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Clinical Radiation Oncology Contribution:

Definitive radiotherapy for a head and neck Merkel cell carcinoma and comprehensive nodal volumes: a case for using a computer-designed variable-thickness compensator to reduce risk and severity of mucositis

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ABSTRACT

When contemplating how to treat head and neck primary cancers and regional lymph nodes with radiotherapy, we often select the contemporary intensity-modulated radiotherapy (IMRT) without much consideration of older methods that may give fewer side effects and be more cost-effective. For an 87-year-old female with a 1.5-cm Merkel cell carcinoma (MCC) located 1.5 cm lateral to the orbital rim, we were challenged to deliver 50 Gy to comprehensive elective nodal regions and 70 Gy to the primary. We were particularly concerned about the potential adverse acute effects of radiotherapy to mucosal structures in this elderly female. Acute mucositis could impair nutrition, quality of life, and treatment intensity especially given her age. We compared 3 techniques that are appropriate for this target: step-and-shoot IMRT, matched electron fields (MEF), and electron conformal therapy (BolusECT™). We selected and treated her with BolusECT™ because of better sparing of larynx, pharynx, oral cavity and lips, and shortest treatment time. This is a reasonable option for treating ipsilateral head and neck target volumes at centers where only these 3 techniques are available.

Introduction

We present this case to illustrate the value of a more classical technique than intensity-modulated radiotherapy (IMRT) that we employed to treat a patient with a head and neck Merkel cell carcinoma who was treated with radiotherapy only.[1] Over the past decade, IMRT stood out as an elegant technique to create and deliver radiotherapy to targets adjacent to critical organs at risk (OARs). Where it is available,

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we commonly select it for head and neck cancers,[2,3] especially when the regional lymph nodes are part of the clinical target volume (CTV). New methods to deliver radiotherapy for better cure rates and less toxicity are increasing the options for treating anatomic sites that are challenging for delivery of high doses of radiotherapy. However, we should individualize technique to specific patients' characteristics. Unilateral head and neck superficial primary tumors and nodal volumes were often treated using matched electron fields (MEF) of varying energy up to the last decade.[4] A third option is electron conformal therapy (BolusECT™) that employs an electron beam with a computer-designed variable-thickness compensator (.decimal LLC, Sanford, FL).[5] To select the optimal treatment for this patient, we compared IMRT, MEF, and BolusECT™.

Case description

An 87-year-old woman with minimum background comorbidity who lived independently, presented with a Merkel cell carcinoma measuring 1.5 cm that was located 1.5 cm lateral to the right orbital rim as shown in Fig. 1A. The pretreatment workup included positron emission tomography, which showed no metastases. The patient was therefore clinically staged as stage IA. She was evaluated by a multidisciplinary team and offered surgical resection and comprehensive neck nodal dissection. She declined surgery and we offered definitive radiotherapy with curative aim.

The initial target volume spanned from the scalp to below the clavicle. We aimed to spare the adjacent tissues. We exercised care to obtain adequate dose to skin margin in the region of the outer canthus but minimize dose to the eye. At the level of the neck nodes, we were worried about dose to pharyngeal mucosa. Pharyngeal mucositis causes pain and difficulty chewing and swallowing, and disturbed taste and texture that may incur dehydration and malnutrition. This can lead to noncompliance, gaps in treatment, and increased risk and severity of permanent late effects. Acute effects may also lead to inpatient care, which is costly, inconvenient, and poses additional risks. Mucositis is poorly tolerated by the elderly because aging is associated with a progressive decline in the functional reserve of multiple organ systems.[6,7] Therefore, we used extra caution to select the most appropriate technique.

Target delineation

We aimed to deliver 50 Gy to an initial target volume of the lesion with 5 cm circumferential margin (CTV50skin), the peri-parotid nodes, and ipsilateral neck nodes (CTV50nodes), and boost the tumor with a 2 cm circumferential margin to 70 Gy (CTV70bst).

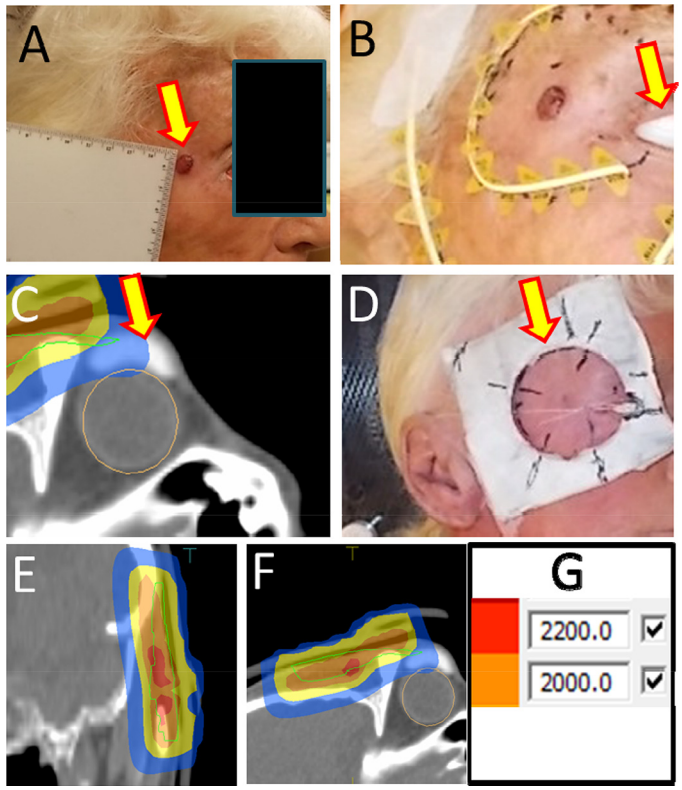

Fig. 1. (A) Photograph of the 1.5 cm Merkel cell carcinoma (arrow) located lateral to the right orbital rim. (B) Photograph of dummy internal eye shield (arrow) that mimics an eye shield. The outer and inner wires that are stuck on the skin demarcate the skin extent of the initial and boost target volumes, respectively. (C) Planning CT image through the dummy eye shield (arrow). (D) Setup for the 20-Gy boost electron field to encompass the CTV70bst volume shown with skin collimation (arrow) *in situ*. (E and F) The dose distribution of the 20 Gy boost plan in coronal and transverse planes, respectively, with the doses represented in colorwash. (G) The dose key (cGy). This boost volume is that which is demarcated on the skin with wires in photograph B and shaped by skin collimation in photograph D. A composite plan of the full 70 Gy was not calculated because the boost plan was calculated on a subsequent CT simulation scan that was performed during week 4 of therapy after the lesion has shrunken. (Color version of figure is available online.)

We immobilized the patient in the open neck position with her head rotated to the left and supported by a head holder. We performed 2 computerized tomography (CT) simulation scans (scans A and B, respectively). For scan A, radiopaque wires were used to mark the gross tumor volume and CTV50skin, and reference BBs were placed. We inserted a dummy internal eye shield over the outer cornea of the right eye to mimic an eye shield and eliminate tungsten metal artifact on CT. This contained no metal that would perturb the electron beam calculations and is shown in Fig. 1B and 1C. We placed a dummy intraoral shield to mimic a wax coated lead shield between the right buccal mucosa and the gingival mucosa to protect the gingival mucosa, and bolus material in the external ear canal. For scan B, we kept the patient in the same position as scan A, but the wires