

## Angiosarcoma of the Scalp : A Case Report and the Radiotherapy Technique

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Cutaneous angiosarcomas are uncommon malignancies which account about 1% of sarcomas. They are found most commonly in the head and neck regions, frequently on the scalp. Although preferred treatment has been combined surgery and postoperative radiation therapy, the extensiveness and multiplicity of the lesions set limits to such an approach and the patient is often referred for radiotherapy without surgery. As the entire scalp usually needs to be treated, radiation therapy is a challenging problem to radiation oncology staffs. We report a case of angiosarcoma of the scalp, which was treated successfully by radiation therapy with a simple and repeatable method using mixed photon and electron beam technique. Using a bolus to increase the surface dose of the scalp and to minimize dose to the normal tissues of the brain desirable but difficult technically to be well conformed to the three dimensional curved surface such as vertex of the head. A helmet made of thermoplastics filled with paraffin was elaborated and used for the treatment, resulting of the relatively uniform surface doses along the several points measured on the scalp, the difference among the points not exceeding 7% of the prescribed dose by TLD readings.

**Key Words** : Angiosarcoma, Scalp, Radiation Therapy, Treatment Technique

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### INTRODUCTION

The treatment methods of an angiosarcoma, an extremely rare tumor of vascular origin which can be seen often in the scalp, includes simple excision, sometimes with postoperative radiotherapy or radiotherapy only. When radiotherapy is used as a single modality of treatment for the scalp lesions which tend to be multiple and extensive, the radiotherapy technique needs to be sophisticated as it is hard to include the whole scalp in the treatment fields with even dose distribution in the

repeatable way. We report a case of an angiosarcoma which had been treated successfully by using a mixed photon and electron beam technique and a custom-made helmet.

### CASE REPORT

A 76-year-old man presented with multiple bruise-like colored indurations on the scalp which has been aggravated for a few months. Tightness and pain of the scalp accompanied the skin lesions. On clinical examination, he was generally healthy without specific medical history. Inspection of the scalp revealed a large area of dark-colored indurations on the right side of the forehead and the left parieto-occipital regions of the scalp. There were several scalp nodules around the lesions with scattered reddish patches.

Several biopsies obtained from different areas of

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the scalp showed angiosarcoma which is characterized by anastomosing vascular channels with a typical endothelial cells ramifying through the dermis. Mitotic figures were occasionally observed. Chest X-ray and a full blood count including ESR were within normal ranges. There was no evidence of local extension into the skull bone and the underlying brain parenchyma on the brain MRI.

The patient was referred for radiotherapy. As the lesions were extensive and scattered over the scalp, the entire scalp had to be irradiated. Radiation therapy was done through combined photon and electron beam technique to save normal tissues of the brain, up to 50 Gy/25F/5weeks with a boost to the residual lesion up to 60 Gy by tangential 6 MV X-ray beam. The mixed electron and photon beam technique consisted of both lateral 6 MeV electron fields to the central part of the scalp and parallel-opposing 6 MV photon fields to the rest of the scalp was used.<sup>1, 2)</sup> Blocks were built for both photon and electron fields which use the same field center to ensure the reproducibility of set-up (Fig 1, 2).

A bolus can be used to increase the surface dose and to limit the range of electrons. However, it is difficult to immobilize a bolus to the three dimensional curved surface such as vertex of the head. Furthermore, it can not be completely conformed to the patient's contour, leaving an air gap between the bolus and the skin surface. Surface doses can have the variances of 20-40% for extreme cases (low electron energies, small field

sizes, thick bolus, and large gaps).<sup>3)</sup> Hence, We have made a helmet with approximately 5 mm thickness which is made of three sheets of commercially available thermoplastic, U-Frame<sup>TM</sup>. The spaces of the meshes of thermoplastics were filled with paraffin. This helmet was useful to increase the surface dose from 6 MeV electron beam and to compensate for the build-up region of 6 MV photon for the treatment of the scalp. Also, Mevgreen<sup>TM</sup> was attached to the back of the helmet for better neck support and immobilization (Fig. 3).

Solid TLD chips were used to verify the dose on the several selected points around the scalp. The relative surface doses from the TLD readings were well agreed with the prescription dose within 7% variation. The result of increasing surface dose for each field was calculated from TLD readings both inside and outside of the helmet. With the helmet, surface doses measured at the c

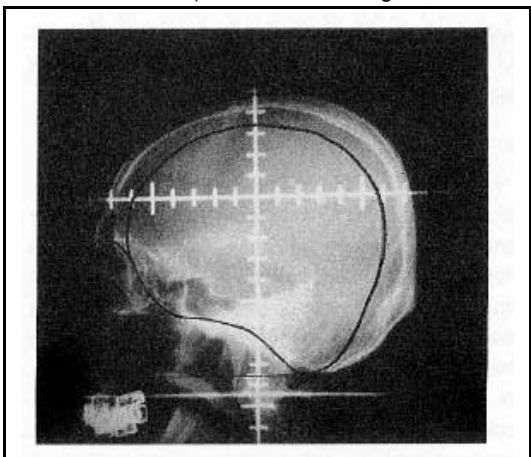


Fig. 1. A simulation film for the composite photon and electron beam technique.



