Original Article

ID: JCDR/2012/3850:0032

Pathology Section

Paediatric Malignancies

NIHARIKA PATTNAIK, MOBARAK AHEMAD KHAN, EPARI SANJEEVA RAO, B. RAMA MOHAN RAO

ABSTRACT

Objective: Paediatric malignancies, being a significant cause of death among children, this study was performed with an aim to find out the profile of childhood cancers in western Orissa, India for a period of two years (2005-2007).

Materials and Methods: The paediatric population (0-14 yrs of age), which was diagnosed to have malignancy, in the Department of Pathology, V.S.S Medical College, Sambalpur, Orissa, India was the study group.

Result: Paediatric malignancies comprise 4.4% of the cancer load of all the age groups. The incidence of different variants, based on the International Classification of Childhood Cancer (ICCC), showed laeukaemia as the commonest cancer, to constitute 45.45% of the total cancer load, followed by soft tissue sarcomas -11.82%, malignant bone tumours- 10%, lymphomas- 8.17%, retinoblastomas- 5.45%, neuroblastomas- 4.55%, Wilms' tumour- 4.55%, germ cell tumours -4.55%, CNS neoplasms- 3.64%, hepatoblastomas- 0.91% and squamous cell carcinomas of the skin- 0.91%, in the decreasing order of their frequencies. The age distribution showed an incidence of 31.82% in the 0-4 years age group, 24.55% in the 5-9 years age group and 43.64% in the 10-14 years age group. The sex ratio showed a male predominance.

Conclusion: The frequency of different diseases which are detected at a particular centre is not an exact reflection of the disease spectrum of that population, but it can give a rough estimation of the trend. There exist regional and geographic differences in the incidence and the histologic types of paediatric cancers.

Key Words: Paediatric, Malignancy, Cancer, Profile

INTRODUCTION

The paediatric population (0-14 years of age) constitutes 32.4% of the total population of India [1]. Cancer in children is an emerging major childhood killer. Malignant neoplasms are the third commonest causes of death in the 1 to 4 years age group and the second commonest causes of death in the 5 to 14 years age group [2]. These are histologically very diverse and it has been firmly established that the classification of childhood cancer should be based on the morphology of the cancer cells. *Birch and Marsden,* in 1987, presented the classification of childhood cancer, which was widely accepted as a standard [3]. They divided childhood neoplasms into 12 major diagnostic groups. In *1996, Kramarova and Stiller* modified this classification and they presented the International Classification of Childhood Cancer (ICCC), based on the ICD-0-2 (International Classification of Diseases for Oncology) [4]. Paediatric neoplasms constituted 3.7-4% of all the cancers, according to data which was available from the population based cancer registries at Bangalore, Bombay and Madras, as was studied by Kusumakumary et al., [5]. In US, it is about 2%, according to Singh and Silverman [6].

Geographic differences in the occurrence of childhood cancers have also been described by some authors [5,7]. From the viewpoint of cancer control, particularly in the context of developing countries like India, there is a need to detect cancers at an early, curable stage of the disease. The five year survival rate for certain cancers like Hodgkin's lymphoma and retinoblastoma is now 95% in resource-rich countries [8]. Their late presentations may be due to many factors which include lack of awareness and socioeconomic conditions, to some extent.

The purpose of the present study was to give an insight into the pattern of distribution of childhood cancer. It provided the incidence figures for the types, age and sex distribution of childhood malignant tumours. Hospital registries are the only available sources of information for assessing the disease pattern in the community.

MATERIALS AND METHODS

With an aim to study the profile of childhood malignant tumours in western Orissa, the present study which was entitled "Paediatric Malignancies", was conducted. The study group consisted of paediatric patients (0-14 years of age) who were diagnosed to have cancer, in the Department of Pathology, V.S.S. Medical College Hospital, Sambalpur, Orissa. The study period was of two years duration from 2005 to 2007.

After a thorough clinical examination and after correlating its findings with the history, a provisional diagnosis was made and investigations were done accordingly. A detailed haematological examination, which included peripheral smear and bone marrow studies and special stains whenever they were required, were done in case of haematological malignancies. Patients with palpable lumps were subjected to FNAC and cytological studies. A histopathological diagnosis was made for the biopsy specimens .

