

Clinical Profile of Pediatric Oncology Patients Treated by Radiotherapy: A Retrospective Audit from a Tertiary Cancer Care Center in South India

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Abstract



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Introduction With the increase in the number of pediatric cancers in India, there is a need for a multimodal approach involving various disciplines of therapy in which radiotherapy is one of the important areas of treatment. As there is a paucity of studies in South India about the profile of pediatric cancer patients who have undergone radiotherapy the present study was undertaken.

Methods A record-based retrospective study was conducted at the department of pediatric hematology-oncology and radiotherapy at a tertiary care hospital in South India using a data abstraction form which consisted of sociodemographic details of study participants, primary diagnosis, confirmed diagnosis, site of radiotherapy, current status of the patient, etc. Chi-square test or Fisher's exact test was used to find out significant association between current status of study participants and various determinants influencing it.

Results Highest proportion, $n = 35$ (30.4%), of cases were in the age group of 10 to 14 years. Among them, 48 children were primarily diagnosed to have hematolymphoid malignancy while 67(%) had solid tumor. Majority of the patients, $n = 110$ (95.6%), were treated on curative intent.

Conclusion Radiotherapy remains an important modality of cancer-directed therapy in children with cancer. Radiotherapy still forms an integral part of cancer-directed treatment in children with cancer as demonstrated in our population.

Keywords

- ▶ pediatric oncology
- ▶ children with cancer
- ▶ clinical profile
- ▶ radiotherapy
- ▶ tertiary cancer care center

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Introduction

It has been a matter of grave concern in India that around 78,000 patients aged 0 to 19 years are diagnosed with cancers every year.¹ But the cure rates remain dire, with only 10 to 30% of those children are projected to having been cured, in comparison to developed countries where the cure rates are up to 80%.¹ A multidisciplinary approach is required in the management of pediatric cancers involving various departments like paediatric surgery, radiation oncology, medical oncology, etc. The need for radiation therapy in 40 to 50% of children with cancer emphasizes the importance of this modality of treatment.² However, the percentage of pediatric cancer patients that require radiation therapy is not well documented to date, especially in low- and middle-income countries like ours.

Several studies have explored the clinical profile of pediatric oncology patients treated with radiotherapy. Central nervous system tumors followed by hematological and bone malignancies were the most common indications for radiotherapy which were cited in some of the studies.³

It has been observed that although evidence-based estimation of radiotherapy utilization rates has been well documented in many cases of adult cancers,⁴ it has been seldom reported in pediatric malignancies. There has been a gradual decline in the radiotherapy utilization rates in the United States due to radiation-related toxicities,⁵ but there is paucity of data of pediatric cancers requiring radiotherapy in low- and middle-income countries. As the data pertaining to profile of pediatric cancer patients who are on radiotherapy is scarce in South India, we carried out the present study among pediatric cancer patients who received radiotherapy alone or combined with chemotherapy and surgical management.

Materials and Methods

The present study was a record-based retrospective study conducted in the department of pediatric hemato-oncology and radiotherapy at a tertiary care hospital in South India. A complete enumeration of all pediatric oncology cases that have been treated with radiotherapy between 2016 and 2023 at the department of pediatric hemato-oncology and radiotherapy was done and these cases were included for the study. Records which were incomplete were excluded from the study. The data abstraction form consisted of the following details: sociodemographic details of study participants, primary diagnosis, confirmed diagnosis, the intent of therapy, the current status of the patient, etc. Primary diagnosis was made by the treating physician before laboratory confirmation whereas confirmed diagnosis was done after laboratory investigation. These details were accessed through the electronic medical records (EMRs) and radiotherapy planning console. Data was analyzed using Statistical Package for Social Sciences (SPSS) version 21. Continuous variables were summarized using mean and standard deviation and categorical variables as proportions and percentages. Chi-square test or Fisher's exact test was used to find out significant

association between current status of study participants and various determinants influencing it.

Results

A total of 129 cases were listed out from EMR out of which 14 cases were excluded because the data in the EMR was incomplete. Boys constituted majority (62%) of the study group. Highest proportion (30.4%) of cases was in the age group of 10 to 14 years while the age groups of 5 to 9 and 15 to 18 years formed about 25% each. More than half of the participants had their residence within 100 km from the cancer center.

Study results depicted that 48 (41.7%) cases were hematolymphoid malignancy and 67 (58.3%) were solid tumors. Of the confirmed diagnosis of cases acute lymphocytic leukemia (ALL) (30 [26.1%]) and brain tumor (32 [27.8%]) constituted the majority.