Fig. 2. A linacgram of the photon field, which irradiated a median sagittal strip, to verify the set-up of the patient.

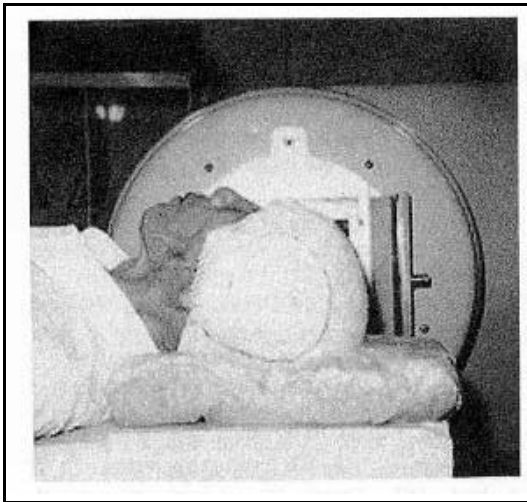


Fig. 3. Patient with a custom-made helmet for treatment.



Fig. 4. The skin lesion of the patient before treatment.

enter of the electron field and at the forehead for the photon field were increased 16% and 20% respectively. Treatment was interrupted at 30 Gy for 2 weeks for moist reaction of the scalp. Multiple scalp lesions resolved completely at 50 Gy except for an area of residual induration at the left posterior parietal area of the scalp. The lesion was treated with additional 10 Gy by reduced tangential photon fields. One month follow up examination after completion of treatment revealed complete clearance of all scalp lesions. (Fig. 4, 5)

#### DISCUSSION

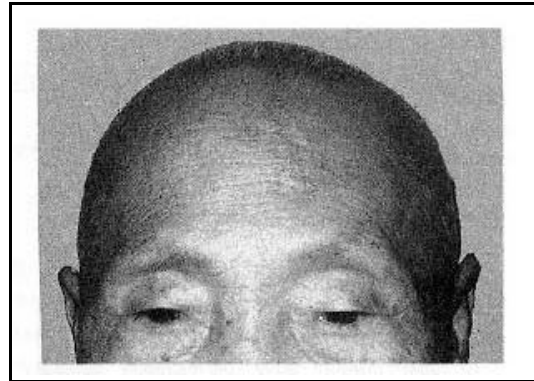


Fig. 5. The clearance of scalp lesions of the patient after treatment.

Angiosarcomas are extremely rare tumors of vascular origin, comprising less than one percent of all sarcomas. It usually affects men in their sixties or seventies. About 50 percent of cutaneous angiosarcomas are found in the head and neck regions and most commonly on the scalp.<sup>4)</sup> Because of its extensive nature, especially in the case of scalp lesions, the treatment has been radiation therapy alone or in combination with surgery. Attempts to reduce the extent of disease by systemic chemotherapy was disappointing.<sup>5)</sup> The best treatment results from the point of local control are seen with the combined treatment by surgical excision and postoperative radiation therapy.<sup>4, 6, 7)</sup> The prognosis of this disease is usually poor with propensity for both local recurrences and distant metastases. Tumor size and the mitotic figures are known prognostic factors.<sup>8-10)</sup> This case showed complete clinical response of the tumor to radiotherapy alone with clearance of the patient's clinical symptom such as headache and skin lesions.

When the lesion is superficial and is not involving the skull like this case, electron beam treatment should be considered in order to spare the brain. For the entire scalp irradiation, there is a difficult problem of matching multiple electron fields.<sup>10)</sup> Electron beam arc technique has been used to give uniform dose distribution for treating superficial tumors along curved surfaces since almost two decades ago.<sup>11, 12)</sup> However, this technique requires the arcing capability of linear accelerators and still has not gained general acceptance because of its complexity both in the calculation of dose distributions and in the actual dose delivery.<sup>13)</sup>

To gain uniform dose or increase surface dose, several types of bolus material have been used - wax,<sup>2)</sup> paraffin, water bag,<sup>14)</sup> Superflab™, acrylic<sup>15)</sup> and even a wire mesh.<sup>16)</sup> The selection of bolus material is determined by availability, convenience of fabrication, adjustment to the patient's topology, and reproducibility of setup. Although there had been a report in which a good dose distribution over the entire scalp could be achieved by using the wax casting for the treatment of an angiosarcoma and lymphoma,<sup>2)</sup> the fabrication process of a wax bolus is said to be so complicated and time-consuming. We have found that using a custom-made helmet is simple and efficient way for total scalp irradiation. It also gives an excellent accuracy of daily setup for the treatment as well as reproducibility.

The mixed electron and photon beam technique which are presented here using a custom-made helmet simplifies fabrication and set-up procedures, increase the accuracy of the treatment, and minimize the dosages to the underlying brain while providing an excellent dose distribution around the entire scalp.

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