Several different classification systems were used in the past. We followed the International Classification of Childhood Cancer (ICCC) which was given by *Kramarova and Stiller in 1996,* which was modified and which was based on the ICD-0-2 (International Classification of Diseases for Oncology) [4].

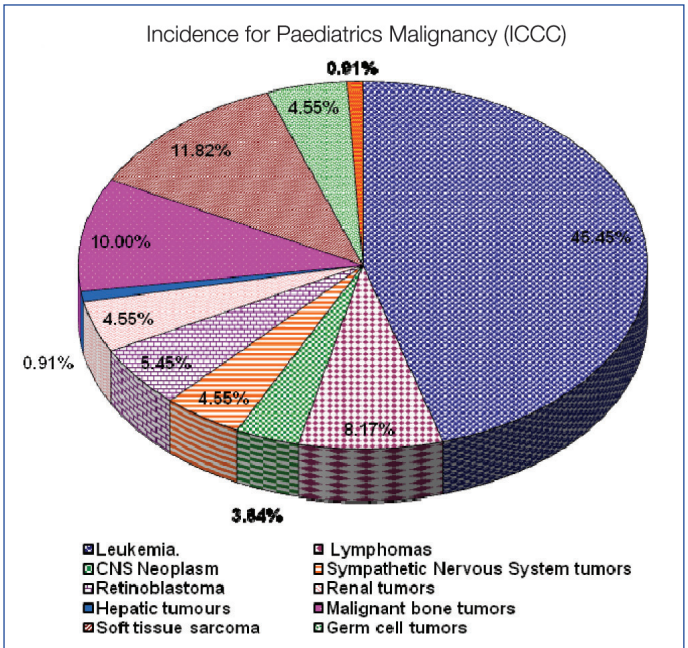
RESULTS

During the two year study (2005-2007) which was carried out in the Department of Pathology, V.S.S. Medical College, Burla,110 paediatric malignancies (0-14years) were diagnosed, which comprised 4.4% of the total cancer load i.e 2,500 malignancies in all the age groups. Haematological malignancies [50 cases (45.5%)] and malignant solid tumours [60 cases (54.5%)] were observed respectively.

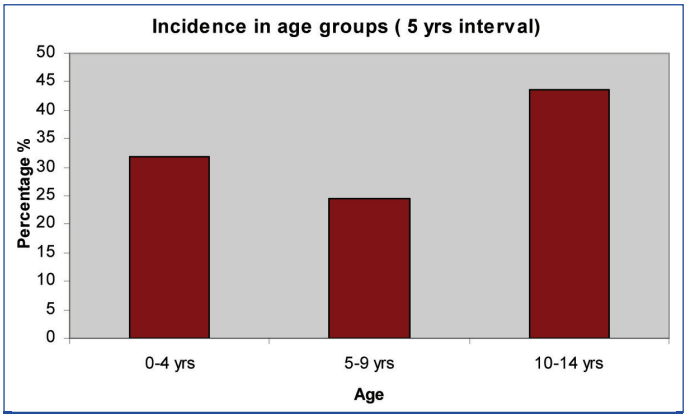
The most common malignancy in children was leukaemia, which constituted 45.45% of the cancer load, followed by soft tissue sarcomas -11.82%, malignant bone tumours -10.00%, lymphomas- 8.17%, retinoblastomas- 5.45%, neuroblastomas- 4.55%, Wilms' tumour- 4.55%, germ cell tumours- 4.55%, CNS neoplasms -3.64%, hepatoblastoma s-0.91% and squamous cell carcinomas of the skin -0.91% in the decreasing order of their frequencies [Table/Fig-1].

The commonest paediatric malignancies which were observed were acute lymphoblastic leukemia (ALL) among the haematological malignancies, rhabdomyosarcoma among the soft tissue sarcomas and osteogenic sarcoma among the bone tumours.

Stratification by the age group (5 years interval) in the present study delineated an incidence of 31.82% in the 0-4 years age group, 24.55% in the 5-9 years age group and 43.64% in the 10-14 years age group respectively.



[Table/Fig-1]: Incidence of different types of Paediatric malignancies



[Table/Fig-2]: Incidence of Paediatric malignancy in different age groups

The most common cancer in all the three age groups was leukaemia. The second most common cancer in the 0-4 years age group was retinoblastoma, in the 5-9 years age group, it was lymphoma and in the 10-14 years age group, it was soft tissue sarcoma.

