# Radiation oncology: Colors and hues

Treating cancer involves a multidisciplinary approach. Nearly 60-65% of all cancer patients will require radiotherapy during the course of their disease. This issue of the journal presents three articles on diverse aspects of radiation oncology. Over the past few decades, radiation oncology has taken huge leaps in technology.[1] The traditional low-energy orthovoltage machines have become a curiosity. Orthovoltage machines were replaced by Cobalt machines, the latter in turn being replaced by elegant and sophisticated linear accelerators (LAs). LAs themselves have undergone serial metamorphoses. As a result, the initial machines capable of delivering simple square or rectangular 4 MV/6 MV beams have given way to the present C-arm LA, which boasts of multileaf collimators, arc treatment, asymmetric jaws and dynamic motion capabilities. Taking inspiration from computerized tomography (CT) scanners, helical rotational machines have been developed. Intensity-modulated radiotherapy and image-guided radiotherapy are considered modern radiotherapy approaches in treatment.[2,3]

These technologies allow us to create otherwise challenging patterns of dose fluence across the target area. This allows the radiation oncologist to deliberately inhomogenize the dose intensity depending on the extent of gross or microscopic disease burden in a particular area.[4] Treatment planning for patients with metallic hip prostheses composed of high-Z materials, however, can still be challenging due to the presence of streak artifacts from prosthetic hips in the CT dataset and inhomogeneous dose distribution within the target volume. Rana *et al.* present a dosimetric study of volumetric modulated arc therapy planning techniques for treatment of low-risk prostate cancer in patients with bilateral hip prostheses.[5] The authors have compared three treatment plans created using rapid arc (RA) techniques. They utilized 2 arcs (2-RA), 3 arcs (3-RA) and 4 arcs (4-RA) for the 6 MV photon beam in an Eclipse treatment planning system. All three RA plans were calculated with the anisotropic analytical algorithm. They found that the plan conformity index was highest in the 2-RA plan, but the 4-RA technique reduced the doses to rectum by up to 18.8% and to bladder by up to 7.8% as compared with the 2-RA technique. This study demonstrates the intricacies of modern day radiation planning and the need to be cognizant of its nuances.


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A major stride in radiation oncology has been the transition from two-dimensional to three-dimensional radiotherapy. The second article in this issue of the journal reveals the dosimetric variations one encounters while traversing from X-ray based (2 D) to CT-based (3 D) radiotherapy.[6] The authors of this study compared the prescribed dose versus the calculated dose of spinal cord in standard head and neck irradiation assessed by the 3 D plan. They selected 42 patients with histologically proven squamous cell carcinoma at the head neck region and distributed them in two treatment protocols. In group A, 46 Gy was given in 23 fractions, followed by a tumor boost with off-cord field received 24 Gy in 12 fractions. In group B, 50 Gy was prescribed in 25 fractions initially, then off-cord field given 20 Gy in 10 fractions to analyzes the outcome. The maximum dose to cord was 52.6 Gy (range 48.1-49.7 Gy) in group A and 54.3 Gy (range 51.48-52.33 Gy) in group B initially. Off-cord fields received a mean dose of 8.07 Gy (85.85% of maximum) in group A and 5.47 Gy (86.84% of maximum) in group B. At the end of 6 months from the last date of radiotherapy, grade 1 spinal cord toxicity was noted in two patients in group A and one patient in group B ($P$ = 0.55). Both the groups received an additional dose that was higher than the prescribed dose, but no patient showed significant spinal cord toxicity after 6 months of follow-up. This study sends out the message of being aware of the possible pitfalls in 2 D planning.

Radiotherapy has been used in cancer patients both for radical treatments as well as for achieving palliation. The third study in the journal dwells on an important aspect of treatment in cancer care, which relates to palliation of their symptoms.[7] Hemibody irradiation is an economical way of palliation of pain in bone metastasis in advanced cancer.[8] The authors have reported the outcome of their patients of Hemibody irradiation with respect to pain and quality of life in cancer patients with extensive bone metastases. A total of 21 patients received lower or upper Hemibody irradiation at their center. Evaluations were performed before and 2, 4, 8, 16 and 24 weeks after treatment. Pain evaluation was performed using the Visual Analogue Scale (VAS) (10 points VAS), Verbal Rating Scale of patients at 4 points scale, Percentage of Pain Relief and Global Pain Score. Response (control of pain) was partial in 67% and complete in 22% of the patients. As such, the quality of life was better due to decreased pain and also due to lowering of the dose of analgesics. The toxicity was within acceptable limits. The average total cost of treatment, including hospital stay, medicines and radiation charges, was around INR 400.00. Such cost-effective treatments of cancer care need to be recognized and more commonly used in a resource-constrained country such as ours.

To summarize, modern day radiotherapy can be used in cancer patients for a wide variety of indications ranging

from fully curative aims to palliative treatments. What is needed is judicious use of this very powerful anticancer modality in the most cost-effective manner.[9]

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