH Pub. No. 99-4646.
17. Kusumakumary P, Jacob R, Jothirmayi R, Nair MK (2000) Profile of pediatric malignancies: A ten year study. *Indian Pediatr* 37: 1234-1238.
18. Jabeen S, Haque M, Islam MJ, Talukder MH (2010) Profile of pediatric malignancies: A five year study. *J Dhaka Med Coll* 19: 33-38.
19. Pizzo PA and Poplack DG (2011) Malignancy in children. In *Principles and Practice of Pediatric Oncology* J.B. Lippincott Co.: Philadelphia, PA, USA.
20. Binesh F, Hashemi A, Vakil M, Shakeri MM, Dehshiri RM (2016) Incidence and Trend of Childhood and Adolescent Cancers in Yazd, Iran. *Iran J Ped Hematol Oncol* 6: 15-23.
21. Satyanarayana L, Asthana S, Labani SP (2014) Childhood cancer incidence in India. A Review of Population-Based Cancer Registries. *Indian Pediatr* 51: 218-220.
22. Bhalodia J, Patel M (2011) Profile of pediatric malignancies: A three year study *National Journal of Community Medicine* 2: 24-27.