On estimation of the sex incidence, a higher frequency was seen in males over females, with a ratio of 2.34:1.

DISCUSSION

In the present study, 110 cases of paediatric malignancies were detected, which constituted 4.4% of the total cancer cases in all the age groups, which was comparable to the findings of other studies, like 4.5% in *Kusumakumari et al's* study and *Jussawalla and Yeole's* study which showed that they formed 3.5% of the total cancer load [5,9]. But in the literature which was reviewed by Bhalodia et al, in 2011, paediatric tumours were found to constitute 2% of all the malignancies [10]. According to *Arora et al,* in 2009, the incidence of cancer in India varied between 1.6-4.8% [8]. So, our finding fell in this range. In contrast to this, the incidence in the United States was found to be only 2% [6].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 [5].

The maximum number of paediatric malignancy cases were observed in the first and the third age groups, which was at par with the findings of other studies [9,11].

The diversity in the age distribution in our study, as compared to that which was found by other authors, is due to the difference in the environment and the molecular mechanisms [12,13,14,15].

In all the paediatric age groups, leukaemia was found to be the most common type of cancer, which was similar to that which was reported by most of other literatures [5,11,14,16,17]. Retinoblastoma and lymphoma were the second most common malignancies in the 0-4 years and the 5-9 years age groups respectively [14].

Studies	M/F Ratio
1. Jussawalla et al., Bombay, 1988 [8]	1.7
2. Mangal et al., Rajasthan, 1991 [18]	1
3. Das et al., West Bengal, 1994 [16]	2
4. Nandakumar et al., Bangalore, 1996 [11]	1.8
5. Grovas et al., Ncdb, UU, 1997 [19]	1.2
6. Martin et al., Cuba, 1997 [12]	0.98
7. Gutierrez et al., Mexico, 1997 [20]	1.6
8. Ocana et al. Mexico, 2004 [14]	1.1
9. Bryan et al., Vellore, 2011 [21]	4
10. Bryan et al., Usa , 2011 [21]	1.10
11. Bhalodia et al., Gujarat, 2011 [10]	1.3
12. Present Study, 2007	2.34

[Table/Fig-3]: Comparison of overall M to F ratio with other studies.

Most of the studies. including the present study. revealed a male predominance [Table/Fig-3].

The male predominance in our country could be due to the extra at-tention which is given to the male child as a result of cultural factors [8]. According to Kusumakumary et al, male predominance is a salient feature of many childhood tumours. The male excess is particularly marked in the neoplasms of lymphoid origin, possibly

Types of cancer	Bombay (1988) [9]	Rajasthan (1991) [18]	West Bengal (1994) [16]	Bangalore (1996) [11]	Kerala (2000)[5]	West Bengal (2003) [17]	Gujarat (2011) [10]	Present study, Orissa, 2007
Leukemia	31.8	26	36.0	29	30	39.1	44:18	45.5
Lymphoma	10.7	32	9.5	19	10	10.8	16.27	8.2
CNS Neoplasm	12.2	1.6		13.2	19.3		6.97	3.6
Neuroblastoma		13		4.7	5.1	1.7	6.97	4.5
Retinoblastoma	6.3	1.2	32.6	3.8	4.5	19.2	-	5.5
Renal Tumour	6.1	16	4.2	5.1	5.4	10	9.30	4.5
Hepatic Tumour				0.9			-	0.9
Malignant Bone Tumours	8.9		5.8	3.4	5.4	5	2.32	10
Soft tissue sarcoma			5.2	4.7	6.6	11.2	2.32	11.8
Germ cell Tumour		5.7	5.2	2.9			-	4.5
Carcinoma				5.5			-	0.9
Miscellaneous	15.3	4.5	1.5	3.8	13.8	2.5	11.67	

[Table/Fig-4]: Comparison of Incidence of Pediatric malignancies with studies in India

