Correspondence

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Extensive basal cell carcinoma of the forehead and anterior scalp: use of helical tomotherapy as a radiotherapy treatment modality

Editor — Sir,

We present the first case in the literature of an extensive basal cell carcinoma of the forehead that has been managed with helical tomotherapy (HT). A 95-year-old lady had first presented in 2004 but had refused surgery. She re-presented with extensive local disease in 2009, at which time the tumour in the forehead was extending to the scalp in close proximity to the optic apparatus.

Surgery was thought to be too extensive and quite challenging, given the site of disease. Photodynamic therapy (PDT) was considered, but owing to the thickness of the tumour, extensive nature of disease and proximity to critical organs was considered inappropriate [1]. Radiotherapy was therefore the treatment of choice.

Despite the very challenging geometry, HT was able to create and deliver a plan, giving high dose to a complex target with excellent sparing of adjacent critical organs, including the optic apparatus. The patient was examined by the treating physician in the presence of mould room staff, treatment planning dosimetrists and a physicist in order to determine the best way to set up and scan the patient for treatment with HT.

The head and neck were immobilised using a customised beam directional shell (BDS) made of polyethylene terephthalate glycol (PTEG). The shell consisted of a custom-made back and front half, attached using the Posifix 5-point fixation system. Wire marks were placed on the BDS to ascertain the extent of the disease on the CT scan and facilitate outlining of the main planning target volume (PTV1) (Fig 1).

The disease extending down between the patient's eyes was outlined as a separate target volume (PTV2) to allow more control over the trade-off between target coverage and lens dose in this region. Organs at risk outlined included the brain, brain stem, bilateral optic nerves, lens, orbits and optic chiasm.

The main aim of treatment was to achieve adequate palliation of the lesion, with acceptable toxicities to the adjacent critical structures in this elderly patient. Although BCC is considered to be radiosensitive, given the extent of the disease a dose of 63 Gy in 30 fractions was prescribed to the PTV.

There has been some discussion in the literature with regards to the necessity of bolus (Fig 1) when treating with HT [2, 3]. As the PTV for this patient extended to the skin surface we chose to add bolus over the target area in order to avoid driving the optimisation in the low dose build-up region.

Additional thicknesses of PTEG were vacuum-formed over the original shell to give a total of 5 mm PTEG over

the area of the PTV, plus a 5 mm circumferential margin. This approach was found to facilitate adequate coverage of the surface tumour with the prescription dose. Figures 2 and 3 show the isodoses and give the dose volume histogram (DVH) data for the target and critical organs. Despite the difficult geometry of the target volume, 97.5% of the combined PTVs received at least 95% of the prescribed dose (63 Gy).

The chiasm was limited to a maximum dose of 25.9 Gy. Although the PTVs were drawn within 7 mm and 10 mm of the right and left orbits, doses to the right and left lenses of 11.0 Gy and 8.0 Gy, the orbits of 33.8 Gy and 30.5 Gy and the optic nerves of 36.5 Gy and 37.6 Gy were achieved.

The choice of appropriate modality (electrons or photons) for treating locally advanced BCC in the forehead necessitates consideration of the proximity of the lesion to nearby eyes, depth of invasion, invasion of underlying bone or cartilage and the convex contour of the forehead and anterior scalp. When treating superficial non-melanoma skin cancers with photons it is common to use lower energies (100–250 Kv) to avoid skin sparing and minimise side-effects resulting from the significant dose to deeper tissues, which is seen with megavoltage energy photons [4].

An alternative is to use low energy electrons (6–9 MeV), perhaps with tissue equivalent bolus to increase the surface dose. The treatment of whole scalp lesions with low dose to the brain has been reported using matched electron fields [5]. However, such plans may have significant dose inhomogeneity and require complex planning and verification processes [5].

Figure 1. A surface-rendered image of the patient's CT scan showing wire markers placed to facilitate outlining of PTVs. The red wire frame structure indicates the area covered by bolus.

Figure 2. DVH coverage of the PTVs and OARs.

The use of intensity-modulated radiotherapy (IMRT), delivered by static segmented linear accelerator-based techniques [4], serial tomotherapy [10] although feasible, the dose to the brain was reported to be higher than the matched electron technique. More recently, helical tomotherapy [7] has also been explored for extensive scalp lesions.

Despite not completing the full course of treatment, the palliative requirements of this elderly patient were met. Given the excellent treatment plan achieved in this case, more hypofractionated regimes could be explored in future as palliative treatment in elderly patients with extensive lesions using fewer fractions. Similarly, with potential for an improved therapeutic

Figure 3. Axial (a), sagittal (b) and coronal (c) views of the dose distribution. (d), Isodose wash. Isodoses are in absolute dose (Gy) and show 30, 50, 70, 80, 90, 95, 100 AND 107% of the prescribed dose (63 Gy). Note the homogenous dose distribution in the scalp and sparing of critical organs.

index, superficial more radio-resistant scalp tumours could also be targeted with a higher radiation dose, to achieve adequate tumour control in the scalp and forehead.

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