With respect to the outcomes of the study participants, 78 (67.8%) patients were alive under remission and 6 (5.2%) were alive with the disease. Regarding the intent of treatment, 95.7% were treated with curative intent while only 4.3% were treated with palliative intent.

There was no significant association between sociodemographic variables, namely, gender, age group, and the current status of cancer patients, distance of residence from the cancer center, and the current status of cancer patients. However, it was observed that among the people who were alive with remission, the numbers decreased with increasing distance of residence from the cancer center and this trend was statistically significant ($p = 0.005$) (**→Table 1**).

Among the 48 cases who were primarily diagnosed to have hematolymphoid malignancy, 35 (72.9%) were alive under remission, whereas out of the 67 cases who had solid tumor 43 (64.1%) were alive under remission but the association was not statistically significant. Even when we categorized the cases under confirmed diagnosis into various categories like ALL, neuroblastoma, lymphoma, etc., we did not find any significant association with the current status of patients with pediatric cancer. However, regarding the intent of treatment, it was observed that among the 110 patients who were treated with curative intent 78 (70.0%) patients were alive in remission, whereas among the 5 patients who were treated with palliative intent only 1 (20.0%) was alive in remission and this association was statistically significant ($p = 0.003$) (**→Table 2**).

Discussion

There has been a significant increase in the incidence of pediatric cancers in India with leukemia being the most common type in both boys and girls. Also, it has been observed that there is a regional difference with southern region having higher age-adjusted incidence per million (boys: 91.6–159.6 [1.7–3.1]; girls: 69.9–112.4 [1.4–2.0]), whereas the northeast region has the lowest incidence (boys: 18.6–111.1 [0.8–2.9]; girls: 11.3–69.3 [0.5–2.5]).⁶

Table 1 Association of sociodemographic variables with current status ($N = 115$)

	Current status				p-Value
	Alive in remission	Alive with disease	Died due to disease	Lost to follow-up	
Gender					
Male	47	3	16	5	0.646
Female	31	3	9	1	
Age group (y)					
0–4	14	0	5	1	0.382
5–9	25	0	5	0	
10–14	20	3	9	3	
15–18	19	3	6	2	
Distance of residence from cancer center (km)					
< 99	41	2	18	2	0.005
100–199	19	2	6	0	
200–299	15	2	0	2	
300–399	2	0	0	2	
> 400	1	0	1	0	

However, the overall incidence is lesser when compared to that of developed countries, but the increasing trend which is seen in India is definitely a cause of concern. In the present study, 62% of the study participants were males and the rest were females. Various studies in India have consistently shown a higher incidence of pediatric cancers among males.⁷ Although the reason for this difference is not fully understood, it is thought that potential genetic and hormonal

factors may be implicated in causing higher incidence among males.⁷

Results of the present study depicted that 41.7% of the cases had hematolymphoid malignancy and 58.3% had solid tumors. In a similar study conducted by Dasgupta et al⁸ at a referral hospital in Kolkata, West Bengal, India, it was found that 49.39% were cases of hematological malignancies and the rest were nonhematological malignancies. ALL was the

Table 2 Association of determinants of disease treatment with current status ($N = 115$)

	Current status				p-Value
	Alive in remission	Alive with disease	Died due to disease	Lost to follow-up	
Primary diagnosis					
Hematolymphoid malignancy	35	1	9	3	0.499
Solid tumor	43	5	16	3	
Confirmed diagnosis					
ALL	18	1	8	3	0.539
Neuroblastoma	3	0	1	0	
Lymphoma	14	1	1	0	
Wilms tumor	3	0	1	0	
Brain tumor	22	0	9	1	
Bone tumor	4	2	2	1	
Other	14	2	3	1	
Intent of treatment					
Curative	78	5	21	6	0.003
Palliative	1	0	4	0	

Abbreviation: ALL, acute lymphocytic leukemia.

most common hematolymphoid malignancy (26.1%) and brain tumor (27.8%) was the most common solid tumor in our study population, which is also consistent with the study results reported by Gupta et al⁷ wherein ALL constituted 44.3% of cases and brain tumor constituted 7.27% of cases. Dasgupta et al⁸ in their study found that 25.08% of cases had ALL and among nonhematologic malignancies retinoblastoma was the most common tumor (10.62%).