Types of cancer	U.S. 1997[19]	Cuba , 1997[12]	Mexico, 1997[20]	SEER 1999[13]	Mexico, 2004[14]	Present study, India, 2007
Leukemia	29.6	31.2	39.2	31.5	36.1	45.45
Lymphoma	11.2	18.4	17.6	10.7	11.4	8.18
CNS Neoplasm	23.6	15.2	12.6	20.2	11.6	3.64
Neuroblastoma	6.0	7	3.0	7.8	2.3	4.55
Retinoblastoma	1.8	2.5	2.5	3.1	4.3	5.45
Renal Tumour	6.6	4.6	4.5	6.3	4.2	4.55
Hepatic Tumour	1.2	1.4	0.5	1.3	1.8	0.91
Malignant Bone Tumours	5.1	5.5	4.5	4.5	5.7	10.00
Soft tissue sarcoma	7.4	6	5.0	7.0	5.2	11.82
Germ cell Tumour	2.8	2	8.6	3.5	6.5	4.55
Carcinoma	1.6	3.7	1.5	3.5	1.1	0.91
Miscellaneous	2.9	2.1		0.5		

[Table/Fig-5]: Comparison of incidence of Pediatric malignancies with studies outside India

due to the genetic differences in the immune function. However, the female excess which was seen in germ cell tumours may be due to the earlier development of ovarian tumours than the testicular tumours [5].

Comparison of the relative frequencies of childhood cancer with those of other studies in India and outside India has been depicted in [Table/Fig-4] and [Table/Fig-5] respectively.

Leukaemia was the commonest of the childhood cancers in most of the studies from India and also from abroad.

The incidence of lymphoma in the present study was 8.17%, which was comparable to that in other studies, which had an approximately 10% incidence [5,13,16,17].

The incidence of neuroblastoma, nephroblastoma, soft tissue sarcomas, germ cell tumours and hepatoblastoma in the present study was comparable with that of other studies [Table/Fig-4 and 5].

The percentage of the CNS neoplasms in present study was 3.64%, which was comparable to the finding of Mangal et al, but a higher incidence was observed in other studies from India and other countries [18]. This is probably due to the inadequate facility for paediatric neurosurgery at our hospital.

The incidence of retinoblastoma in present study (5.5%) was in accordance with that which was observed by Jussawalla et al., (6.3%), Nandakumar et al (3.8%), Kusumakumary et al (4.5%) and Ocana et al., who found a 4.3% incidence [5,9,11,14]. The studies from West Bengal showed significantly higher frequencies of 32.6% and 19.2% which were observed by Das et al. and Chaudhuri et al respectively [16,17]. Retinoblastoma runs in families and a higher incidence was associated with older paternal age, which increased the frequency of the mutation [16]. Most of the studies from outside India showed a lower frequency of retinoblastoma. It was found to be more prevalent in India than in the western countries (Breslow et al.,) [7].

Malignant bone tumours constituted 10% of the cases in the present study and this finding was at par with *Jussawalla et al's* finding, whereas it was slightly higher than that in most of the other studies, where it was found to vary from 2.32%-5.8% [9].

Our study revealed a lone case of squamous cell carcinoma of the skin (0.9%), which was similar to that which was found by others [14,19,20,21]. Sharma et al., also had reported a case of squamous cell carcinoma of the skin [22].

CONCLUSION

To conclude, the frequency of different diseases which are detected at a particular centre is not an exact reflection of the disease spectrum of that population, but it can give a rough estimation of the trend. The incidence data are important in the planning and in the evaluation of health strategies. Population based statistical data on childhood cancer will help in assessing the magnitude of the cancer problem in our country. Hence, an early diagnosis which is made by applying advanced technologies and an improved treatment modality will increase the survival rate in these children. In general, it is important to remember that when a child is affected by cancer, it creates a deep emotional impact on the entire family and they need special care and education.

