Original Article

Radiotherapy in pediatric patients without anesthesia or sedation: Feasibility and challenges

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ABSTRACT

Conventionally fractionated radiotherapy treatment involves strict immobilization for accurate delivery and typically is delivered in five daily fractions every week for several weeks. To ensure rigid immobility during treatment planning and delivery in children, anesthesia or sedation has been used but valid concerns have been raised about the safety and long-term consequences of such practice on daily basis for prolonged periods. We tested the feasibility of avoiding daily anesthesia or sedation in our pediatric radiotherapy patients by extensive pretreatment counseling and demonstration of the treatment procedure ensuring their comfort and compliance.

Key words: Anesthesia, cancer, children, radiotherapy, sedation

INTRODUCTION

Eleven patients in the age range of 2-13 years were treated at HCG Chennai in the last 6 months with radiotherapy for different indications employing a variety of immobilization devices and using different techniques. We consciously tried to avoid anesthetizing or sedating these patients during the entire process of radiotherapy planning and delivery due to our shared concerns regarding the implications and long-term consequences of repeated exposure to short-term anesthesia or sedation over a prolonged period of time in small children.[1,2] Especially since the course of radiotherapy typically involves treating these children 5 days a week over multiple weeks and involves anesthetizing or sedating them repeatedly for every treatment.[3,4] We took upon ourselves the onus of trying to achieve cooperation from these small children by explaining to them the entire treatment process and showing each child treatment delivery on other children to gain their confidence.

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PATIENTS AND METHODS

Eleven children were treated in the Department of Radiation Oncology at HCG Chennai between January and June 2013 [Table 1]. The age range was between 2 and 13 years. Anesthesia or sedation was not used in any of these children during the immobilization/planning computed tomography (CT) scan or treatment delivery at any stage.

Table 1: Patient and treatment characteristics

Age	Youngest 2 years
	Oldest 13 years
	Mean 6.27 years
Diagnoses	Retinoblastoma 5
	Acute Lymphoblastic Leukaemia 3
	Low grade astrocytoma 1
	Recurrent medulloblastoma 1
	Recurrent sacro-coccygeal PNET 1
Treatment technique	3D conformal 6 patients
	IMRT 3 patients
	RapidArc 2 patients
Monitor units per treatment	Lowest 191
	Highest 1145
	Mean 421.45
Number of fractions	Lowest 7
	Highest 31
	Mean 20.82
Immobilisation device employed	Head and neck thermoplastic mould 9
	Pelvic thermoplastic mould 1
	VacLoc 1

IMRT: Intensity modulated radiotherapy, PNET: Primitive Neuro Ectodermal Tumor

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All children went through a process of counseling where the entire treatment process was explained to them and also demonstrated during treatment of other pediatric patients by radiation oncologist/radiotherapy technologist/staff nurse over single or multiple sessions as required to ensure cooperation from the child. On two occasions immobilization had to be refashioned after an initial unsuccessful attempt post counseling as the child was noncooperative on the first occasion, but complied on subsequent attempt.

RESULTS

Mean age of the treated children was 6.27 years with a range of 2-13 years. Five children were treated for retinoblastoma, three received prophylactic cranial irradiation for acute lymphoblastic leukemia (ALL), and one child each was treated for low grade astrocytoma, recurrent medulloblastma, and recurrent primitive neuroectodermal tumor (PNET) of the sacrococcygeal region. Six patients were treated with three-dimensional conformal radiotherapy (3DCRT), three with intensity modulated radiotherapy (IMRT), and two with RapidArc techniques. Number of gantry positions used in the 3DCRT patients ranged from 2 to 4 and for IMRT patients ranged from 5 to 8. Both RapidArc patients were treated with two arcs to achieve the optimal dose distributions. All patients were treated with conventional fractionation with daily dose range from 180 to 200 cGy. The number of monitor units (MU) required for treatment delivery in each daily fraction ranged from 191 to 1145 with a mean MU of 421.45. We observed lowest MU were necessary for 3D conformal plans for prophylactic cranial irradiation in the ALL patients (191-197), and highest MU was required for 6 and 8 field IMRT plans for our retinoblastoma patients using 982 and 1145 MU, respectively. RapidArc plan MU ranged from 350 to 361 in total for dual arcs. Number of fractions of radiotherapy treatment ranged from 7 to 31 with a mean of 20.82. Immobilization devices were used in all patients to ensure accuracy and reproducibility of treatment delivery, and most patients were immobilized using head and neck thermoplastic molds, while two patients receiving pelvic radiotherapy were immobilized using VacLoc and pelvic thermoplastic mold, respectively. Treatment delivery was uneventful and patients were cooperative and comfortable during the entire schedule.

DISCUSSION

Radiotherapy treatment of young children is fraught with challenges since it is imperative to ensure absolute immobility of the child in the position every day during treatment delivery. A variety of immobilization devices like thermoplastic molds and VacLocs are used to achieve reproducibility of the same position daily, however it is a greater challenge to ensure that the child remains immobile in these apparatus during the entire treatment. Many centers anesthetize or sedate children during the treatment process everyday[1] to address this issue. In a retrospective analysis published earlier, Scott *et al*., had to use sedation in 9.5% patients,[1] while we avoided using sedation or anesthesia in all our patients as part of our standard institutional protocol for pediatric radiotherapy. Scott *et al*.,[1] and Wojcieszek *et al*.,[4] have documented their experience of delivering radiotherapy under anesthesia for children between 2-5 and 2-8 years, respectively while we included children between 2 and 13 years in our cohort. Buchsbaum *et al*.,[2] documented a treatment duration ranging from 1 to 49 fractions in their cohort compared to 7-31 fractions in our series. Concerns have been voiced regarding risks and complications like altered sleep patterns and nutritional deficiencies in these children as a result of this daily sedation or anesthesia.[1] There are also reported instances of children falling from Gurney during recovery from anesthesia[2] and aspiration resulting in hospital admission and mechanical ventilation support.[2] This has also reported to significantly increase the treatment time and decrease the throughput of patients in a busy radiation oncology department and necessitates the services of a mobile anesthesia unit and anesthesiologist every day during treatment and is not cost-effective.[2-4] While in our patients, significantly higher patient throughput was possible as time spent in delivering anesthesia every day for each patient was not necessary. Other recent studies have elucidated the cardiorespiratory safety of daily anesthesia[3] for pediatric radiation therapy, while others have dwelt on the currently accepted anesthesia techniques,[4] while these concerns did not arise in our cohort of patients as no anesthesia was used during the entire process of radiotherapy. In our small cohort of patients, we have found the children to be intelligent and cooperative, if some time is spent in counseling them and demonstrating the entire process of immobilization, treatment planning and treatment delivery prior to embarking on their own treatment. A dedicated oncology team comprising radiation oncologist, radiotherapy technologist, and oncology nurse experienced in handling pediatric cancer patients can certainly achieve the goal of safe and accurate administration of radiotherapy treatment every day without subjecting these children to anesthesia or sedation.

CONCLUSION

It is our observation in this small cohort of children that it is feasible to achieve good immobilization and safe delivery of radiotherapy to pediatric patients without subjecting them to anesthesia or sedation on a daily basis if due care is taken to take them into confidence regarding the treatment process.

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