In the present study, we did not find any association between gender and the current status of patients with pediatric cancers. Williams et al⁹ found that males have worse survival rates for certain childhood cancers like ALL, ependymoma, neuroblastoma, osteosarcoma, thyroid carcinoma, and malignant melanoma, with the association between gender and death being mediated by disease stage for some cancers, namely, neuroblastoma, thyroid carcinoma, and malignant melanoma. Although studies have established the fact that male gender has been associated with worse survival rates for pediatric cancers, few studies have shown associations between female sex and cognitive dysfunction after cranial irradiation, cardiovascular outcomes, obesity, radiation-associated differences in pubertal timing, development of primary hypothyroidism, breast cancer as a second malignant neoplasm, and suggests an increased prevalence for the development of osteonecrosis among females.¹⁰

We could not find any significant association between various age groups and current status of pediatric cancers in our study. Regarding distance from the cancer center, it was observed that among the people who were alive with remission, the numbers decreased with increasing distance of residence from the cancer center and this trend was statistically significant ($p = 0.005$). We did not find any statistically significant difference between the current status of patients diagnosed to have hematolymphoid malignancy and solid tumors. Even when the cases were categorized under confirmed diagnosis into ALL, neuroblastoma, lymphoma, etc., there was no significant association with the current status. Long-term systematic follow-up of cured patients or patients in remission may reveal previously unknown side effects by comparison of groups of children who are treated with different regimen over different periods of time.

Conclusion

Radiotherapy remains an important modality of cancer-directed therapy in children with cancer. A multidisciplinary approach is required with an organized, dedicated team of health care professionals for better outcomes in pediatric cancers and also calls for further research in areas of quality of life of long-term survivors of pediatric cancers.

Ethical Clearance

Ethical clearance for the study was obtained from the Institutional Ethics Committee of Kasturba Medical College Manipal and Kasturba Hospital Manipal vide letter

no: IEC2: 35/2023 dated January 13, 2023. All the tenets pertaining to the Declaration of Helsinki were followed.

Data Availability

Data regarding this study can be obtained from the link: 10.6084/m9.figshare.25251583.

Authors' Contributions

The conceptualization and data curation was done by S.K.B., V.B., D.A.P., A.K. while formal analysis was done by S.K.B., V.B., M.A., A.P. Investigation, methodology, project administration was completed by S.K.B., V.B., A.P., K.G., U.V. and resources, software, supervision, validation, visualization: S.K.B., V.B., A.P., K.G., U.V. The original draft was written by S.K.B., V.B., A.P.

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Conflict of Interest

None declared.

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References

- Arora RS, Bagai P, Bhakta N. Estimated national and state level incidence of childhood and adolescent cancer in India. *Indian Pediatr* 2021;58(05):417–423
- Suhag V, Sunita BS, Vats P, Sarin A, Singh AK, Jain M. Clinical profile of paediatric oncology patients treated by external beam radiotherapy: an institutional experience. *Indian J Med Paediatr Oncol* 2017;38(01):28–32
- Bokun J, Popović-Vuković M, Stanić D, et al. Clinical profile and outcome of 806 pediatric oncology patients treated with radiotherapy at the Serbian National Cancer Center. *J Pediatr Hematol Oncol* 2023;45(03):116–122
- Tyldesley S, Boyd C, Schulze K, Walker H, Mackillop WJ. Estimating the need for radiotherapy for lung cancer: an evidence-based, epidemiologic approach. *Int J Radiat Oncol Biol Phys* 2001;49(04):973–985
- Jairam V, Roberts KB, Yu JB. Historical trends in the use of radiation therapy for pediatric cancers: 1973–2008. *Int J Radiat Oncol Biol Phys* 2013;85(03):e151–e155
- Satyanarayana L, Asthana S, Labani S P. Childhood cancer incidence in India: a review of population-based cancer registries. *Indian Pediatr* 2014;51(03):218–220
- Gupta V, Kalraiya A, Mekle D. Spectrum of pediatric malignancy- a cancer hospital-based study. *Int J Pediatr Res* 2020;7(01):27–31
- Dasgupta S, Chakrabarti S, Deb AR. Spectrum of pediatric malignancies in a referral hospital of the eastern region of India. *Biomed Biotechnol Res J* 2020;4:246–250
- Williams LA, Richardson M, Marcotte EL, Poynter JN, Spector LG. Sex ratio among childhood cancers by single year of age. *Pediatr Blood Cancer* 2019;66(06):e27620
- Armstrong GT, Sklar CA, Hudson MM, Robison LL. Long-term health status among survivors of childhood cancer: does sex matter? *J Clin Oncol* 2007;25(28):4477–4489