REFERENCES

[1] Park K. Test book of Preventive and Social Medicine, 19th ed. Banarsidas Bhanot, *Jabalpur*; 2007; 382.
[2] Maitra A, Kumar V. Diseases of infancy and childhood: Robbins and Cotran. Pathologic Basis of Disease, 7th ed., Elsevier, New Delhi; 2004; 469-510.
[3] Birch JM, Marsden HB . A classification scheme for childhood cancer. *International Journal of Cancer* 1987; 40 : 620-24.
[4] Kramarova E, Stiller CA . The International Classification of Childhood Cancer. *International Journal of Cancer* 1996; 68 : 759-65.
[5] Kusumakumary P, Jacob R, Jothirmayi R, Nair MK. Profile of paediatric malignancies: A ten year study. *Indian Pediatrics* 2000; 37: 1234-38.
[6] Singh HK, Silverman JF Paediatric tumours: Fine needle aspiration cytology by Orell et al., 4 th ed. *Churchill living stone*, New Delhi; 445-68, 20.
[7] Breslow NE, Langhalz B. Childhood cancer incidence: geographical and temporal variations: *International Journal of Cancer* 32; 703-16.
[8] Jussawalla DJ, Yeole BB. Childhood cancer in Greater Bombay. *Indian Journal of Cancer* 1988; 25: 197-206.
[9] Arora R.S., Eden TOB, Kapoor G. Epidemiology of childhood cancer in India. *Indian J. of Cancer* 2009; 46 (4): 264-73.
[10] Balhodia JN, Paterl MM. The profile of paediatric malignancy: A three year study. *National J. of Community Medicine* 2011; 2(1):24-27.
[11] Nandakumar A, Anantha N, Appaji L, Swamy K, et al. Descriptive epidemiology of childhood cancers in Bangalore, India. *Cancer Causes and Control* 1996;7: 405-10.
[12] Martin AA, Alert JA, Reno JS, Lonchong M, et al. Incidence of childhood cancer in Cuba (1986-1990). *International Journal Cancer* 1997;72: 551-55.
[13] Ries LAG, Smith MA, Gurney JG, Linct M, et al. 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. Bethesda, MD, 1999.
[14] Ocana SJ, Miranda GG, Arangure JMM, Madias MER, et al. The frequency of cancer in children who reside in Mexico City and who are treated in the hospitals of the Instituto Mexicano del Segurosocial (1996-2001). *BMC Cancer* 2004; 4: 50-58.
[15] Miller RW, Young JL, PH, Novakovic B. Childhood cancer. *Cancer* 1995; 75(1): 395-405.
[16] Das S, Chakraborty AK, Mukharjee K, Kundu BK, et al. The profile of malignant lesions amongst children in north Bengal. *Indian Paediatrics* 1994; 31: 1281-85.
[17] Chaudhuri K, Sinha A, Hati GC, Karmakar R, et al. Childhood malignancies at the BS Medical College: a ten year study: *Indian J. Pathol Microbiol* 2003; 46(2): 194-96.
[18] Mangal N, Miglani N. The pattern of paediatric malignancies is Rajasthan. *Indian Pediatrics* 1991; 28: 1517-18.
[19] Grovas A, Fremgen A, Rauck A, Ruymann FB, et al. The National Cancer Data Base Report on the patterns of childhood cancers in the United States. *Cancer* 1997; 80(12); 2321-32.
[20] Gutierrez AF, Martinez AN, Garcia MR, Morales MEZ, et al. Incidence of malignant neoplasms in children who attend social security hospitals in Mexico City. Med Paediar. *Oncology* 1997; 29: 208-12.
[21] Bryan EH, Kenneth F, Barbara N, Meenakshi S. Paediatric solid malignant neoplasms: A comparative analysis. *Indian Journal of Pathology and Microbiology* 2011; 54 (3): 514-19.
[22] Sharma S, Mishra K, Agarwal S, Khanna G. Solid tumours of childhood. *Indian J. Paediatric* 2004; 71: 501-04.

AUTHOR(S):

1. Dr. Niharika Pattnaik
2. Dr. Mobarak Ahemad Khan
3. Dr. Epari Sanjeeva Rao
4. Dr. B. Rama Mohan Rao

PARTICULARS OF CONTRIBUTORS:

1. Assistant Professor, Department of Pathology, KIMS, Amalapuram, A.P., India.
2. Professor, Department of Pathology, KIMS, KIIT University, Bhubaneswar, India.
3. Professor, Department of Pathology, KIMS, Amalapuram, A.P., India.
4. Professor & Head, Department of Pathology, KIMS, Amalapuram, A.P., India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:

Dr. Niharika Pattnaik
Assistant Professor of Pathology,
Konaseema Institute of Medical Sciences,
Amalapuram - 533201
East Godavari Dist, Andhra Pradesh, India.
Phone: 09000269074.
E-mail: debnit2005@yahoo.co.in

FINANCIAL OR OTHER COMPETING INTERESTS:

None.

Date of Submission: **Dec 23, 2011**
Date of Peer review: **Mar 08, 2012**
Date of Acceptance: **Mar 29, 2012**
Date of Publishing: **May 31, 2012**